IRON.

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OF

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IN

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ILLUSTRATED ARTICLES.

IRON.

An Illustrated Weekly Journal of Science, Metals, and Manufactures in Iron and Steel.

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THE PAST YEAR.

GENERAL RETROSPECT.

ANOTHER year has just closed upon us, with its pleasures and its anxieties; its joys and its sorrows; its hopes, its fears, and its regrets; and a new one yesterday opened before us. In taking our customary retrospective glance at the old one, we cannot discern much that enables us to speak satisfactorily of it from a commercial point of view as we peer down the long, hazy vista behind us. Let us, however, deal tenderly with it, as its sins and shortcomings are not wholly its own, but are, for the most part, inherited from some of its recent predecessors. After all, perhaps, it does not leave us quite so hopeless as it found us, and, moreover, it has done its part in digging graves for many things that were pernicious and objectionable in commercial—or, rather, uncommercial—circles. The iron and steel trades—of which we shall speak in detail later on—have suffered, and are still suffering, from the effects of the general depression, the latest event of the year in this connection being the closing on Saturday last of the steelworks of Messrs. Bolckow, Vaughan & Co. at Eston for an indefinite period. The shipbuilding trade has suffered most severely, a falling off of 50 per cent. and more as against 1883 having been experienced in some localities. This depression, like those in the iron and steel trades [illegible] production in previous years. This, however, is not [illegible] seeing that during the first three years of the present decade the rate at which tonnage was produced was enormous, the output for 1881-3 being estimated at over 3,000,000 tons in the United Kingdom. But besides having to cope with prior over-production, iron and steel making firms have had to wrestle with competition. And it is a question whether limited liability may not fairly be charged with lending a helping hand in keeping down prices, inasmuch as it is a great temptation in some of the best regulated establishments to take a contract which shows but a very slender margin of profit, with the comforting knowledge that if it turns out to be a loss, that loss will not be severely felt as it will be distributed over a number of pockets. On the other hand, an individual proprietor or a private firm would hesitate, and probably decline, to take contracts under such circumstances in view of a loss which, falling upon them in a concentrated form, would be serious, and might prove ruinous in its consequences. But although iron manufacturers and shipbuilders have suffered, it has largely been given to manufacturing engineers to be relieved from the great pressure of untoward circumstances which has prevailed in other directions, and to be able to show a fair output of work at the end of the year. This, however, is not so much due to home consumption as to foreign demand, as our export returns clearly show, those for machinery being on the whole satisfactory as things go. One class of producers there are who have been pre-eminently favoured in certain respects, and these are our agricultural friends, who have had a better season and consequently better crops than have fallen to their lot for many a long day, although 1883 was by no means a bad year for them. But still they are not happy, inasmuch as their produce in cereals has not fetched the price it should in order that they might make a fair profit. This is owing to the remarkably low prices which have prevailed in the corn market. This is very disheartening after nature has been so bounteous to them, but it leads up to further and deeper questions, which it is not our province to discuss here, but which will probably have to be discussed very seriously elsewhere before long. These questions are in part met by some large-hearted, because perhaps long-pursed, landlords, of whom we read now and again as making a return to their tenants of a certain percentage of rent. But these are exceptions, and the broad fact remains that, in the main, the financial relations between landlord and tenant, as regards farms, require readjusting.

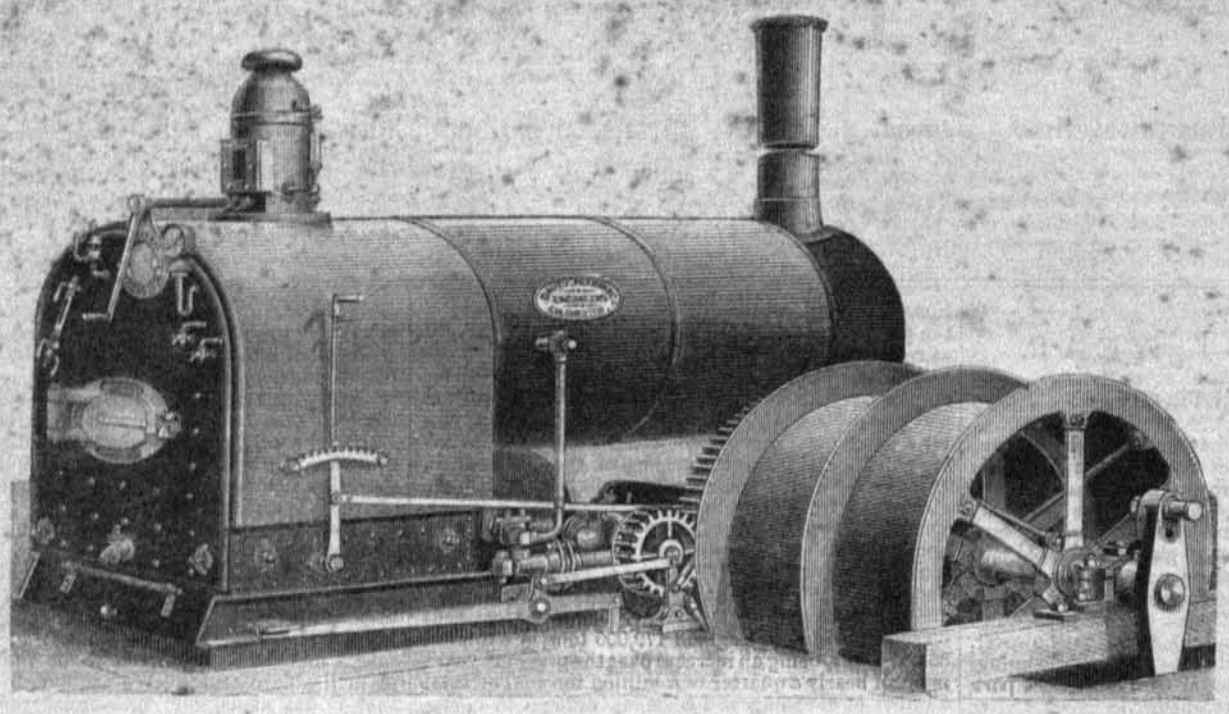
Setting aside the discussion of abstract questions, and leaving the special consideration of the condition and prospects of the iron, steel, and coal industries for a subsequent section, we will now proceed to review in general terms the science of the past year, in order to see what further applications have been made and what fresh developments have taken place. Turning first to the metallurgy of iron and steel, we note the satisfactory progress of the basic process during the past year. The make of Thomas-Gilchrist dephosphorised steel and ingot iron for the year ending September 30, 1884, was, on the Continent 685,000 tons, and in England 179,000 tons, or a total of 864,000 tons, being an increase over the previous year's make of nearly a quarter of a million tons. The total number of Bessemer and Siemens furnaces in operation on this process is nearly eighty, and eight more will be in operation early in the coming year. The most noteworthy feature about the return is, however, the evidence it gives of the superior enterprise and quicker appreciation of the advantages of improved methods of manufacture shown by our Continental rivals. Considering that England makes two million tons more pig-iron than the whole of the Continent together, it is not a little singular that the English make of basic steel should be little more than a fourth of that produced on the Continent. In other departments there is not much for notice. Early in the year we learned that Mr. William R. Jones, manager of the Edgar Thomson Steelworks, had devised an improvement in the method of treating the metal in a Bessemer converter when the temperature of the bath became too high. The method previously employed for obviating this [illegible] metal until the heat was sufficiently reduced. The improvement suggested by Mr. Jones consists in the introduction of steam into the molten metal in conjunction with the air blast. In practice, Mr. Jones found that the length of time during which steam should be admitted to the converter depended upon the size of the pipe delivering the steam, as well as upon the nature of the metal and the pressure and volume of the air blast. He also found that in working a 10-ton converter with steam delivered at about 50 lb. pressure through a pipe of 1½ inch in diameter, the steam might be forced with the air about six minutes, or from one-third to one-half the length of the blow. Mr. Jones claims as a marked advantage of the process that it allows for the use of a grade of pig metal which shall be high enough in silicon to avoid the presence of an objectionable percentage of sulphur, and yet, despite its greater heating capacity, be under the easy control of the operator, who is able to counteract any harmful increase in temperature that may develop during the blow. From America also come particulars of an improved puddling furnace at the works of the Bethlehem Iron Company, Bethlehem, Pennsylvania. An addition is built to the puddling furnace, and, while one heat is being worked in it, the pig-iron for the next heat is heated by a stove, which is in the furnace. When the next heat is drawn, the heated iron for the succeeding one is pushed into the working chamber, and in a short time is also ready to be drawn. By this improvement an hour's time is stated to be saved in the working of each heat, and also a large amount of coal. In England Mr. Alfred Davy, of Sheffield, introduced a process for producing steel either in large or small quantities in small works. The principle is that of the Bessemer process, although, as carried out, the practice is different as regards the means of applying the blast, for a blast of air is used to decarbonise and purify molten cast iron. The converter resembles an ordinary foundry ladle, and is covered by a lid which has a short spout projecting upwards from it at a slight angle. The tuyere of the blast-pipe passes through the lid, and dips into the converter to near the bottom. When the blast is turned on, the gaseous products are driven out at the spout, the action being similar to that in the Bessemer converter. In Mr. Davy's system, however, the converters are independent of the blast-pipe connections, and can be taken with either a large or a small charge at any time and placed under blast. From Sweden we had an anomaly brought under our notice in some wrought scrap castings, which were produced at the Carlsvik Foundry, Stockholm. Their composition is said to be soft steel or wrought-iron scrap; but above and beyond this there is a little secret in the manipulation, the result of which is a material embodying all the qualities of good wrought iron or mild steel. Splendid examples of casting were produced, some of which were bent cold into the most trying shapes. This material is said to contain 0·12 per cent. of carbon, to be very easy to weld, and to be practically free from blow-holes. The temper can be varied to suit requirements, and the cost is stated to be the same as that of malleable castings. We are not, however, aware that it has made any commercial progress in this country.

The extraction of gold from its ores has been materially advanced by the ingenious process devised by Mr. Rowland Jordan, which embodies four novel principles or conditions of treatment. In the first place the ore is reduced and the gold amalgamated while in a perfectly dry condition. In the second the ore is reduced entirely by impact, and not by abrasion, so that the particles are not rubbed or pounded together. Complete separation and individuality of the various constituent particles is thus maintained, the ore being divided into a powder of extreme fineness. In the third place, in this finely divided, clean, and dry condition, the ore is subjected to the action of mercury under considerable pressure, and under the constant action of mechanism which continually separates the particles. The ore is thus retained under the mercury a sufficiently long time for each particle of the gold-bearing powder to be effectually acted upon by the mercury. Fourthly, the whole process is perfectly automatic from first to last, air currents being employed for the separation, conveyance, and delivery of the ore powder, instead of sieves, water, and labour. In coal-mining appliances, we have had a new mechanical coal getter devised by Mr. W. Low, and introduced at the Haswell colliery. This machine is a combination of the lever, the wedge, and the screw. It consists of a couple of expanding blocks, which are forced asunder by a wedge piece actuated in its forward motion by means of a screw and link arrangement. The apparatus is inserted in a bore-hole in the coal after a space has been made at the top or bottom of the seam and the coal spragged. The workman then turns the screw gently, pausing as he hears the coal cracking until he deems it to have been sufficiently wedged. The sprags are then knocked away, and the jud comes down in a mass, breaking into large pieces as it falls. The bursting action is accomplished by the wedge as in the old stub and feather, in which, however, the force applied was simply that of a man with a mallet, whilst in the new coal getter the power is greatly multiplied, gradually applied, and readily governed by a judicious combination of mechanical forces. Moreover, in the old instrument the bursting action commences at the face of the jud, which is the worst place, as it breaks away the front of the coal. In the new machine the bursting force is so placed that the front coal remains intact, and assists in bringing down the jud in a body to the back of the kirving by its weight and leverage. From America we had an improvement in the safety lamp, by Mr. J. L. Williams. The improvement consists of a tube or sleeve sliding upon the wick tube, and attached to a wire which passes through the body of the lamp to the bottom, where a recess is formed for the admission of the finger or thumb. A single movement of the finger presses the wire upwards, carrying the sleeve over the wick, and instantly extinguishing the light. If it is desired to reduce the flame for the purpose of testing for gas, the extinguisher may be partly raised, and the flame reduced to any required extent, thus obviating the necessity of the tedious and dangerous operation of pulling

GEARED WINDING ENGINE.

BY MESSRS. DAVEY, PAXMAN & CO., COLCHESTER.

(*For description, see page 15.*)



down the wick by means of a picker. The advantages of this device, in enabling the most inexperienced or excited person, in danger from a rush of gas, to instantly extinguish the flame of his lamp, is obvious, as few in these circumstances are likely to have the calmness to stop and pull down the wick by means of a picker. The new safety lamp is said to have been tested by some of the most experienced and practical men of the Pennsylvania coal fields, who all agree that it is the best improvement on the Davy lamp ever offered.

Turning next to steam motors and generators, we may first notice the Tower spherical engine which attracted considerable attention when it was practically introduced early last year. In this engine the sphere—which is the soul and body of the machine—contains three principal parts, namely, the two shafts, one of which is called the driving shaft, because it protrudes through a stuffing box and is attached to the machine to be driven, and another, a short one, called the dummy shaft, which revolves only in its bush and is not brought through the casing, the whole forming a most compact and—for its size—powerful high speed engine. A new and remarkable motor, known as the triple thermic motor, the motive power of which is the vapour of carbon, was reported from New York, the inventor being Mr. W. S. Colwell. The material from which the vapour is generated, bisulphide of carbon, was discovered in the last century. The force and power of the vapour is said to surpass that of steam, and its application and regulation are stated to be under more perfect control than with steam. Bisulphide of carbon is evolved into a vapour for operating machinery by generating heat in a generator and transferring it into a vessel containing the bisulphide. The latent heat of the steam is utilised to convert the bisulphide of carbon into vapour, only 118° being necessary to produce this vapour. An American engineer, giving the result of his examination of the new motor, stated that a 15 horse-power boiler with very little fire under it generated steam which operated the new motor, which in turn drove an engine of 60 horse-power. An eminently practical little steam motor was perfected during the year, and is already largely in use in this country. This is the domestic motor of Mr. Henry Davey, of Leeds, which is a combined engine and boiler. The engine is worked by steam at or slightly below atmospheric pressure, and, as its name indicates, is intended for use where small powers are required, say from ¼ horse to 2 horse-power. In locomotives we had particulars of a high speed engine, which was designed to work a train on the New York division of the Lehigh road at the rate of eighty miles an hour. The engine weighs nearly 100,000 lb, and the tender, when filled with coal and water, 70,000 lb. The engine, it was stated, would develop from 1,400 to 1,500 horse-power. The great speed expected with this engine was said to be attained by constructing the cylinders with the steam and exhaust entirely independent. This is done by using fewer plain slide valves (gridiron valves) on each cylinder The valves are worked by a peculiar arrangement of valve gear, in which the motion is taken from the connecting rod, working on true centres.

The chief feature of the year in steam generation was the blowpipe-flame furnace, which was brought out by Mr. A. C. Engert towards its close, and which has given a remarkably high rate of evaporative efficiency to the boiler to which it is applied. This high efficiency has been the subject of comment in IRON and other professional journals, as well as at a meeting of the Society of Engineers, when Mr. Engert read a paper on the subject. In view of this and of the recent publication by us of an illustrated description of this furnace, we need only here state that the ashpit is dispensed with, and only a shallow curved passage for air left under the firebars. The mouth of the furnace is closed by a hanging door placed within a box entrance and having perforations near its lower edge for the admission of air to the fuel. The furnace is fitted under a double flued or Lancashire boiler 18 feet long and 7 feet diameter, and it has a grate area of 7 square feet only, the two flues forming returns for the products of combustion. At the end of the fire grate, which inclines towards the doors, is a firebrick wall 3 feet 6 inches thick, and which is carried up to within 8 inches of the underside of the boiler at the front and 7 inches at the back. Then comes a chamber or pocket 3 feet long for dust to settle in, and then the bridge proper, which, like the wall or embankment, follows the contour of the boiler and has a space of 6 inches between its top and the bottom of the boiler. By keeping a comparatively thin fire, and, above all, by properly disposing and proportioning the air-entrances, a transparent flame having a pale greenish tint is obtained. This flame gives the greatest intensity of heat, which, however, would be worse than useless if concentrated within a small area, as it would burn the plates of the boiler. In the Engert furnace, however, by means of the brick embankment, the flame is drawn out and distributed over a large surface of the plates, and, penetrating through them to the water, is fully utilised in producing steam. It is claimed that not an atom of oxygen entering the furnace, either from below or from the front, escapes to the flues without having done its work by coming in contact with the fuel and producing almost perfect combustion. The independent results obtained by two experts have been in one case an evaporation of 13·02 lb. of water per pound of coal from 70° Fahr. by slow combustion, and in the other an evaporation of 11·48 lb. of water per pound of coal from 74° Fahr. under conditions of quick combustion. In the discussion which has taken place on this furnace the main contention is that the evaporative efficiency is higher than the coal can give, but it does not appear that sufficient account is taken of the special and altered conditions under which the coal is burned. The figures of the experts—Mr. D. K. Clark and Mr. W. Schönheyder—have been freely published, and it is open for those who doubt the results to go to Mr. Engert's works, and by testing the furnace for themselves, either to disprove the conclusions of those gentlemen or to satisfy themselves that science never stands still. Every one admits that there is room for improvement in steam generating appliances, and why should not Mr. Engert have hit upon a successful method of advancing practice in this direction a stage?

The old question of the application of liquid fuel for steam-raising was revived in the autumn, by some trials of a system devised by Mr. E. C. Burgess. This system was applied, and we believe is still in use, at the Forth Bridge works, for turning shale oil is being used as a substitute for [illegible] engines which is driving the air-compressing machinery. The oil is stored under pressure in tanks near the engine furnace, the tank and furnace being connected by tubes. The fire-bars of the furnace are taken out, and a cylindrical retort is suspended in the furnace, which retort is surrounded by a spiral tube. From the reservoir of the oil, and from a water main, two pipes with valves convey oil and water to the retort and to the coil. The retort being warmed, the water valve is slightly opened, and a fine stream passing into the retort is converted into steam, which is carried through a superheating coil to a jet underneath the retort, from which jet it issues. The oil is then admitted in the same manner, and carried by another heating tube to the same jet, which it reaches in a nearly gaseous condition. It is then caught by the superheated steam, and thrown against the convex bottom of the retort, the force of the impact breaking up into finely divided vapour any portion of the oil which the heat may not have already converted into gas. In a short time the retort and heating tubes become red-hot. The steam has become a dry gas, which is thoroughly intermixing with heated carbon. The force of the jet sucks into the centre of the flaming gases a current of air, which completes their combustion, without producing smoke, dirt, or residue. The result of the whole process is stated to be almost perfect combustion—an immediate and intense heat which consumes all the products and leaves, practically, no residue to be cleared away. The use of liquid fuel was also reported from America. In this case an apparatus for the manufacture of vapour fuel for heating purposes was introduced at the rolling mills of the Joliet Iron and Steel Company, Illinois. In the saving of labour and fuel, as well as other incidental expenses, it was said to be very important. The invention takes the place of the present expensive system of heating the furnaces by means of coal-gas, and is called a "thermogen." The apparatus consists of a small cylinder about 4 feet long and 18 inches in diameter, with a shell 4 inches thick. This is placed in a furnace about 7 feet long and 4 feet wide, and is kept, when in use, at a cherry-red heat. It is connected with a crude petroleum oil tank by a small pipe, and also by a steam pipe from a boiler. This boiler generates hydrogen gas, and the thermogen makes the oil gas, and the two are combined by pipes that bring the two gases in contact, making the vapour fuel and

AUTOMATIC SMOKE CONSUMER AND FUEL ECONOMISER.

BY MESSRS. CLARKE & CO., NOTTINGHAM.

(*For description, see page* 15.)

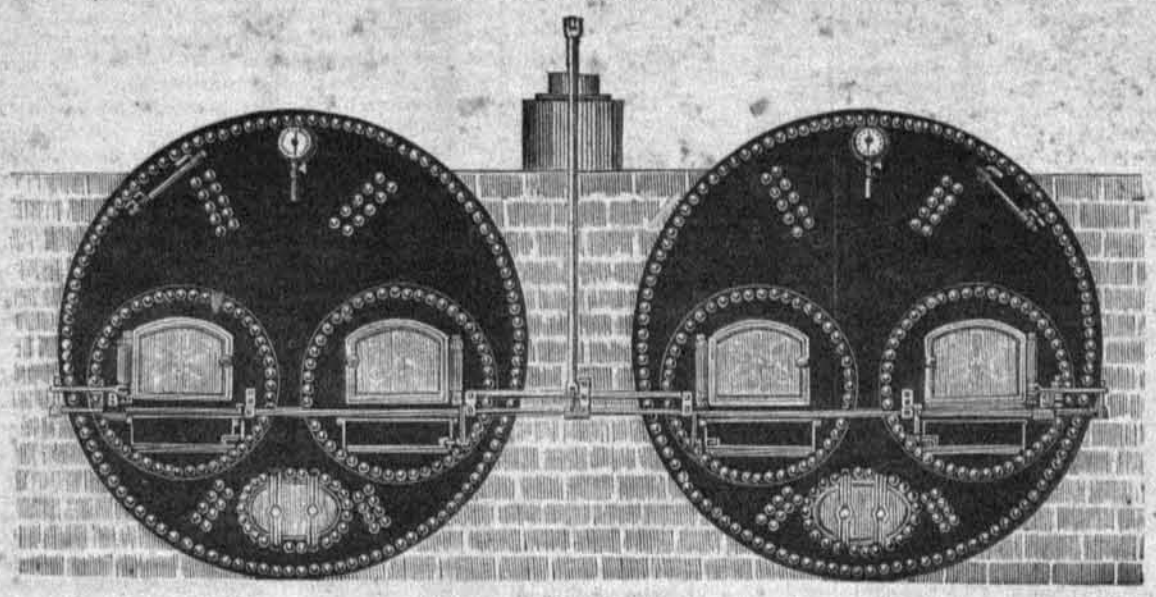


FIG. 1.

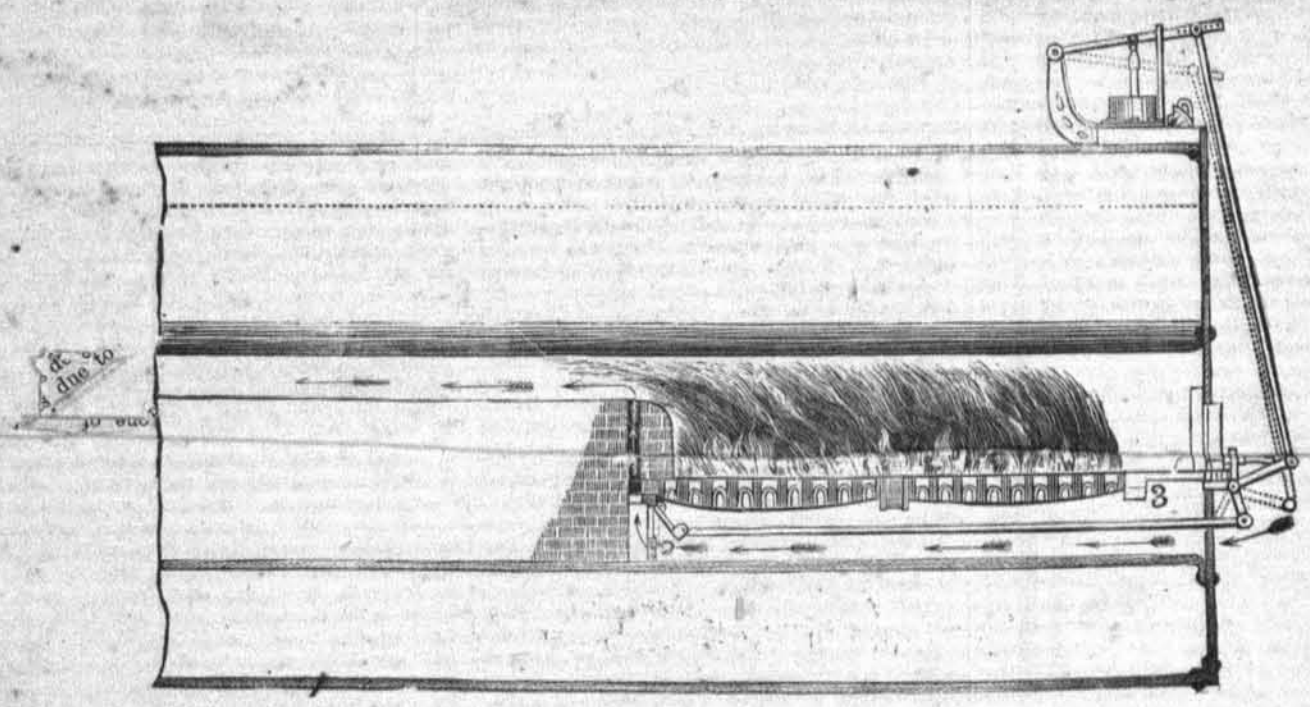


FIG. 2.

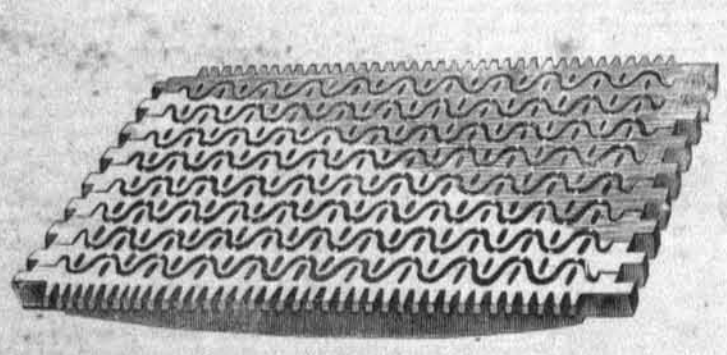


FIG. 3.

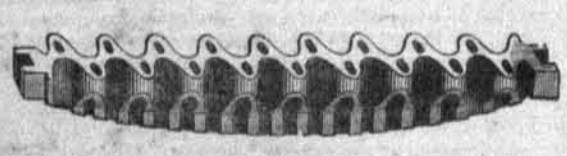


FIG. 4.

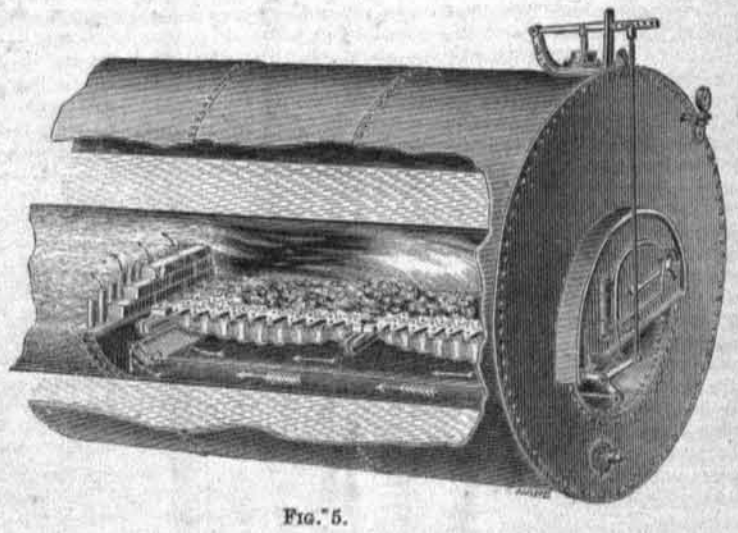


FIG. 5.

causing the necessary combustion. A number of furnaces are now heated by this vapour fuel, and the results are said to be far more satisfactory than those obtained by means of the coal-gas system. The only other matter for notice in connection with steam boiler practice is the perfecting by Mr. Hannay of a means of preventing corrosion by galvanic action. The result of his investigations was the "electrogen," which appears to be a most effectual preventive of the evil to which we have referred. It consists of a ball of zinc, with a copper conductor cast through the centre of it, the copper being so combined and amalgamated with the zinc at the junction of the two metals as to form brass, and thus no corrosion can occur between them to stop the galvanic current. The ball is fitted in the boiler by a simple device, and a wire from each end of the copper conductor is soldered firmly to the iron. From that moment the electrogen keeps up an uninterrupted galvanic current, and the whole of the interior of the boiler is protected from corrosion so long as any of the zinc remains. It is stated that a very small surface of zinc is sufficient to afford protection for a radius of 25 feet from the point of contact.

In naval construction the most important development has been the *Riachuelo*, Brazilian armourclad turret ship, which was designed and constructed by Messrs. Samuda Brothers. This vessel has been pronounced upon high authority to be one of the most valuable additions to the armourclad ships of the world that could be imagined. She is, in fact, the most perfect fighting ship afloat. The *Riachuelo* is a twin-screw ship of 6,000 tons displacement and 6,000 horse-power, and she possesses in speed, coal endurance (or the capability of steaming without re-coaling), and the arrangement and range of fire of her

guns, special advantages, which have not been previously attained in combination in any other ship. She is 305 feet long, 52 feet extreme beam on water-line, and 30 feet extreme depth, her displacement tonnage being 5,700 tons at load-line. Her draught of water at load-line, with 400 tons of coal in her bunkers, is 19 feet 6 inches. Her estimated speed, with 872 tons of deadweight on board, is 15 knots an hour, but on her official trials she attained a speed of 16¼ knots with a natural draught, and 16¾ knots with a forced draught. She is protected by armour 11 inches and 10 inches thick respectively, and her armament consists of four 9-inch 20-ton breechloading rifled guns in two revolving turrets, and six 6-inch breechloaders, besides fifteen Nordenfelt machine guns; she also carries Whitehead torpedoes, as well as torpedo boats. A horizontal deck of 2-inch steel armour runs through the ship, and joins the inclined armour at each end. On this are two oval breastworks built up of plates and angles, and protected by 10-inch armour-plates and teak backing. Within the breastworks are two revolving turrets similarly built up and protected, and in each of these are two of the 20-ton guns. The disposition of her breastworks and the arrangement and fire of her guns are the main points which render the *Riachuelo* such a splendid fighting vessel, and give her such importance. The breastworks are *en echelon*, and are so carried out as to enable the guns in each turret to command an unbroken fire for 180° on their own side of the vessel, and 50° on the opposite side. Thus the whole four guns can be brought to bear ahead or astern, while an all-round fire can be always maintained with two guns, and all four of them can be used for broadside firing on either side of the ship. The six 70-pounder guns are placed on the upper deck, while of the fifteen Nordenfelt machine guns five are for use in the mast tops, and the remainder are placed on pedestals, so as to keep off torpedo-boats. The torpedo guns are arranged to fire from five ports, four broadside and one right aft. It will thus be seen that, as regards her fighting capacity, the *Riachuelo* is the most offensive vessel afloat.

In America, Professor J. L. Tuck, of New York, has been busy realising the dreams of Jules Verne by producing a submarine torpedo-boat, which is reported to possess remarkable powers. This boat, which has been named the *Peacemaker*, is built of iron, 30 feet long, 7½ feet broad, and 6 feet deep, and is driven by electricity. Ordinarily, the top of the boat is not much above the surface of the water. By inverting fins the boat can be driven entirely under water. By expelling ir and letting in water as ballast, the boat can be sunk to any depth. The water can be expelled and its place taken by air in the same manner. The vessel is steered by two rudders, whose planes are at right angles. The captain, acting also as steersman, clad in diver's dress, and surrounded by water, stands in a well on the boat. In the interior of the boat, which is lighted with glow lamps, and supplied with compressed air, are the electrician and a man to attend to the air pumps. The captain signals the electrician to manage the boat and to discharge the torpedoes. The torpedoes are made buoyant with cork. The boat, driven by electricity from storage batteries, runs up under a vessel, when the captain places a torpedo on each side of the keel, and, being supplied with electric magnets, they cling to the bottom of the ship. Then the boat runs off, and at a safe distance the torpedoes are exploded. Should the services of this craft ever be successfully employed against an enemy, she will doubtless be re-christened the *Piece*maker. In gunnery there has been considerable discussion with regard to the efficiency of the Woolwich system of construction, the correctness of which is seriously called in question, whilst Mr. Longridge has again been propounding the system of built-up wire-bound artillery, which he has so long and so consistently advocated. Following in this direction a German inventor has made a gun by wrapping a steel tube with silk until a diameter was attained corresponding with the ballistic power required. After the tube has been made it is centred upon a lathe which turns with a great angular velocity. Above and parallel with the tube are arranged a number of spools of silk, which cover the surface in the form of a helix, by means of guides, without leaving any space between the threads. When the desired thickness has been obtained the silk is coated with gutta-percha, in order to preserve it from air and dampness. The silk being a bad conductor of heat, the gun could be fired very often without getting hot, and it is stated that it can be more easily managed, since its weight is only one-third as great as if it were all of steel. We have not heard of the adoption, or even the trial, of this gun by the German government or by any other power. In small arms the most extraordinary advance has been made by Mr. Hiram S Maxim, who has produced a machine gun which we have seen fired at the rate of 600 rounds per minute. This gun has a single barrel, and its mechanism is such that the force of the recoil from one round at the moment of firing is utilised and forms the motive power for loading and firing the next round, and so on round after round in succession. In this way one recoil performs all the functions of bringing the next cartridge into position, forcing it into the barrel, cocking the hammer, pulling the trigger, extracting the empty shell, and ejecting it from the gun. At the moment of firing the recoil drives the barrel rearwards about three-quarters of an inch, and it is this movement of the barrel alone that actuates the mechanism of the gun, and enables it to keep up a continuous fire. As this gun has recently been described and illustrated in Iron, we need not here enter into its constructive details.

Electric lighting, as a system, has not made great advances during the past year as regards its public and general application. This is to some extent to be accounted for by the hindrances which are found to arise in the practical working of the Electric Lighting Act. This was, however, to be expected, as the subject for legislation was not only novel, but very imperfectly developed at the time the act was passed. Experience, however, has shown some of its weak points, and the prejudicial effect having been pointed out, steps will no doubt be taken in due course to remedy real, but not fancied, wrongs. But if all could be arranged to meet the views and requirements of the various electric lighting companies, we doubt whether there would be any substantial advance unless a definite scale of charges could be decided on. These charges would, of course, have to be such as would prove acceptable to the great mass of gas-users. If they could be offered the electric current for the same price they now pay for gas, a great many would be disposed to adopt it. If to this there could be added Aladdin's offer of "new lamps for old ones"—inclusive of fittings and of fixing—there would probably be a still greater number of acceptances. If electric lighting companies went a step further and added a reasonable cash bonus by way of compensation for the disturbance of or damage to walls or ceilings and the infliction of workmen, then the success of electric lighting in general would be assured. In other words, until some great inducement is offered to the public at large, the average British householder will stick to his gas as pertinaciously as he does to his beer. The electric lighting station at Pimlico will doubtless soon be in operation, and may afford an opportunity of testing this question. But although the system has not made great progress in public it is making good way for private purposes. The cases in which it continues to be adopted may be classified under four heads, namely where money is no object, where steam can be spared or water power can be cheaply utilised, where its use will facilitate industrial operations without materially adding to the cost of production, and where an ulterior object is to be gained by using it as an advertising medium which will cause it to prove, if not remunerative, at any rate not a loss in the end. One noteworthy attempt to determine the cheapest and best method of illuminating public thoroughfares, and of distributing light by means of electricity, should not pass unnoticed. This was made at Wimbledon under the superintendence of Mr. W. H. Preece, the experiments being exhaustive and on a practical scale. A Hochhausen 750 volt dynamo, capable of maintaining 64 glow lamps of 50 candle power each, was used. The current, before being distributed to the lamps, was passed through an automatic regulator, which consisted of a battery of 20 Planté cells, and which acted as a safety-valve, and conduced to the steadiness of the light. The lamps finally adopted were the Woodhouse and Rawson glow lamps of 50 candle-power each, and these were variously arranged for the purpose of comparison as to the best method of suspension and light distribution. Some of them were placed singly, and also in small clusters, on poles 20 feet high, while others were suspended singly from cantilevers, over the pathways, and at a less height. Others, again, were suspended at a height of 20 feet above the centre of the roadway, and 100 feet apart. This latter proved to be the most efficient method of lighting, as it was also the most sensible, a large proportion of the light not being wasted on houses and walls. The results, so far as they went, were stated to be most satisfactory; they did not, however, extend to the region of cost.

The use of the electric light on board ship continues to extend, the largest installation in this direction having been made during the past year on board the *Umbria*, where four Brotherhood engines are employed to drive a 200-light and three 350-light Siemens dynamos, glow lamps being principally used. The electric light has also been tried at Aldershot in connection with ambulance work at night, a very interesting programme having been carried out there, as reported by us at the time. The demonstration was given with an electric light waggon as constructed for military purposes in France by Messrs. Sautter, Lemonier & Co. This contrivance consists of a wrought iron travelling carriage, upon which is fitted a Field boiler. A Brotherhood three-cylinder engine of 3 horse-power is also mounted upon the carriage, together with a Gramme dynamo machine, driven direct from the engine. An arc lamp is carried on the waggon, but is removable for use at any desired point, the practice being to operate it at a distance from the waggon. The light from the carbons is not thrown direct on to the field, but is condensed in a small concave reflector, from whence it is reflected on to a larger one, the rays from which are thrown forward on to the object to be illuminated in a concentrated form, and covering a comparatively limited area about 50 yards in diameter. It is this form of light that is used for examining and bandaging the wounded on the field at night after a battle, but for making the search the light is diffused over an area about three times as large by means of a lens which is hinged to the lamp, and in fact forms its door.

Railway train lighting by electricity has been advanced an important stage by Mr. Stroudley and Mr. Houghton on the London, Brighton and South Coast Railway. The system perfected by these gentlemen has been successfully at work for months past on some of this company's trains, and is being applied to others. It is essentially simple and self-working. It comprises the generation by the train itself of all the power required for its lighting; the storing of power to provide for lighting when the train is not in motion and when unusually great supplies are needed; the control of the supply of current by an ingenious apparatus which prevents the storing battery from working back upon the generating dynamo machine, and the prevention of waste, as the guard can turn the light on and off instantaneously. The electric current is generated in, and distributed from, the guard's van. The generator is a Brush dynamo machine driven off the carriage axle through counter-shafting and belting. The current thus generated is controlled by self-regulating apparatus, and is stored in the accumulators ready for use whenever required. Another system of train-lighting by electricity was tried on the Metropolitan District Railway. In this case a Siemens dynamo and a Willans three-cylinder engine were placed in a luggage van attached to the train. In the van was also a small boiler from which steam was supplied to the engine. The carriages were lighted by means of Swan glow lamps. A system of working railway signals by means of electricity was also introduced to public notice during the past year. This consists of a long-pull electro-magnet, the invention of Mr. Stanley Currie, which has been wedded to a system of interlocking railway signals and points devised by Mr. Illius A. Timmis. The bobbin of the Currie electro-magnet consists of an annular chamber of soft iron in which the coils are placed, the centre portion of the chamber being hollowed out to receive the stem of the armature for which it acts as a guide during its descent. The armature is composed of a pair of soft iron plates of the same diameter as the bobbin, carried on the stem just referred to, and having a rim of iron on its circumference, the whole forming, as it were, a lid or cover to the bobbin. The inside of this rim is stepped and the bottom of its outer and thinnest edge is corrugated. The outer portion of the stem of the armature is of iron, and the lower part of gun metal. The result of this ingenious arrangement is that instead of the action being practically instantaneous, the impact very violent, and the pull very short, as in the ordinary electro-magnet, the action is very gradual, the impact gentle, and a pull of several inches is obtained, hence its name—the long-pull electro-magnet. The length of the pull, moreover, can be graduated according to requirement, and the principle involved is capable of application wherever a mechanical pull is required.

No striking advance has to be recorded in connection with electric light-producing machinery, although various detail improvements have been made in several machines. Noteworthy amongst these is that effected by Dr. Hopkinson in the Edison dynamo, by which its size has been considerably reduced, whilst its commercial efficiency has been increased to 90 per cent. In primary batteries one new example has come under our notice. This is the Lalande battery, by means of which it is claimed that a current of electricity can be generated and used either for lighting or for driving machinery, and that certain of the elements which produce the current become converted during the time they are doing their work into a substance of greater value than before the battery was started. The battery we inspected was composed of forty-eight cells, each 1 foot square, and giving a current of from 15 to 20 amperes, with the somewhat low electromotive force of 0·94 volt. The battery itself is capable of maintaining fifteen glow lamps of 10 candle-power each, or of driving a small motor. Each cell of this battery consists of an iron tray, on the bottom of which is placed the depolarising agent, which is oxide of copper. Just above this and supported at each corner is a plate of zinc, the cell being filled with a solution of caustic soda. Under ordinary circumstances, and when the circuit is open, no action takes place between these elements; but on the circuit being completed the work of decomposition commences. The oxygen of the oxide of copper combines with the zinc and forms oxide of zinc, metallic copper being left behind. When the battery is exhausted the zinc is recovered from the liquor in the form of an oxide, and this is stated to be fully 50 per cent. more valuable than the metallic zinc. In secondary batteries we have that of Mr. H. T. Barnett, which we saw in practical operation in the telegraph department of the Great Western Railway at Paddington. The invention is of a twofold nature, and consists of an accumulato or secondary battery, and an apparatus for automatically replenishing the battery with the current whenever the draught upon it by the lamps renders it necessary. The battery consists of a trough 1 foot 10 inches long by 7 inches wide and 6 inches deep,

outside measurement, and is divided into a number of compartments by alternate partitions of lead and porous earthenware. In the batteries for ordinary work the lead plates are coupled in quantity, but for lighting railway carriages they would not be coupled at all, but would be well insulated from each other. The spaces between the lead and the porous ware are packed down with alternate transverse layers of lead and asbestos felt. The battery is practically dry, the only solution required being contained in the pores of the active matter and felt. This solution is used very acid, so that in the event of evaporation, when the air became moist again the affinity of sulphuric acid for water would attract the requisite amount of moisture from the atmosphere; but practically it operates by not allowing evaporation to take place. This battery is reported to possess a very high efficiency.

An important practical application of the Gaulard-Gibbs system of secondary generators took place during the year at Turin. In connection with the electrical exhibition there, the Italian government, together with the city of Turin, offered a prize of 15,000 francs, or £600, for the most important improvement in that department of electrical science which so closely affects so many branches of industry, namely, the transport of electrical energy over a great distance. The Gaulard-Gibbs system was in competition for the prize, and succeeded in carrying off a a remarkable share of honours. By this system electrical energy was transported and applied to lighting under practical and economical conditions over a much greater distance than had hitherto been done by anyone. The motive power of the National Company and their dynamo (an alternating current machine by Messrs. Siemens Brothers, of 60 horse-power, and supplying a current of 3,000 volts and 10 ampères) being installed within the exhibition, the company undertook to transport electrical energy as far as the railway station of Lanzo, a town at the foot of the Alps, and at the entrance of the valley of the Stura. By this installation we had the unprecedented fact of electrical energy furnished by a Siemens machine being transmitted to a distance of 40 kilometres, or 25 miles, from the machine along a single conductor, which forms, consequently, a circuit of twice that length, electrical currents of varying potential being developed at the extremity as well as at several intermediate points of the circuit.

In matters pertaining to coal-gas illumination a prominent feature in the carbonising department has been the Cooper coal-liming process, which is in successful operation at the Tunbridge Wells Gas Works. This new method of gas manufacture was introduced there by Mr. R. P. Spice, the consulting engineer to the gas company, and was first put in operation on October 31, 1883, since when it has worked without let or hindrance, and has proved itself to be a thorough success. The process consists simply in mixing 2½ per cent. of lime with its own weight of water, and adding it to the coal, thus giving 5 per cent. by weight of the quantity of coal to be carbonised. In other words, 1 cwt. of lime and water is mixed with every ton of coal, and charged with it into the retort. By this means, Mr. Cooper has rendered the process of coal-liming not only practicable and successful as regards the object in view, but profitable also to the user; for at Tunbridge Wells pure gas is obtained, a public nuisance is avoided, and an extra profit yielded to the gas company. In the illuminating department of coal gas the close of the year introduced to us a new gas burner, over which considerable time and thought, and no small amount of money, had been expended by Mr. George Bower. Our readers will doubtless remember the Grimston gas lamp which has been described by us. The Grimston patents were acquired by Mr. Bower, who, with his son, combined the whole of them with their own ideas and produced the Bower lamp, which is on the regenerative principle, and a number of them are now in regular use with excellent results. In this lamp the gas supply descends from the point of suspension to a ring-burner fixed in the middle of a semi-globe of glass. The flame spreads outwards and upwards from this ring, forming a ball of light. The products of combustion rise through the tubes of a regenerator placed above the glass semi-globe. These tubes become red hot, and being wrapped round with several thicknesses of wire gauze, cause this to become red hot also. The cold air has to pass through the wire gauze, and between the tubes, and is thus in a highly heated condition before reaching the burning gas. A small portion of the heated air is allowed to flow down the sides of the glass so as to keep it clean, and a third supply of air, which can be regulated to suit varying qualities of gas, comes up from beneath to give form to the flame and to supply the requisite quantity of air to the outside of it. The flame reaches its greatest intensity in about 15 minutes after lighting, and increases in power from three candles per cubic foot when cold to eight candles per cubic foot when hot, Recent photometric testings have shown that these lamps, consuming from 15 to 30 cubic feet of gas per hour, give eight candles per cubic foot, but considerably more when tested at an angle of 45 deg., and still more if the light receives any assistance from reflection. It follows, therefore, that the light of 200 candles may be obtained from ordinary London gas for somewhat less than 1d. per hour, which would appear to render it difficult for the electric or any other light to successfully compete with this new development of scientifically-burning gas. Before quitting the subject of illumination, we may perhaps refer to the exhaustive series of experiments now being carried out by the corporation of the Trinity House, in order to test the practical value of the various modern systems of illumination adapted for lighthouse purposes. The three illuminants mainly available for lighthouse purposes are oil, gas, and electricity, and it is with these that the committee are now dealing at the South Foreland Lighthouse station. Three timber towers of a temporary character were constructed, and are respectively used for the electric, the gas, and the oil lights. Observing sheds were erected in the vicinity, and stations were appointed in outlying districts, as well as at sea on the lightships, and, in fact, everything has been, and is still being, done to ensure accuracy and to render these experiments of practical value to the maritime nations of the world, which is the object of the Trinity Brethren.

Turning to civil engineering matters, we may notice the fact that early in the past year—namely on January 17—the boring of the Mersey Tunnel was successfully completed, and direct communication under the bed of the river thereby established between Liverpool and Birkenhead. The event is the consummation of one of the most important engineering works yet carried out in this country. The tunnel under the Severn, which is being made by the Great Western Railway, exceeds the Mersey Tunnel in length; but the latter is at present the longest roadway under a tidal river. The tunnel has been driven through the red sandstone, and is about 30 feet under the bed of the estuary. It has been worked from both ends, and the excavation of the driftway has still to be completed to the full dimensions of the tunnel. The Beaumont boring machine, by the aid of which the work has been done, marks the great progress made since Brunel. The latter had of course a very different soil to deal with; but the length of the Thames Tunnel is only 1,300 feet, whereas that of the Mersey Tunnel is nearly three times the length, or 1,230 yards. About the middle of the year it was satisfactory to be able to report that after an enquiry lasting more than thirty days, a select committee of the House of Commons passed the Barry Docks and Railways Bill. This scheme was one of the largest and most important of the session, and its utility cannot be denied. Yet it was thrown out in the previous session by the Lords, for no reason that could justify such a proceeding. The bill, which eventually received the Royal assent, authorises the construction of a dock at Barry Island, in the Bristol Channel, and a system of railways is to be created in order to bring the dock into direct communication with the Rhondda valley. The object of the scheme is to establish competition with Lord Bute's docks at Cardiff and the docks of the Taff Vale Railway Company at Penarth. The necessary capital was more than subscribed for this scheme, which will provide that extra dock accommodation so imperatively demanded by the pressing requirements of the trade of Cardiff. The Select Committee of the House of Commons last session rejected the Manchester Ship Canal Bill which they had before them for twenty-one days. The preamble of the bill was stated not to have been proved to the satisfaction of the committee. The bill has now been passed and thrown out twice by both Lords and Commons committees. In 1883 it occupied thirty-nine days in the Commons committee, and was passed, and ten days in the Lords, and was thrown out; and last session the Lords committee sat forty-one days, and passed the bill, and the Commons took twenty-one days, and threw it out. The promoters, however, nothing daunted, are once more going to try their fortunes in parliament, and we hope this time with success. Plans have been prepared for the session of 1885. With regard to the engineering features, no change of importance has been made in the canal from Manchester to Runcorn. The docks at Manchester, however, have been entirely remodelled, and instead of one large dock on the racecourse site, three docks have been designed. The character of the estuary works is completely changed in the new plans. Instead of training walls constructed in the centre of the estuary, the canal, which formerly terminated at Runcorn, will be continued to Eastham, partly along the Cheshire shore and partly through the adjacent land. It will pass through the outer basins of the Mersey and Irwell Navigation Company above Runcorn, and be thence continued along the Runcorn shore, widening out so as to form a dock and wharves for Runcorn, passing under Runcorn Bridge and alongside the outer walls of the Runcorn and Weston Point Docks, across the mouth of the River Weaver, into the Frodsham marshes. Passing through the marshes, and nearly parallel with the river, it will skirt the shore near Ince and pass inland across Stanlow Point and in front of Ellesmere Port, thence inland again until it nearly reaches Eastham Ferry, where it enters the river in deep water. With these modifications and improvements we trust the promoters will obtain their act, the results of which are fraught with such importance to Manchester.

Space fails us or we could greatly lengthen this review of scientific progress, as there are many other matters worthy of notice. As it is, we can only refer in passing to the new patent act, which came into operation on the first day of last year, and caused a large and immediate expansion of business at the Patent Office, and which, although somewhat lessened, still continues to prevail. In like manner we may refer to the ingenious Tehuantepec ship railway, proposed by Mr. Eads; to Mr. Leggo's no less ingenious automatic system of telegraphy; to Professor Bell's radiaphone, the function of which is to transmit speech by means of a ray of light and without wires; to the new process of bleaching introduced by Mr. J. B. Thompson, and to various other matters. As it is, however, we are obliged to conclude the present section, and to pass on to the consideration of—

THE HOME IRON TRADE.

To say that the condition of this great industry during 1884 was bad, is but inadequately to describe the state of matters that prevailed. It would, indeed, be possible to imagine a worse concourse of adverse circumstances, but it is to be hoped that such may never be experienced by this country. From every point of view the position of the iron trade during the year just closed upon us must be regarded as eminently unsatisfactory. The most despondent estimate of the future, formed at the beginning of 1884, was more than justified by the progress of events as month after month passed over our heads, and from bad the iron trade went to worse. Looked at broadly, and as a whole, the only movements by which it was characterised were a continuous and persistent fall in prices, most pronounced, perhaps, in the earlier months of the year; and a constantly diminishing demand, which was most marked towards the autumn and winter. There were, doubtless, exceptions here and there to the otherwise monotonous decline in values; but such were due entirely to local or extraneous circumstances, and only helped to prove the general rule of an uninterrupted decline. Since the opening days of 1884 the fall in prices may not have been so severe as might have been expected, looking merely at the excessive depression prevailing; but this is wholly owing to the fact that values were then already at a very low level, and that there was not much margin for further reduction, since makers in many instances preferred to stop work rather than accept utterly unremunerative prices. In fact, prices in most cases dropped much more in 1883 than they did last year, but the former was an incomparably better year. Then manufacturers were able to obtain plenty of work for their mills, whilst in 1884 the most harassing circumstance was the utter collapse which took place in consumption. No reduction in price which makers would yield within reason seemed of avail to stimulate demand or to impart the slightest activity to business. It appeared at times almost as if the world had ceased to require iron or steel.

In the early weeks of last year two movements took place in prices, both due to abnormal influences in no way connected with an improvement in trade. Prices of Cleveland pig-iron went up about 1s. 6d. per ton, and sympathetically those of Scotch iron rose about 9d., in consequence of the agreement come to amongst the ironmasters of the former district to blow out some eighteen furnaces, a proceeding which it was calculated would reduce production by some 400,000 tons per annum. The other movement was a rise of about 10s. per ton in the price of steel rails, ensuing upon the successful termination of the negotiations which had been going on amongst the manufacturers for combined action with a view to their mutual protection. But of this more presently. Prices opened at about 35s. 6d. for Cleveland pig-iron, and 43s. for Scotch pig-iron; but under the influence of the closing of the English furnaces had risen in the former case to 37s., and in the latter to 43s. 9d. by the end of January. Thenceforward the price of Scotch iron drooped slowly but steadily, until it had reached 41s. in the early part of June, after which it stiffened gradually, and at last in the beginning of November went up with a bound to 44s. 4d., entirely owing, however, to speculative operations. This price was not, of course, maintained, and the relapse was hastened by the growing conviction entertained in the trade that the end of the year would show a large increase in stocks. How far such anticipations were justified, our readers can judge when we mention that stocks, which at Christmas 1883 amounted to 584,138 tons in Connal's stores, and 250,862 tons in makers' yards, stood a week ago at 579,423 tons and 241,577 tons respectively; the latter figures, however, are an estimate only, the manufacturers having declined to furnish returns. The changes in the price of Cleveland pig-iron were not by any means so great, and between the opening and the closing figures of the year the difference was scarcely 6d. per ton. In October last the makers' combination was broken up so far as the regulation of prices was concerned, and although manufacturers' and merchants' quotations approached nearer in consequence, yet no great movement took place, owing, doubtless, in a large measure, to the paucity of business. Notwithstanding the restriction in the make, which caused the monthly production to decline from 159,563 tons in January

to 128,640 tons in July, stocks increased from 253,105 tons at the beginning of last year to about 300,000 tons at the close; for, although the quantity in public stores remained almost stationary, that in makers' hands increased considerably. This result, however, is not to be wondered at when we turn to the foreign shipments. According to the figures published by the Board of Trade, the quantity of pig-iron exported by this country in the eleven months ending November 30, 1884, was 262,531 tons less than in the corresponding period of 1883, and we fear that, when the returns for last month are published, it will be found the total exports for the year are some 300,000 tons below those for the preceding twelve months. In addition to this, it must be remembered that the home consumption of iron must have been grievously affected by the stagnation which has prevailed in the shipbuilding industry, and which latterly has reached a very acute stage indeed. The proposals of the government with reference to having some of the contemplated additions to the navy built in private yards come very opportunely, although in reality the relief which will thereby be afforded will be comparatively trifling. From other directions there does not at present appear to be any prospect of amelioration of the bad times on which the shipbuilding trade has fallen. Under the influence of the great depression prices of shipbuilding iron fell during the first quarter of last year about 10s. per ton for plates, 5s. per ton for angle iron, and 2s. 6d. for bars; and that quotations have remained since at almost the same level is probably due to the smallness of the business doing. Orders of any importance might always have been placed at considerably under quoted rates. Other industries have not escaped a similar fate. The engineering trades, which for a long time appeared to enjoy immunity, have latterly felt the pinch also; but, to judge by the Board of Trade Returns of the exports, manufacturers of bars, rods, hoops, sheets, tinplates, and cast or wrought articles have enjoyed an improved foreign demand, not sufficient, however, to prevent values from falling appreciably.

One of the most notable events of 1884 was the successful establishment of the Steel Rail Makers' Association, which is, perhaps, the most unique combination of the kind which has been seen in British trade for a long time. The makers of steel rails throughout Great Britain, with only one exception, made common cause to maintain prices and restrict production pro rata in accordance with the necessities of the demand; whilst, simultaneously, a second association was formed, embracing as well the makers of Germany and Belgium, for the purpose of regulating the terms upon which the manufacturers of the three countries entered into competition with each other on neutral ground. The immediate result of the formation of the association was to raise the price of steel rails from £4 5s. per ton to £4 15s., and it brought in a small rush of buyers anxious to place their orders before a further rise took place. The excitement, however, soon gave place to a profound dulness, which lasted for the greater part of the year, and was due in a large measure to the secret struggle which was being carried on as to whether the associated manufacturers or the buyers could stand out longer. It must be admitted that the former used wisely the power which combination gave them, and did not seek unduly to inflate prices. The minimum which they fixed, and which has since been maintained, is certainly a moderate one. Even from a buyer's point of view £4 15s. per ton cannot be called an extravagant price for steel rails; and considering the greatly reduced production which makers have had to submit to, it is very doubtful whether it has covered the cost of manufacture in all cases. If makers had been dependent entirely for work upon the demand of the hour, the summer and autumn of 1884 would have proved very disastrous to them. As it was, the steelworks of Messrs. Bolckow, Vaughan & Co., at Eston, had to be closed during the whole of August and part of September for want of work. Both home and foreign railways were buyers of steel rails to a much smaller extent. It is impossible as yet to ascertain how far the former restricted their purchases; but from the information published by the Board of Trade, it would appear that the latter received from our manufacturers almost a quarter of a million tons less than in 1883. The falling-off was especially marked in the cases of Italy, the United States, Mexico, Canada, South Africa, and India. During the last quarter of the year, however, there was a decided improvement in the position of affairs. The recommendations of the committee which sat on Indian railways justified the expectation that there will be an increased demand from that quarter during the next few years. But apart from this cheering anticipation, there was an immediate accession of general enquiries, and several important orders were given out, so that altogether the close of the year has been the brightest part of it in this department of the iron trade.

"Hope springs eternal in the human breast,"

and so there are not a few who look forward to the year upon which we have just entered as likely to bring with it better times for the iron trade. Several of the elements of improvement undoubtedly exist, for prices are low and production is cheap; but whether or not the flow of the tide has actually commenced, we trust our friends may enjoy in 1885 a more prosperous year than they have experienced in 1884.

BIRMINGHAM AND DISTRICT.

The year has been an exceedingly quiet one for the manufacturers in and around Birmingham of iron and hardwares. 1883 was one of the worst years, so far as the trade was concerned, which had been experienced for many years previously, and it was thought that matters could not be much worse. The expectations formed at the close of last year have not been realised. On the contrary, things have gone from bad to worse, and the end of 1884 finds manufacturers in a worse position than they were a year ago. Profitable transactions have been exceedingly difficult to obtain, and in face of this drawback it is not surprising that several important firms have been unable to pay twenty shillings in the pound. Competition has been exceedingly keen, not only from foreigners, but amongst home manufacturers. Underselling has been carried to such an extent that to keep the works going hardwares have been sold at prices which must have meant a considerable loss to the producer. There seems to be a general concensus of opinion that matters have now "touched bottom," and that the new year will be a better one than any of its recent predecessors. In the hardware trades buying throughout the year has been of a hand to mouth character. Electric light fitting manufacturers have perhaps been the best off for work during the year, whilst the chandelier and gas-fitting firms have been amongst the heaviest sufferers. In the iron-wire trade a protracted strike against a reduction in wages resulted in the men having to give way. By this many tons of wire on hand were disposed of, and the last three months of the year has seen the works actively employed. Tubeworkers as a rule have had a bad year, but the builders' ironmongers have been most fortunate. The manufacture of bicycles and tricycles has been extensively developed, and employment has been found for a large number of hands. Prices have not varied much during the year, and for sheet iron goods, nails, hinges, screws, nuts and bolts, and bedsteads, lamps, and hollow-wares of various kinds, the quotations are with few exceptions the same as in January. In the iron trade there has not been much progress made as the result of the twelve months' business. When the year opened, prices were:—Pig-iron steady at £3 5s. for hot blast native all-mine; £4 5s. for cold; £2 10s. to £2 15s. for medium qualities; £2 for cinder. Finished iron was £7 10s. for marked bars, with 12s. 6d. extra for the Earl of Dudley's brand. Unmarked iron could have been had at £6, but the ruling quotation for good medium qualities was £6 10s. Common sheets were £7 10s. to £7 15s. for singles; £8 5s. to £8 10s. for doubles, and £9 10s. for lattens. Nail strip was from £6 10s. upwards, and Welsh coke tinplates in this district were quoted at 16s. 6d. per box. Trade remained in a stationary condition during the first six months of the year; and there was no change calling for comment. In September several of the leading ironmaking firms lowered their prices because the ironworkers had generally consented to accept the drop in their wages which had been declared by the arbitrator, and they had settled down to work at it. The New British Iron Company's new prices were:—Best Congreaves bars, £6 10s.; Lion, £7 10s.; best Lion, £9; best best scrap Lion, £10; best best best Lion, £11; best charcoal, £11 10s.; best Congreaves plating, £7; Lion plating, £8; best Lion plating, £9 10s.; best Lion turning, £11; best Lion rivet, £9; Lion chain, £10; best Congreaves horseshoe, £6 10s.; Lion horseshoes, £7 10s. At the November meeting in Birmingham of the Ironworkers' Wages Board, the masters did not prefer any claim for any further reduction in wages, and the men agreed to withdraw their claim for an advance, and the rate of pay was left at 7s. 6d. for puddlers'; and millmen's wages in proportion. At this rate they remained at the end of the year. Only at a few places can the men be kept on more than three days a week, and even at this all the iron manufactured cannot be sold. Stocks are increasing. In many instances the prices realised scarcely cover the cost of production. At the end of December the official quotation for marked bars was £7 10s., although it is no secret that very few, if any, sales are effected at this figure. Unmarked iron was £6 to £6 5s., and the commonest qualities, £5 15s. The sheet makers were doing better, an improved foreign demand having sprung up. For Braby's gun brand, and the Blackwell Company's brand, the quotation in Birmingham is £14 10s. for 24 g. packed, and £16 for 26 g. Common sheets (singles) sell at between £6 15s. and £7. Doubles, which at the opening of the year were £8 5s. to £8 10s., could be bought at the close for £7 10s., and lattens for £8, or 30s. less than a twelvemonth ago. Best quality sheets were firm at £11 to £13 per ton. Mild steel sheets were nominally £15. Tinplates were quoted at about 14s. 6d. per box for cokes. Pig-iron prices were stronger than during any part of the quarter, although orders were not very plentiful. Derbyshire pigs were quoted at 42s.; and Northamptons at 41s.; and Staffordshire pigs were £3 for hot and £4 for cold blast, and cinder sorts, 35s.

CLEVELAND.

The year 1884 has undoubtedly been a sad year of depression for Cleveland. The price of pig-iron, which during the previous year had fallen from 42s. 6d. to 36s. 3d., stood at the latter figure at the beginning of the year, with a not unreasonable apprehension that it would fall lower still. During the first quarter of the year this apprehension seemed not to be realised, the price seeming to have advanced a shilling per ton in the course of the quarter. This was owing mainly to the persistent restriction in the make and a determination on the part of the makers not to accept less than a certain price. This nominal improvement was maintained until near the close of the second quarter, when a decidedly declining tendency began to be felt. Through the third quarter makers had to give way gradually, ending with the surrender of their minimum price. During the last quarter of the year the price sunk to 36s., with a tendency to sink lower still. The official returns show the realised price of No. 3 Cleveland pig-iron to have been over the first quarter 36s. 8·95d., being a fall of 6¼d. below that of the previous quarter; for the second quarter, 36s. 4·65d., being a further fall of 4·35d., and over the third quarter, 36s. 5·93d., showing a very slight improvement on the preceding quarter. There can be little doubt but that the last quarter will show a still further declension. In consequence of there having been from twelve to eighteen blast-furnaces less blowing this year than last, the output of 1884 is considerably smaller. In all probability it will turn out to be close on 2,477,310 tons, as against 2,760,740 tons in 1883. That stocks will have increased some 50,000 or 60,000 tons, notwithstanding the reduced make, is not to be wondered at under the circumstances. For the first six months of the year 1884, the exports of pig-iron somewhat exceeded those of the corresponding period of the preceding year. They were largely sustained by increased shipments to Russia in anticipation of the increase of duties there, which took effect on July 13. During the last six months they gradually fell away. The shipments for December amount to 69,202 tons, and the exports for the year are 927,496 tons, compared with 992,973 tons in 1883. It must be allowed, however, that, although the depression has been by no means light, it has not been so heavy as was at one time apprehended. The manufactured iron trade may be said to have led a precarious existence during the past year. At a time when prices were running down, the price of forge pig was running up on account of its scarcity caused by the restrictions. Prices, however, have been much the same all the year round. The wage question has been a very restless one for this trade throughout the year. A reduction of 2½ per cent. at the mills and forges was made in April under arbitration, and a further reduction of 2½ per cent. under mutual arrangement was made from the end of June. Subsequent disputes were settled amicably by the arbitrator deciding that there should be no further change. The shipbuilding trade, as in other districts, has gradually collapsed during the year. As orders were finished the men were paid off. One shipbuilder who used to be considered the largest employer of labour in the district, himself made a joke of the lamentable fact that his yard, like a distressed ship at sea, was under bare poles, and that he himself, like his men, was tramping the country to obtain employment. With regard to the steel trade, which is gradually superseding wrought iron, the early part of the year is notable for the intimation of the engineers of Lloyd's Committee that after having made numerous experiments they had found that plates made from basic steel would for shipbuilding purposes answer all the requirements of the committee. The latter part of the year also has witnessed the largest steel firm in the district varying the nature of its plant so as to turn out ship plates, sheets for tinplates, billets, &c., as well as steel rails. Ironfounding has been rather an exception [to the general depression, although prices have not been as good as desirable. One firm has materially extended its works in the course of the year, and maintains an increasing business. Other varieties of the iron trade have been working fitfully, like the mills and the forges. The engineering works have managed to keep going, and seem to be weathering the depression very fairly. The enterprising firm, the first to raise the salt in quantity to the surface, has in the course of the year made a further development of the salt trade by establishing soda works on the latest principles. The exports of coal and coke have been fairly maintained, and, indeed, show a slight improvement on the previous year. The same may be said of other exports as well, taking the average for the year. It is confidently believed that the winter months will touch the bottom of the depression, and that spring will likely bring the revival of the staple trade of Cleveland as it brings that of the world.

DERBYSHIRE.

The history of the Derbyshire iron trade during the past year cannot be said to be over bright. Prices have ruled low, and business has been tame and, to a great extent, unremunerative. In the first month of the year there were thirty-seven out of fifty-five furnaces in blast, those belonging to the Oakerthorpe Company and that owned by Mr. C. P. Plevins having been idle all the year. The trade grew rather better during the first quarter of the year, but at no time was it brisk. The output of pig-iron in 1883 was 353,474 tons, and 16,838 tons of ironstone was raised in the district. As the year wore on, the position of affairs did not improve, only thirty-three furnaces being in blast as the year closes. Of the four large furnaces belonging to the Erewash Valley Iron Company only two have been in blast for some time prior to the liquidation of the company, and these were blown out in the September quarter, whilst the affairs of the firm went into liquidation. The furnaces, plant, &c., cost about £80,000. The firm have excellent railway and canal communication, yet, strange to say, the whole has just been disposed of for £9,100 to a Mr. Hopkinson. As the year closes the Butterley and Stanton Company are erecting a new furnace each. There has throughout the year been but a quiet business done at the lead mines, some of which have changed hands. The local foundries have only been in receipt of moderate orders. A few of the large works, such as Staveley, have transacted a good business in large gas and water pipes, and heavy castings, for which excellent appliances have been put down. The coal trade cannot be said to have been more than an average one. Competition and a large output of coal have kept prices low. The opening year found the demand for house coal quiet, the weather being unusually mild. The pits for some time did not make more than three or four days per week, and even then the labour market was agitated with a demand for an advance of wages. In the first month of the year the Clay Cross Company had a decline of close upon 10,000 tons in the quantity of coal sent to London. So quiet was trade in some parts of the coalfield that the Unstone Coal Company gave their men notice for a reduction of wages in March, and the Renishaw miners left work against a reduction.

The close of the half year did not find the trade much better, yet some of the pits sent largely to London, twelve of the leading pits in the district having sent 147,300 tons in May against 130,800 in the month of April, whilst in the month of June twelve pits supplied 116,300 tons against 128,000 tons in July. Neither during the month of August nor September did trade improve, and short time was the rule rather than the exception. With the advent of the month of October the usual advance of 6d. and 1s. per ton was made in the price of house coal. The quantity sent from the district to London was only moderate, for close upon 15,000 tons less coal was sent in the month of November by all lines to the metropolis than was sent during the month of October. There has been only a moderate business in steam coal for exportation, but a good tonnage has been consumed for smelting purposes at the district works. Gas and locomotive coal have been supplied in about average quantities, but prices have not improved. A large tonnage of coke has been weekly imported into the district from South Yorkshire, whilst ore has been sent from North Lincolnshire. The output of coal in 1883 was 8,787,967 tons, of the value of £2,489,923 tons, or an average of 5s. 8d. per ton. In the same year 27,904 persons were employed about the pits above and below ground. The proposed amalgamation of the Chesterfield and Derbyshire Mining Institute with the Midland Institute, and the removal of the headquarters from Chesterfield to Sheffield, created great interest and no little opposition ere it was abandoned. Several minor strikes have occurred in the district during the year, and about 200 men and boys were towards the close of the year on strike at the Norwood Colliery against an alteration about the weighing of the coal.

DURHAM.

The past year has been an exceptionally dull one. There has been a considerable limitation of trade, and in most cases a shrinkage of values. As pointed out twelve months since, there was a great decline of shipbuilding, which has become more marked as 1884 proceeded, and this in turn has told upon the other industries, especially those of crude and manufactured iron. The demand on foreign account has also been less, which has also imposed no inconsiderable limitation. The shipbuilding trade, it was computed a couple of years since, absorbed between 70 and 80 per cent. of the whole of the finished iron produced in the North of England. As only about one-third of the berths in the shipbuilding yards are now occupied between the Tyne and Whitby on the north-east coast, the vastly decreased consumption of iron is at once apparent. In addition, there is the fact that many of the ships now being built are of steel plates, a material which bids fair to supersede iron altogether for shipbuilding, as being scarcely any more costly—certainly not more than 10s. per ton—having more durability, besides charging the vessel with less deadweight. This transition from iron to steel is recognised by large producing firms, and during the year the Consett Iron Company have gone largely into steel plate manufacture. Palmer's Iron and Shipbuilding Company are doing likewise, as also the Weardale and West Hartlepool Iron Companies, while Bolckow, Vaughan & Co., on the other side of the Tees, have also started Siemens plate-making plant. It looks, therefore, as if iron ships will soon be a thing of the past. The decline of shipbuilding has also largely affected other branches. Engineering, boiler works, ships' fittings, and other branches of business have severely suffered, including, of course, ironworks of every class. Nearly all these industries are confined to the county of Durham, and hence there has been a dearth of employment for labour, which has produced much misery, and has now taken a most aggravated and extensive form at Tyneside, Sunderland, Hartlepool, Stockton, Witton Park, &c. It is computed, taking in the Tyne district, and all the shipbuilding and iron and coal centres, that 25,000 fewer hands must be employed than was the case a year and a-half since. Extraordinary measures have had to be taken to meet the distress. Whilst the branches named have been so adversely affected, there are others which have been mostly doing a steady, and probably, on the whole, remunerative trade. These include general engineering, bridgeworks, foundry, and tank and sanitary appliances. The steelworks also, with few exceptions, have been kept in steady operation, while the combination of railmakers has led to better prices being secured. The locomotive and rolling plant establishments have also been doing a steady business, including the large railway establishments, though the end of the year finds these latter in not quite so good a position mostly speaking. The production of finished iron as given in the returns to the board of arbitration will probably be about 440,000 tons this year, as against 660,000 tons in 1883. The net average price of bars, rails, plates, and angles in December 1883 was £5 17s. 11d. At the end of October this year it had got down to £5 1s. 8½d. There will be a probable output of more than half a million tons of steel, while the production in the whole North of England district in pig-iron will reach about 2,480,000 tons, a reduction on 1883 of about 280,000 tons. The stocks of pig-iron will have increased by about 65,000 or 70,000 tons as near as can be estimated. The shipments also show a decline. Prices have changed but slightly in the twelve months. Steel rails have advanced during the year from £4 5s. to £4 15s. through the action of the syndicate. The introduction of the hoop manufacture, also iron joists and girders, has taken place. It will probably be found that there has been a material diminution in the production of coal and coke when any available returns are at hand. This county is the greatest producer of bituminous products of any district in the kingdom. In 1883 over 29,000,000 tons of coal were produced. There has been a comparatively small decline in the prices of coal as compared with iron during the year. Practically there has been little change in other sorts than manufacturing coals, while coke has been sold at about the same rate this autumn as in the previous year. There has not been much change in pitmen's or blast-furnacemen's wages. The ironworkers by two awards of Dr. Spence Watson have been reduced 5 per cent. Shipbuilding operatives have been materially reduced in wages, and are now under a notice of reduction of 7½ per cent. It is difficult to indicate what will be the state of trade in 1885, though the general impression in trading circles is that there is a more hopeful aspect. Ships which have been idle are again being taken up, and there have been a few orders placed to build more. Prices of iron have rather stiffened for next year's delivery in anticipation of a better demand.

EAST WORCESTERSHIRE.

Things have been much less eventful in the finished iron trade of East Worcestershire and district this year than last, when we had to chronicle a strike amongst the ironworkers. This year the area of disturbance has been transferred to the sister industry (the coal trade), and its baneful effects are still felt. The first week of the year saw the occurrence of the winter quarterly meetings, which took place as usual at Wolverhampton and Birmingham. The outlook was then looked upon as not unfavourable, although makers complained that profits were cut to a fine point. The then existing rate of ironworkers' wages was to continue until terminated by a month's notice. Orders were fairly plentiful in the several sections of manufacture. Makers regarded the activity of certain constructive industries, which were good customers for iron, as evidence of trade being in a fairly healthy condition. The bridge building and iron-roofing works were busy on good contracts for the colonies and for Brazil. At the beginning of February a considerable lull seems to have settled upon the finished iron trade. One or two manufacturers of best brands continued fairly busy, and sundry makers of common iron were doing well; but, taken all round, the prevailing condition of the iron trade was one of unmistakable lethargy. £7 10s. was still quoted as the general basis of marked bars, with the usual extra 12s. 6d. per ton for Lord Dudley's brand. Some fair Australian and home orders were reported for shoe iron, with, however, less briskness in this department than customary. At the commencement of March a slight recovery had been experienced with some of the best makers of marked iron, but business in the bulk kept slack. Angles, tees, and girder iron were in fair demand. The spring quarterly meetings saw the confirmation of current prices. Export orders, notably from Australia, had improved. Tire iron was in pretty good request, also shoe iron. Business in hoops and strips, and in angles and tees, was somewhat dull. Orders for tinplates of the best makes continued fairly plentiful. Some good requirements were stirring for rivet iron, &c. During the first part of May, the finished iron trade was a little better. Some firms reported an accession of business on shipping account, chiefly for small sections. The export trade for shoe iron showed animation with one or two houses. The demand, however, for America in this branch manifested little vitality, but home orders were fairly good. With the promulgation of the arbitrator's award, business, as a whole, had evinced more stability and firmness. During June, the manufactured iron trade could not be called animated. Many ironmasters had stocks of fuel, and what they lacked they could get from outlying collieries; so that the colliers' strike, which commenced at the end of the month, did not put the ironworks to any very serious straits for fuel. After the midsummer quarterly meetings, the iron trade witnessed a slight recovery, some of the best marked houses having received more satisfactory specifications. Orders for unbranded iron had also slightly improved, but manufacturers still complained of the paucity of requirements. Few orders were coming to hand for export requirement. In the month of September the finished iron trade showed a fair volume of business. The leading manufacturers were able to maintain nearly full time at their mills, chiefly on account of orders received from the colonies. Makers of cheap angles in the smaller sizes, for bedstead making, continued busy. The chain trade was dull, in consequence of the miners' strike, which caused a very limited demand for iron of that branch of manufacture. Sheets for galvanising continued in very good enquiry. Makers of nail-rod iron were hardly so actively employed. Tinplates of good brand found a ready sale, and there was an increasing demand for tin sheets. The nail trade of East Worcestershire was without energy. The firms engaged in the bridge-building and girder trades were, in general, busily employed, not only on contracts for this country, but on important requirements for the colonies. The "fall" quarterly meetings of the trade, held on October 8 and 9, attracted a large attendance from all parts of the country. As was generally expected, the current basis of prices for marked bars was not altered. Some little improvement took place in the finished iron trade about this time, although business was not so free and buoyant as it would have been if the wages questions, then still pending in both the coal and iron trades (although, as the after event proved, approaching a settlement in the first-mentioned industry), had received some sort of adjustment. The girder and bridge trades were in full activity, and in addition to large contracts previously in hand, smaller requirements were in course of execution for Brazil, Buenos Ayres, and other ports of Central America. A proposed revision of the ironworkers' wages rate of 7s. 3d. per ton was voluntarily waived, or rather postponed, on two separate occasions by the masters, and that rate still obtains, subject to one month's notice on either side for its alteration. The present condition of the finished iron trade is one of moderate activity, but ironmasters are hoping for an accession of business after the quarterly meetings early in January. In the pig-iron trade, some good business for rather large parcels was done at the commencement of the year. Prices were somewhat less buoyant, in some cases showing a drop of 2s. 6d. per ton. All-mine hot-air pig-iron was quoted at 62s. 6d., 65s., and 67s. 6d. per ton; part-mine, 47s. 6d. and 50s.; and cinder iron, 37s. 6d. to 40s. For contracts of large size, lower prices still were quoted. During March, the crude iron market was in a somewhat dull condition. Consignments were going on in respect of running contracts, but otherwise business was limited. Quotations ranged from 60s. to 67s. 6d. per ton; part-mine, 47s. 6d. to 50s.; cinder iron, 37s. 6d. to 40s. These are practically the official rates now. Business in pig-iron has fluctuated throughout the year, but in no case has it been remarkably brisk. The coal trade has emerged from a crisis during the year, which has, however, left it rather shattered. The early part of the year did not see a brisk demand; in fact, trade was under, rather than over, its usual volume. The Coal Trade Wages Board had been successful in inducing Mr. Joseph Rowlands to accept the office of arbitrator-president (in the place of Mr. Haden Corser, resigned), and that gentleman, after hearing the arguments pro and con. at a duly convened meeting of the wages board, issued an award, reducing thick coal colliers' wages from 3s. 8d. to 3s. 4d. per day, and those of thin coal miners from 2s. 10d. to 2s. 8d. per day. The masters regarded this award as restoring something of the proportion that formerly existed between list prices of coal and colliers' wages, under the old sliding scale; but the men, encouraged by their leaders (who admittedly committed a gross breach of good faith), resolved to contest and repudiate the award, and the result was a lengthened strike of fourteen or fifteen weeks' duration, which, however, with one or two isolated exceptions, was not signalised by any acts of violence on the part of the men, but which drove a good portion of the already limited trade to other outlying collieries, in whose hands a part of it still remains. The men have remained at work quietly since the close of the strike, but the men's delegates are now urging notices for an advance of wages, although the vast majority of miners are not fully at work, and the coal trade generally compares unfavourably with last year.

FOREST OF DEAN.

Perhaps no more fitting and concise description of the general twelvemonths' trade which the Forest of Dean has experienced could be given, than to say that it is little more or less than a reflection of the year's business which preceded it. Especially is this the case in regard to iron and the manufacturing industries arising therefrom, whose history is devoid of scarcely a momentary encouraging feature. Whatever changes have taken place in monetary matters has been an encore of the preceding year. 1883 opened with best pigs top price at about 60s. to 63s. in the yard, and the year closed with quotations reduced to 57s. to 60s. for very best brands hematite bars. To-day reveals the melancholy fact that the downward course in point of worth of crude iron has followed closely in the wake, and only small parcels are sent out, and fewer contracts signed, at from 48s. to 50s. per ton, and this contemporaneous with increasing stock; demand not equal to supply. However, it is worthy of note that although reductions in wages to employés have taken place, it is by no means equivalent to the difference deduced from the above figures. Steady-going and uneventful proceedings have marked the course of time since a retrospect of this district was last chronicled. The great difficulty to be combated is the reaching of lower beds of ore. There are known to be valuable churns which only water prevents being won. During the year the government introduced a bill dealing with the vexed question; and the same was withdrawn at the instance of dogged opposition of those very persons whom the measure sought to relieve. However, at Shekmantel, where for years extensive works for fixing an immense engine for pumping purposes have been going on, although private enterprise in the expenditure of £40,000 has resulted, yet a considerable sum must yet be sunk before full advantage can be secured for the outlay, and the undertaking is completed. In the manufacture of rods, small bar and wire goods, still more spiritless and disheartening exigencies have waited upon proprietors, with whom Germany has taken up the cudgels of competition in so fierce a manner as to reduce prices from about £8 per ton in January of this year down to from £6 15s. to £7 5s. As a consequence, wages are now with the reduction just accepted from 10 to 20 per cent. less on the year, and even with this concession only very meagre and limited orders are secured. Foreign goods are on offer at Birmingham at less than was ever remembered. There is undoubtedly a better feeling existing in the tinplate industry, and the five or six thousand boxes a week, estimated gross make of the district, has been fairly well sustained. But a glance at Christmas 1882 will show that the echo of downward tendency haunts even this industry, prices per box best coked tins there being 18s. Orders are now accepted or lost to the district at 14s. to 14s. 9d. Makers are loud in their complaints that these terms are untenable for a lengthened period, profits are alleged to be nil, and this is strengthened by the fact that wages are practically equal to last year's average. With regard to the coal trade, quite another régime has existed. The whole twelvemonth has been characterised by a spell of trade, which it was feared the district had long since lost. The autumn trade discovered to colliery owners the fact that their best energies must be exercised in order to meet the great demand for household block. A check of some serious proportions somewhat upset calculations, and the Board of Trade Returns for November at the docks show a falling-off; but the eleven months ascertained output, and taking one twelfth added for December, places the gross output from Lydney at 294,000 tons, a higher figure than any other recorded notice, late years' totals averaging about 50,000 tons less. Prices of best block are from 9s. 6d. to 10s. 6d. at the pit banks. Colliers' wages are on the whole well sustained at 5 per cent. advance, accruing at the November advance, when coals went up 1s. per ton.

LANCASHIRE.

The year just closed has, all through, been one of excessively low prices both in iron and coal. Notwithstanding there has been a fairly large volume of trade doing, an entire absence of buoyancy has characterised business, and to secure orders sellers have had constantly to follow

receding prices, with the result that values have gone considerably under even the very low level of the preceding year. In both pig and finished iron, from the commencement to the close of the year, there has been a persistent downward movement in prices, which only in the case of Derbyshire and outside brands, such as Scotch and Middlesbrough, has shown any recovery. The basis of prices at the commencement of the year was about 44s. 10d. to 45s., less 2½, for local and district brands delivered equal to Manchester; but almost immediately a downward movement set in, which before the close of January had brought down prices quite 6d. to 1s. per ton. The concessions offered by makers brought forward a moderate amount of buying, and for a month or so prices remained stationary, but directly the running out of contracts necessitated the seeking of new orders, still further concessions had to be made, until by the end of the first half of the year prices had got down to about 42s. 6d. and 43s., less 2½. In the face of these low prices and the fact that concessions failed to stimulate increased buying of any weight, makers began to consider the question of blowing out furnaces as a preferable alternative to a forced business at unremunerative rates. Here and there furnaces in the district were either damped down or blown out, but even this had no perceptible effect upon the market. Prices certainly did not gain any strength, and where business had to be sought the downward movement continued, until in August not only the two principal competing brands, Lancashire and Lincolnshire, but also Derbyshire iron, could be got at about 41s. to 42s., less 2½, delivered here. These figures apparently tempted consumers to place out some fairly large contracts, and the low quotations for Derbyshire were withdrawn, whilst in the other brands a disposition was shown to hold out for about 1s. per ton above the minimum rates that had been taken. It was, however, only in very exceptional cases that any actual advance was realised, and for the last quarter of the year business has gone on simply from hand to mouth, with a gradual easing down in prices to about 40s., less 2½, as the minimum for Lincolnshire forge iron, about 41s. to 41s. 6d. for foundry qualities, and about the same figures for Lancashire forge and foundry pig-iron. The hematite trade has been in a very depressed condition all through the year, and prices have touched a lower point than has probably ever been known. Although engineers as a rule have been fairly employed, there has been so general a want of confidence in the future, that low prices have not tempted consumers to buy beyond actual requirements, and it has been difficult to effect sales of good foundry brands delivered here even at as low as 52s., less 2½. During the past couple of months there has, however, been more doing, and prices have gone up about 1s. per ton from the lowest point, good foundry brands selling at about 53s., with some special brands quoted at about 55s., less 2½, delivered here. In the manufactured iron trade forge proprietors generally have been able to keep their works going on about full time during the greater part of the year, but there has been an absence of any pressure of orders in the market, and buyers have been able to force down prices gradually but steadily during the whole twelve months, until they close the year fully 10s. per ton under the basis of quotations on which the year opened; bars which were then quoted at £6 to £6 2s. 6d. for delivery into the district being now obtainable at £5 10s. to £5 11s. 3d. per ton. So far as the engineering trades are concerned, the year opened with very fair prospects in nearly all branches except shipbuilding, and a moderate amount of activity prevailed pretty generally for the first half of the year, even marine engine builders being kept fairly busy finishing work, which, however, not being replaced by new orders, has since left them in most cases very slack. Locomotive builders have been well supplied with work all through the year, and although the weight of new orders coming forward has recently shown a falling off, the year closes with the large private shops still well supplied with work. Tool makers also commenced the year with their shops generally well supplied with orders, and although not quite so busy with the close, there is still sufficient work to keep them moderately well employed. Stationary engine building and millwright work has been rather fluctuating, but still fairly good generally, and the large engineering firms have also been tolerably well employed. In fact, it may be said that, apart from the depression resulting from the complete collapse of shipbuilding, the engineering trades of Lancashire have during the year held their own, and although employment certainly is not so good as at the commencement, there is no serious increase in the number of men out of work, whilst, except in the shipbuilding districts, wages have been fully maintained. A more or less depressed tone has characterised the coal trade during the whole of the past year. The close of last year left prices on a moderate basis following the advance made at the commencement of the winter, but the exceptional mildness of season subsequently very soon necessitated reductions, and with small requirements for house fire consumption being accompanied by only a moderate demand for ironmaking and general trade purposes, prices got to quite as low a point as any they ever touched during the previous year, whilst pits in most cases had to go on about half time. The commencement of the present winter season was made the occasion for bringing prices back to something like the level at which they stood at the beginning of the year, but this advance has only been very partially maintained, and the year closes with prices for all classes of round coal quite 1s. per ton lower than they were at the same period of 1883. The question of wages has necessarily been a matter of serious consideration during the year. During the earlier months the men renewed a previous agitation for an advance. This, of course, had to be abandoned, and subsequently it was followed by the employers taking action to enforce a reduction of 10 per cent., which, though not accepted without some show of opposition, did not meet with any serious resistance, and this has led up to mutual efforts on the part of the coal owners and the men in West Lancashire to establish a sliding scale by which wages may be regulated in the future without recourse to those protracted struggles which have proved so disastrous to the trade of the district in the past.

LEEDS AND WEST YORKSHIRE.

Generally speaking, throughout the year in all branches of the iron trade of this district prices have been low, and profits even lower than they were in 1883. At the same time, Leeds, Bradford, and Halifax have been well off for trade as compared with the two or three preceding years, and especially in the production of machinery and tools of large capacity, and the skilled mechanics of those towns have been well employed at wages at least equal to those of several former years. The best Yorkshire iron manufacture has at no period of the year just expired been anything like brisk. The competition of steel has been felt very much, and buyers of plates, bars and axles have with few exceptions given the preference to steel. The specifications given out and executed for these articles have been considerable, and the expectation of our steelmakers is that next year will show a considerable increase in the demand. Locomotive builders have been well employed both on home and foreign orders, and as well are already assured of fair employment for several months of the new year. Until within the last month or two business in traction engines had been slow, but a few orders have been placed recently for both descriptions, although at prices which cannot be very remunerative. The steel plant ordered some time ago of Messrs. Tannett Walker & Co., of Leeds, for Bilbao, in Spain, has been delivered, and is being erected. The large compound engines for rolling steel rails and girders, made by this firm, will be delivered early in the spring. These are also for Spain, and will weigh 400 tons. One of the largest, if not the largest, rivetting machines ever made has just been completed by Tannett Walker & Co. for the Caledonian Railway Company, Glasgow. It is worked by hydraulic pressure, and has two powers, one for large rivets of 1¼ inch diameter, and one for rivets of a smaller size. The gap, or distance from the centre of the rivet to the bottom of the machine where the holder on is bolted, is 12 feet ½ inch. The machine is entirely of cast steel. The castings, which are the largest of the kind ever made, were supplied by Messrs. John Brown & Co., of Sheffield. The same firm has recently received a large order for hydraulic cranes for the new dock at Tilbury. These cranes are moveable, and so constructed that waggons can pass under them while at work. They are 55 feet high, and have 60 feet lift. A trial crane was made by Tannett Walker & Co., and erected at the South Dock of the East and West India Dock Company, and tested in the presence of the dock company's chief officials. It made eighty-one lifts in forty-seven minutes, the work being that of unloading bales of wool. The bales, four in number, were lifted out of a ship and landed on the quay. Each bale weighed 4 cwt. This firm has received orders since the trial to construct fifty-five such cranes for the new dock at Tilbury above-named. They have also similar cranes on order for two of the Italian ports. The cranes move on rails along the dock side, the rails being 13 feet 3 inches centre, and the crane is so constructed as to be perfectly stable without any clips or other attachments. Each crane lifts and turns 30 cwt. The enormous speed attained in these cranes will be of great advantage, as the ships need not be kept long in dock. The coal trade in Leeds has been fairly prosperous during the year, except that there has been no improvement in prices. The West Yorkshire coal trade has been principally remarkable during the past year for an increased extent of exportation as compared with several years past, but the prices of both domestic and engine fuel have remained stationary.

LIVERPOOL.

1884 commenced with very little apparent prospect of relief from the long-drawn period of depression; it now ends with no greater approximation to all appearance to the much wished-for change, other than what is due to the whirligig of time. The course of the year has been marked by continually decreasing values in most branches of the metal trades, as will be seen from the subjoined figures, viz.:—

		In January.	In December.	
Staff. common bars	f.o.b. Liverpool	£6 5s.	£5 12s. 6d.	per ton.
Lanc. ,, ,,	,, ,,	£6 2s. 6d.	£5 10s. 0d.	,,
South Wales bars	,, ,,	£5 12s. 6d.	£5 2s. 6d.	,,
Hoop iron	,, ,,	£6 10s.	£6	,,
Sheet iron (singles)	,, ,,	£7 15s.	£6 17s. 6d.	,,
Ship-plates	d.d. ,,	£6 2s. 6d.	£5 7s. 6d.	,,
Tinplates	f.o.b. ,,	15s. 6d.	14s.	per box.

Thus prices are now brought down to those which prevailed in the calamitous early part of 1879, and it is a wonder that, even with the sternest economy, manufacturers have been able to sustain their position in the way in which they have done. There should be no hesitation about buying now among those who have any requirements to fulfil or to legitimately anticipate. One of the chief features of this year's trade here has been the immense if not unprecedented business in tinplates. The year commenced with the transference of the greater part of the large stocks here to warehouses, &c., in the States. Exports have kept up since then in an almost unabated manner, and yet the production has continued too great for the demand, and prices have drooped all the while except for a very short period, when an advance to 15s. 6d. per box was sought by makers, but was little conceded by the export houses. Financial difficulties in the States seem to be likely to curtail credits, which are too widely afforded to small houses, and from this cause alone some restriction in the demand seems likely to be effected now. The pig-iron market has been dull all the year here—sales are made at such cutting prices that most firms stand from under and leave the bears to the full possession of their feast. The accusations brought against the quality of Glasgow G.M.B pig in the beginning of the year having met neither with disproof nor even with attempt at disproof, has again called attention to the abuses of the ring—and this feeling has been emphasised this autumn by the disgraceful disclosures as to the conduct of affairs amongst brokers and dealers. The Glasgow market has lost its credit and prestige, and is tottering to its well-deserved fall. The prices of Cleveland pig have fluctuated but little during the year, and it is a pity that in this district a larger use of the better Middlesbrough brands is not made. In the finished iron branch the signs of decadence of Staffordshire made iron become yearly more apparent, as there is a considerable falling-off in the quality of much Staffordshire-made iron. On the other hand the Lancashire-made iron is increasing in quantity and improving in quality, which is frequently better than Staffordshire ordinary brands—Walmsley's, of Bolton, pre eminently holds its own—and some of the Warrington iron is, perhaps, as well finished as anything which comes here, though there is a tendency to sacrifice quality to appearance. The use of mild steel, whether in bridge work, for shipbuilding, boiler work, in making tinplates, both coke and charcoal, and for many other purposes, seems to be rapidly extending, and this year a demand for it has sprung up even among the smaller workshops. It may be noted here, that for boiler work the new basic steel seems to be singularly well adapted. Among the chief local events of the year may be chronicled the large amount of constructional ironwork which has been carried on, or commenced in this neighbourhood. The ground has been cleared for the large new Lancashire and Yorkshire Railway Company's station, and a large number of bridges constructed over the approaches. Several loop lines and branches have been added to our already large local railway system. The Mersey tunnel has nearly approached completion. The first sod of the Wirral Railway extension was cut this autumn by the Premier. The Parkgate and Hoylake extension of the Deeside Railway is well under way. An immense number of large warehouses and buildings have been put up at the north end of the town, which have absorbed large quantities of girder work, and it is to be noted that the rolled girders made in the Middlesbrough district are commencing to supplant the inferior Belgian article. The Mersey shipbuilders have been, on the whole, fairly well off for work all through the year, as they commenced with a good supply of contracts, and when their yards began to get bare towards its close, they were fortunate enough to secure further orders, which will keep them fairly well employed for some months ahead. It may be said generally of the year that, although profits have been small and hardly fought for, yet the volume of business has been a very large one, also that credit is good and trade as a rule in a sound condition. It may be added that perhaps the landlord, the mineowner, and the merchant have had a better share of the small profits than the iron manufacturer himself; but after all the persons chiefly benefited by an era of cheapness are "the dim mysterious millions" toiling for dear life all the world over.

LONDON.

The year now closed was about as uneventful in the metal trade as any within recollection. There certainly was a struggle in many branches to invest the markets with something like resuscitation, but the efforts either proved abortive or entirely without effect. The fact undoubtedly is that the fearful collapse of 1882, which was the fruition of over-trading and over-speculation that had been carried on to a prodigious extent, has by no means exhausted its circle of influence. Speculative operations are a necessary, and to some extent a desirable accompaniment to all business prosperity. If merchants and consumers did not anticipate markets, activity would be limited to "hand to mouth" operations—a most ruinous system for our large manufacturing centres. There is no doubt, however, that an excess of speculation invariably leads up to a disastrous climax, such as characterised the early part of 1882, when some of our chief metals, in less than a week, depreciated from 10 per cent. to 25 per cent. in value. Since that time there have been unflagging efforts made to restore confidence in these particular metals, which efforts have succeeded, but to a very limited extent indeed, operators' attention having been directed into other and safer channels. With regard to 1884, after considerable fluctuation in the prices of all classes of metals, we find the year closed pretty well as it begun. Values, generally speaking, are very nearly the same; thus—

	Early part of 1884.	Latter part of 1884.
Pig-iron ..	42s. to 42s. 3d.	42s. 1½d
Copper ..	£54	£52 15s.
Tin	£83 5s. to £83 10s.	£83 to £83 5s.
Tinplates ..	15s.	14s. 9d. to 15s.
Lead (Spanish)	£11 to £11 10s.	£10 17s. 6d. to £11 2s. 6d.
Spelter ..	£14 7s. 6d. to £14 12s. 6d.	£14 2s. 6d. to £14 7s. 6d.

This is rather a remarkable feature, inasmuch as between these two periods prices advanced 2½ to 10 per cent., showing that in spite of endeavours to increase values and inspire confidence, the markets return to their original condition. Throughout the year it cannot be said that business has been inactive, as the exports show a full average, and in some descriptions above the average; but production from the first had so heavily anticipated every possible demand that all chance of benefiting by occasional spurts was removed. This state of things has, on the other hand, prevented buying more than necessary to meet actual orders; consequently we cannot but see that there exists a healthier condition of affairs than would have been the case had the attempt to rig the market been effectual. Then, again, the prevailing low prices and bare profits have tested the strength of manufacturers so far as to weed out many who were selling their heavy stocks without a profit, and even with a loss, for the sake of securing and maintaining connections, to the ruin of legitimate trade. Therefore, although the year 1884 cannot show very satisfactory returns in the shape of profits, neither will it be an incubus upon any improvement that may be awaiting us in the coming year.

NEWCASTLE AND THE TYNE DISTRICT.

The iron industries of this part of the country have just got to the close of one of the worst years ever experienced. Prices of everything, from the crude pig to the finished

steamer, have been on the decline, and are now at the lowest ebb that they can get to without leaving makers in the condition of working at an absolute loss. There is some slight improvement noticeable in the sea-carrying trade, not so much in better freights as in the more general demand for steamers to bring the produce of foreign countries into the midst of our thick European populations. This change affords a gleam of sunshine to the dark cloud that has hung over our iron industries for the last four or five years, and may be the beginning of another prosperous era. Of one sign of improvement we in this remote corner of England are certain; three months ago no less than 104 steamers, having an average deadweight carrying capacity of 2,500 tons each, were laid up idle in the docks and in the open river Tyne; at the turn of the year that number was reduced to a little over fifty, and if the number decreases at the same rate as it has done in the past six months, we may have no idle steamers in our river. It would be nonsense to look for any great increase in the demand for new steamships whilst so many old ones are unemployed; but recent experience points to a coming time of fair if not large profits in the shipping trade, and to an increased demand for new ships, without which all our iron industries will remain stale and flat. The returns of shipbuilding at our north-eastern ports, as elsewhere, will present a sorry contrast to those of former years; at the Tyne and Wear yards the production has been the smallest known for many years, and the destitution amongst the working people who are usually kept employed in the making of ships has been correspondingly great. As we have pointed out, however, the worst seems to have been passed, and a better state of things may be looked for in the new year. The Admiralty contracts for the contemplated strengthening of our naval forces will doubtless benefit this and other shipbuilding communities in some degree; but it is more to the expansion of the carrying trade of the world that we must look for the desired return of prosperity than to any passing anxiety on the part of our government with regard to the efficiency of the navy. In the past four years several new shipyards have been opened on Tyneside in the face of a declining trade, but when once the return of the demand for ships is felt, there is no doubt as to their soon getting a good share of the work that will be created. To go into details would be tedious and unsavoury as far as our shipbuilding trade is concerned. As regards the pig and manufactured iron trades of the district, however, we must face stern facts. Pig-iron at the commencement of 1884 was cheaper than at the close of the year by about 9d. per ton. In January last No. 3 Cleveland pig was bought—delivered to the Tyne after an expense of 2s. 3d. per ton in freight and dues—at 38s. per ton; the figure in November and December was 38s. 9d. to 39s. The fluctuations were so trifling during the year that further reference to them would be uninteresting. In the manufactured iron business we have only seen a gradual decline of prices to the extent of about 10s. or 12s. 6d. per ton. In January last, ship plates were bought in the Tyne at £5 10s. per ton; the price is now £5, and in some cases a fraction less is taken. Angle iron began at £5 5s. in January, and now £4 15s. is the extreme value. Bars have not deteriorated to quite the same extent, for in January £5 7s. 6d. was their price, at Midsummer it was £5 5s., and at Christmas £5 2s. 6d. was the current value per ton. Boiler plates have receded in the twelve months from £6 15s. to £6 2s. 6d. per ton, and until the revival in the shipbuilding business becomes more pronounced there is little chance of the price mending. Looking at three years' export figures for the eleven months ending on November 30 we see ample evidence of decreased trade as far as the Tyne is concerned. They are as follows:—

	Tons of Pig exported.	Bar.	Rail.
1882	109,111	10,185	701
1883	75,521	12,278	1,193
1884	61,198	6,757	476

The contrast of figures is certainly disheartening, but the decline is not greater than might have been looked for. In the subsidiary branches of the iron trade, such as forges, foundries, bolt and rivet works, &c., a corresponding depression has been felt, and it would be wearisome to go into statistics. There are some engine works on Tyneside, however, that have turned out nearly as much good work in 1884 as in any of the former years of the past decade. Sir W. G. Armstrong & Co.'s ordnance, engine, and shipbuilding works have had an uninterrupted time of prosperity, one branch taken with another, this firm alone employing nearly 5,000 men. The engine works of the North-Eastern Railway Company, at Gateshead, have also been well employed during the year, the low rates of raw material and the settled condition of the labour market being all in favour of such powerful companies laying up stock at moderate cost. The coal trade of the north-east coast has not been quite so prosperous as it was in 1883. Exports show a decrease, but not an alarming one. Steam coals, after a steady maintenance of their price at 10s. per ton, with 2½ per cent. discount, fell in the late autumn to 9s. less 2½ to 5 per cent. In the value of gas coals no change took place in the course of the year, the best qualities making 6s. 9d. to 7s. 3d. per ton. Manufacturing sorts also have held their old position as far as prices are concerned. Coke has ranged from 13s. to 15s. per ton, with a declining export business.

NORTHAMPTONSHIRE.

Throughout the year the iron trade of this district has been fairly sustained considering the general quietness which has characterised business in other iron-producing districts. Out of the twenty-six furnaces erected in the district, about fifteen have been kept going during the year with a few variations. The Stowe Works, belonging to Mr. W. McClure, are, so far as the two blast-furnaces go, at a stand. The Cransley Company, who have two out of their three furnaces in blast, are erecting a new one on the most improved principle. It is near completion, and will, it is expected, be ready for work in a short time. Messrs. Butlin & Co. are also erecting an additional furnace. The output of pig-iron in 1883 was 217,183 tons. A large portion of the iron made is sent away by rail. An extensive trade has during the year been done in ironstone, which is put into waggons at the pits at from 2s. to 3s. per ton, and largely sent to Staffordshire, Derbyshire and South Yorkshire. The output during the year has been larger than that of 1883, when 1,290,087 tons were raised, of the value of £172,615. Of this quantity 601,530 tons were used at the district furnaces. At the present time a vast stack of ironstone belonging to the Hunsbury Hill Coal and Iron Company (Limited) has accumulated. A good deal of South Yorkshire coke has of late been forwarded to the district, and has so injured the use of hard coal that the Derbyshire coalowners have recently made an unsuccessful attempt to induce the Midland Railway Company to advance the tonnage rates of coke from South Yorkshire.

NORTH LINCOLNSHIRE.

Although the year just closed has been by no means a brilliant one for iron smelters, still a large output has been secured in this district. The year opened with seventeen out of the twenty erected furnaces in blast, the Frodingham Company having damped one down, whilst Redbourne Hill started two. The output of pig-iron in 1883 was 237,068 tons, including the produce of two furnaces in Leicestershire, whilst ten years before—viz. in 1873—it was only 52,076, in which year the number of furnaces in blast was nine. As the year wore on the number of furnaces at work did not change, there being seventeen in blast at the close of the March and June quarters. In October two furnaces were blown out, one belonging to the Frodingham Iron Company and another to the Appleby Company, causing only fifteen out of the twenty-one to be in blast at the close of the year. Both the firms named have repaired the furnaces blown out, and the latter firm are erecting a new one. The output, therefore, on the whole, has been fairly sustained, and will doubtless compare favourably with the make of the previous year, when about the same number of furnaces were at work, as compared with thirteen in 1881. The tonnage by rail and water has during the year been very fair, a good deal of the pig-iron made being sent to other districts at some distance from North Lincolnshire. The furnaces belonging to the Lincolnshire Iron Smelting Company, which had been idle for a long time, have been taken over by another district firm, and are now at work. The company was established about fourteen years ago, with a capital of £75,000. They hold a lease from Mr. R. Winn, M.P., which entitled them to receive ore delivered at the works at 3s. 6d. per ton of 21 cwt. for a period of twenty-five years, with land on which to erect their furnaces at a nominal rent of £3 per acre, extending over fifty years. In addition to the make of pig-iron, the district is noted for the large tonnage of ore which is raised, and on which now very many other districts have to rely. There are ten or eleven firms still at work raising the ironstone with which the district tracts of land abounds. Amongst other firms, Messrs. Cliffe & Sons, of Leeds, the West Yorkshire Coal and Iron Company, and the Kiverton Park Company may be mentioned. The quantity of ironstone raised goes on increasing year by year, inasmuch as that obtained from the coal measures cannot be got at anything like the price at which some of the district firms can supply it. The quantity raised in 1883 was 1,006,219 tons, of the value of £180,691. The quantity raised ten years ago—viz. in 1873—was 350,281 tons, whilst in 1863 only 69,618 tons were got. In addition to the large tonnage used in the district a large quantity has during the year been sent to the Parkgate Works, West Yorkshire Ironworks, as well as into Derbyshire and other places. Large as is the traffic in iron ore from the district to other places, the quantity of coke and coal obtained from South Yorkshire and Durham is fully as large. Of late years the use of Yorkshire coke has been more largely adopted, the carriage being only from 1s. 10d. to 2s. per ton, whereas that from Durham ranges from 5s. to 6s. per ton. The extension of the trade has led to a vast output of coke in South Yorkshire, where great improvements have been introduced into the manufacture by means of washing and cleansing the coal before it passes into the ovens. The Frodingham Iron Company still manufactures a portion of its own coke at Silkstone Common, near Barnsley, but the bulk of what is consumed at the distant furnaces is supplied by contract.

NORTH STAFFORDSHIRE.

The year opened with promises of being a fairly satisfactory one to makers in all departments of the iron trade in North Staffordshire. Prices were considered to be very good—much in advance, at any rate, of those booked at the commencemont of the previous year. Hopes were therefore entertained of a good year, but these promises were speedily doomed to disappointment, for before the first quarter had got far advanced there was a falling-off, especially in the home trade. The prices at the commencement of the year were nominal, crown bars, £6 5s.; best, £6 15s., delivered at Liverpool. But before the end of the quarter there was a serious falling-off in orders, and the mills which had hitherto been working somewhat regularly, had to be put on short time—a proceeding which was immediately followed by underselling, which, of course, meant a reduction in prices. Underselling has unfortunately been a conspicuous characteristic on the part of a few firms, to a greater or lesser extent during the whole year, and as a consequence the orders booked by them have been executed at comparatively unremunerative prices. At the beginning of April prices generally had dropped fully 5s. per ton, but a further general decline was temporarily stopped by some very good specifications coming in from the colonies, but not of sufficient weight to cause any improvement in prices. The effect of these orders was that the works were enabled to keep on fairly regularly for some time afterwards. Towards the end of July business again became brisker, and the seeming prospect of a plentiful harvest gave some little animation to the home trade, which had hitherto been of a discouraging nature. Warehouse stocks, which had been allowed to become very low, were replenished to a considerable extent, and merchants bought for future delivery on a somewhat extensive scale. This alteration for the better, although bringing with it no tangible alteration in prices, for a time checked a decline, and this continued till the end of September, but during this month matters became quieter, but still the works were enabled to keep their plant running far better than had been the case in many other iron-producing districts. The last month of the year has, however, been a very discouraging time for makers; but this was not altogether unanticipated, as December is always a crucial month in the iron trade, as buyers always withhold all they possibly can till the new year, so as to keep down stocks to the least possible point, and, at the same time, render their liabilities equally small. Taken altogether, the year 1884 has not been one to be remembered with feelings of pleasure by makers, low prices having generally ruled. Neither have buyers been benefited to any extent thereby. The principal decline has appertained to the home market. Prices have now almost touched the lowest level known for many years, and most works are being carried on at a positive loss. For export, there has been a fairly good trade done, particularly with Australia and South America. Russia, who in years past has been one of the best customers this country knew, has practically ceased to specify for any quantities worth mentioning. Turkey also seems to have dropped out of the market. The United States and Canada have sent out orders for some very good lots; but their requirements fell far short of what it has been usual for them to specify during any previous twelve months for some years past. The close of the year finds prices low, crown bars standing at £5 12s. 6d. to £5 17s. 6d., according to brand; best, 10s. extra; plates, £7 to £7 5s. delivered at Liverpool. The pig-iron and ironstone trade has followed the sheet iron trade in its fluctuations during the year. The plate trade is in a most depressed condition, consequent on the competition by Cleveland makers, and also by the steady progress made by steel, the latter having to a great extent superseded iron, and some of the North Staffordshire makers are about putting down plant for the production of steel. There are heavy stocks held by all makers of pig-iron and producers of ironstone at the present time; and most ironmasters affirm that trade generally is carried on either at a loss, or at unremunerative prices. This district has not suffered so much from competition as some districts, especially South Staffordshire and the North of England; and whilst its mills and forges have been kept on more regularly than in those districts, trade disputes have been almost unknown. In the early part of the year there was a slight agitation on the part of mill and forge men for an increase of wages, and the attempt was again renewed in the autumn, but in neither instance did anything come of it. The coal trade has been of a steady character all through the year, but it was a little more animated during the first six months, and better time was made at the collieries. The coal trade generally may be said to have been very uneventful. Both in respect to coal and iron, satisfactory orders have been booked for the new year, which it is expected will open as promising as did the present year, but with, it is hoped, a more substantial improvement.

NORTH WALES.

In looking back over the year 1884, it cannot be said that there have been any great changes in the coal and iron trades. What changes have taken place have certainly been for the better. The year closes with a good demand for coal with the collieries well employed, the prices slightly better, and the men contentedly at work. There have been a few differences between the colliers and their employers during the year, but these, excepting those at the Buckley and Mostyn collieries, have not been of long duration, and with few exceptions the men are now all at work. Although not active, the demand for iron has been sufficiently steady to keep the furnaces going, and the year closes with slightly better prices than it commenced. In this industry there seems to have been perfect agreement between the masters and the men. Lead mining, which has been a very important industry in North Wales and the borders, has been well-nigh annihilated during this year, owing to the almost unprecedented low price of the metal. One important group of mines—Tankerville Consols—has been closed. Another great mine—Snailbeach, which for many years has been one of the largest producers of lead, has been nearly closed, and the stoppage of these mines has caused very great distress in their neighbourhood. Some attempts have been made to galvanise into new life some of the old mines, but these attempts seem to have been more in the interests of speculation than in those of legitimate work. The lesson to be learned from this depression in lead mining is that leases and royalties will have to be fixed upon a more equitable basis between mineral owners and mine adventurers than heretofore. The same remarks are true of copper mining, which has become a nearly extinct industry in the principality. Although not over pressed with orders, the slate trade has been in a condition of steady, healthy activity during the year. There has not been a spirit of enterprise, and no new quarries have been opened. Work has, however, been resumed at one or two quarries where it had been discontinued for some years. The important industries connected with the working of the clays of the coal measures have made great advances. New and extensive works have been erected, and both these and the old works have been, and still are, very busy. The centre of this industry is Ruabon, and it affords the means of subsistence to between 20,000 and 30,000 people. The same village is the centre of the freestone quarrying industry, which during the course of this year has experienced a considerable revival. The more important foundries and engineering establishments have been tolerably well employed, and they have been much engaged in the construction of machinery for

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NOTICES.

Communications on literary subjects and books for review are to be forwarded to the Editor. Anonymous correspondence will be wholly disregarded. The return of rejected MSS. cannot be guaranteed. Correspondents are requested to write on one side of the paper only. Periodicals sent for reference should have the articles marked.

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France.

Messrs. Galignani (Baudry, Jeancourt & Cie.), 224, Rue de Rivoli, Paris.

Mr. Em. Terquem, 15, Boulevard Saint-Martin, Paris.

Germany.

Mr. A. Twietmeyer, Leipzig.

Italy.

Messrs. Ermanno Loescher & Co., Libraj, Rome.

United States.

Messrs. Willmer & Rogers, Beekman Street, New York.

Messrs. Pratt & Co., S.W. Corner, Ninth and Arch Streets, Philadelphia.

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mines worked by British companies abroad. There has also been a beneficial side to the exceedingly low price of lead ore. It has made the smelting works busy, and it has enabled our smelters to maintain their supremacy as the chief exporters of lead to foreign countries and the British colonies. One of these great works is that connected with the new supply of water to the City of Liverpool from the valley of the river Vyrnwy in the Berwyn mountains. There a lake five miles long and nearly a mile wide is being constructed by the erection of a masonry dam across the valley, and the construction of an aqueduct or conduit seventy miles long to Liverpool. In order to construct the dam, an excavation had to be made though drifted matter of the valley down to the solid rock—a depth in places of nearly 90 feet. Blocks of stone up to 12 tons weight are used, and these are quarried near to the work. The masonry is rising up towards the surface of the ground, and in the course of another year will probably be level with the surface all across the valley. From this level the dam will be built 90 feet high. Along the conduit one row of iron pipes 3 feet 6 inches in diameter have been laid for about two-thirds of the distance. It is contemplated ultimately to lay three rows. There are three tunnels, one of which is completed and the other two will probably be finished during the next year. Another great work destined to connect North Wales more closely with Liverpool, is the Mersey tunnel, which as far as the portion under the estuary of the Mersey is concerned is now completed. There are besides the new docks at Connah's Quay, the new docks between Conway and Llandudno, and the extensive alterations at the Bangor station of the London and North-Western Railway. There has been a revival of railway enterprise, and several important lines are in the initiatory stages of progress. With these several public works of great utility in progress, there has been abundant employment for labour; so that, altogether, there is more room for satisfaction and congratulation over the result of the year's trade than there is for complaint.

NORTH-WEST OF ENGLAND.

The progress of the hematite iron trade of the North-West of England during the past year has, perhaps, not been so marked as in previous years, the cause not being far to seek. Inaugurated with a very limited demand, which declined as midsummer was reached, and only showed signs of a revival in the autumn of the year, 1884 may briefly be described as a year in which little trade was done, few developments effected, and limited profits made. There has, however, been considerable steadiness in the output, and the number of furnaces in blast remains about the same as when the year commenced its career. Stocks, however, are smaller than in January last, but this is owing mainly to a considerable delivery during the past few weeks on shipping account. Prices show up to November a decline of something like 2s. 6d. to 5s. per ton on the year, but since November set in an improvement has been established of fully 2s. per ton, prices now standing at 45s. to 46s. for mixed parcels of Bessemer iron net at works, and 44s. to 45s. for forge and foundry samples net at works. These prices are practically as low as it is possible for iron to be produced at, with even a small profit. It is noticeable that some of the ironworks which are most fortunately placed have been able to declare a dividend of 5 to 6 per cent. on their share capital, but this has only been done in cases where ironworks are not connected with steelworks. The profits in the latter department have been nil, and the margin of gain obtained by the ironworks departments has been swallowed up by the cost of the more advanced stage of manufacture. The position now occupied by steelmakers is in many respects unsatisfactory, and throughout the year very little activity has been shown. Some of the works suspended operations for several weeks, while at other establishments the hours of working are very erratic and very irregular. The capacity for producing steel has far outgrown the demand, and the unwelcome fact stares makers in the face that even with a revival in demand the power to meet it is so great as to prevent the realisation of much profit. Possibly this was the reason for the birth of a protective association of steel makers with the view of keeping up prices. This attempt has not, however, been very successful, as the demand has been confined to the wants of users who required deliveries for renewal purposes only, and very few orders for new railways have come to hand. Lately, however, large contracts have been booked, and it is now fairly well understood that after the Christmas holidays there will be regular work for some months in the rail, as well as in merchant departments. It is worthy of remark that there has been of late a very great development of the merchant steel trade of the district, and that one of the chief features of the steel trade of the district is that of mild and hard qualities of steel required for cutlery and other general purposes. This feature has been largely developed, and it is confidently believed it will be one of the leading lines in connection with local Bessemer industry. Shipbuilders have been indifferently employed throughout the year; but at present there are in the hands of builders at Barrow several new orders which are likely to result in the employment of about 2,500 men up to midsummer next. Several large contracts have lately been tendered for; and it is believed local builders will find some of these contracts placed in their hands during January and the early months of the year. Iron ore has been quiet in tone throughout the year, and raisers have continued to hold large stocks in anticipation of an improved demand, which has not yet shown itself. Coal and coke have remained in fair demand at low prices. Shipping has all throughout the year been poorly employed. The general prospect of trade during 1885 is regarded by those best capable of forming an opinion to be much better than our experiences of 1884, and there seems reason to believe the demand on both home and foreign will be alike strengthened, and that prices will be slightly improved.

NOTTINGHAMSHIRE.

The iron trade of this district, although only quiet, has during the year become developed, and is increasing. Last year the output exceeded that of 1883, when 68,740 tons of pig-iron was produced, 202,050 tons of ore used, and 151,454 tons of coal and coke consumed. The output of pig-iron will doubtless increase. The Bestwood Coal and Iron Company, Limited, have worked their two furnaces put into blast in 1882 during the whole year, whilst the Awsworth Iron Company, who have made considerable alteration to their works, have had all their furnaces going. The Stanton Iron Company have also kept a goodly number of furnaces at work. The make of pig-iron has enabled a good tonnage to be despatched to Lancashire, Staffordshire, and other places. The foundries have on the whole perhaps fared better than those in most other districts. Several contracts for railway companies, have been executed in the district, which is noted for railway girders. A very fair quantity of merchant iron has been produced, whilst engineers and machinists have been fairly off for orders. The coal trade, which has been considerably developed of late years, has been fairly active. Like most other districts, the year opened with a demand for an advance of wages at a time when coal realised 1s. per ton less than in the last month of 1883. A ballot of the district was taken, and ultimately the movement collapsed. During the first quarter of the year the weather was mild, yet towards the end of March trade began to improve a little. Most of the collieries being nearer London than the Yorkshire, owners have cultivated a fair business with London, and efforts were during the year made to induce the railway companies to make still further concessions in the rates, but without favourable results. During the month of March fifteen of the leading collieries in the district sent over 80,000 tons of coal to the metropolis. In the month of April fourteen collieries sent 81,000 tons, against 77,500 in April. As the year progressed the house coal trade seems to have held well up, for in July the tonnage was good, whilst in the month of September fifteen collieries supplied 94,500 tons. For the latter part of the year a fair business was done, the Hucknall Colliery in October forwarding 10,800 tons, Linby 13,600 tons, and other firms in proportion. The district collieries have also done a fair business with the Midland counties in both gas and house coal; orders for locomotive coal have been fairly sustained. There has been some difficulty with the sale of small coal and slack during the year, but this will disappear if the manufacture of coke is further developed, as it is said will be the case. The output of 1883 was 531,880 tons, of the value of £1,439,717. In connection with the winning of the coal 11,795 persons were employed below and 3,491 above, or a total of 15,286 persons. With the exception of the agitation for an advance of wages at the beginning of the year, the labour market has been pretty quiet. In May, the Stanton Company gave notice to their workmen of their intention to increase the rents of their workmen 3d. per week, and charge them at the rate of 3s. per ton for coal for house consumption. The friendly relations which the firm enjoy with their workpeople, however, enabled an amicable arrangement to be come to.

SCOTLAND.

The year which has just drawn to a close may be reckoned one of the most unsatisfactory that the Scotch iron trade has ever passed through. The promise at the opening was certainly none of the brightest, but there were hopes that in the spring the depression which had prevailed with more or less intensity from early in 1880 would pass away, and a gradual and sure improvement set in affecting most departments of commerce. These hopes were, however, doomed to disappointment; shipbuilding, one of our staple trades, instead of getting better, grew worse, until some yards had to close altogether, others to go on short time, and others to dismiss most of their workmen. Employment could not be found for the ships already in existence, and it was little use building more whilst ships representing several hundreds of thousands of tonnage were laid up in various docks in the United Kingdom for want of freights. Then though money was cheap there was a lack of enterprise. Produce of almost every description was continually drooping in price, until such staple articles as wheat and sugar reached a lower level than ever known before. Home and foreign producers and dealers everywhere were losing heavily, and consequently could neither afford to go in for improved machinery nor to renew their plant, and the effect of this has been seriously felt in the Scotch manufacturing districts, which so largely supply the world with sugar making machinery, engines, and all kinds of heavy machinery, as well as the raw material for the manufacture of fine castings in the foundries of America, India, and the Continent; and the best evidence of this is the fact that foreign shipments show a falling-off of 96,149 tons when compared with last year, and are 77,034 tons under the average of the past five years, whilst the consumption of pig-iron in the foundries in Scotland is 237,000 tons against 235,000 tons in 1883, but 31,000 tons less than in 1882, which was the year of largest consumption. The manufactured iron trade has been dull and inanimate throughout the whole year, but especially in the last two months, when the Indian and foreign orders got worked off. At the opening of the year, common bars were quoted at £5 12s. 6d., and they may now be bought at £5, whilst the pig-iron consumed in malleable works is only 231,000 tons, against 248,000 in 1883. The growing disposition to build ships of steel instead of iron has had an adverse effect on the Scotch malleable ironworks, though the leading firms are meeting this by adapting their works to the manufacture of steel plates and angles. Several new firms in Scotland have commenced the manufacture of steel, and as such extensive English firms as the Consett Company and Bolckow, Vaughan & Company have also begun to make steel plates, the old-established makers are meeting with a keen competition, and to secure orders prices have been gradually going down, until they are now at an unprofitable figure, and yet the works cannot be kept going full time. The large pipefounders have had a quiet time of it this year, and no contracts of any magnitude have been taken, except recently one for 20,000 tons; delivery, however, is spread over next year. The smaller foundries, making ship, house, and mill castings and odd work, have had a bad time of it, and many of them have not turned out 50 per cent. of the usual amount of work, whilst remunerative prices could not possibly be got. On the whole, the general trade of this country has been suffering great depression—doubtless from a variety of causes, but chiefly, it is probable, from the unfortunate state of affairs abroad. Here money has been scarce, more especially in the latter months, when accounts have been difficult to collect. So far as regards the pig-iron trade (which may be called the commercial barometer of the district), it is seldom that makers and dealers have had more cause for grumbling than this year. The estimated make of pig-iron was 988,000 tons, or 141,000 tons less than last year, and 218,000 tons less than in 1870. The shipments were 516,714 tons, or a falling-off from last year of 102,943 tons, and from 1872 of 324,286 tons. The Scotch iron consumed locally was 468,000 tons against 483,000 tons last year, which was one of moderate consumption. The quantity of iron forwarded per rail into England was 17,286 tons against 27,343 tons last year. During the year the stock in Connal's store has decreased 4,715 tons, and makers' stocks have decreased 9,285 tons, leaving a stock of Scotch pig-iron in Scotland alone of 821,000 tons, which was largely exceeded by the stock held on December 31, 1882, which amounted to 940,000 tons. The fluctuations in the warrant market have been com-

SCOTCH PIG-IRON STATISTICS.

Prepared by MESSRS. BOST & TURNER, 33, *Renfield Street, Glasgow.*

COMPARATIVE STATEMENT FOR THE LAST TWELVE YEARS.

	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.
Annual production ... ... Tons	993,000	806,000	1,050,000	1,103,000	982,000	902,000	932,000	1,049,000	1,176,000	1,126,000	1,129,000	988,000
Foreign shipments ... ... ,,	398,850	296,803	368,453	303,752	274,409	233,908	340,385	440,200	356,115	436,175	419,612	322,863
Coastwise ... ... ,,	214,061	166,104	174,056	166,190	170,654	161,620	200,133	200,848	193,414	184,021	204,045	197,251
Total shipments for the year ... ,,	612,911	462,907	542,509	469,942	445,063	395,528	540,518	641,048	549,529	620,196	623,657	520,114
Consumption in Scotland ... ,,	373,000	317,000	360,000	370,000	335,000	294,000	302,000	384,000	397,000	585,000	483,000	468,000
Forwarded per rail to England, about ... ... ,,	81,000	50,000	73,400	70,000	60,000	38,500	23,500	30,000	28,500	28,800	27,343	17,286
Imports of English pig-iron ... ,,	125,000	200,000	220,000	285,000	353,000	325,000	315,000	335,000	420,000	345,000	432,000	277,509
Stock, December 25 ... ... ,,	120,000	96,000	170,000	363,000	505,000	679,000	745,000	739,000	940,000	836,000	835,000	821,000
Average number of furnaces in blast ...	119	96	117	116	103	90	88	106	116	108	110	95
Furnaces in blast, December 25... ...	122	121	113	116	86	92	100	124	105	112	102	93
Highest price for the year	145/ Feb. 27	109/ Jan. 2	77/ Jan. 6	66/6 Jan. 11	57/10½ Jan. 5	52/4 Feb. 4	68/ Oct. 6	73/3 Jan. 12	53/9 Jan. 4	53/11½ Jan. 9	49/ Jan. 2	44/7½ Jan. 21
Lowest price for the year	101/3 Nov. 28	71/6 April 17	57/6 June 10	55/9 Aug. 25	51/6 Dec. 28	42/3 Nov. 26	40/ July 8	44/5 June 2	45/ May 23	46/8 April 20	42/10 Dec. 27	40/10 June 4
Average price for the year	117/3	87/6	65/9	58/6	54/4	48/5	47/	54/6	49/1½	49/4½	46/9	42/1½
Price, December 31	107/6	76/6	64/6	57/9	51/6	43/6	67/	52/9	51/10	49/	43/	42/3

COMPARATIVE PRICES OF SCOTCH PIG-IRON ON DECEMBER 31, 1877-84.

Brands.	1877.		1878.		1879.		1880.		1881.		1882.		1883.		1884.	
	No. 1.	No. 3.	No. 1.	No. 3.	No. 1.	No. 3.	No. 1.	No. 3.	No. 1.	No. 3.	No. 1.	No. 3.	No. 1.	No. 3.	No. 1.	No. 3.
Coltness ... ... f.a.s. Glasgow	64/6	55/6	50/6	45/6	77/6	67/	63/	53/	62/	54/6	67/6	56/	55/	51/	56/6	51/6
Gartsherrie	59/6	53/6	48/6	45/6	75/	67/	63/	53/	60/	54/	64/	55/	51/	49/	52/6	47/6
Summerlee...	59/	53/	47/6	43/	75/	66/	62/	52/	60/	53/	63/	53/	52/6	48/6	53/	47/
Langloan	62/	54/	51/6	45/6	75/	66/6	63/	53/	63/	55/	67/	56/	54/	50/6	57/	52/
Calder	58/6	51/6	49/6	44/	75/	65/	63/	54/	60/	53/6	63/	52/6	54/	47/6	53/	47/
Govan	53/	51/6	43/6	42/6	68/	64/6	54/	52/	52/6	...	50/	48/6	44/6	43/	43/	41/
Carnbroe	54/6	51/6	45/	44/	77/6	66/	58/	52/6	55/	53/	56/	51/	52/	47/6	49/6	47/
Monkland	53/	50/6	43/6	42/6	68/	64/6	53/	51/	52/6	51/	50/6	48/6	44/6	43/	43/	41/
Chapelhall...	...	...	...	...	...	...	58/	...	...	...	63/	...	...	...	...	...
Clyde	54/	51/6	44/	43/	68/	64/6	53/	51/	53/	51/	53/6	51/	47/9	45/9	47/6	43/6
Quarter-Clyde	53/	50/6	43/6	42/6	68/	64/6	53/	51/	52/6	51/	49/6	48/	43/6	42/6	42/6	40/6
Shotts { Bessemer / Ordinary } f.a.s. Leith ...	68/6	...	60/	...	...	...	72/6	71/	67/6	66/	66/6	65/	...	...	52/6	51/6
	61/	55/6	50/6	46/	75/	67/6	63/	53/6	61/	55/	66/	56/	54/	52/	53/	51/6
Glengarnock ... ... Branded Eglinton. f.a.s. Ardrossan	58/6	53/	47/	44/	77/6	66/	58/	53/6	54/6	53/	55/6	50/	52/	45/6	49/	43/
Eglinton																
Lugar	53/6	50/6	43/	42/	70/	64/	53/	51/	52/6	50/	51/6	49/6	45/6	43/	43/6	40/6
Muirkirk																
Portland																
Dalmellington	53/	51/6	43/6	42/6	69/	64/	52/6	50/6	52/6	51/	51/	50/	48/6	46/6	48/	44/
Kinneil ... ... f.a. Forth	54/	51/	...	47/6	...	...	53/	51/	51/	50/	49/6	...	46/	45/6	45/	44/
Almond	[illegible]	[illegible]	46/6	45/6	70/6	...	55/	53/	53/	...	[illegible]	...	[illegible]	...	[illegible]	[illegible]
Carron { Selected / Ordinary }	70/	...	65/	...	...	...	...	...	...	...	...	...	...	...	...	...
	65/	...	60/	...	67/6	64/	54/6	52/6	52/6	51/	51/6	...	48/6	...	48/6	47/6

PRINCIPAL FLUCTUATIONS IN SPECIAL BRANDS DURING 1884.

Makers' Prices.	January 2.	February 4.	August 7.	October 2.	December 31.
Coltness, No. 1	56/	58/	57/6	60/	56/6
Gartsherrie, do.	50/	53/6	51/6	56/	52/6
Langloan, do.	54/	55/	54/	58/	57/
Calder, do.	53/6	54/	52/	53/6	53/
Shotts, do.	54/6	54/	52/	55/	53/
Summerlee, do.	52/6	53/	51/	54/	53/
Carnbroe, do.	51/6	52/	50/	50/6	49/6
Glengarnock, do.	51/6	52/	49/6	50/	49/
Carron, Selected	56/	53/6	52/6	53/6	53/

paratively unimportant. The opening price on January 2 was 42s. 10½d., and from this it rose to 44s. 7½d. on the 21st, owing to the Middlesbrough ironmasters having agreed to blow out eighteen furnaces, which led to a rush of bear covering, though next day the price was 1s. lower; and by the end of February bad news from Egypt and talk of the iron in store being cinder pig led to renewed selling, and down to 42s. was accepted. During March and April, the price remained steady at 42s. to 43s. per ton; but in May, June and July dull trade and small shipments led to heavy selling by bears, and as low as 40s. 10d. was accepted on June 4. In August the highest price was 41s. 8d., the lowest 41s. 5d. In September, though the prospects of trade were extremely bad, one large firm began to buy secretly all they could lay their hands on; this was continued during October, when, towards the end of it, two outside speculators failed. It was then found that the market was enormously beared, and that one firm practically held all the iron. There was now an eager desire to buy, and on November 10 up to 44s. 4½d. was paid, and at about this price a large number of bear accounts had to be closed. Since then the price has gradually drooped to 41s. 10d., the firm who formerly bought having sold heavily. At the present moment it is difficult to give any idea as to what the future course of prices may be. The good harvest seems to have had no effect, and with depression ruling everywhere, it is hard to see where any improvement can first come from. Like other trades, the coal trade has been dull and miserable all the year through, and prices are now at a low point. The pig-iron makers this year have declined to make their usual returns of production and stocks, so that the above are the estimate of the committee of the Iron Brokers Association. The year closes with warrants at 42s. 3d. cash.

SHEFFIELD.

The correspondent of the *Times* writes:—With the exception of several branches—notably armourplates, railway rolling stock, and one or two of the lighter industries—the year's work in Sheffield has been discouraging. There has not been so much complaint of the volume of work as of the unremunerative prices obtained for it. Though steel rails have been ordered during the year, both rails and ship plates are regarded as lost industries, owing to the cost of carriage from the inland mills to the port of delivery. The prevailing features of the year's trading are faithfully reflected in the share list, which shows a deterioration in local companies of about three-quarters of a million on the twelve months. The condition of the iron market is always a sure indication of general business here. Hematite iron, Nos. 1, 2, and 3, was 55s. per ton in December 1883. It was 53s. 6d. in June 1884, and the price now ruling is 53s. The hematite iron market is rather firmer at the present time. Five or six weeks ago hematites were sold at 52s. to 52s. 6d., but makers will not accept these figures now. At the end of October last prices of this class of iron fell as low as ever known, excepting only when in 1879 they dropped to the same figure, 52s. With regard to the heavy trades there has been a constant demand for armour-plates both on home and foreign account. The two well-known firms, Messrs. John Brown & Co. and Messrs. Charles Cammell & Co., have manufactured plates for nine ships of the British navy, viz. the *Hero*, *Warspite*, and *Rodney*, building at Chatham; the *Anson*, *Howe*, and *Collingwood*, building at Pembroke; the *Camperdown* and *Impérieuse*, building at Portsmouth; and the *Benbow*, which is in the yard of the Thames Iron Company. For the *Impérieuse*, *Warspite*, and *Collingwood* the plates are nearly finished; the *Howe*, *Camperdown*, and *Benbow* are rather more than half done; and the *Hero*, *Anson*, and *Rodney* are well commenced. The announcement by the government of their intention to strengthen the navy by the addition of four first-class ironclads, as well as smaller vessels, means that 12,000 tons of armour will be rolled in Sheffield during the next four years, being at the rate of 1,500 tons per year for each establishment. These orders, however, standing alone, will not equal the weight rolled in the ordinary course of business this year. It is an open question whether Sheffield will continue for many years to retain the entire production of armour-plates on the compound principle. Messrs. Charles Cammell & Co. have entered into an arrangement with the Russian admiralty, by which, at Kolpino, near St. Petersburg, these plates are being produced by Sheffield workmen under the superintendence of Sheffield managers. Mr. George Wilson, the chairman of the company, claims for this arrangement that its effect will be to bring to Sheffield a large amount of work, spread over a lengthened period; but it is highly probable that at the expiration

of this period the Russians will produce their own armour-plates. By another arrangement with Messrs. Cammell, France is making compound armour, and Italy, much to the disappointment of local firms, has adopted the all-steel plates of Messrs. Schneider & Co., of Creusot. Denmark has had plates for the *Ivar Hoitfeldt* made in Sheffield, and further orders are expected next year. Brazil has ordered armour for the sister ship to the *Riachuelo*. During the year Germany has supplied considerable armour to Chinese warships, as German makers also produce armour. In the gun department there has been considerable uneasiness during the year. It was stated that the authorities at Woolwich Arsenal contemplated entering vigorously into the production of heavy steel castings and gun forgings, but towards the close of the year it was definitely announced that this idea had been abandoned. Speaking generally, trade cannot be said to have been very brisk, but there are evidences that 1885 will bring more work. Several leading local companies are increasing their productive powers, and although they state they have never yet failed to produce any piece of steel ordered by the government, they are nevertheless improving their facilities for the production of heavy ordnance. The engineering firms have been fairly well employed, and one of the leading establishments has at present an important order from the Spanish government for plant and machinery to produce heavy ordnance in Spain, where iron and steel works are already established. The steel trade has been ingularly dull during the year, as regards both crucible and Bessemer qualities. Prices may be roughly stated at about 10 per cent. lower than at the corresponding period of last year. The foreign markets have been exceptionally depressed. In January 1882 the value of steel exported was £175,635. In January 1883 the value fell to £117,069; and in January 1884 to £98,641. The United States, the chief customer for unwrought steel, shows the heaviest decline. For November 1884 (the latest return obtainable) the value of steel exported was £86,446, while we imported £11,450, chiefly in the form of Swedish Bessemer. In steel rails the values exported in January 1882-3-4 were, respectively, £377,249, £415,102, and £213,202, while in November last year the value had fallen to £193,512, or £20,000 less than in the opening month of the year. In this department the details as to destination are somewhat curious. Italy, in November 1882, took a value of £59,433; in November 1883, £10,450; and last month, only £517. Mexico, for similar periods, had values of £20,767, £12,365, and £7; Brazil, £29,308, £32,841, and £8,471; British North America, £15,504, £32,357, and £11,240; British possessions in South Africa, £28,381, £21,302, and last month nil. Several countries which have had no rails for some time are again our customers, Chili to the extent of £3,067; Egypt, £1,028; while Peru's purchases have increased from £328 to £2,753, and those of Australia from £52,736 to £56,366. In hardware and cutlery the values for the three periods mentioned were £324,586, £341,962, and £283,446. In November 1884 the value exported was £247,930, being £35,000 less than in the opening month of the year. Comparing November 1883 with 1884, Germany is the only market showing improvement. The principal decreasing markets are the United States, Spain, Brazil, the Argentine Republic, British North America, British Possessions in South Africa, British East Indies, and the Australian colonies. A noticeable feature of the year has been the extraordinary demand for razors. So great has been the call that at the end of 1884 this firm expects to be just able to clear out their orders for 1883. Bombay and Calcutta have been very heavy markets for razors. Their manufacture has been seriously retarded by the dry summer. A large number of Messrs. Rodgers' workmen are grinders who labour at little wheels in the suburbs. The blades are ground by water, and the supply is dependent on the rainfall. These men will not leave their rural homes, where they combine small farming with cutlery grinding, and the effect is that the orders cannot be completed for want of a sufficiency of ground blades. American competition in razors as well as in high-class cutlery has been a comparative failure. A considerable number of German razors are sent to America to be finished, and are sold as American productions. The depressed condition of the cutlery trade with the States has been mainly caused by the tumult of the presidential election, and now that it is over there is still a lack of confidence, owing to the uncertainty as regards the tariff. It is not, however, expected that any material alteration will be made in the fiscal arrangements, and, as stocks are very low, storekeepers having recently been ordering from hand to mouth, a largely increased business is expected in the new year. The returns of Sheffield trading with the States for 1884, when completed, will show a serious falling off as compared with those for 1883. The Canadian trade has also been excessively dull, while continental business has been fairly brisk. South African trade has been in a state of collapse, and no improvement is anticipated until the present political disquiet is over. As yet the Franco-Chinese difficulty in Tonquin has not affected Sheffield trade; but it is feared that in the new year advices from Shanghai, which is an excellent market for the productions of this district, will fall away very seriously unless the Franco-Chinese quarrel come to an end. The Australian market has been affected by the drought, which has wrought such havoc amongst the sheep. Whole flocks have been decimated, with the result that large orders for sheep shears, spoons, and various kinds of cutlery have been countermanded. Very little business has been doing with Egypt. The Cairo and Alexandrian merchants, to whom Sheffield goods are consigned in London, have ordered very sparingly. There will be no resumption of business in the Soudan and the interior until a more settled state of affairs prevails. The goods usually taken for these markets are small table knives, cheap plated goods, scissors, and pocket knives. Ivory, which had been locked up for a considerable time, is now coming in more freely from the interior, and the best qualities are making £52 to £56 per cwt., and lower sorts 30s. to 40s. less. Ten million tons of coal have been carried to the London district during the eleven months of the year from January 1 to November 30. Of this 6,200,000 tons have been brought by railway and 3,800,000 tons by sea. The railway carried coal, as compared with the corresponding eleven months of 1883, is less by 210,000 tons, while the seaborne coal has increased by 160,000, the net decrease being thus 50,000 tons. The average price of best silkstone delivered in London during the year has been 21s. 7d., which is less by 1s. 3d. per ton than the realised value in the previous year. Although the coal brought to London by railway has fallen off to the extent of 210,000 tons, Messrs. Newton, Chambers & Co., of the Thorncliffe Collieries, have increased their tonnage by 9,543 tons, having sent to London more than any other colliery in the kingdom—to wit, 249,202 tons. In consequence of the depression in the carriage trade freights by sea have been excessively low, while the inland coalowners have still had to bear the heavy rates imposed by the railway companies. The cost of carriage by sea from the Tyne is less than half the cost from Yorkshire by rail. The mild winters, the warm summer, and the dry weather which prevailed in the autumn are the chief causes of the general falling off in the railway-borne coal, which is chiefly house coal, that brought by sea being to a great extent coal used for gas and steam purposes. The Yorkshire coalowners find that their silkstone coal is being more largely used for household purposes where Wallsend formerly was preferred. Investors in collieries will be much disappointed by the result of business done during 1884, as competition has been keen and prices all round very low. There has been remarkable freedom from disputes with the colliers about wages. The coalowners state that this has not been because reductions were not warranted, but chiefly owing to a hope, which earlier in the year seemed to be justified, that as the season progressed an improvement in trade would take place.

SOUTH STAFFORDSHIRE.

South Staffordshire has sympathised with the other iron and steelmaking centres in experiencing what some would term depressed trade during 1884. There have been seasons of improvement for a short while together, but these have proved to be merely spurts, and the long-looked-for revival is still delayed. Prices have been low all the year, but there have been no large fluctuations. In the finished iron branch most business has been done by the sheetmakers. The output of this description of iron is every year becoming larger and larger, particularly of sheets for galvanising and merchant purposes. The best index of the course of the market is to be found in the conditions which prevailed at the dates of the several quarterly gatherings. At the January meeting the highest quotations for bars were those from the Round Oak Works of the Earl of Dudley, £8 2s. 6d. being his lordship's price. B.B H. and similar makes were announced as £7 10s. A very good bar was, however, procurable at £7. Medium sorts ranged from that figure down to £6 5s., while common qualities were to be had at from £6 2s. 6d. to £6. Plates rolled by the "list" iron houses were understood to stand at £9 nominal. Sheets (singles) for galvanising were £7 5s. and upwards at works, and doubles were £8 2s. 6d. to £8 5s. Hoops were £6 7s. 6d. and on. The demand was very slow, and makers complained of being unable to obtain specifications for orders which were then upon the books. Sheets were, in leading values, very cheap, as in many cases, compelled to refuse the orders. In March a determined effort was made to formally bring about a restriction in the production of sheets, but the attempt was unsuccessful, and at the April quarterly meetings prices for ordinary merchant qualities had got down to £7 for singles, and galvanising doubles had fallen to £7 10s., with £8 10s. for lattens. Marked bars, sheets, and plates remained without alteration, but second class bars had fallen to £6 15s. and £6 10s., and common bars to £6 5s. and £5 17s. 6d. Transactions for finished iron, all round, remained very limited. When the July quarterly meetings arrived, the colliers had been out on strike for a fortnight against a drop in wages, but this circumstance had no strengthening effect upon the market, and prices were generally from 2s. 6d. to 5s. per ton lower than at previous quarter-day. Common sheets (singles) might have been bought as low as £6 15s., and unmarked bars were freely offered at £5 15s. Transactions were reported at even lower prices. Nominal quotations for best bars were upheld on the basis of £7 10s., but it was notorious that many firms were taking from 10s. to 20s. less for good shipping orders. Throughout pretty much the whole of this, the third quarter of the year, the colliers' strike continued, and it was not until after the October quarterly meetings that it terminated in favour of the masters. At those gatherings the best reports were brought in by the sheet makers, who quoted an advance of from 2s. 6d. to 5s. per ton compared with the previous three months. Doubles were £7 7s. 6d. to £7 12s. 6d., and trebles £8 7s. 6d. to £8 12s. 6d. Other prices were not, however, stronger, still they were certainly not weaker than three months previously. Thin sheets for working up and stamping purposes were £11 and £13 per ton, according to brand. Since the October meetings prices have very generally declined again. The improvement which some makers had looked for during the last quarter of 1884 has not appeared, and the year is closing up very quietly, with not bright prospects for 1885. Throughout the year competition from iron and steel masters in Lancashire, North of England, and Wales has been keen, and the former have been sending some descriptions of iron, such as plates and angles and bars, into South Staffordshire at 20s. below native rates. The native pig-iron trade has been depressed all the twelvemonth. All-mines have suffered severely from the competition of hematites imported from distant districts, and second and third class qualities have been assiduusly competed with by imports from other parts of the Midlands. The year opened with quotations at:—Hot blast all mines, 60s.; cold blast, 80s.; medium qualities, 47s. 6d.; and cinder pigs, 40s. Prices have now got down to 57s. 6d. and 55s. for hot blast all mines, 42s. for part mines, and 37s. 6d. to 35s. for cinder pigs.

SOUTH WALES.

The year 1884 opened under conditions of a desponding character. In the previous autumn the iron and steel trades had been gradually evincing signs of serious depression, but with the dawn of the new year hopes were entertained that the depression was temporary only, and that before makers were absolutely in want of orders, an improvement would have set in. How those hopes were belied is but too well known. Suffice it to say that the gloom grew deeper month by month, but signs tend to the belief that the darkest hour is now being experienced, and daylight not far off. In this district quotations for all-mine pigs, net at works, on January 1, were 50s. to 55s.; March 1, 45s. to 47s. 6d.; June 1, 47s. 6d. to 52s. 6d.; and November 1, 40s. to 45s., giving an average of 42s. 6d. Manufactured iron averaged, for merchant bars, £5 2s. 6d.; coke bars, £5 3s.; and steel bars, £5 17s. The shipments of iron during the eleven months ending November 30 were—Cardiff, 77,083 tons; and Newport, 102,858 tons, as against 95,453 tons and 179,566 tons respectively in the like period of 1883. In the steel trade, more particularly the rail departments, very little was doing throughout the year. At nearly all works short time had to be resorted to in lieu of reduction of wages, and at some a complete cessation of work took place, but there were some happy exceptions to the general rule, in the case of works in which attention was turned to the production of Bessemer steel for tinplate manufacture, in the Swansea and Monmouthshire districts, and at the Siemens works, Landore, where a certain amount of activity was maintained with regularity, in the turn-out of steel plates, bars and angles for the construction of the Forth Bridge, and ship plates for the British and Italian governments. It is somewhat remarkable, and an indication of faith in a brighter future, that under the condition of affairs prevailing, the conversion of existing ironworks to the making of steel was carried on steadily, noticeably so in the case of Cyfarthfa, where the erection of most extensive plant was completed, and a vast store of pig-iron amassed for future use. At Dowlais also a well-defined plan, with the aim of placing it at the head of the great steel-producing works of the kingdom, was begun, which, when completed, will add another to the list of first-class steelworks in this district. The iron ore trade was extremely depressed throughout the year. The quantity imported at the three principal ports in the eleven months were less by 378,000 tons than in the same period of 1883, Cardiff importing only 449,000 tons, against 610,000 tons; Newport, 585,000 tons, against 678,000 tons; and Swansea, 87,000 tons, against 100,000 tons. In briefly reviewing the tinplate trade, it may be safely stated that on the whole the past year has been a satisfactory, if not prosperous one. During the first half, ordinary cokes averaged 15s. 6d. per box, and the total exports of the kingdom were at the rate of 500,000 boxes per annum in excess of 1883. Makers generally in this district then booked orders which kept their works going with great regularity. A noticeable feature was the increased exports to foreign countries, other than the United States, the large extra production entailed by the restarting of old works, combined with an abnormal decrease in the American demand in the latter portion of the year, caused a sharp drop in prices to 14s. per box for ordinary cokes, and in other descriptions of plates in proportion. At the figure, however, for forward delivery, makers declined business. The direct shipments of plates from this district rapidly increased during the year. In the eleven months the exports from Swansea to North America and other countries reached 62,113 tons, compared with 39,057 tons in 1883, an increase of nearly 60 per cent. The exports of coal to foreign ports, although below expectations, were still unprecedented in the aggregate totals. The shipments for the eleven months were—Cardiff, 6,523,300 tons; Newport, 1,569,900 tons; and Swansea, 890,662 tons. These figures give, in the case of Cardiff, an increase of 5 per cent., Newport 8 per cent., but no increase at Swansea. Prices throughout were remarkably steady at from 10s. to 11s. per ton for first-class steam coal, and but few strikes took place, wages being regulated by the sliding scales. The patent fuel trade, although showing a slight decrease in the latter portion of the year, was, on the whole, in a healthy condition. The exports in the eleven months were:—Swansea, 300,000 tons, and Cardiff, 162,581 tons; total, 462,581 tons, a decrease on 1883 of 21,000 tons. The importations of pitwood were considerably in excess of requirements, stocks at times rapidly accumulated, and the trade throughout the year displayed extreme sluggishness. In January, prices averaged 20s. 6d. per ton, but gradually fell to 17s. 6d. in the latter portion of the year.

SOUTH YORKSHIRE.

So far as the iron trade of this district is concerned, the year has been a very quiet one. The make of pig-iron has been greatly diminished by the stoppage of all the furnaces at Elsecar and Milton, so long worked by Mr. George Dawes. The works at Milton have been totally dismantled, and those at Elsecar have been almost entirely laid idle, and will probably be closed when the lease expires. The year opened with twenty-four out of forty-nine furnaces in Yorkshire in blast, and closes with twenty-one at work, being three less than at the close of the half-year. The make of pig-iron in the West Riding in 1883 was 304,381 tons, involving the use of 805,349 tons of ore and 78,891 tons of coal and coke. At the present time the Parkgate Company are erecting a new furnace, having in the quarter ending September blown one out. Throughout the year the Yorkshire Steel and Ironworks at Penistone have done a good business in Bessemer steel rails and tires, having during the early part of the year put down some very large machinery and other appliances, which enables them to turn out a large tonnage of steel weekly. In the last month of the year the Dearne and Dove Steelworks, belonging to a limited company, were opened at Worsborough Bridge. The company, who has a nominal capital of £10,000, has taken over the works of the Worsborough Foundry Company, and have put up two Bessemer furnaces and appliances for producing general castings. The works at Thorncliffe have had a long period of pros-

perity. Not only have the furnaces been kept fully going, but the make of castings and apparatus for gas and water companies has been active. The local foundries have not experienced much prosperity, having had to depend for the most part on repairs and local alterations in works and collieries. The coal trade, for which the district is chiefly noted, has been fairly active, but not remunerative. Competition, not only in London, but also in other markets, has been keen, and prices therefore have ruled low. The usual agitation for an advance of wages set in early, but collapsed, the trade during the early part of the year being very quiet, about 25 per cent. less coal being sent to the metropolis in the first month of the year than was supplied in the last month of 1883. The total for the eleven months was 6,193,375 tons, against 6,405,110 in the corresponding period of last year. The steam coal trade on the whole has been very fair. The Yorkshire collieries have done a good business with Hull and the Humber ports, where the quality of the thick seam coal is well known. Whilst there was a falling-off for the past eleven months of no less than 6,920 tons only, 188,896 tons having been sent against 115,816 tons last year, the collieries connected with the South Yorkshire Steam Coal Owners' Association had an increase. The thirteen collieries which form the federation sent 16,848 tons of coal to Hull in November against 13,360 tons last year, being an increase of 34,888 tons, whilst in the eleven months the same pits supplied 245,380 tons as compared with 231,024 tons in the same period of 1883. There has on the whole been about an average business done in gas coal. Contracts have been pretty freely placed, but prices are no higher than last year. The various railway companies which usually take a large tonnage of Yorkshire locomotive coal held out for lower rates, so that contracts have for the most part been renewed on last year's terms. Scarcely an average tonnage of slack and small coal has been sent to Lancashire, where the consumption of engine fuel is large. The coke trade has been a fairly average one, and although about the month of March a few ovens were damped down, business on the whole has been fairly active. The contracts for the new year are, however, likely to be entered on at slightly reduced rates. The output of the district continues to be unusually large, Barrow Golliery Company having fully 200 ovens at work although their collieries have been virtually laid idle since the latter end of September. The closing year has not witnessed any great struggle between capital and labour, or any violent explosion, but prices of coal have rendered profits very small, whilst the new Yorkshire valuation greatly increased some of the collieries. No violent changes such as marked several previous years have taken place in connection with the trade, but colliery property has not improved. The Hoyland Silkstone Collieries, which were in the hands of an official liquidator, were offered for sale in September. Although valued at from £30,000 to £35,000, only £12,000 was bid, and they were withdrawn, £20,000 being named as the reserve. It is to be regretted that the dispute at the Barrow collieries, which has been in existence since September 24, is not settled. The men have lost in wages alone fully £1,000 per week. The Yorkshire Miners' Association has during the year formed political agencies, and have held meetings in connection with the franchise and the movement for a redistribution of seats, with a view, it is said, of securing a labour candidate. On the other hand, the [illegible] Miners' Permanent Relief Fund has done a good work, and has secured a grant of £1,500 from the surplus of the Oaks Colliery Explosion Fund; the interest on the surplus capital of the fund will not only meet all the claims, but enable the committee to save something like £500 a year.

CLEVELAND PIG-IRON SHIPMENTS.

WEEKLY SHIPMENTS.

Week ending	1884. Tons.	1883. Tons.	1882. Tons.	1881. Tons.	1880. Tons.
Jan. 5..	12,133	15,907	14,992	12,231	14,347
12..	15,447	12,106	18,128	13,454	21,712
19..	13,311	13,775	16,125	10,246	19,384
26..	13,164	9,600	18,648	6,890	15,315
Feb. 2..	8,763	9,804	14,990	9,761	11,988
9..	20,978	11,135	15,591	15,035	18,082
16..	15,034	11,557	14,929	14,681	15,725
23..	12,470	14,582	16,941	16,116	21,055
Mar. 1..	19,263	19,853	25,669	19,135	28,546
8..	17,068	13,288	21,245	13,474	14,322
15..	18,375	15,897	19,400	17,464	18,295
22..	22,896	19,325	15,433	19,370	24,241
29..	17,317	17,945	19,850	20,498	12,138
April 5..	19,316	19,571	17,530	13,154	22,145
12..	16,549	21,990	14,934	19,390	18,835
19..	16,120	23,404	16,406	19,221	17,111
26..	17,160	16,645	16,286	22,946	20,878
May 3..	22,439	18,816	14,000	15,537	20,509
10..	14,113	18,143	16,841	15,395	19,239
17..	19,769	16,454	17,609	16,480	16,471
24..	19,408	23,298	16,801	21,426	21,648
31..	26,434	20,284	8,943	17,568	22,400
June 7..	15,403	29,797	17,678	19,796	18,368
14..	22,428	20,156	15,596	21,834	17,078
21..	16,498	18,047	15,715	21,827	15,312
28..	18,572	20,395	20,803	22,802	24,117
July 5..	23,736	17,390	18,473	15,265	18,613
12..	14,957	29,955	12,349	21,159	19,190
19..	16,296	14,117	14,218	22,046	17,362
26..	16,430	15,568	18,477	21,529	17,135
Aug. 2..	14,024	18,440	22,361	20,983	15,734
9..	18,738	14,163	21,199	15,982	17,651
16..	16,916	22,560	20,002	17,980	18,387
23..	19,716	21,941	18,864	21,923	14,067
30..	10,963	16,495	20,536	15,027	20,699
Sept. 6..	23,329	22,957	26,000	22,364	15,375
13..	16,342	23,143	25,491	16,866	14,472
20..	22,021	22,826	17,555	17,218	19,165
27..	20,555	21,983	27,395	19,903	19,657
Oct. 4..	19,134	22,635	26,079	26,941	15,922
11..	18,755	29,686	20,143	21,755	20,884
18..	23,033	21,912	24,357	13,358	27,593
25..	17,035	23,631	24,823	12,106	17,055
Nov. 1..	18,065	23,903	16,308	24,052	15,610
8..	16,615	31,549	15,211	19,741	20,617
15..	28,993	24,678	10,829	21,383	17,649
22..	13,010	18,842	18,120	17,887	16,219
29..	14,936	18,442	16,783	18,646	15,676
Dec. 6..	16,660	12,360	12,470	20,423	22,862
13..	11,741	18,640	13,423	17,639	21,635
20..	15,176	13,930	15,366	14,525	14,599
27..	15,557	14,932	10,934	10,265	11,855
Totals ..	*903,161	*988,432	*923,849	*922,727	*954,804

MONTHLY SHIPMENTS.

Month ending	1884. Tons.	1883. Tons.	1882. Tons.	1881. Tons.	1880. Tons.
Jan. 31 ..	62,043	56,841	71,458	47,890	78,941
Feb. 29 ..	69,860	53,828	66,893	58,370	71,573
Mar. 31 ..	80,865	75,295	89,837	81,609	84,375
April 30 ..	78,287	88,050	68,909	78,894	88,018
May 31 ..	92,750	87,786	71,405	75,729	81,829
June 30 ..	80,116	94,154	68,373	91,577	82,186
July 31 ..	71,817	85,217	74,311	87,580	82,306
Aug. 31 ..	71,815	88,485	95,861	84,901	72,665
Sept. 30 ..	89,751	94,367	100,838	78,897	78,928
Oct. 31 ..	86,336	99,200	98,956	84,472	86,050
Nov. 30 ..	74,651	101,114	67,298	86,935	75,325
Dec. 31 ..	69,202	68,418	57,134	74,567	78,185
Total ..	927,493	992,815	931,273	931,421	960,381

SCOTCH PIG-IRON SHIPMENTS.

WEEKLY SHIPMENTS.

Week ending	1884. Tons.	1883. Tons.	1882. Tons.	1881. Tons.	1880. Tons.
Jan. 5	5,190	7,409	3,389	6,182	6,689
12	9,295	8,396	5,767	6,677	12,288
19	9,229	8,051	7,742	4,608	7,566
26	6,819	8,788	8,041	8,906	13,383
Feb. 2	9,079	8,894	12,236	7,226	14,190
9	8,900	12,530	10,786	10,072	10,617
16	9,010	8,887	10,933	7,405	15,152
23	10,084	11,614	10,739	11,266	12,603
Mar. 1	7,974	10,217	12,600	9,900	17,968
8	10,686	10,552	13,287	8,261	23,985
15	12,238	11,876	17,544	7,893	20,987
22	11,575	12,421	12,375	12,262	23,507
29	10,990	8,500	10,107	10,421	15,822
April 5	11,457	12,328	12,662	10,649	18,309
12	12,981	14,431	11,694	13,736	15,794
19	9,403	14,945	14,170	11,492	16,279
26	12,204	11,019	18,056	13,147	17,749
May 3	15,233	13,198	11,387	9,461	14,799
10	11,925	16,296	14,982	10,568	13,123
17	8,939	13,141	12,122	9,532	11,036
24	16,240	14,130	9,760	11,943	12,819
31	12,107	11,609	9,867	14,509	13,198
June 7	10,086	14,713	14,270	12,331	11,660
14	11,151	13,255	15,308	13,537	9,507
21	12,731	14,347	10,147	10,977	11,514
28	8,133	13,273	15,324	13,095	12,527
July 5	14 612	12,398	10,474	13,825	10,158
12	10,199	12,441	13,136	11,118	10,478
19	8,706	13,843	13,763	12,805	10,815
26	10,315	14,058	13,116	9,285	10,015
Aug. 2	9 544	13,722	13,579	12,669	12,200
9	9,727	14,054	13,258	11,336	14,252
16	11,484	14,884	14,083	10,965	15,877
23	9,320	17,009	13,151	11,239	13,530
30	9,539	15,683	16,076	13,795	15,522
Sept. 6	12,978	12,894	10,629	14,812	12,546
13	13,167	10,311	10,902	14,449	10,788
20	11,021	14,338	12,933	12,841	8,072
27	9,242	13,238	15,023	16,434	11,725
Oct. 4	9,655	12,023	12,495	11,102	10,955
11	11,661	11,787	14,199	8,708	11,196
18	10,245	16,440	13,058	12,451	9,905
25	10,806	12,758	12,116	11,981	7,556
Nov. 1	8,949	12,167	10,792	11,333	12,430
8	6,783	7,574	12,199	12,890	10,550
15	6,678	12,107	11,316	11,153	7,051
22	6,935	9,617	11,781	7,131	8,062
29	6,540	9,268	12,221	8,161	9,452
Dec. 6	4,822	8,274	7,145	9,191	9,049
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	5,815	7,171	9,706	9,359	10,228
Totals	528,236	620,907	618,171	561,660	650,909

THE ENGINEERING TRADES IN 1884.

WE take the following particulars respecting the engineering trades from the half-yearly report published by Messrs. Matheson & Grant, 32, Walbrook, E.C. They state that bridges, roofs, and structural ironwork have not been so cheap for many years as they are at present, from £12 to £15 per ton embracing most of the prices for structures of ordinary kind, anything dearer than these rates being for complicated or light structures. This cheapness is caused partly by the low cost of material, partly also by the economies in manufacture which modern machinery allows, and also by the pressure of competition. At home there is a constant and considerable flow of work from the railway companies for widenings and station extensions, the demands for these purposes going far to compensate for the absence of new railways. There is no branch of the engineering trade more dependent than this on export orders. India and Australia are the principal purchasers at present, and the demands from these countries are likely to increase rather than diminish. Several new factories are being established.

Mechanical engineers have, with few exceptions, been fairly well employed during the year, but during the last few months there has been a considerable falling-off, and the immediate prospects are not favourable. Any general improvement in trade would, however, benefit manufacturing engineers immediately, as there is hardly any kind of new enterprise which does not need their services. As all branches of the sugar trade continue dull, those engineers who work for them, share the depression. There is a growing demand for refrigerating and ventilating apparatus of all kinds. The exhibition just opened at New Orleans will bring together an unprecedented collection of machinery for the treatment and manufacture of cotton. Ironfounders throughout the country are ill-employed, the competition is keener than ever, and prices are very low. Locomotive builders continue busy, but the keen competition and low prices at which new contracts are taken, indicate a want of faith in the prospects of the coming year. Very considerable orders have been given out and more are expected from India, Australia and South America, but another large factory has been established in Scotland, railway workshops are increasing, and any reduction of the demand would produce the same depression which marked this branch of trade in 1877–9. Agricultural engineers feel severely the continued depression of the farming interest, and, notwithstanding the abundant harvests, the low price of wheat affords no margin for outlay in the purchase of new machinery and implements. Not only at home, but in the colonies and foreign countries which look to England for their machinery, a forced retrenchment has reduced greatly the usual demands. Those manufacturing firms suffer least who are not dependent entirely on agriculturists, but who make steam engines and machinery for contractors and other purposes. At the Smithfield Club annual cattle show, just held in London, there was the usual display of machinery, but, except trifling alterations in detail, there are no novelties or improvements to record.

Railways and other public works on which the engineering trades so much depend are not at present very active in this country. No new railways of magnitude are projected, and there is a truce between the great companies whose rivalries have in the past given so much employment to engineers. The number of private bills deposited for the coming session of Parliament is much less than that of last year, and the prospects of those who assist in the preliminary work of new lines are correspondingly dull. Most of the companies seek powers for extensions and widenings, and these, with similar undertakings already sanctioned, will afford much work for contractors. In London, the old scheme of an underground line from Euston to Charing Cross is likely to be authorised, and further development of the Metropolitan system will probably be carried out during the next few years. The completion of the Inner Circle Railway and its connection by Whitechapel and the East London Railway through the Thames Tunnel opens out an important link with the southern lines. The large new Barry Dock works at Cardiff are going on; the improvements of the River Ribble at Preston are also commenced; the Tilbury Docks approach completion, and the promoters of the Manchester Ship Canal are determined to again seek powers for their great project. Hydraulic transmission and distribution of power which have hitherto found their chief development at docks, railway stations and steelworks, have been extended in a notable manner during the past year. From one central pumping station in London many miles of hydraulic main pipes have been laid under the paving of the principal streets of the City and Westminster. By means of the pumping engines and accumulators at the central station a pressure equal to about 700 lb. to the inch is maintained in the pipes, this great force allowing cranes, elevators and other machinery to be worked in warehouses and factories with mechanism occupying little space, without the risk and trouble which steam or other motors involve. The high-pressure water can also be applied instantaneously in combination with the ordinary municipal supply to eject water for fire extinction with a force greater than that of a steam fire engine. Compressed air, which is so useful in mines and for special purposes, is not adapted for cheap and general distribution, and schemes at present projected for so using it will probably fail.

Messrs. Matheson & Grant conclude their valuable report by stating that, although much of the trade of the in a sound [illegible] and manufacturers were never better equipped than now for a revival when it comes. But with every revival in trade, the producing power of the country is increased, and greater therefore is the void when the next depression comes. While England is rapidly losing the custom of those countries which have manufacturing facilities of their own, it is satisfactory to know that only in a few countries like Belgium and Germany is the loss due to direct competition, and that where the prohibition is due to protective tariffs, the latter entirely prevent competition with us in the non-manufacturing countries open to all. In these the field is vast enough for many years to come. Spain is about to grant us the most favoured nation tariff. In India the construction of strategical railways in the north-west, which has been going on for the last ten years, will be followed by extensions in other directions, and the aggregate mileage of the empire will for mere renewals afford much employment to makers of railway material here. In the Australian colonies large sums have been voted for public works, and the attempt to manufacture material instead of importing it, rests at present on too unsubstantial a basis to cause much apprehension here. In Canada the approaching completion of the trans-continental line will develop subsidiary railways and other works on the Pacific coast; in South Africa, when the present war troubles are settled, there are certain to be important extensions westward and northward, with outlet to the east coast at Delagoa Bay. In the Argentine Republic the success of the railways is inducing the investment of much additional capital, and the completion of the trans-Andean line to Chili is likely to be accomplished. Brazil has need for railways beyond her present means, but the delay is only temporary; in Mexico the Northern lines recently constructed have exhausted all the available credit, but progress will soon recommence, and as the attempts of the United States to obtain a preferential customs tariff against this country have not succeeded, most of the railway material is likely to be made here. The Panama Canal, when finished, will revolutionise Central America in the interests of civilised progress. In China there are significant signs that the country is about to be opened to European improvements, and that the telegraphs already successfully established will be followed by railways ere long.

THE CONTINENTAL IRON TRADE.

We stated in our review of the iron trade of the Continent in 1883 that the cycle of depression which commenced in that year would not be of short duration,

* The totals of the weekly shipments differ from those of the monthly shipments in consequence of the former, which are got from the custom house, being only approximately correct. The latter may be relied on as correct, being obtained from the ironmasters' returns.

and we are sorry to own that our prediction has proved only too true. The year which has just come to an end has been bad, although the effects of bad trade have not been so severely felt, because, unlike its predecessor, which came close upon comparatively prosperous times, people had become somewhat used to the precarious nature of business. The causes of the depression, which has now continued through two years and over, are still the same. As our German correspondent observes, "Works are endeavouring, by adopting the most recent improvements in the manufacture of iron, and by producing in large quantities, to reduce the first cost to a minimum. But there is at present an absence of the power of purchase for this forced production, and prices finally reach a level at which small manufacturers find it impossible to compete." What is true of Germany is equally true of other countries. It is this excessive production which leads to keenest competition, and which finally beggars the manufacturer and starves the workman. The fact that the demand in 1884 has kept pretty well on a par with that of 1883, and in some branches has been even better, proves our assertion that the origin of the depression is still the same; and it is only too palpable that the causes at work will continue to undermine honest industry until a common effort be made to arrest them. Although the exports of English iron to the Continent, as far as known, have been smaller in 1883 than during the preceding year, the reduction has not been so great as might have been anticipated. There is one event to which we ought to draw attention in this review. We refer to the establishment of the international syndicate of English, German, and Belgian rail makers, which was founded for the purpose of regulating the terms under which the associated manufacturers should enter into competition with each other on neutral ground. The result, so far, has been to raise the price of steel rails in England from £4 5s. to £4 15s., in Belgium from 120 fr. to 130 fr., whilst German manufacturers have been able to maintain their old quotation. If prices of iron in 1884 have not declined to the same extent as during 1883, it is because the fall in the latter year was such a heavy one that there was very little margin left between profitable manufacture and production at a loss. We refer our readers to the special reports below.

AUSTRIA.

There were signs at the opening of 1884 that the good times which the Austrian iron trade had enjoyed during the preceding years was coming to an end. Moreover, a silent change was slowly working its way in the conditions under which the metallurgical industry of the Austrian monarchy had hitherto been carried on. In the Hungarian portion of the empire, that industry began to be more fully developed, partly from natural causes, partly from a desire of the Hungarians to make their country independent, industrially, from the other portions of the monarchy. Not only the retail trade, but also large consumers and railways, now prefer to use exclusively products manufactured in Hungary itself, even if they can obtain them somewhat more cheaply from the other part of Austria or from abroad. As a continual increase of production is accompanied by enlarged consumption, the future prosperity of the Hungarian iron trade appears to be ensured. In the same degree that Hungary ceases to be a customer of Cisleithan Austria, the metallurgical industry of the latter part of the monarchy will suffer. This reaction is felt all the more severely as it comes in conjunction with events of far-reaching influence. The construction of railways, which had been actively carried on during the last three years, has almost ceased, and rail mills, locomotive and engineering works, carriage building and machine-tool shops, have worked off their orders. The ample harvests of large districts of country remain unsold, and agriculturists are consequently unable to buy in the machinery market. At the same time, the crisis in the sugar trade withdraws work from engineers supplying the special machinery used in the industry. In the shipyards, too, the vessels ordered have been completed, and new orders are not obtainable. In short, the position of the Austrian iron and related industries would no doubt be critical if there were not a ray of hope in the dreary outlook of the present time. It is argued, with some degree of justification, that, as former periods of stagnation have been followed by times of activity, the present depression will pass off. It is well known that the construction of a large mileage of railways is in contemplation; also that there is an immediate want of rolling stock, 1,000 carriages and 100 engines being spoken of. It is true that the Austrian government have ordered a large war vessel in England; but it is equally true that that vessel is merely to serve as a model for others to be built in Austrian yards. The industrial crisis must come to an end soon, and, taking all in all, the Austrian iron trade would not appear to be in such a desperate condition as it has been represented in some quarters. The fluctuations in prices have not been very great during the past year. Styrian charcoal pig-iron fell about 2 fl. during the last twelve months, other descriptions of pig and Bessemer iron about 1 fl., whilst spiegeleisen has maintained its price (64 fl.) throughout the year. The fall was greater in finished iron. Styrian bar iron receded 5 fl., other bar iron 10 fl., sheet iron 5 fl. The heaviest drop was in joists, which fell from 140 fl. to 115 fl. Steel rails have scarcely changed in price. The following quotations show the values ruling at the beginning and close of 1884, all per 1,000 kilogrammes, pig-iron and steel rails delivered at stations nearest to works, all other descriptions of iron at Vienna:—

	Jan. 5. Florins.	Dec. 5. Florins.
White charcoal pig	51–54	50–51
Grey charcoal pig	55–57	54–55
Bessemer pig	57–59	56–58
Spiegeleisen	64	64
Other pig-iron	48–50	48–49
Styrian and Carinthian bar iron	130	125
Other bar iron	120	105–110
Sheet iron	165–195	160–185
Joists	140–145	115–120
Steel rails	112–124	120
Old rails	75–95	70–85

BELGIUM.

If 1884 cannot be called disastrous to the Belgian iron trade, it has, at any rate, been one of the worst of recent years. There has not been that decline of activity which would follow a contraction of exports, for the latter have kept up pretty well. There were exported of iron and steel during the first ten months 345,750 tons, against 353,444 tons in 1883, and 312,584 tons in 1882. It will be seen that there is not much to complain of on that score, the principal cause of concern to manufacturers being the low rates at which, owing to great competition, they were compelled to sell their products. The lowness of prices led to repeated reductions in wages, the rates of which were too high under the altered circumstances to permit Belgian ironmasters to compete successfully with others abroad; but it is satisfactory so far that the workmen willingly, if not cheerfully, submitted to the reductions. The year 1884 began gloomy for the Belgian iron trade. It was very difficult to sell anything at all, unless concessions were made. The consequence of the flatness of the market was a further weakening of rates, especially as makers, at first unwilling to dispose of their productions at their depreciated values, thereby caused stocks to accumulate. This was especially the case with pig-iron, but still makers held on to their quotations; and it is worthy of note in this connection that producers of crude iron have been able to maintain them at almost uniform rates throughout the year. It was not so with finished iron, however. Bars being in little demand, rolling mills began to stop work for several days in the week, at the same time reducing the wages of their operatives 10 per cent. Prices of bars had not been so low for years, even during the bad times from 1876 to 1879. The announcement made early in the year, which subsequently turned out to be true, that the Belgian government were on the point of constructing a number of narrow-gauge railways, helped for a time to invigorate the market, and to revive the hopes of manufacturers, but it could do nothing against the tendency towards lower prices, the undoubted result of over-production and subsequent keen competition. Makers of pig-iron took a practical step in counteracting this tendency by reducing their output; but producers of finished iron, being less united and anxious to secure work at any price, had to submit to repeated reductions. The result was that the latter, having to buy raw materials at old rates, and to sell their finished products at continually receding prices, were at last driven to the only alternative left them—to stop work altogether, or, at least, to considerably reduce production, which many of them ultimately did. Still, this step, while it arrested further depreciation, could not supply the orders needed to impart renewed activity, and the outlook at the end of the year is far from satisfactory. As far as we can judge at present, the Belgian production of iron and steel during 1884 will not be much below that of 1883. Belgium produced during the first half of 1884 a total of 766,819 tons, against 774,971 tons in the corresponding period of 1883. This is a reduction of only 8,152 tons for the half-year. There was even an increase in the output of pig-iron and finished iron, counter-balanced by a larger reduction in the quantity of steel produced. The steel industry of Belgium has been fairly well employed throughout the past year, and is in an even better position at its close than at its beginning. As we remarked above, the prices of pig-iron have changed little during the year. Belgian foundry pig, for instance, has remained at about 67 fr. 50 c. English foundry pig, also, has seen almost no change, slight fluctuations excepted. Bars, however, have fallen from 120 fr. in January to 115 fr. and 112 fr. 50 c. in December; plates from 165 fr. to 150 fr. and 145 fr. Steel did not follow the movement of manufactured iron. Steels rails were sold as low as 112 fr. 50 c. at the beginning of the year; they are now 130 fr. The following comparative statement will show the decline that has taken place during the past year in the prices of the various descriptions of iron:—

	Belgian Foundry Pig. Francs.	English Foundry Pig. Francs.	Bars No. 1. Francs.	Ordinary Plates. Francs.	Steel Rails. Francs.
January	67·50	52	120	165	112·50
February	67·50	53	120	160	110
March	67·50	53	120	160	110
April	67·50	53·50	120	160	110
May	67·50	54·55	117·50–120	160	120
June	67·50	54·55	112·50	157·50	120
July	66·50	53·50–54	112·50–115	155	120
August	66·50	53·50–54	112·50–115	155	130
September	67·50	53	112·50	155	130
October	60·50	53	112·50	155	130
November	67·50	53	115–117·50	145–150	130
December	67·50	53	112·50–115	145–150	130

FRANCE.

The past year may be considered a mere continuation of that which preceded it as regards the movement in the French iron market. If 1883 witnessed a steady reduction in the values of all descriptions of iron, 1884 has seen that depreciation accentuated, as we shall show at the close of this brief review of the condition of the French iron trade during the past year. Only, the decline in prices last year was not so great, proportionately, as in 1883, which in this respect stands singular. The total output of France of metallurgical products, at the same time, experienced a considerable contraction, accompanied, as already observed, by a steady decrease in their value. There were produced during the first six months of 1884 a total of 1,650,654 tons of iron and steel, as compared with 1,746,821 tons during the second half-year of 1883. This shows a decline of 96,157 tons; the decrease in pig-iron being 64,276 tons, in manufactured iron 17,133 tons, and in steel 14,748 tons. There has been a correspondingly great falling-off in the imports of foreign iron and steel, owing to the great depreciation in value of home products. The French imports of iron and steel during the first seven months of 1884—the period for which reliable statistics are at present available—amounted to 183,234 tons, compared with 261,886 tons in the corresponding period of 1883. The decrease for 1884 was consequently 78,652 tons, or more than 30 per cent. French makers of pig-iron have been rather chary during the past year in publishing the prices obtained by them; but from what has transpired, it is certain that, in the principal district of pig-iron production (the Meurthe-et-Moselle), they have declined from 10 fr. to 15 fr. per ton on the year. Foundry pig fetched in January last 76 fr. at the furnaces, and is now about 66 fr., if not less. Forge pig, which was 58 fr. at the commencement of the year, is said to have been sold recently at 48 fr. in the Longwy district. Manufactured iron has fallen much more heavily, between 15 fr. and 30 fr. per ton, according to the class of iron. Merchant iron as sold at Paris has lost 15 fr. in value, having declined from 155 fr. in January to 140 fr. in December. In the Nord, the drop for the same description of iron has been very considerable; in January it fetched 155 fr. to 160 fr., last month only 125 fr. to 130 fr. Iron rolled from coke pig, as made in the Haute-Marne, has dropped from 175 fr. in January to 155 fr. and 150 fr. in December. But a tremendous reduction has taken place in the rates paid for steel rails. Whilst at the end of 1883 they could not be bought under 170 fr. at works, large quantities have quite recently been disposed of at a reduction in price of nearly 30 per cent. We need add no more in illustration of the condition of the French iron market during the past year, confining ourselves to indicating the average quotations of the various classes of iron during the year:—

	Foundry Pig in the Meurthe-et-Moselle. Francs.	Merchant Iron at Paris. Francs.	Merchant Iron in the Nord. Francs.	Coke Iron in the Haute-Marne. Francs.
January	76	155	155–160	175
February	76	155	155	175
March	75	160	150	170–175
April	73	150–155	140	170–175
May	70	155–160	150	170–175
June	70	155–160	155	170–175
July	68	165	155	170–175
August	68	155–160	130–140	165–170
September	67	150–155	130–140	165–170
October	66	145–150	135–140	160
November	66	145–150	130–135	155–160
December	66	140	125–130	150–155

GERMANY.

The German iron trade, considered broadly, and compared with 1883, has done very well during 1884, at least so far as prices which manufacturers have obtained for their products are in question. Although there was a steady decline in the value of nearly all classes of iron, yet the difference between the rates secured at the beginning of the year and those paid at its close is not very great. With regard to the production of iron, there has been no falling off, but, on the contrary, a slight advance on 1883. According to latest figures published, the production of pig-iron alone during the first ten months of 1884 exceeded that for the corresponding period of 1883 by 176,206 tons. This is very little below the increase in the latter year over its predecessor, 1882. Besides this home production, Germany took from England during the first eleven months of 1884 no less than 331,246 tons of iron, principally pig, against 356,829 tons in the corresponding period of 1883. As "Holland"—an elastic term—also took 222,629 tons of iron from Great Britain, it may be assumed that a large proportion of that quantity found its way into Germany. On the other hand, the depression in the iron trade has somewhat affected the German export trade, which, while it has slightly expanded as regards iron and steel, shows a counterbalancing decrease in the quantity of machinery sent away. The total exports of iron and steel during the first six months of 1884 amounted to 530,000 tons. We said already that there was a decline in values, but, as will be seen from the statements below, it has not been very serious. In the Westphalian iron market, the course of trade has been, if not prosperous, at least of a nature that cannot have inflicted much hardship on producers. Forge pig has dropped only from 3 to 4 marks in the course of the year, which, compared with what took place the previous year, cannot be considered ruinous. German Bessemer pig has receded to 48–50 marks, compared with 55 marks in January, whilst English Bessemer iron has fallen only about 2 marks. With regard to finished iron, there have been slight fluctuations throughout the year. Bars commenced at 113 to 118 marks; they at one time reached the maximum price of the year of 115 to 120 marks, and they close at 110–112 marks. Steel rails have scarcely changed at all. They were quoted 140–150 marks in January, and in December stood at 140–146 marks. The following statement below gives the values for each month in Westphalia:—

	Forge Pig. Marks.	German Bessemer Pig. Marks.	English Bessemer Pig. Marks.	Bar Iron. Marks.	Steel Rails. Marks.
January	50–53	55	47	113–118	140–150
February	50–53	55	46	115–118	140–150
March	50–53	55	46	115–118	140–150
April	50–53	54–55	46	115–120	140–150
May	49–53	54–55	46	113–118	140–150
June	49–53	52–54	46	115–120	140–150
July	48–50	52–53	46	115–120	140–150
August	51–53	51–53	46	112–118	140–145
September	47–49	50–52	46	112–118	140–145
October	47–49	49–51	46	112	140–145
November	47–49	49–51	46	112	140–145
December	47–49	48–50	44–45	110–112	140–146

With regard to the Silesian iron market, it must be admitted that the past year is not one upon which iron manufacturers in that part of the empire can look back with unmingled satisfaction. In all the branches of metallurgical production the movement of prices—isolated cases excepted—was downwards, the supply being greater than the demand. Works are endeavouring, by adopting the most recent improvements in the manufacture of iron, and by producing in large quantities, to reduce the first cost to a minimum. But there is at present an absence of the power of purchase for this forced production, and prices finally reach a level at which small manufacturers find it impossible to compete. Combination has not been very successful in its operation during the past year in Silesia. The Upper Silesian convention of rolled iron manufacturers was established in March 1882; it came to an end two years later, in February last. The contest which followed was very severe, the Laurahütte forcing the price down to 100 marks per ton. Owing to the efforts of the larger producers, the downward course of prices was arrested, and an equilibrium established which permitted working at a fair profit. During the last few months of the year, Westphalian competition in the markets for Silesian iron has become very keen, and it requires all the efforts and concession on the part of Upper Silesian manufacturers to hold their own. In those markets the quoted price of 110 marks is only nominal, as large local reductions are made. As about 388,000 tons of iron came into the market, the total price obtained in 1884 will compare unfavourably with the return in 1883. The movement in the Silesian manufactured iron market is illustrated in the following statement. Rolled iron was quoted per 1,000 kilogrammes at works:—

	1881. Marks.	1882. Marks.	1883. Marks.	1884. Marks.
January	102½	130	137½	120
February	107½	132½	132½	115
March	96½	135	132½	100
April	95	135	132½	100
May	95	135	132½	110
June	96	135	132½	110
July	100	135	125	110
August	105	135	125	110
September	110	137½	127½	110
October	115	137½	127½	110
November	117	137½	127½	110
December	120	137½	120	110
Average	105	135·2	129·4	109·6

GEARED WINDING ENGINE.

AMONGST the various types of engines turned out by Messrs. Davey, Paxman & Co., of the Standard Ironworks, Colchester, is the improved geared winding steam engine combined with a locomotive boiler, which we illustrate on page 2 of our present issue. From our engraving it will be seen that the engine is mounted on a wrought-iron frame, and is fitted with all the most modern improvements. It combines strength and durability with handiness—the cylinder is of large area, and is made of cold blast iron. The crank-shaft, connecting-rod, eccentric rods, reversing link, and crosshead are of the best forged scrap iron. The gudgeon of the crosshead, slide rods, joints and pins are of steel. The wearing parts are all deeply case-hardened, and the bearings and glands are all of gun-metal. The winding drums are mainly of wrought iron and steel, and are fitted with an efficient brake. The spur-ring and pinion are of best cast steel, and the starting, reversing, and brake levers are all brought together into a convenient position within easy reach of the engine-driver. The boiler is of the locomotive type, well stayed throughout. It is complete—with all usual fittings and mountings, and is of more than ample size to supply the steam required. It is found to be a reliable winding engine both for light and heavy loads.

AUTOMATIC SMOKE CONSUMER AND FUEL ECONOMISER.

AMONGST the various devices which have been brought out for consuming smoke, or, more correctly, in preventing its formation, there is one which is manufactured by Messrs. Clarke & Co., of Forest Road, Nottingham, which enjoys a full share of public support. This contrivance, which is the invention of Mr. J. Butler, is illustrated on page 3 of our present issue. Fig. 1 represents a front view of a couple of double-flued or Lancashire boilers fitted with the smoke-consuming apparatus, fig. 2 being a longitudinal section of one of the boilers with the levers and details of the mechanism clearly shown. Fig. 3 represents a set of firebars in one length, one of the bars being shown singly in fig. 4. Fig. 5 shows the automatic smoke consumer and the fire bars combined.

Having explained what the various figures in our illustrations represent, we will next explain the system itself. In working it out the object of the inventor was to follow out as closely as possible the principle upon which combustion is effected in a mineral oil lamp. In that case the air is admitted below the flame, and after being heated, mixes with the products of combustion and causes them to burn. In like manner, in the consumer the air is admitted below the bars and at the bridge (the quantity being regulated by a simple internal contrivance), and being heated is passed into the furnace gases and causes complete combustion of all the inflammable properties. Upon the fireman opening the furnace-door to fire up, the door comes in contact with a lever (see figs. 1, 2, and 5), and this causes a rod to open the back valves, at the same time an automatic arrangement is put in operation, and which can be regulated to close the back valves in ten, fifteen, or twenty minutes, according to requirement. The impure gas, as it passes over the fire bridge, mixes with the air which has been heated in its passage under the firebars, and escapes from the tubes enclosed in the bridge, and bursts into flame. The air thus introduced into the flue through the tubes is said to secure a consumption of 95 per cent. while the fire door is open, and yet to produce no retarding effect on the full action of the furnace. The saving in fuel is stated to be from 10 to 15 per cent.

With regard to the firebars we may mention that the principle upon which they are made is that the air space under the grate is large, allowing for a good current of air. Gradually tapering towards the surface the openings are small, thus preventing all coal from slipping through the grate before being thoroughly burned down to dust. These bars, as well as the smoke-consumer, are in use at some of the leading ironworks and manufacturing establishments, where they are reported to be giving every satisfaction.

THE "SILENT" SYSTEM OF VENTILATION FOR PRISONS.

THE ventilation of prisons has always been a matter of peculiar difficulty, as owing to the necessity of having the cells thoroughly isolated from each other, any system that did not effect that and at the same time secure a continuous change of air in each cell was practically useless. As there was really no such system in existence whereby a number of cells could be ventilated into one shaft, and at the same time sound prevented from passing from one cell into another, Messrs. Robert Boyle & Son, of 64, Holborn Viaduct, London, and Glasgow, have, after careful consideration, devised an arrangement which is very ingenious and yet simple, and there can be very little doubt but that it will effectually answer the purpose for which it is intended. The system is carried out by taking a block or wing of a prison consisting of say three tiers of cells on each side, composed of thirty cells on each tier or row, making 180 in all. Three brick flues—internal measurement, 2 feet by 2 feet—are built at equal distances against each of the side walls, and carried up above the roof, where they are surmounted with the self-acting air-pump ventilators, 3 feet diameter. Three horizontal shafts run along each tier immediately underneath the ceiling and close to the wall. Each of these shafts is connected with ten cells by means of protected openings varying in size in proportion to the distance of the opening from the upcast shaft, so as to equalise the quantity of air extracted from each cell. Three of these horizontal shafts—one in each tier—are connected with one of the upcast shafts, which forms a junction at their centre. The horizontal shafts vary in size according to proximity to the top of the upcast shaft, so as to equalise the quantity of air drawn from each tier. A ring of gas jets is fixed at the bottoms of the upcast shafts for the purpose of warming them in cold weather and preventing condensation of the ascending column of foul air. The peculiar feature in this arrangement is that the ventilating opening in one cell is isolated from the openings in the other cells by means of a metal plate or partition extending from it along the shaft and past the opening of the second cell to it, and so on with all the partition plate overlapping the other the length of two cells from the one it is connected with until the central upcast shaft is reached, where a divisional plate is fixed in the horizontal shaft to prevent the two currents travelling in opposite directions, from striking each other and creating a swirl as they enter the upcast shaft. Each partition plate is deafened round the opening into the cell by means of a double plate packed with sand. The horizontal shafts as they pass through the cells are also protected and deafened by means of a double casing, having the space between packed with sand. The advantage of this system is that every cell is equally and separately ventilated, whilst perfect isolation is secured, it being impossible for sounds to pass from one cell into another through the ventilating shafts or openings, whilst as many as from ten to twenty cells can be ventilated with the one pipe, and three or four of these lead into one upcast shaft. An important feature is that there are no valves used in connection with any part of the system, so that when once fixed no further attention is required, and the ventilation cannot be interrupted through negligence, as is usually the case when ventilating arrangements are employed that require looking after. Messrs. Boyle have designated this arrangement the "Silent" system of ventilation for prisons, a very appropriate name. Fresh warmed air is introduced into each cell through vertical channels cut in the walls, protected outside and inside with strong iron gratings. These channels open into the galleries on the inside of the building, and are supplied with air from two large openings at each end of the block, through which the fresh air passes over a heating arrangement in cold weather, and is thoroughly warmed before entering the cells through which it must pass before finding an exit. We understand that Messrs. Boyle are taking steps to have the system practically tried at one of our large prisons.

Correspondence.

STEAM GENERATION.

To the Editor of IRON.

SIR,—The valuable letter of Mr. B. H. Thwaite in IRON of December 12 has only just come under my notice, and I beg you to allow me space to answer his questions. To prevent any mistake, I beg to say that the boiler in question was set some eight years ago for the purpose of burning wood chips and sawdust, and the reason the boiler was fired underneath was to work the sawdust, &c., with one blowing machine. This may show that the boiler was not made or set for efficiency, but to make use of lumber for combustion, and for some four years we often had a difficulty in raising steam with best coals (when there was an insufficient supply of chips and sawdust), with which the highest evaporation obtained was 6½ lb. of water per pound of coal. In the beginning of 1880 I completed my first apparatus for preventing smoke, in which the area of grate surface was considerably curtailed, and with which better combustion was produced. We were then able to evaporate 9 lb. of water per pound of coal. This apparatus was described and illustrated in IRON of November 19, 1880. Not being satisfied with the results obtained, I worked on for another four years, and completed at last my blowpipe flame furnace with sloping firebars, and the smallest area of firebars ever introduced in any steam boiler, and where the holes at the bottom of the curtain act in some degree like the blowpipe on burning fire, forcing mechanical and chemical combustion and producing a long transparent flame of intense heat, never seen before in a steam boiler furnace, and spreading this intense heat and flame over a much larger boiler plate surface, and evaporating 11·48 lb. of water per lb. of common hard steam coal.

This brief statement will show that all the improvement has been produced by diminishing the supply of atmospheric air and the area of the firebars in the furnace, and producing therein the best possible combustion, in combination with two very small steam jets under the firebars to keep them cool, and to assist the formation of greater heat in the furnace. Now it stands to reason that as the heat and flame in the furnace is so much more intense, and is kept for a distance close to the boiler plates, the vibrations will penetrate so much quicker, and be absorbed by the water within; and this really has been proved by the 18-foot-long boiler, in which almost all the intense heat was absorbed at the end of the top of the boiler flue, showing at the highest only 356 degrees Fahr., and even this remaining heat may have been partly caused by the absorbed heat in the surrounding brickwork, which coincides with the dimished heat in the chimney flue, as the end of the boiler is 5 feet distant from the damper; and this heat has then to travel downwards nearly 3 feet to get under the damper (which is only 8 or 9 inches open) into the chimney flue, 2 feet high, where the heat was only about 200 degrees Fahr., and 20 feet further one-half degree less.

I think I have been able to show that the entire improvement in evaporation has been accomplished in the furnace only, and I have not the slightest doubt that if the apparatus was fixed within a boiler containing vertical tubes still better results would be obtained from such a boiler when properly bricked in. I beg now to remark that in all the trials and tests the same common hard steam coal was used, containing 12·5 lb. of evaporative power from 212 degrees Fahr., and about 4 per cent. of ashes and 2 per cent. of clinkers. The water used was always from 70 to 75 degrees Fahr. The various short trials made by me had no other object than to find out how many pounds of coal could be burnt per hour per square foot of firebars by natural draught, and secondly to find the smallest grate area which was able to produce the steam required for my factory. No other particulars were observed as asked by Mr. Thwaite, as on such short trials no minute observations can be depended on. Only in the official tests were the particulars given. better results, but he says if this is to be accepted for steam boilers, they ought to have larger heating surface. This may be correct in the ordinary way, but I think I have shown by my new system that I have more than ordinary heat in the furnace by slow combustion, or rather, slow draught, so that the heat formed remains longer within the furnace and flues, and which naturally is partly absorbed by the brickwork, and will return and again form steam in the same way that the heat of the steam enters the cylinder in the first instance, and is there absorbed and afterwards returns. Some of the radiating heat of the boiler itself, combined with the existing heat in the flue, will again form steam, just as raw meat has been put in a tin case, brought to the boiling point, packed quickly in a non-conducting case so that very little heat can escape, and is thus kept boiling for hours. A similar example is to be found in Honigmann's fireless locomotive, where the heat of the water or the steam pressure is used over and over again for some six hours. Besides, it has been proved many times that a forced combination of gases produces greater heat, especially if such gases meet at a certain angle, as with the coal gas jets, which so placed produce larger and better illuminating flames. In making water-gas only a small proportion of coal is used, but a gas is produced which, when burned, develops about ten times the heat due to the mere coal. This and my previous statements will, I think, make clear the reason why the evaporation with my blowpipe-flame furnace is so much greater than that produced by the same coal under the ordinary system. For the benefit of those who cannot see anything beyond the mere coal fed into my furnace, I repeat, once and for all, that my results are due to the combination of circumstances which I have described, and which should be clear to any unprejudiced seeker after truth.—I am, &c. A. C. ENGERT.

Three Mills Lane, Bromley-by-Bow,
December 30, 1884.

Notices of Books.

Almanach für die k. k. Kriegs-Marine, 1885. Vienna: Gerold & Co.

THIS almanac has been received this year somewhat sooner than usual, and its early arrival is thus doubly welcome, for it is at all times a very trusty book of reference on the naval matters of all countries. The book is ably edited by the staff of the *Mittheilungen aus dem Gebiete des Seewesens*, and on that account the information contained in it may be relied on. We note, however, that the new classification of vessels in the German navy has not been observed, that portion of the *Almanach* having probably

passed through the press before the new division was ordered. From the same cause, the name given to the new ironclad added to the German navy, E, is wrongly stated to be *Hessen*. The vessel received the name of *Oldenburg* at her launch, which took place on December 20.

The Centenary of the "Times."—The *Times* entered upon its second century yesterday, reckoning according to the number upon its title-page, although, as the first 939 copies were issued under the name of the *Daily Universal Register*, the centenary of the journal under its present title falls on the corresponding date three years hence. In commemoration of the event, Mr. W. Fraser Rae contributes to the current number of the *Nineteenth Century*, under the above title, an account of the rise and progress of the journal, which gives an interesting picture of the growth of journalism during the last hundred years.

BOOKS RECEIVED.

Technical Journal. Part 2. Ward, Lock & Co.
Transit Tables for 1885. By Latimer Clark, M.I.C.E. E. & F. N. Spon.
Cassell's Popular Educator. Part 2. Cassell & Co.
Young England. Part 40. Sunday School Union.
The Goldfields of Victoria. Reports of the Mining Registers for the Quarter ending September 30, 1884.
Report of the Commissioner of the Imperial Japanese Mint for the Year ending June 30, 1884.
Bo-peep for January. Cassell & Co.
Cassell's Technical Educator. Part 11. Cassell & Co.
The Library of English Literature. By Henry Morley, LL.D. Part 24. Cassell & Co.
Science for All. Part 16. Cassell & Co.
Almanach fur die k. k. Kriegs-Marine, 1885. Vienna: Gerold & Co.
Anglo-French Mercantile Review. No. 4. Waterlow & Sons.

NEW BOOKS.

Lectures on Agricultural Science, and other Proceedings of the Institute of Agriculture, South Kensington, London, 1883-4. Chapman. 2s.
Animal World. Vol. 15. Partridge. 2s. 6d.
Elsom's Yorkshire Arithmetical Test Cards. Standards II. to XII. Marshall. 1s. each.
Graduated Mental Arithmetic for the Standards. Simpkin. 8d.
Answers to Paragon Arithmetical Examination Papers and Cards. Standards I. to VII. By J. S. Heywood. Heywood. 4d.
Treatise on Steam Boiler Incrustation and Methods of Preventing Corrosion and the Formation of Scale. By C. T. Davis. Low. 8s. 6d.
The New Chemistry. 8th edition. By J. P. Cook. Paul. 5s.
Letts's Popular County Atlas. Letts. 17s. 6d.
Popular Treatise on Medical Electricity. By H. Woodward. Simpkin. 2s.
Dictionary of English History. By S. J. Low and F. S. Pulling. Cassell. 21s.
Text of Euclid's Geometry. Book I. By J. D. Paul. Bell. 7s. 6d.
Class Handbook of Mixed Geographical Questions. By P. Proudfoot. Simpkin. 9d.
Historical and Miscellaneous Questions. By R. Mangnall. W. H. Allen. 1s.
Mathieson's Vade Mecum for Investors for 1885. E. Wilson. 2s. 6d.
The Art of Leather Manufacture. By A. Watt. Lockwood. 12s. 6d.
Mathematical and Physical Papers collected from different Scientific Periodicals from May 1841 to the Present Time. Vol. 2. By Sir W. Thompson. Cambridge Warehouse. 15s.
Tables, Memoranda, and Calculated Results for Mechanics, Engineers, Architects, Builders, Surveyors, &c. By F. Smith. Third edition. Lockwood. 1s. 6d.
A Short History of Greek Mathematics. By J. Gow. Cambridge Warehouse. 10s. 6d.
The Preparation and Mounting of Microscopic Objects. By T. Davies. W. H. Allen. 2s. 6d
A Short History of the Kingdom of Ireland from the Earliest Times to the Union with Great Britain. Second edition. By C. G. Walpole. Paul. 6s.
The Popular Guide to the Telegraph and Postal Service. By W. Lynd. Wyman. 2s. 6d.

Obituary.

Doncaster.—Mr. Charles Doncaster, steel manufacturer, Sheffield, died at his residence, Totley Grove, on December 25, from rheumatic fever. Mr. Doncaster sustained a severe accident by falling from his bicycle two years ago. This caused a great shock to his system, though it is believed that he recovered from his injuries.

Science and Art.

Electrical Exhibition at Paris.—The International Society of Electricians has decided to hold an exhibition in January next, on the occasion of the first general meeting. The exhibition, which will last several days, is to be held in the rooms of the Observatory of Paris, which have been lent for the purpose by the director.

Telephonic Diving Apparatus.—Some experimental trials are ordered to be carried on at Chatham Dockyard with a new telephonic diving apparatus by means of which conversation can be kept up with divers when engaged in carrying out diving operations. The trials are to be made on board the *Pembroke*, flagship of the Steam Reserve, in the steam basin at Chatham.

South Kensington Museum.—Visitors during the week ending December 27, 1884.—On Monday, Tuesday, Friday, and Saturday (free), from 10 a.m to 10 p.m., Museum, 21,749; Mercantile Marine, Indian Section, and other Collections, 6,824. On Wednesday (admission 6d.), from 10 a.m. to 4 p.m., Museum, 161; Mercantile Marine, Indian Section, and other Collections, 11; total, 28,745. Average of corresponding week in former years, 38,057. Total from the opening of the museum, 23,623,092

Electric Lighting in the Isle of Bute.—Upon the site of the old Mount Stuart House, which was almost entirely destroyed by fire some years ago, the present Marquis of Bute has erected a mansion, which is now nearly completed. Provision is made for 400 electric lamps, and wires have been permanently laid into every room in the house, the greater part of which has been successfully lighted by electricity for more than two months, so that the builders have been able to push on rapidly with their work. Dr. Rowland Anderson, of Edinburgh, is the architect of New Mount Stuart House, and the electric light arrangements are in the hands of Mr. W. H. Massey, of Twyford.

The Storage of the Water of Towns.—At the meeting of the Civil and Mechanical Engineers Society, held on December 31, the president, Mr. Thomas Cole, in the chair, a paper was read by Mr. J. Tertius Wood, C.E., entitled "Criticisms on the Storage of Towns Water." The author said that the introduction of subsidiary pounds to catch what would otherwise be flood, a waste water, was a feature introduced by him to equalise as far as possible the unequal distribution of rainfall during the year, and assist in employing the utmost available yield from a surface drainage catchment area, and remarked that of course an open reservoir can be constructed to hold a volume of water calculated to expend itself during a considerable period of abnormally dry weather, but such a reservoir might for many months be in a low and somewhat stagnant condition, so similar results may be obtained by having covered pounds adjacent to the reservoirs, and connected therewith by culverts having floor levels on the same horizontal plane as the sill of the overflow; that when the reservoir had reached its limit of capacity, the pounds would commence to fill, and the water therein contained would be removed from evaporative rays, and kept cool and wholesome. The author further remarked that it has now become necessary that steps should be taken to institute a thorough enquiry into the whole question of water supply, and, as a sanitary unit, be kept parallel with the uses to which it has to be applied. And he said that this past year has been fruitful in causes and effects, and has practically illustrated the dangers likely to arise from a forgetfulness of its importance as a social and mercantile commodity.

The Institution of Civil Engineers.—The annual general meeting of the institution was held on December 23, the president, Sir J. W. Bazalgette, C.B., in the chair. The report of the council, which was read, stated that it might be convenient to take, as a starting point, the condition of the institution when the present by-laws were enacted on December 2, 1878. Then the strength consisted, irrespective of the students, of 2,815 of all other classes; now that number was 3,782, or an increase of 34 per cent. in six years. During the past session there had been 279 elections, while the deductions from deaths, resignations, and erasures were 85, leaving a net effective increase of 194, or 5½ per cent., in the twelve months. Out of the elections, 100 candidates were resident beyond the sea—a proof that engineers in the colonies were well satisfied with the way in which the affairs of the institution were conducted and administered. The death of Mr. Charles Manby, who was for seventeen years the secretary, and had since 1856 been the honorary secretary, had removed from the books one who had taken for many years a leading part in the conduct of the affairs of the institution. By his tact and energy at an early and critical period of its history, he had managed to secure the co-operation of the principal members of the profession, and of scientific men generally, and thus laid the foundation for its present reputation and success. The changes in the class of students had been very numerous; for, although there were 170 admissions, exactly the same number had disappeared from the list, of whom 7 had died, 722, as at the close of last year. Of the 1,964 students admitted since the creation of the class seventeen years ago, 48 were now members, 545 associate members, and 6 associates. As greater activity had of late been displayed by the students, the council had sanctioned, as an experiment, the announcement of twelve meetings for students only for the session 1884-85, three before Christmas and nine afterwards, at fortnightly intervals. No paper would, after the current session, be received from a student in competition for the Miller scholarship and the Miller prizes, when he was qualified by age—viz twenty-five years—for election into the corporation. As there seemed to be a strong desire among many non-resident members that the day for holding the annual general meeting should be altered, the out-going council expressed the hope that its successor would see fit to convene a special general meeting, at an early and convenient date, for the purpose of considering the propriety, and, if approved, of making the necessary alteration in the by-laws to effect the change. The statement of receipts and payments for the year ended November 30 showed that the income proper had amounted to £14,292 17s. 3d, of which £1,769 17s. 5d. arose from dividends on institution investments, aggregating £48,000, and mainly placed in debenture stocks of British railway companies. There had also been received £3,495 9s. from life compositions and the admission fees of new members, which were treated as capital, and £432 11s. 2d., from dividends on trust investments, the total of which was represented by £14,642 13s. 10d., almost entirely standing in government stocks. On the other side of the account, the general expenditure had been £12,476 18s. 5d., of which £6,193 15s. 5d. had been applied in the production of the publications, about twenty-five thousand volumes in all, which were delivered free of charge to all members wherever resident. The capital investments during the year had amounted to £5,322 3s. 8d., and the premiums under trust had absorbed £516 11s. 11d. The council were directed to arrange for the publication of the papers read at the ordinary meetings, and of such other documents as might be calculated to advance professional knowledge, in aid of the public and scientific objects for which the society was founded. In pursuance of this obligation, it was satisfactory to refer to the four volumes of Minutes of Proceedings, as they must necessarily afford the main evidence to distant members of the work of the institution. These volumes had included, in addition to the papers read and discussed at the ordinary meetings, forty "other selected papers," of which five were by students, besides "Abstracts of Papers on Foreign Transactions and Periodicals," a section of the volumes much appreciated by members in the colonies, as well as by others. There had likewise been issued to every member the series of six lectures on "The Practical Applications of Electricity"—the first lectures ever delivered delivered at the institution—and this series would be speedily followed by those given last session on "Heat in its Mechanical Applications." Arrangements had been made for the delivery during this session of six lectures on "The Theory and Practice of Hydromechanics." For papers read at the ordinary meetings, the council had had pleasure in awarding a Watt medal and a Telford premium to Mr. S. W. Barnaby, Telford medals and Telford premiums to Mr. S. B. Bolton and Mr. W. Foster, Telford premiums to Mr. W. T. Douglass, Mr. J. A. Longridge, and Mr. W. Hackney, and the Manby premium to Mr. G. H. Stayton. For papers printed in the Proceedings without being discussed, Telford medals and Telford premiums had been awarded to Mr. T. Andrews and Mr. F. Collingwood, and Telford premiums to Mr. J. H. Apjohn, Mr. T. Gillott, Mr. J. W. Wyatt, and Mr. W. S. Crimp. For papers read at the supplemental meetings of students, the awards had included the Miller scholarship to Mr. A. R. Sennett, and Miller prizes to Messrs. P. C. Cowan, W. O. Rooper, R. Moreland (tertius), E. W. Cowan, and J. Fawcus. Referring to the list of subjects for papers which had lately been circulated, it was stated that it was not to be regarded as limiting in the least degree the range of enquiry, nor to be taken in any sense as supplanting previous lists, but only as supplementing them, in the same way as it would in turn be altered, amended, and enlarged. One direction in which it was thought members might materially enrich the Proceedings was by furnishing detailed particulars of a technical character respecting the engineering resources of newly-developed countries, embracing observations on preliminary exploration or pioneer work on the materials used, and on the tools and appliances available. This brief statement would, it was trusted, be taken as evidence that the council had zealously endeavoured to adopt every possible means for the advancement of the institution, and so to transact its business as to confer the greatest benefits on the greatest number of members. After the reading of the report, the president presented the premiums and prizes to the several recipients. The adoption of the report, having been duly moved and seconded, was declared to be carried, and ordered to be printed in the Minutes of Proceedings in the usual manner. Hearty votes of thanks were then passed to the president, the vice-presidents, and other members of council, to the lecturers, the auditors, the secretary, and the scrutineers for the services they had rendered to the institution. The ballot for council for the ensuing year resulted in the election of Sir Frederick Bramwell, F.R.S., as president; of Mr. E. Woods, Mr. G. B. Bruce, Sir John Coode, and Mr. G. Berkley, as vice-presidents; and of Mr. B. Baker, Mr. J. W. Barry, Sir Henry Bessemer, F.R.S., Mr. E. A. Cowper, Sir James N. Douglass, Mr. C. D. Fox, Mr. A. Giles, M.P., Mr. H. Hayter, Dr. W. Pole, F.R.S., Mr. W. H. Preece, F.R.S., Sir Robert Rawlinson, C.B., Sir E. J. Reed, K.C.B., F.R.S., M.P., Mr. F. C. Stileman, Sir William Thomson, F.R.S., and Sir Joseph Whitworth, Bart., F.R.S., as other members of council. Numerically speaking, the institution commences the year well. A list of its members corrected to this date (January 2, 1885) contains the names of 1,447 members, 1,889 associate members, 508 associates, 20 honorary members, and 804 students, making a total of 4,668 [illegible]

CALENDAR FOR THE WEEK.

Monday, January 5.

Victoria Institute.—8 p.m.
Royal Institute of British Architects.—8 p.m. Ordinary (business) meeting.
London Institution.—7 p.m. Professor O. Lodge, on "Modern Views of Electricity." Second lecture.
Society of Chemical Industry.—London Section (at Burlington House). 1. Mr. C. N. Cresswell will open a discussion on "The Proposed Rivers' Pollution Bill." 2. Messrs. Cross and Bevan, on "Cellulose and Hydration." 3. Professor Munroe, on "Composition and Manurial Value of Filter-pressed Sewage Sludge."

Tuesday, January 6.

Royal Institution of Great Britain.—3 p.m. Christmas lecture. Professor Tyndall, F.R.S., on "The Sources of Electricity." Subject—Thermo-electricity.

Wednesday, January 7.

Society of Arts.—7 p.m. Second juvenile lecture. Professor J. Norman Lockyer, F.R.S., on "Universal Time: our Future Clocks and Watches."

Thursday, January 8.

Royal Institution of Great Britain.—3 p.m. Christmas lecture. Professor Tyndall, F.R.S., on "The Sources of Electricity." Subject—Magneto-electricity.
London Institution.—5 p.m. Professor C. Stewart, on "Sketches of Marine Life." First lecture.

Friday, January 9.

Quekett Microscopical Club.—8 p.m.
Architectural Association.—6.30 p.m.

Naval Architecture.

LAUNCHES.

English.

On December 19, there was launched from the yard of the Sunderland Shipbuilding Company an iron screw steamer, built to the order of Messrs. J. & J. Denholm, of Greenock. The leading particulars of the vessel are:—Length, 163 feet by 23 feet 6 inches beam by 12 feet 3 inches depth of hold. The main engines are 70 nominal horse-power, by the North-Eastern Marine Engineering Company.

Scotch.

Isabel.—On December 19, a schooner was launched from the yard of the Abercorn Shipbuilding Company, at Paisley, for the River Plate trade. Her dimensions are—125 feet by 27 feet by 8 feet moulded. She is strongly built, and made suitable for carrying a large cargo on a small draft.

Loodiana.—On December 19, Messrs. Wm. Denny & Bros. launched from the Leven Shipyard, Dumbarton, the *Loodiana*, a steel screw steamship, for the British India Steam Navigation Company. The *Loodiana* is a vessel of about 3,310 tons gross register, and of the following builders' dimensions:—Length between perpendiculars, 340 feet; breadth (moulded), 42 feet; depth (moulded), 29 feet. The vessel will be fitted by Messrs. Denny & Co.

with direct-acting surface-condensing engines of about 2,000 indicated horse-power, designed on the triple expansion principle, having four cylinders.

TRIAL TRIPS.

Calliope.—The *Calliope*, 16, screw corvette, steel and iron cased with wood, went out of Portsmouth Harbour on December 23. The wind was blowing with a force of five, and varied considerably during the trial; the sea was smooth. The draught of the ship forward was 14 feet, and aft 17 feet 6 inches. The safety valves were loaded to 90 lb., and the steam in the boilers reached a pressure of 87·15 lb. to the square inch. The vacuum in the condenser was 26·02 forward, and 26·05 aft. The mean pressure in the cylinders was 35·12 high, and 14·27 low, and the indicated horse-power 1,438·771 high, and 1,718·389 low, or 3,157·16, being about 157 over the contract power. The mean revolutions were 81·30, and the mean speed realised was 14·784 knots. The result was regarded as highly satisfactory.

River Indus.—This twin screw steamer, built by Messrs. Workman, Clark & Co., of Belfast, and owned by Messrs. James Little & Co., of Glasgow, went down the river on December 20 on her official trial trip. The tonnage of the steamer is 3,452 gross, and 2,255 net register, and she will carry 5,000 tons of deadweight. The principal dimensions are:—Length, 330 feet; breadth, 43 feet; depth of hold, 28 feet, with two pairs of engines of the compound surface-condensing type. The sizes of the cylinders of each engine are 26 and 52 inches, with a stroke of 42 inches. Steam is supplied by two large double-ended boilers, with eight of Fox's corrugated furnaces. These, with the engines, have been constructed and fitted on board by Messrs. Muir & Houston, Harbour Engine Works, Glasgow. The steamer proceeded to Skelmorlie, and during a succession of trials over the measured mile attained a mean speed of 11½ knots with both engines working, and 5½ knots with one engine going, and the second propeller dragging (which is equal to a speed of 7 knots with the second propeller disconnected), the consumption of coal being at the rate of about 20 tons per day. These results were considered highly satisfactory to all interested.

DISASTERS AT SEA.—Twenty-six British-owned and 13 foreign vessels were reported as actual shipwrecks during the week ending December 24, eight of which were British steamers, of an aggregate tonnage of nearly 7,000 tons. Again, there were a large number of vessels sunk by collision, viz. 10. Of these nine were British, and eight British and one Norwegian went down off the British Isles. Three vessels (two British and one German) were reported lost with "all hands." Two were destroyed by fire.

THE "CAROLINE."—The *Caroline*, 12, unarmoured screw corvette, 1,420 tons, 950 horse-power, whose completion for sea has been delayed on account of some alterations in her armament, has received the whole of her steel breech-loaders from Woolwich Arsenal, and is now ready for the pennant. The *Caroline* has been placed in the first division of the Medway Steam Reserve, and will shortly be commissioned for active service. She is equipped with twelve 5-inch breechloading guns, Vavasseur system, and command an all-round fire, and is also fitted with an armament of Nordenfelt and Gardner machine guns and the electric machinery for discharging the spar torpedo.

THE MEDWAY STEAM RESERVE.—The first division of the Medway Steam Reserve is more powerful at the close of the present year than it has been for some time past. In addition to two corvettes which have recently been repaired, there are seven new vessels which are either ready for sea or not far from completion, among them being the armour-plated turret ship *Ajax*, 4, 8,510 tons, 6,000 horse-power, and the *Conqueror*, 4, double screw steel armour-plated turret ship and ram, 6,200 tons, 4,500 horse-power. There are also the three second class steel steam cruisers, *Leander*, *Arethusa*, and *Phaeton*, which were delivered from the contractors about a year ago. The composite corvette *Caroline*, 12 guns, is ready for sea at a moment's notice, and considerable progress has been made during the year with the steel corvette *Calypso*, 2,765 tons, 3,000 horse-power, which was launched at Chatham in the course of 1882.

New Patents.

[The New Applications are arranged alphabetically, and comprise Nos. 16,650 to 17,012, being the entries from Dec. 19 to Dec. 29, 1884. The Abstracts of Specifications relating to Metals are placed in the order of their official numbers.]

NEW APPLICATIONS.

Adapting Existing Watches and Clocks to the Twenty-four o'Clock System of Time.—*E. Powell*, 20, *Eastgate Row, Chester.* [16946

Advertising.—*W. R. Oswald*, 75, *Gracechurch Street, and G. E. Welsman*, 172, *Fenchurch Street, London.* [16748

Advertising and Postal Packet.—*R. Shaw and J. Lyon*, 115, *St. Vincent Street, Glasgow.* [16783

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Sash Fastener.—*T. Broomhall and J. Broomhall, 4, Cherry Street, Birmingham.* [16771

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Securing the Meeting Bar of Sash Fasteners.—*S. Willett, 4, Commercial Place, Herne Hill, Surrey.* [16943

Securing Skull-caps within Gentlemen's Hats.—*J. W. Walker, 1, Commercial Street, Halifax.* [16880

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Steam Engines.—*G. Westinghouse, jun., 24, Southampton Buildings, Chancery Lane, London.* [16835

Steam Pumping Engines.—*S. G. Browne and W. Boby, 11, Wellington Street, Strand, London.* [16888

Steam Signal Whistles.—*F. Gill, 33, Villiers Street, Sunderland, Durham.* [16776

Steam Traps for Separating Water or Liquids from Vapours.—*I. S. McDougall, J. T. McDougall, and T. Sugden, 47, Lincoln's Inn Fields, London.* [16768

Steering Apparatus for Tricycles.—*J. Carver, 45, Southampton Buildings, London.* [16919

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Stoppering Bottles.—*Don P. P. de la Sala, 24, Southampton Buildings, Chancery Lane, London.* [16969

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Suspending Spring Stirrup.—*T. Temple, 16, Portland Street, Leamington, Warwick.* [16654

Sweeping Chimneys.—*J. M. Ross, 33, Chancery Lane, London.* [16963

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Telephone Exchange Call Indicators.—*S. Williams, 185, Commercial Road, Newport, Mon.* [16825

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Tracing Wheels.—*J. Simmonds, 9, Bridgewater Square, Barbican, London.* [16796

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Uncapping and Capping Lenses of Photographic Apparatus.—*F. W. Branson, 33, Chancery Lane, London.* [16793

Uncapping and Capping Lenses of Photographic Apparatus.—*F. W. Branson, 33, Chancery Lane, London.* [16794

Universal Calorimeter.—*T. J. Baker, 68, Granville Street, Birmingham.* [16940

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Valve Gear for Steam Engines.—*G. H. Daglish, 4, Clapton Square, Liverpool.* [16869

Valve Motions of Steam Engines.—*W. N. Dack, 4, Mansfield Chambers, St. Ann's Square, Manchester.* [16929

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Ventilating and Draining Conduits for Underground Wires.—A communication.—*J. B. Pash, 53, Chancery Lane, London.* [17011

Ventilation of Mines.—*J. L. Lobley, 59, Clarendon Road, Notting Hill, Middlesex.* [16812

Ventilation of Mines.—*W. Teague, jun., 21, Cockspur Street, Charing Cross, London.* [16842

Visible-feed Lubricators for Machinery.—*T. Brabson, 169, Fleet Street, London.* [16739

Warp-sizing Machines.—*J. S. Sutcliffe and J. S. Smith, 41, John Dalton Street, Manchester.* [16936

Washing Machines.—*H. St. G. Voales and R. H. Lowe, 323, High Holborn, London.* [16695

Washing Machines.—*J. Hunt, 8, Quality Court, London.* [16859

Waste-prevention and Respirating Horses' Nose-bag.—*H. Cable, 48, Whiskin Street, Clerkenwell.* [16879

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Water-circulating Fire-bars.—*D. Riley and W. Lee, 70, Chancery Lane, London.* [16691

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Window-sash Fastener.—*H. A. Williams, 57, Gurney Road, Stratford, Essex.* [16790

Window-sash Fasteners.—*J. Walker, Recent Parade, Birmingham.* [illegible]

Wire Tongs for Domestic Purposes.—*W. T. Smith, 4, Cherry Street, Birmingham.* [16716

Wood Cutting or Planing Apparatus.—*P. R. Shill, 6, Worlingham Road, East Dulwich, Surrey.* [16791

Wood Planing Machinery.—*S. S. Hazeland, St. Sampson's Par Station, Cornwall.* [16951

Working, Loading, and Checking the Recoil of Guns.—A communication.—*A. Sauvée, 22, Parliament Street, Westminster.* [16736

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Wrought Iron and Steel Tube Machinery.—*T. Jones and J. Smith, 7, Staple Inn, Middlesex.* [16689

Wrought-iron Window Frames.—*J. Griffin, 8, Quality Court, London.* [16968

ABSTRACT OF SPECIFICATIONS RELATING TO METALS

PUBLISHED DURING THE WEEK ENDING DECEMBER 27, 1884.

Prepared by PHILIP M. JUSTICE, Patent Agent, 55 and 56, Chancery Lane, London, W.C.

Zinc Roofing—2374 (1884).—*J. Mould* and *J. J. Mould.* The zinc roofing is especially applicable to flat roofs. Each end of the zinc sheet is turned upwards into a corrugated flange or double curl. Over this is sprung a saddle which holds the sheets, and is itself secured by screws, the whole being covered with a curved or circular-shaped plate.

Wrought Iron Wheels.—2720 (1884).—*P. Edwards.* Two furnaces are employed for welding on the bosses of wrought-iron wheels, one furnace is moveable, between the two being placed the wheel, the blast from the two furnaces passing into the centre or boss, which, when sufficiently heated, is placed on a block with a washer above and below, and by means of steam or hydraulic power, welded and completed.

Metal Name Plates.—3182 (1884).—*W. Pope.* Raised letters are formed upon blocks of metal which are adjustable in a moulding frame, into which the molten metal is run, the finished casting consisting of a plate having sunken letters.

Machinery for Forging Nuts.—3203 (1854).—*W. Leyland.* The machine consists of a frame carrying a horizontal shaft, on which are suitable cams operating by wedge-shaped slides four horizontal slides, the two front ones carrying V or other shaped cutting tools, and the two back ones dies or swages forming one-half of a hexagon on other nut. The heated bar of iron is placed between the front cutters, released and pushed between the dies or swages.

Extracting Castings from Moulds.—3580 (1884).—*Haddan.* Communicated by C. F Brush. For the purpose of withdrawing soft metal castings having thin projections or leaves from their moulds without injuring them, a gripping apparatus is employed to take a firm hold upon a series of transverse ribs, which for this purpose are formed on one side of the castings.

Founders' Ladles.—3619 (1884).—*C. McNiel, jun.* A circular mild steel plate is subjected to the action of a suitable number of dies of graduated shapes, the last die turning out a completed ladle bowl ready for the handles to be affixed to it.

"IRON" DIRECTORY OF ADVERTISERS.

[This Directory contains the names of bonâ fide Advertisers in "IRON" only. It will be published at intervals; but separate copies of it may be obtained, gratis, at any time on application at the Office, 161, Fleet Street, E.C.]

Accountants.

Ashford, Clarke & Co.	72, Mark Lane, E.C.
Legal Aid Agency	65, Tower Chambers, Finsbury Pavement, London, E.C.

Agricultural Machinery and Implements.

Barnard & Lake	Rayne Foundry, Braintree
Davey, Paxman & Co.	Colchester
Fowler, J., & Co.	Leeds
Harrison, McGregor & Co.	Albion Ironworks, Leigh, Manchester.
Hunt & Tawell	Atlas Works, Earl's Colne, Essex.
Johnstone Harvester Co.	70 and 71, Chiswell Street, E.C.
Ransomes, Sims & Jefferies, Ltd.	Ipswich
Wood, Walter A.	36, Worship Street, E.C.

Air Compressors.

Fowler, John & Co.	Leeds
Hathorn, Davey & Co.	Colchester
Owens, S., & Co.	Whitefriars Street, E.C.
Thwaites Brothers	Bradford
Walker Brothers	Wigan
Westinghouse Brake Co., Ltd.	York Road, King's Cross, N.

Anvils.

Bush, H. C.	Small Heath, Birmingham
Child Brothers	Smethwick, near Birmingham.

Asbestos Manufactures.

Bell, John	Asbestos Works, Southwark, S.E.
Hollywood, W.	Margaret Street, Glasgow
Toope's Asbestos Covering Co.	Ben Jonson's Road, Stepney, E.
United Asbestos Co., Limited	161, Queen Victoria Street, E.C.

Auctioneers.

Fuller, Horsey, Sons & Cassell	11, Billiter Square, E.C.
Harman & Matthews	35, Walbrook, E.C.
Ventom, Bull & Cooper	35, Old Jewry, E.C.
Watson, Alfred	60, Queen Victoria Street, E.C.
Wheatley, Kirk, Price & Goulty	Albert Square, Manchester.
Whitehead, Thomas	Bewsey Chambers, Warrington.

Axles.

Brown, Bayley, Dixon & Co., Limited	Sheffield
Clarke's Patent Crank Co.	Lincoln
Hadfield's Steel Foundry Co.	Sheffield.
Lancaster Waggon Co., Ltd.	Lancaster
Landore Siemens-Steel Co., Ltd.	Landore R.S.O., South Wales.
Roberts, Charles, & Co., Ltd.	Horbury Junction, Wakefield

Bars (Iron).

Brandon Iron and Steel Co.	Motherwell, N.B.
Henderson & Glass	Liverpool
Kirkstall Forge Co.	Leeds
Leeds Forge Co.	Leeds
Miller, A. & T.	Globe Ironworks, Motherwell, N.B.
Moore & Manby	14, St. Mary Axe, E.C.
Stora Kopparbergs Berslag (Swedish)	Stockholm'
Wedekind, H.	158, Fenchurch Street, E.C.

Bars (Steel).

Brandon Iron and Steel Co.	Motherwell, N.B.
Brown, Bayley, Dixon & Co., Ltd.	Sheffield
Kirkstall Forge Co.	Leeds
Osborn, S., & Co.	Sheffield
Spencer, John, & Sons	Newburn Steelworks, Newcastle-on-Tyne
Steel Co. of Scotland, Limited	Glasgow

Bears, Punching.

Galloway, W. & J., & Sons	Manchester

Belts (Driving).

Angus, G., & Co.	Newcastle-on-Tyne
Hancock, J. L.	226, Goswell Road, E.C.
Hepburn & Gale, Limited	Long Lane, Southwark, S.E.
Norris, S. E., & Co.	56, High Street, Shadwell, E.

Belting Syrup.

Lincoine & Co.	Glasgow

Boilers (Steam).

Appleby Brothers	East Greenwich, S.E.
Babcock & Wilcox Co.	107, Hope Street, Glasgow
Burnet, I., & Co.	Govan, Glasgow
Copeland, J., & Co.	Dobbie's Loan, Glasgow
Davey, Paxman & Co	Colchester
Fowler, John, & Co.	Leeds
Galloway, W. & J., & Sons	Manchester
Goodwin, J., & Co.	Motherwell, N.B.
Hall, J. & E.	Dartford, Kent
Hanna, Donald, & Wilson	Paisley, N.B.
Hartley & Sugden	Halifax
Jordan, T. B., Sons & Commans	52, Gracechurch Street, E.C.
Leeds Forge Co., Limited	Leeds
Marriott & Graham	Govan, Glasgow
McCulloch, T. & Sons	Kilmarnock
Nichols, U.	Oldfield Road, Manchester
Olrick, L., & Co.	27, Leadenhall Street, E.C.
Patent Non-explosive Boiler Co. Ltd.	28, Threadneedle Street, E.C.
Russell, George, & Co.	Motherwell, near Glasgow
Shanks, A., & Son	Dens Ironworks, Arbroath
Walker Brothers	Pagefield Ironworks, Wigan
Wilson, W.	Lilybank Ironworks, Glasgow

Boiler Furnaces (Corrugated).

Leeds Forge Co., Limited	Leeds

Boiler Manholes.

Galloway, W. & J., & Sons	Manchester
Leeds Forge Co., Limited	Leeds

Boiler Tubes.

Caledonian Tube Co.	Coatbridge, near Glasgow
Eadie, J., & Sons	Rutherglen, near Glasgow
Henderson & Glass	Liverpool
Lloyd & Lloyd	Birmingham
Marshall, J., & Sons	Glasgow
Olrick, L., & Co.	27, Leadenhall Street, E.C.
Stewart, A. & J., Limited	41, Oswald Street, Glasgow
Shorthouse, B. & G.	Birmingham

Boiler Tubes (Chemical).

Donald, J., & Son	Glasgow
Galloway, W. & J., & Sons	Manchester

Bolt, Nut, and Spike-making Machines.

Marsden, S., & Sons	London Road, Manchester.

Bolts, Rivets, Nuts, Screws, &c.

Bush, H. C.	Small Heath, Birmingham
Child Brothers	Smethwick, near Birmingham
Clyde Rivet Works	Glasgow
Galloway, W. & J., & Sons	Manchester
Marsden, S., & Son	London Road, Manchester
Measures Brothers & Co.	Southwark Street, S.E.

Brakes (Railway).

Westinghouse Brake Co.	Canal Road, King's Cross, N.

Brass Founders and Finishers.

Manganese Bronze & Brass Co.	St. George's Wharf, Deptford, S.E.
Martin & Son	Vine St., York Rd., Lambeth, S.E.
Shorthouse, B. and G.	Birmingham

Brick and Tile Making Machinery.

Bradley & Craven	Wakefield
Nichols, U.	Oldfield Road, Manchester.
Scholefield, R.	Burley Vale, Burley, near Leeds.
Whitehead, J. & Co.	Albert Works, Preston.

Bricks (Fire, Ganister, &c.).

Garnkirk Fireclay Co.	Garnkirk Works, near Glasgow
Lowood, J. G., & Co.	78, Attercliffe Road, Sheffield
Stevens & Co.	Kidwelly, South Wales
Young, J., & Sons	42, Bath Street, Glasgow

Bridge Foundation Cylinders.

Hanna, Donald & Wilson	Paisley

Bridges.

Appleby Brothers	East Greenwich, S.E.
Arrol Brothers	Germiston Ironworks, Glasgow
Dawson & Nunneley	Hunslet, Leeds
Goodwin, J. & Co.	Motherwell, N.B.
Hanna, Donald & Wilson	Paisley
Walker Brothers	Wigan

Builders' Ironwork.

Dawson & Nunneley	Hunslet, Leeds
Measures, Bros., & Co.	Southwark Street, S.E.

Carts and Waggons.

Bristol Waggon Works Co., Ltd.	Bristol

Castings (Iron).

Goodwin, J. & Co.	Motherwell, N.B.
Hall, J. & E.	Dartford
Martin & Son	Vine Street, Lambeth
McCulloch, T., & Sons	Kilmarnock

Castings (Steel).

Brown, Bayley, Dixon & Co.	Sheffield
Hadfield Steel Foundry Co.	Sheffield
Landore Siemens-Steel Co.	Landore, South Wales
Osborn, S., & Co.	Sheffield
Spencer, John, & Sons	Newburn Steelworks, Newcastle-on-Tyne
Steel Co. of Scotland, Ltd.	Glasgow
Wedekind, H.	158, Fenchurch Street, E.C.

Coffin Furniture.

Hickman & Clive	Birmingham

Colliery Plant.

Goodwin, J., & Co.	Motherwell, N.B.
Hathorn, Davey & Co.	Leeds
[illegible]	[illegible]

Condensers (Ejector).

Morton & Thomson	96, Buchanan Street, Glasgow

Cooking Ranges.

Wilson Engineering Co.	227i, High Holborn, E.C.

Couplings (Railway).

Martin & Son	Vine Street, Lambeth, S.E.
Roberts, C., & Co., Limited	Horbury Junction, Wakefield

Cranes, Travellers, Winches, &c.

Appleby Brothers	East Greenwich, S.E.
Arrol Brothers	Germiston Ironworks, Glasgow
Hanna, Donald & Wilson	Paisley, N.B.
Nichols, U.	Oldfield Road, Manchester
Ransomes & Rapier	5, Westminster Chambers, S.W.
Russell, G., & Co.	Motherwell, near Glasgow
Shanks, A., & Son	Dens Ironworks, Arbroath
Thwaites Brothers	Vulcan Ironworks, Bradford

Crank Shafts.

Clarke's Crank Co., Limited	Lincoln

Cupolas.

Thwaites Brothers	Bradford

Disincrustants.

Bell, J.	Asbestos Works, Southwark, S.E.
Disincrustant Marseillais Co.	Cheetham, Manchester
Hannay's Marine Appliances Co.	67, Great Clyde Street, Glasgow
Lincoine & Co.	Glasgow
Maburn & Co.	Salford, Manchester

Disintegrators.

Jordan, T. B., Sons & Commans	52, Gracechurch Street, E.C.

Dredging Machines.

Hanna, Donald, & Wilson	Paisley, N. B.

Earth Boring Machines.

Nichols, U.	Oldfield Road, Manchester

Economisers (Fuel).

Clarke & Co.	Forest Road, Nottingham
Lowcock, A.	Coleham Foundry, Shrewsbury

Emery Wheels.

Slack's Emery Wheel and Machine Co., Limited	Ardwick, Manchester

Engine and Boiler Fittings.

Galloway, W. and J., & Sons	Manchester

Engines (Blowing).

Galloway, W. & J., & Sons	Manchester

Engines (Gas).

Crossley Brothers, Limited	Manchester

Engines (Locomotive).

Appleby Brothers	East Greenwich, S.E.
Black, Hawthorn & Co.	Gateshead-on-Tyne
Dick, Kerr & Co.	Kilmarnock
Hunslet Engine Company	Leeds
Kerr, Stuart & Co.	20, Bucklersbury, E.C.
McCulloch, T., & Sons	Kilmarnock
Merryweather & Sons	Greenwich Road, S.E.
Walker Brothers	Pagefield Ironworks, Wigan

Engines (Marine).

Appleby Brothers	East Greenwich, S.E.
Black, Hawthorn & Co.	Gateshead-on-Tyne
Hanna, Donald & Wilson	Paisley, N.B.
Shanks, A., & Son	Dens Ironworks, Arbroath
Yarrow & Co.	Isle of Dogs, Poplar, E.

Engines (Portable).

Appleby Brothers	East Greenwich, S.E.
Davey, Paxman & Co.	Colchester
Fowler, John & Co.	Leeds
Hindley, E. S.	Bourton, Dorset
Ransomes, Sims & Jefferies	Orwell Works, Ipswich
Turner, E. R. & F.	St. Peter's, Ipswich

Engines (Stationary).

Appleby Brothers	East Greenwich, S.E.
Alley & Maclellan	Sentinel Works, Glasgow
Copeland, J., & Co.	Dobbie's Loan, Glasgow
Davey, Paxman & Co.	Colchester
Donkin, B., & Co.	Bermondsey, S.E.
Fowler, John & Co.	Leeds
Galloway, W. & J., & Sons	Manchester
Hathorn, Davey & Co.	Sun Foundry, Leeds
Hindley, E. S.	Bourton, Dorset
Jordan, T. B., Son & Commans.	52, Gracechurch Street, E.C.
Martin & Son	Vine Street, Lambeth, S.E.
McCulloch, T., & Sons	Kilmarnock
Nichols, U.	Oldfield Road, Manchester
Ransomes, Sims & Jefferies, Ltd.	Orwell Works, Ipswich
Russell, G., & Co.	Motherwell, near Glasgow
Shanks, A., & Son	Dens Ironworks, Arbroath
Turner, E. R. and F.	Ipswich
Walker Brothers	Pagefield Ironworks, Wigan

Engines (Traction).

Fowler, John, & Co.	Leeds
Nichols, U.	Oldfield Road, Manchester
Ransomes, Sims & Jefferies, Ltd.	Orwell Works, Ipswich

Fans and Blowers.

Bradley & Craven	Westgate Common Foundry, Wakefield
Donald, J., & Sons	42, Cadogan Street, Glasgow
Donkin, B., & Co.	Bermondsey, S.E.
Martin & Son	Vine Street, Lambeth, S.E.
McCulloch, T., & Sons	Kilmarnock
Schiele, C., & Co.	2, Clarence Buildings, Manchester
Thwaites Brothers	Vulcan Ironworks, Bradford
Walker Brothers	Wigan

Feed-water Heaters.

Moffat, A.	26, College Street, Dowgate Hill, E.C.
Morton & Thomson	98, Buchanan Street, Glasgow

Files.

Howell & Co.	Sheffield
Jowitt, T., & Sons	Sheffield
Osborn, S., & Co.	Sheffield
Spencer, J., & Sons	Newcastle-on-Tyne

Firebars.

Clarke & Co.	Forest Road, Nottingham
Venetian Air Valve Furnace Bar Co.	36, Walbrook, E.C.

Fireproof Flooring.

Dawson and Nunneley	Hunslet, Leeds
[illegible]	[illegible]

Forging (Iron).

Bush, H. C.	Small Heath, Birmingham
Kirkstall Forge Co.	Leeds
Walker Brothers	Wigan

Forgings (Steel).

Brown, Bayley, Dixon & Co.	Sheffield
Clarke's Crank Co., Ltd.	Lincoln
Landore Siemens Steel Co., Ltd.	Landore, South Wales
Leeds Forge Co.	Leeds
Osborne, S., & Co.	Sheffield
Spencer, J., & Sons	Newcastle-on-Tyne
Steel Co. of Scotland, Ltd.	Glasgow
Walker Brothers	Pagefield Ironworks, Wigan

Furnace Fittings.

Galloway, W. & J., & Sons	Manchester

Galvanised Iron.

Morton, F., & Co.	Naylor Street, Liverpool
Smith & McLean	Glasgow

Gas Exhausters.

Donkin, B., & Co.	Bermondsey, S.E.
Owens, S., & Co.	Whitefriars Street, E.C.
Thwaites, Brothers	Vulcan Ironworks, Bradford

Gas Fittings.

Bray, G., & Co.	Blackman Lane, Leeds
Eadie, J., & Sons	Rutherglen, near Glasgow.

Gas Governor.

Busch, J.	Oldham

Gasworks (Plant for).

Dowson Economic Gas Co., Ltd.	3, Great Queen St., Westminster.
Hanna, Donald and Wilson	Paisley, N.B.

Girders.

Arrol Bros.	Glasgow
Dawson & Nunneley	Hunslet, Leeds
Goodwin, J., & Co.	Motherwell, N.B.
Hanna, Donald & Wilson	Paisley
Henderson & Glass	Liverpool
McCulloch, T., & Sons	Kilmarnock
Measures, Bros. & Co.	Southwark Street, S.E.
Morton, F. & Co.	Naylor Street, Liverpool
Walker Brothers	Wigan.

Governors (Engine).

McCulloch, T., & Sons	Kilmarnock

Gunpowder Machinery.

Hall, J. & E.	Dartford, Kent

Hoisting Machinery.

Appleby Brothers	East Greenwich, S.E.
Crowley, J., & Co.	Sheffield
Shanks, A., & Son	Dens Ironworks, Arbroath

Horse Gear.

Crowley, J., & Co.	Sheffield.
Hunt & Tawell	Earl's Colne, Essex.

Hydraulic Machinery.

Hathorn, Davey & Co.	Leeds
Owens, S., & Co.	Whitefriars Street, E.C.

Hydraulic Presses.
Copeland, J., & Co. .. .. Dobbie's Loan, Glasgow

India Rubber Goods.
Angus, G., & Co. .. .. .. Newcastle-on-Tyne
Hancock, J. L. .. .. .. 226, Goswell Road, E.C.
Moulton, S., & Co. .. .. Bradford-on-Avon
Norris, S. E., & Co. .. .. 57, High Street, Shadwell.
North British Rubber Co., Ltd. Edinburgh
Tuck & Co., Limited .. .. 116, Cannon Street, E.C.

Injectors.
Donald, J., & Son .. .. 42, Cadogan Street, Glasgow
Morton & Thomson .. .. 98, Buchanan Street, Glasgow.
Schäffer and Budenburg .. St. Mary Street, Manchester

Insurance Companies.
Railway Passengers Insurance Co. 64, Cornhill, E.C.
Sun Fire and Life Office .. Threadneedle Street, E.C.

Iron and Steel Works (Plant for).
Galloway, W. & J., & Sons .. Manchester
Goodwin, James, & Co. .. .. Ardrossan, N.B.
McCulloch, T., and Sons .. Kilmarnock
Thwaites Brothers .. .. Bradford
Walker Brothers .. .. .. Wigan

Iron Bars.
Brandon Iron & Steel Co. .. Motherwell, N.B.
Henderson & Glass .. .. Liverpool.
Kirkstall Forge Co. .. .. Leeds.
Leeds Forge Co. .. .. .. Leeds.
Miller, A. & T. .. .. .. Globe Ironworks, Motherwell.
Moore & Manby .. .. .. 14, St. Mary Axe, E.C.
Stora Kopparbergs Berslag (Swedish) .. .. .. Stockholm.
Wedekind, H. .. .. .. 158, Fenchurch Street, E.C.

Iron Buildings.
Morton, F., & Co., Limited .. Naylor St. Ironworks, Liverpool

Iron Forgings.
Bush, H. C. .. .. .. Small Heath, Birmingham.
Kirkstall Forge Co. .. .. Leeds.
Walker Brothers .. .. .. Pagefield Ironworks, Wigan.

Iron Plates.
Henderson & Glass .. .. Liverpool.
Measures Brothers & Co. .. Southwark Street, S.E.
Miller, A. & T. .. .. .. Globe Ironworks, Motherwell.
Moore & Manby .. .. .. 14, St. Mary Axe, E.C.

Iron Rails.
Simpson, J. .. .. Middlesbrough.

Launches and Yachts.
Burnet, L., & Co. .. .. Govan, Glasgow
Hanna, Donald and Wilson .. Paisley, N.B.
Kerr, Stuart & Co. .. .. 20, Bucklersbury, E.C.
Yarrow & Co. .. .. .. Isle of Dogs, Poplar, E.

Lead Ashes, Buyers of.
Pass, C., & Son .. .. .. Bristol.

Leather Goods.
Angus, G., & Co. .. .. .. St. John's Works, Newcastle-on Tyne
Hepburn & Gale .. .. .. Long Lane, Southwark, S.E.
Norris, S. E., & Co .. .. 57 and 58, High St., Shadwell, E.

Locomotives (see *Engines, Locomotive*).

Lubricants and Oils.
Bell, J. .. .. Asbestos Works, Southwark, S.E.
Crane, P., Meir & Co. .. .. Bank Street, Manchester
Ragosine & Co. .. .. .. 7, Idol Lane, E.C,

Machine Tools.
Atkins & Co. .. .. .. Stanley Street, Sheffield
Carter, J., & Co. .. .. .. New Bailey Street, Salford, Manchester
Craig & Donald .. .. .. Johnstone, near Glasgow.
Galloway, W. & J., & Sons .. Manchester
Martin & Son .. .. .. Vine Street, Lambeth, S.E.
Scott Brothers .. .. .. West Mount Ironworks, Halifax
Smith and Coventry .. .. Ordsal Lane, Salford, Manchester

Marine Safety Signals.
.. .. .. Great Turnstile, Holborn, W.C.

Metals (Phosphor, Alloys, &c.).
Billington & Newton .. .. Longport, Stafford
Dick, Alex. .. .. 110, Cannon Street, E.C.
Law, F. .. .. 2, Rue Marengo, St. Etienne, France
Manganese Bronze and Brass Co. Lombard Street, Southwark, S.E.
Phosphor Bronze Co., Ltd. .. Sumner Street, S.E.
Wiggin, H., & Co. .. .. .. Birmingham

Mill Gearing, Shafting, &c.
Brown, Bayley, Dixon & Co. .. Sheffield
Kirkstall Forge Co. .. .. Leeds
McCulloch, T. & Sons .. .. Kilmarnock

Mill Machinery (Flour, Corn, and Rice).
Copeland, J. .. .. .. Dobbie's Loan, Glasgow
McCulloch, T., & Sons .. Kilmarnock
Ransomes, Sims & Jefferies .. Ipswich
Turner, E. R. & F. .. .. Ipswich

Mining Machinery.
Hathorn, Davey & Co. .. .. Leeds
Jordan, T. B., Son & Commans. 52, Gracechurch Street, E.C.
Walker Brothers .. .. .. Wigan

Non-conducting Compositions.
Bell, J. .. .. Asbestos Works, Southwark, S.E.
Leroy, F., & Co. .. .. .. Gray Street, Commercial Road, E
Toope's Asbestos Covering Co., 1, Ben Jonson's Road, Stepney, E.

Oil Distilling Plant.
Copeland, J., & Co. .. .. Dobbie's Loan, Glasgow

Packing (Engine).
Angus, G., & Co. .. .. .. Newcastle-on-Tyne.
Bell, John .. .. Asbestos Works, Southwark St. S.E.
Lindsay, R. B., & Co. .. .. Plantation Quay (West), Glasgow
Tuck & Co., Limited .. .. 116, Cannon Street, E.C.
United Asbestos Co., Ltd., .. 161, Queen Victoria Street, E.C.

Paints.
Ragosine & Co. .. .. .. 7, Idol Lane, Great Tower Street
Sanitary Paint Co .. .. .. 51, South John Street, Liverpool
United Asbestos Co., Ltd., .. 161, Queen Victoria Street, E.C

Paper Making Machinery.
Donkin, B., & Co. .. .. .. Bermondsey, S.E.

Patent Agents.
Davies, George .. .. .. St. Ann's Square, Manchester
Mewburn, J. C. .. .. .. 169, Fleet Street, E.C.

Permanent Way.
Dick, Kerr & Co. .. .. .. 101, Leadenhall Street, E.C.
Kerr, Stuart & Co. .. .. .. 20, Bucklersbury, E.C.
Ransomes & Rapier .. .. .. 5, Westminster Chambers, S.W.

Pile Drivers.
Nichols, U. .. .. Oldfield Road, Manchester
Owens, S. & Co. .. .. .. Whitefriars Street, E.C.

Pistons and Piston Rings.
Atkins & Co. .. .. Stanley Street, Sheffield
Taylor, R. H. .. .. .. Trafalgar Street, Sheffield

Pipe Covering.
Toope's Asbestos Covering Co., Ben Jonson's Road, Stepney, E.
United Asbestos Co., Ltd. .. 161, Queen Victoria Street, E.C.

Plates (Iron).
Henderson & Glass .. .. Liverpool
Measures Bros., & Co. .. .. Southwark Street, S.E.
Miller, A. & T. .. .. .. Globe Ironworks, Motherwell
Moore and Manby .. .. 14, St. Mary Axe, E.C.

Plates (Steel).
Brown, Bayley, Dixon & Co. .. Sheffield
Landore Siemens-Steel Co., Ltd. Landore, South Wales
Leeds Forge Co., The .. .. Leeds
Steel Co. of Scotland, Limited . Glasgow

Portable Engines (see *Engines, Portable*).

Portable Railways (see *Railways, Portable*).

Pulley Blocks.
Crowley, John, & Co. .. .. Sheffield
Thomson, W. .. .. .. Kinning Park, Glasgow.

Pulleys (Clip).
Fowler, John, & Co. .. .. Leeds.

Pulleys (Wrought Iron).
Hall, J. & E. .. .. .. Dartford Ironworks, Kent
Richards, G., & Co. .. .. Broadheath, Manchester

Pumps and Pumping Machinery.
Appleby Brothers .. .. .. East Greenwich, S.E.
Bradley & Craven .. .. .. Wakefield
Fowler, John, & Co. .. .. Leeds
Hanna, Donald, & Wilson .. Paisley
Harvey, R., & Co. .. .. .. Park Grove Ironworks, Glasgow
Hathorn, Davey & Co. .. .. Leeds
Mather & Platt .. .. .. Manchester
McCulloch, T., & Sons .. .. Kilmarnock
Nichols, U. .. .. Oldfield Road, Manchester
Owens, S., & Co. .. .. .. Whitefriars Street, E.C.
Ransomes, Sims & Jefferies, Orwell Works, Ipswich
Shanks, A., & Son .. .. Dens Ironworks, Arbroath
Sinclair, J. .. .. 104, Leadenhall Street, E.C.
Thwaites Brothers .. .. Vulcan Ironworks, Bradford
Tyler, Hayward, & Co. .. .. 85, Upper Whitecross Street, E.C.
Westinghouse Brake Co., Ltd. Canal Road, King's Cross, N.

Pumps (Centrifugal).
Hathorn, Davey & Co. .. .. Leeds
Owens, S., & Co. .. .. .. Whitefriars Street, E.C.

Railway and Contractors' Plant.
Brown, Bayley, Dixon & Co. .. Sheffield
Dick, Kerr & Co. .. .. .. 101, Leadenhall Street, E.C.
Goodwin, J., & Co. .. .. Ardrossan, N.B.
Hadfield's Steel Foundry Co. .. Attercliffe, Sheffield
Nicholls, U. .. .. Duncan Street, Manchester
Ransomes & Rapier .. .. 5, Westminster Chambers, S.W.

Railways (Portable).
Dick, Kerr & Co. .. .. .. 101, Leadenhall Street, E.C.
Fowler, John, & Co. .. .. Leeds
Kerr, Stuart & Co. .. .. 20, Bucklersbury, E.C.

Rails (Iron).
Simpson, J. .. .. Middlesbrough.

Rails (Steel).
Brown, Bayley, Dixon & Co. .. Sheffield
Simpson, J. .. .. Middlesbrough
Steel Co. of Scotland, Limited . Glasgow

Refrigerating Machinery.
Copeland, J., & Co. .. .. Dobbie's Loan, Glasgow
Hall, J. & E. .. .. .. Dartford Ironworks, Kent

Rice Dressing Machinery.
Copeland, J., & Co. .. .. Dobbie's Loan, Glasgow

Riveting Machines.
Harvey, R., & Co. .. .. .. Park Grove Ironworks, Glasgow

Rock Drills.
Jordan, T. B., Sons & Commans 52, Gracechurch Street, E.C.

Roofs (Iron, Steel, and Zinc).
Arrol Brothers .. .. .. Germiston Ironworks, Glasgow
Appleby Brothers .. .. .. East Greenwich
Hanna, Donald & Wilson .. Paisley, N.B.
Morton, F., & Co. .. .. .. Naylor Street, Liverpool
Walker Brothers .. .. .. Wigan

Ropes.
Smith, T. & W. .. .. .. Newcastle-on-Tyne

Ropes, Wire (see *Wire Rope*).

Rustless Iron.
Bower-Barff Rustless Iron Co., Ltd., ... 23, Queen Victoria Street, E.C

Screw Cutting.
Atkins & Co. .. .. .. Sheffield

Shafting.
Brown, Bayley, Dixon & Co., Ltd. .. .. .. Sheffield
Kirkstall Forge Company .. Leeds
Martin & Son .. .. .. Vine Street, Lambeth, S.E

Ship Builders.
Hanna, Donald & Wilson .. Paisley
Yarrow & Co. .. .. .. Isle of Dogs, Poplar, E

Ships' Telegraphs.
Chadburn & Son .. .. .. Liverpool.

Smoke Consumer.
Clarke & Co. .. .. .. Forest Road, Nottingham

Springs and Spring Steel.
Brown, Bayley, Dixon & Co. .. Sheffield
Osborn, S., & Co. .. .. .. Sheffield
Spencer, J., & Sons .. .. Newburn Steelworks, Newcastle-on-Tyne

Steam Hammers.
Harvey, Robert, & Co. .. .. Park Grove Ironworks, Glasgow
Massey, B & S. .. .. .. Manchester
Scott Brothers .. .. .. Halifax
Thwaites Brothers .. .. Vulcan Ironworks, Bradford
Walker Brothers .. .. .. Pagefield Ironworks, Wigan

Steel (Bar and Tool).
Brown, Bayley, Dixon & Co. .. Sheffield
Landore Siemens-Steel Co., Ltd. Landore, South Wales
Osborn, S., & Co. .. .. .. Sheffield
Spencer, J., & Sons .. .. Newburn Steelworks, Newcastle-on-Tyne

Steel Castings.
Hadfield's Steel Foundry Co. Attercliffe, Sheffield
Landore Siemens-Steel Co., Ltd. Landore, South Wales
Osborn, S., & Co. .. .. .. Sheffield
Spencer, J., & Sons .. .. Newburn Steelworks, Newcastle-on-Tyne
Steel Co. of Scotland, Ltd. .. Glasgow

Steel Forgings.
Brown, Bayley, Dixon & Co. .. Sheffield
Clarke's Crank Co., Ltd. .. Lincoln
Kirkstall Forge Co. .. .. Leeds
Landore Siemens-Steel Co. Ltd. Landore, South Wales
Leeds Forge Co., Ltd. .. .. Leeds
Osborn, S., & Co. .. .. .. Sheffield
Spencer, J., & Sons .. .. Newcastle-on-Tyne
Steel Co. of Scotland, Ltd. .. Glasgow

Steelmakers
Brown, Bayley, Dixon & Co. .. Sheffield
Gregory & Bramall .. .. Soho Steelworks, Sheffield
Hadfield's Steel Foundry Co. .. Attercliffe, Sheffield
Howell & Co. .. .. .. Sheffield.
Jowitt, T., & Sons .. .. Sheffield
Landore Siemens-Steel Co., Ltd. Landore, South Wales
Leeds Forge Co .. .. .. Leeds
Osborn, S., & Co. .. .. .. Sheffield
Spencer, J., & Sons .. .. Newburn Steelworks, Newcastle-on-Tyne
Steel Co. of Scotland, Ltd. .. 150, Hope Street, Glasgow
Stora Kopparbergs Bergslag .. Stockholm
Wedekind, H. .. .. .. 158, Fenchurch Street, E.C.

Steel Plates.
Brown, Bayley, Dixon & Co. .. Sheffield
Landore Siemens-Steel Co. .. Landore, South Wales
Steel Co. of Scotland, Limited . Glasgow

Steel Rails.
Brown, Bayley, Dixon & Co. .. Sheffield
Steel Co. of Scotland .. .. Glasgow
Simpson, J. .. .. Middlesbrough

Stoves, Slow Combustion.
Hartley & Sugden .. .. Halifax

Stoves Smoke Consuming.
Thompson, H. .. .. .. 29, Marquess Rd., Canonbury, N.

Tanks.
Copeland, J., & Co, ... Dobbie's Loan, Glasgow
Dawson & Nunneley .. .. Hunslet, Leeds.
Hanna, Donald & Wilson .. Paisley, N.B.
McCulloch, T., & Sons .. .. Kilmarnock
Measures, Bros. & Co. .. .. Southwark Street, S.E.
Roberts, C., & Co., Limited .. Horbury Junction, Wakefield

Thatch Making Machinery.
Barnard & Lake .. .. .. Rayne Foundry, Braintree

Tires (Railway).
Brown, Bayley, Dixon & Co. .. Sheffield
Landore Siemens-Steel Co. .. Landore, South Wales
Leeds Forge Co. .. .. .. Leeds

Tools (Hand and Small).
Carter, J. & Co. .. .. .. New Bailey Street, Salford, Manchester
Gregory & Bramall .. .. Sheffield
Martin & Sons .. .. .. Vine Street, Lambeth, S.E.
Smith & Coventry .. .. .. Ordsall Lane, Salford, Manchester

Torpedo Boats.
Hanna, Donald & Wilson .. Paisley, N.B.
Yarrow & Co. .. .. .. Isle of Dogs, Poplar, E.

Traction Engines (see *Engines, Traction*).

Tramways and Tramway Plant.
Black, Hawthorn & Co. (Steam engines) .. Gateshead-on-Tyne
Dick, Kerr & Co. .. .. .. 101, Leadenhall Street, E.C.
Fowler, J., & Co. .. .. .. Steam Plough Works, Leeds
Kerr, Stuart & Co. .. .. 20, Bucklersbury, E.C.
Merryweather & Sons (Steam engines) .. .. Greenwich, S.E.

Tube Brushes.
Rowat, A., & Co. .. .. .. 25, Candleriggs, Glasgow

Tube Expanders.
Thomson, W. .. .. .. Kinning Park, Glasgow

Tubes (Brass and Copper).
Henderson & Glass .. .. Liverpool
Shorthouse, B. & G. .. .. Birmingham

Tubes (Iron).
Caledonian Tube Co. .. .. Coatbridge, near Glasgow
Donald, J., & Sons .. .. 42, Cadogan Street, Glasgow
Eadie, J., & Sons .. .. Clydesdale Tube Works, Rutherglen, near Glasgow
Henderson & Glass .. .. Liverpool
Howell & Co. .. .. .. Sheffield
Stewart, A. & J., Ltd. .. .. Clyde Tube Works, Coatbridge

Tubes (Steel).
Eadie, J., & Sons .. .. .. Rutherlen, near Glasgow
Howell & Co. .. .. .. Sheffield
Marshall, J., & Sons .. .. Glasgow
Stewart, A. & J., Limited .. Clyde Tube Works, Coatbridge

Turbines.
Copeland, J., & Co. .. .. Dobbie's Loan, Glasgow
Donkin, B., & Co. .. .. .. Bermondsey, S.E.
Hanna, Donald & Wilson .. Paisley, N.B.
McKenzie & Son .. .. .. 16, Holborn Viaduct, E.C.
Schiele, C., & Co. .. .. .. Booth Street, Manchester

Valves (Gas, Water, &c.).
Alley and Maclellan .. .. Glasgow
Donkin, B., & Co. .. .. .. Bermondsey, S.E.
Hanna, Donald & Wilson .. Paisley, N.B.
Owens, S., & Co. .. .. .. Whitefriars Street, E.C.
Walker Brothers .. .. .. Pagefield Ironworks, Wigan

Valves, Indiarubber (see *Indiarubber Goods*).

Valves (Safety).
Adams, Thos. (Executors of) .. West Gorton, Manchester
Turnbull, A., & Co. .. .. Glasgow

Ventilators.
Boyle, R., & Son .. .. .. 64, Holborn Viaduct, E.C.
Buchan, W. P. .. .. .. 21, Renfrew Street, Glasgow
Tate, C. M. .. .. 92, High Street, Camden Town

Vulcanised Vibre.
Mosses and Mitchell .. .. 68 to 71, Chiswell Street, E. C.

Waggons (Railway).
Bristol Waggon Works Co., Ltd. Bristol
Dick, Kerr & Co. .. .. .. Kilmarnock
Kerr, Stuart & Co. .. .. 20, Bucklersbury, E.C.
Lancaster Waggon Co., Limited Lancaster
Roberts, C., & Co., Limited .. Horbury Junction, Wakefield

Wheels (Geared).
Hadfield's Steel Foundry Co. .. Attercliffe, Sheffield
McCulloch, T., & Sons .. .. Kilmarnock
Wedekind, Hermann .. .. 158, Fenchurch Street, E.C.

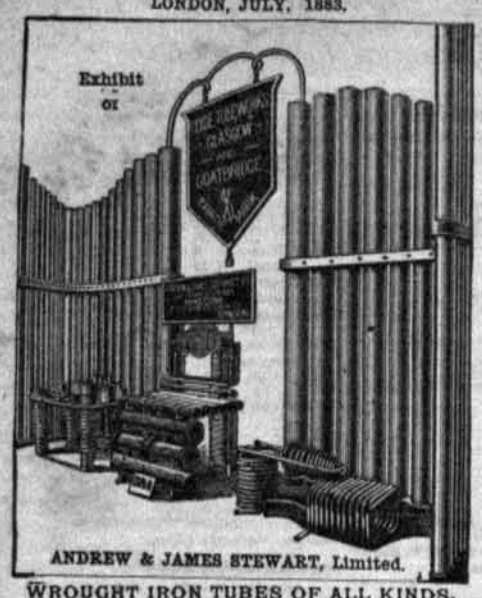
Wheels (Railway).
Hadfield's Steel Foundry Co. .. Sheffield
Lancaster Waggon Co., Limited Lancaster
Roberts, C., & Co., Limited .. Horbury Junction, Wakefield

Wire Rope.
Cradock, G., & Co. .. .. Wakefield
Fowler, John, & Co. .. .. Leeds
Smith, T. and W. .. .. .. St. Lawrence Ropeworks, Newcastle-on-Tyne
Warrington Wire-rope Works 13, Gorree Piazzas, Liverpool

Wire and Woven Wire Goods.
Rowat, Alexander, & Co. .. 25, Candleriggs, Glasgow
Shorthouse, B. and G. .. .. Birmingham
Staniar, John, & Co. .. .. Manchester

Wood-working Machine Makers.
Hindley, E. S. .. .. .. Bourton, Dorset
Richards, G. & Co. .. .. Broadheath, Manchester
Scott Brothers .. .. .. Halifax

ENGINEERING & METAL TRADES EXHIBITION,
LONDON, JULY, 1883.



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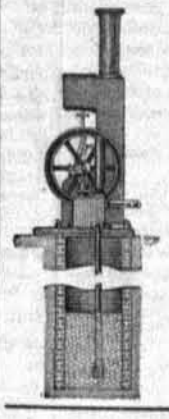

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Cost of fuel one farthing per horse-power per hour.

Prices from £30 and upwards.

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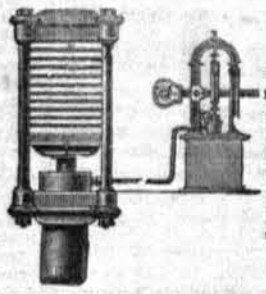

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They also Manufacture all kinds of Flour, Rice, Corn and Sugar Mills, Water Wheels, High and Low Pressure Engines. Steam Boilers, Tanks, Oil Stills, Hydraulic Presses, Lifting Jacks, Distillery Plant, &c.
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JOSEPH PARKIN,
IRON & STEEL MERCHANT, SHEFFIELD.

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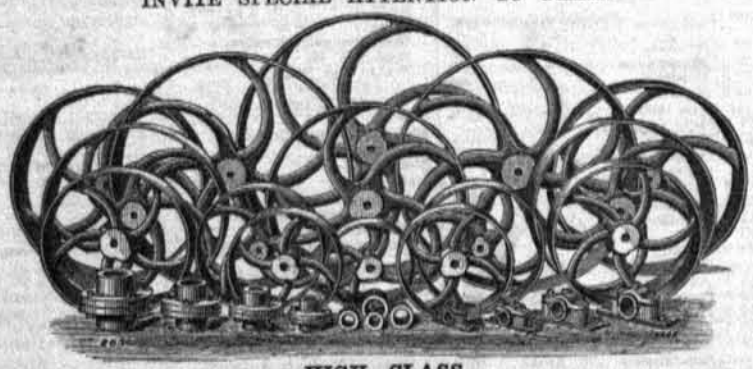
DEFECTIVE STEEL RAILS,
DOUBLE HEAD, BULB HEAD, AND FLANGE SECTIONS.

ALWAYS IN STOCK, DOUBLE SAWN, DOUBLE HEAD, BULB HEAD, AND FLANGE CROPS, OLD STEEL TYRES, BLOOMS, SLABS, INGOTS, FOR SIEMENS PROCESS, &c.

HUNT AND TAWELL

INVITE SPECIAL ATTENTION TO THEIR



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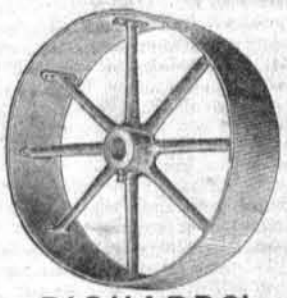

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DELTA METAL

This alloy is an improved brass, strong and hard as mild steel, possessing a fine rich *gold* colour; it can be *forged* and rolled *hot* and cold. When melted, it produces very sound castings of fine close grain. DELTA METAL is being largely used for all kinds of engineering, ornamental, and other work.

Patentee and Manufacturer, ALEXANDER DICK, 110, CANNON STREET, LONDON.

General Notes.

Campbell & Schultz.—We learn that Messrs. Campbell & Schultz, of 90, Cannon Street, London, have been appointed the representatives of the Mossend Iron and Steel Works, N.B., which are laid out to produce largely, on the Siemens process, all classes of mild steel. Messrs. Campbell & Schultz's connection with the Landore Siemens Steel Company ceased with the year which has just closed.

The Depression in the Steel Trade.—According to notice, the steelworks of Messrs. Bolckow, Vaughan & Co., at Eston, were closed on Saturday for an indefinite period. About 800 hands will be affected by this step. It is believed the new Spanish navigation tax, raising the duty on exported ore from 2½d. to 10d. per ton, has a bearing on this movement, the firm being large importers of Spanish ore.

Telegraph Facilities in Canada.—A recent report issued by the public works department of Canada shows that there are 2,259 telegraph offices in the dominion, or one office to every 1,914 persons, a better return than can be shown by any other country. The number of telegrams handled in 1882 was 3,076,576. The telegraph offices are being much extended, and the business will rapidly increase with the railway development that is taking place in Manitoba, the North-West territories, and British Columbia.

The Darlaston Coal and Iron Co.—At the eighth annual meeting of this company, the report presented showed that during the year a profit of £1,465 had been made, and it was proposed to appropriate the money in payment of arrears to the preferred debenture holders and £466 in payment of interest, at the rate of £5 per cent., to the preferred debenture holders for the past year. The profit is small considering the turnover was £33,000, but it is about £700 more than last year, when the turnover was £8,000 less. The report was carried. The retiring directors and auditors were re-elected.

Sheffield Trade with the United States.—The statistics of Sheffield trade with the United States show a continuous decline. The total value of Sheffield goods sent to that market from 1870 to 1883 is £12,517,133. The largest trade was done in 1872, when the value reached the great total of £1,734,626. Business then took a downward tendency until, in 1875, the year's exports were merely £691,232, and in 1878 they touched the lowest figure, viz. £429,016. Then came what Americans call a "boom," which was emphasised during 1881, when Sheffield exported to the States goods to the value of £1,037,401. After that business again fell away till, in 1883, the trading was represented by £793,675. A comparison of last year's business with that of 1884 shows that the tendency is still downward. During the first quarter of 1883 the value was £204,655; second quarter, £204,530; third quarter, £200,175. For the corresponding periods of 1884 the respective values were £143,898, £153,672, and £148,941. The amount for the fourth quarter of 1884 is not yet known, but it is perfectly certain it will be considerably smaller than for the corresponding period of 1883.

The Extension of Telegraphs in China.—The most recent link in the long chain of telegraph lines which was connected directly with London. Now the capital of Southern China is joined with the metropolis in the north; and as Canton was put in communication by telegraph with the frontier of Tonquin at the outbreak of the present political troubles in the latter district, the telegraph now stretches in an unbroken line from Pekin in the north to the most southern boundary of the Chinese Empire, and a message either from London or Pekin might reach the headquarters of the Chinese forces on the Tonquin frontier in a few hours. Four years ago the only telegraph line in China was one about six miles in length, streatching from Shanghai to the sea, and erected to inform the mercantile community of the arrival of vessels off the mouth of the river. The next important line constructed by the Chinese government will probably be one uniting Pekin with the great northern lines across Siberia at Kiachta. This will have to cross the whole of Mongolia, and will give the capital of China a third alternative telegraph route to Europe, a matter to which some political importance is believed to be attached in China. As already pointed out in *Nature*, this extraordinary development is due solely to political considerations.

Gunpowder and the Chinese.—In a paper recently read before the Shanghai branch of the Royal Asiatic Society, Dr. Macgowan affirms the claims of the Chinese to be the originators of gunpowder and firearms. This claim was examined in an elaborate paper some years ago by the late Mr. Mayers, and decided by him in the negative. Dr. Macgowan admits that gunpowder as now used is a European discovery. Anterior to its granulation by Schwartz it was a crude compound, of little use in propelling missiles. This, says the writer, is the article first used in China. The incendiary materials stated by a Greek historian to have been employed by the Hindus against Alexander's army are stated to have been merely the naphthous or petroleum mixtures of the ancient Boreans, and in early times used by the Chinese. The "stinkpots," so much used by Chinese pirates, is, it appears, a Cambodian invention. Dr. Macgowan states also that as early as the twelfth or thirteenth century the Chinese attempted submarine warfare, contriving rude torpedoes for that purpose. In the year 1000 an inventor exhibited to the then emperor of China "a fire gun and a fire bomb." He says that, while the Chinese discovered the explosive nature of nitre, sulphur, and charcoal in combination, they were laggards in its application, from inability to perfect its manufacture, so, in the use of firearms failing to prosecute experiment, they are found behind in the matter of scientific gunnery.

Commercial.

Prices Current of Manufactured Goods of BIRMINGHAM AND DISTRICT.

[This list being compiled exclusively for the pages of Iron, all rights of reproduction are reserved. The quotations given are manufacturers' average prices, dependent, of course, on terms of payment as well as on the quality and quantity of goods ordered and fluctuations in cost of raw material. The price and discounts quoted are carefully revised every week, and great pains are taken to render this list thoroughly reliable.]

December 31, 1884.

There is very little to report concerning the finished hardware trades, business for the most part having been at a standstill during the past week, and in many cases work at the factories has not yet been resumed. Prices are rather weaker, and in several lines show a falling tendency. Orders are scarce and small in volume, the home demand being very limited just at present. Foreign requirements are also anything but what might be desired.

Our "Abridged List" has been crowded out by pressure of other matter; but there have been no alterations whatever since its publication in our last issue.

NEW COMPANIES.

James & Co., Limited.—This is the conversion to a company of the firm of John Ismay & Co., of the Ouseburn, Newcastle-on-Tyne, lead manufacturers, &c., including the business and properties of the firm of James & Co. It was registered on the 19th ult., with a capital of £100,000, in £100 shares.

Mount Carbon Company, Limited.—This company was registered on the 20th ult., with a capital of £50,000, in £100 shares, to carry on coal and other mining operations in America. An agreement of the 5th ult., between Lord C. P. Pelham Clinton and Evan Powell, is adopted, and relates to the purchase of land containing over 1,000 acres, situate in Fayette County, West Virginia, United States.

Neale's Patent Syndicate, Limited.—This company was registered on the 19th ult., with a capital of £1,000, in £25 shares, to acquire interest in the letters patent granted to Melvill Thomson Neale for an improved method of, and apparatus for, forming letters or other characters on paper or other material, from a distance, dated February 23, No. 985.

Spanish Hydraulic Gold Company, Limited.—On the 22nd ult., this company was registered, with a capital of £75,000, in £1 shares, to acquire and work mineral property in Spain or elsewhere.

Steamship "Welsh Prince" Company, Limited.—This company was registered on the 20th ult., with a capital of £16,000, in £10 shares, to purchase for £14,000 the s.s. *Tyneside*, lately built by Messrs. C. S. Swan & Hunter, of Wallsend-on-Tyne.

RATES OF FREIGHT.

The current rates for coal and iron are:—

	Newcastle or Sunderland.	Newport, Cardiff or Swansea.
	s. d.	s. d.
Aden	—	19 0
Alexandria	—	19 9
Alicante	—	10 0
Ancona	—	10 0
Athens	—	—
Bahia	17 0	17 0
Barbadoes	—	13 0
Barcelona	—	12 6
Batoum	—	—
Bermuda	—	11 0
Bombay	18 6	19 6
Brindisi	—	11 0
Buenos Ayres	—	23 6
Bussorah	—	20 0
Cadiz	8 6	—
Cagliari	11 0	11 6
Calcutta	—	17 0
Callao	—	24 0
Cape de Verde	—	10 6
Cape Good Hope	20 0	19 6
Cardenas	—	—
Carthagena	—	9 6
Clenfuegos	—	12 0
Civita Vecchia	10 0	11 6
Coconada	—	—
Colombo	18 0	19 6
Colon	13 0	13 0
Constantinople	—	10 6
Corfu	—	11 0
Demerara	—	12 6
Fayal	—	13 0
Fiume	—	—
Galatz	—	7 6
Genoa	—	10 9
Gibraltar	—	7 6
Havana	—	11 0
Hiogo	—	—
Hong Kong	—	22 6
Iquique	19 0	22 6
Jamaica	—	8 6
Java	21 0	19 6
Kertch	—	—
Kurrachee	—	18 0
Leghorn	—	10 9
Lisbon	5 9	5 9
Madeira	—	10 6
Madras	—	20 0
Malaga	8 6	—
Malta	—	9 0
Maranham	—	15 0
Marseilles	11 6	fr. 13
Martinique	—	—
Mauritius	20 0	21 0
Messina	7 0	7 6
Montevideo	—	20 0
Montreal	6 0	—
Muscat	—	—
New Orleans	—	11 0
New York	—	—
Naples	—	11 6
Odessa	—	10 0
Oporto	8 0	—
Padang	—	23 0
Palermo	7 0	9 3
Panama	—	24 0
Para	—	17 0
Penang	—	21 0
Pernambuco	—	15 6
Port-au-Prince	—	—
Porto Rico	—	11 0
Port Said	—	11 3
Reunion	—	25 0
Rio Grande do Sol	—	47 6
Rio Janeiro	20 0	20 0
Rosario	—	30 0
Saigon	—	22 0
St. Catherine's	—	25 0
St. Jago de Cuba	—	8 6
St. Lucia	—	9 0
St. Paul de Loando	—	20 0
St. Thomas	—	9 6
San Francisco	18 0	17 6
San Sebastian	—	—
Santos	20 0	21 0
Savona	—	11 6
Sebastopol	—	6 0
Seville	—	—
Seychelles	—	—
Shanghae	—	29 0
Sierra Leone	—	17 6
Singapore	19 0	20 0
Smyrna	—	12 0
Spezzia	—	—
Syra	—	—
Taganrog	—	—
Tarragona	—	11 0
Teneriffe	—	9 6
Tientsin	—	—
Trieste	9 6	—
Trincomalee	—	19 0
Trinidad	—	11 6
Valencia	10 0	10 0
Valparaiso	—	22 6
Venice	10 6	11 6
Yokohama	—	—
Zanzibar	—	23 0

PRICE LIST OF IRON AND STEEL.

PREPARED BY

MESSRS. BOLLING & LOWE,

LAURENCE POUNTNEY HILL, LONDON, E.C.

Thursday, January 1.

STAFFORDSHIRE.

Brands at Works. Per Ton.

Bars—	
½ in. to 3 in. rounds and squares	£7 10 0
1 in. to 6 in. flats	7 10 0
Rounds and squares—	
3½ in., 10s. per ton extra.	
4 in., 20s. ,,	
4½ in., 40s ,,	
5 in., 80s.	
Rounds only—	
5½ in., 70s. ,,	
6 in., 90s. ,,	
6½ in., 110s. ,,	
7 in., 130s. ,,	
Rounds and squares—	
7-16 in., 10s. ,,	
½ in., 20s. ,,	
5-16 in., 30s. ,,	
⅝ in., 40s. ,,	
3-16 in., 70s. ,,	
Hoops—	
1 in. to 6 in. wide by usual gauge	£8 0 0
½ in. wide up to 20 w. g., 20s. per ton extra.	
⅜ in. wide up to 20 w. g., 40s. per ton extra.	
⅛ in. wide up to 20 w. g., 80s. per ton extra.	
¼ in. wide up to 20 w. g., 120s. per ton extra.	
Plates—	
To 15 feet long by 4 feet wide, not exceeding 4 cwt.	£9 0 0
4 to 5 cwt., 20s. per ton extra.	
5 to 6 cwt., 25s. ,,	
6 to 7 cwt., 50s. ,,	
7 to 8 cwt., 75s. ,,	
8 to 9 cwt., 110s. ,,	
9 to 10 cwt., 120s. ,,	
10 to 11 cwt., 140s. ,,	
15 to 20 ft. long, 20s. ,,	
20 to 25 ft. long, 40s. ,,	
4 to 4½ feet wide, 20s ,,	
4½ to 5 feet wide, 40s. ,,	
Sheets—	
Singles 11 to 20 gauge	£9 0 0
Doubles, 30s. per ton extra.	
Lattens, 60s. ,,	
Angles—	
1 in. by 1 in. to 8 united inches	£8 5 0
Tees—	
1 in. by 1 in. to 8 united inches	£8 10 0
For each inch above 8 united inches, 10s. per ton extra.	
Best, 20s. per ton extra.	
Best best, 40s.	
Treble best, 60s.	

STAFFORDSHIRE, MIDLAND, &c.

Ordinary Brands (at works).

	£ s. d.	£ s. d.
Bars	5 15 0	to 6 5 0
Hoops	6 0 0	to 7 5 0
Plates	7 0 0	to 8 0 0
Sheets	7 0 0	to 8 0 0
Angles	6 10 0	to 7 0 0

Rods, 10s. to 20s. per ton extra.
Best best, 20s. to 30s. ,,
Treble best, 40s. to 60s. ,,

CLEVELAND AND NORTH OF ENGLAND BRANDS

(at works).

	£ s. d.	£ s. d.
Bars	5 5 0	to 5 10 0
Ship plates to 8 cwt.	5 0 0	to 5 5 0
Angles	4 15 0	to 5 0 0

Best, 10s. per ton extra.
Best best, 30s. ,,
Treble best, 50s. ,,

SCOTCH (at Glasgow).

	£ s. d.
Bars NB crown	5 7 6
Hoops	6 12 6
Ship plates	6 5 0
Boiler	6 10 0
Angles	6 0 0

Best, 10s. per ton extra.
Best best, 30s. ,,
Treble best, 50s. ,,

WELSH (Newport and Cardiff).

	£ s. d.	£ s. d.
Bars	5 0 0	to 5 2 6
Plates	6 10 0	to 7 0 0

Best, 10s. per ton extra.

BELGIAN (f.o.b. Antwerp.

	£ s. d.	£ s. d.
Bars	5 0 0	to 7 0 0
Hoops	6 10 0	to 7 0 0
Plates	7 10 0	to 8 10 0
Sheets	8 0 0	to 8 10 0
Angles	5 15 0	to 6 5 0
Nail rods	5 10 0	to 6 5

Iron Rolled Girders—

Narrow flanges	6 0 0	to 7 10 0
Wide flanges	6 10 0	to 8 0

Steel Rolled Girders, Angles, and Channels, at proportionate differences.

BEST YORKSHIRE

(at works).

	£ s. d.
Bars—	
To 3½ cwt.	18 0 0
3¾ to 5½ cwt	19 0 0
5¾ cwt. and upwards	20 0 0
Boiler Plates—	
To 3 cwt.	21 0 0
from 3 to 3½ cwt.	23 0 0
,, 3¾ ,, 4 ,,	25 0 0
,, 4 ,, 5 ,,	27 0 0
,, 5 ,, 7 ,,	30 0 0
,, 7 ,, 10 ,,	33 0 0
above 10 cwt.	36 0 0

Plates over 6 feet wide, 40s. per ton extra.

Sheets 11 to 17 WG	22	0 0
Angles and Tees	20	0 0

	£ s. d.
Tires to 5 cwt.	18 10 0
from 5 cwt. & upwards	22 0 0
Axles to 5½ cwt.	18 10 0
from 5½ cwt. & upwards	21 10

RAILS

(at port nearest works)

	£ s. d.	£ s. d.
Heavy iron	5 0 0	to 5 5 0
,, steel	4 15 0	to 5 0 0
Light iron	5 10 0	to 5 15 0
,, steel	5 10 0	to 6 0 0

Steel mining rails, 10 to 15 lb. per yard, £8 to £6 15s.
Fish plates, heavy, 30s. per ton above rails.
Fish plates, light, 60s. to 80s. per ton do.

Bolts and Nuts, for Fishes—		
Heavy	12 10 0	to 13 10 0
Light	16 0 0	to 25 0 0
Spikes—		
Heavy	13 0 0	to 14 0 0
Light	16 10 0	to 19 10 0

PIG-IRON.

Scotch warrants (Glasgow) ..... 42s. 3½d.
Cleveland warrants No. 3 (Middlesbrough) .. 35s. 6d.
Cleveland No. 1 (Tyne or Tees) G.M.B. ..... 39s. 6d.

CASTINGS

(f.o.b. shipping port).

Socket Pipes (for gas or water)—	£ s. d.	£ s. d.
1½ to 2 in.	5 0 0	to 5 10 0
2 to 3 in.	4 10 0	to 5 0 0
3 to 8 in.	4 5 0	to 4 15 0
8 to 20 in.	4 2 6	to 4 12 6
20 to 48 in.	4 0 0	to 4 10 0
Chairs	3 5 0	to 4 0 0
Girders	5 10 0	to 14 0 0
Scrap—		
Old rails, D.H.	2 15 0	to 2 17 6
Do. flange	2 5 0	to 2 10 0
Engineers' heavy scrap	2 10 0	to 2 15 0
Light do.	1 15 0	to 2 0 0

WIRE

(at works).

	£ s. d.	£ s. d.
Rolled Fencing Wire—		
Nos. 0 to 4	6 10 0	to 7 0 0
5	7 0 0	to 7 10 0
6	7 10 0	to 8 0 0
Galvanised—		
Nos. 0 to 4	11 0 0	to 11 10 0
5	11 10 0	to 12 0 0
6	12 0 0	to 12 10 0
Drawn Fencing Wire—		
Nos. 0 to 6	9 0 0	to 9 10 0
7	9 10 0	to 10 0 0
8	9 10 0	to 10 0 0
9	10 0 0	to 10 10 0
10	11 0 0	to 11 10 0
Galvanised—		
Nos. 0 to 6	13 0 0	to 13 10 0
7	13 10 0	to 14 0 0
8	13 15 0	to 14 5 0
9	15 10 0	to 16 0 0
10	16 10 0	to 17 0 0
Drawn Bright Wire—		
Nos. 1 to 6	10 0 0	to 11 0 0
7	10 0 0	to 11 0 0
8	10 5 0	to 11 5 0
9	10 15 0	to 11 15 0
10	11 10 0	to 12 10 0
Drawn Bright Steel Wire—		
Nos. 1 to 6	10 5 0	to 11 5 0
7	11 5 0	to 12 5 0
8	11 10 0	to 12 10 0
9	12 0 0	to 13 0 0
10	13 0 0	to 14 0 0

Galvanised Fencing Strand (B.B)

	7 wires.	3 wires.
No. 0	16 10 0 to 17 10 0	15 10 0 to 16 10 0
1	17 0 0 to 18 0 0	15 15 0 to 16 10 0
2	17 10 0 to 18 10 0	16 10 0 to 17 10 0
3	18 0 0 to 19 0 0	17 0 0 to 18 0 0
4	18 10 0 to 19 10 0	17 5 0 to 18 5 0
5	20 0 0 to 21 0 0	17 10 0 to 18 10 0
6	20 10 0 to 21 10 0	18 5 0 to 19 5 0
7	21 15 0 to 22 15 0	19 0 0 to 20 0 0
8	23 10 0 to 24 10 0	19 10 0 to 20 10 0
9	23 15 0 to 24 15 0	21 0 0 to 22 0 0

STEEL (at works)

Siemens-Martin or Bessemer.

	£ s. d.	£ s. d.
Plates	8 0 0	to 10 0 0
Sheets	8 10 0	to 10 10 0
Bars	7 0 0	to 9 0 0
Angles	7 10 0	to 9 10 0
Tees	8 0 0	to 10 0 0
Spring steel	8 5 0	to 10 10 0
Cast steel for tools	40 0 0	to 60 0 0

GALVANISED IRON ROOFING SHEETS

(at Liverpool).

Corrugated Sheets 5, 6, 7, 8 feet long.

Gauges 16, 18, and 20, £12 to £12 10s.
22 and 24 gauge, £12 10s. to £13 10s.
26 gauge, £14 to £15.
28 gauge, £15 10s. to £16 10s.
Sheets 8 to 9 feet long, 20s. per ton extra.
Sheets 9 to 10 feet long, 40s. per ton extra.
Sheets 10 to 11 feet long, 60s. per ton extra.
Sheets 11 to 12 feet long, 80s. per ton extra.

Full size Section Sheets on application.

Iron

Missing copy for 9th January
1885 not asked for (by order).

IRON.

No. 627.

LONDON, FRIDAY, JANUARY 16, 1885.

THE EXPORTS OF IRON IN 1884.

THE publication of the Board of Trade returns for December, from which we are able to judge pretty accurately of the course of trade during the past twelve months, does not serve in any way to mitigate the disappointment created by preceding months' accounts. Last month we exported 50,219 tons less than in the corresponding period of 1883, making the total falling-off in the shipments for the year upwards of half a million tons, while the value declined by over four million pounds sterling. Following upon the decrease exhibited in the exports for 1883, compared with those for the previous year, it will be seen that the shrinkage which occurred in 1884 places it very far below 1882, which will be remembered as the year when the shipments of iron and steel from this country attained their highest level. To speak precisely, we exported last year 857,200 tons less than in 1882; the depreciation in the value of the exports being no less than £7,110,637. But to return to the comparison with 1883, in which we are more immediately interested, we find that the total shipments in the twelve months ending December 31 last amounted to 3,496,352 tons, as against 4,043,308 tons, or a falling off of 546,956 tons. The value of the exports were £24,487,669 and £28,590,216 respectively, showing a decline of £4,102,547. These figures give a decrease of 13·5 per cent. in the quantity and of 14·3 per cent. in the value; the approximation of these ratios indicating the comparatively trifling downward movement which took place in prices last year. They also show that the iron trade suffered from restricted consumption more largely than did the majority of the other industries of the kingdom; for the total imports of all kinds of merchandise exhibit a falling-off of only 8·4 per cent. in value; while the aggregate exports of British and Irish produce show a decline in value of but 2·8 per cent.

The very large decrease in the tonnage exported last year may be practically laid at the door of the diminished shipments of pig-iron and railway material alone, for the alterations which have taken place in other classes are trivial compared with the decline under these two items. The exports of the former were 294,371 tons less than in 1883, while of the latter 241,929 tons less were shipped. At a very long interval behind these figures we have a decrease of 29,639 tons in the quantity of old iron exported, and of 16,517 tons in the shipments of steel blooms. But the variations shown by the different classes of iron and steel have not been all adverse to last year. Under the head of bars, angles, &c., we have an improvement of 8,054 tons; while, at the same time, the exports of tinplates increased by 19,333 tons, and those of cast and wrought manufactures by 19,435 tons. Only in the case of tinplates, however, has an improvement taken place in the value, and there it amounts merely to £40,300. In spite of the increased quantities exported of bars, angles, &c., and cast and wrought manufactures, the values have declined—that of the former by £93,348, and that of the latter by £43,841. The following table exhibits the relations in which the various classes stand to one another, and summarises the results of last year's exports:—

Total Shipments for Twelve Months ending December 31.

Descriptions of Iron.	1882.	1883.	1884.	Increase in 1884 compared with 1883.	Decrease in 1884 compared with 1883.
	Tons.	Tons.	Tons.	Tons.	Tons.
Pig-iron	1,758,072	1,564,048	1,269,677	—	294,371
Bars, angles, &c.	313,155	288,271	296,325	8,054	—
Railway material	936,949	971,165	729,236	—	241,929
Steel or iron wire	86,653	62,620	53 230	—	9,390
Hoops, sheets, &c.	342,599	347,782	348,378	596	—
Tinplates	265,039	269,375	288,708	19,333	—
Cast and wrought manufactures ..	328,262	355,842	375,277	19,435	—
Old iron	132,033	97,475	67,836	—	29,639
Steel (unwrought)	172,329	73,131	56,614	—	16,517
Manufactures of steel or steel and iron	18,461	13,500	11,071	—	2,528
Totals ..	4,353,552	4,043,308	3,496,352	47,418	594,374
			Net decrease		546,956

It is noteworthy that so far as the Board of Trade returns enable us to distinguish the destinations of our exports, the United States continues, in spite of the very large reduction in the volume of its purchases from us, to be this country's largest individual customer for iron and steel goods. In 1884 it took from us altogether 454,804 tons, or some 100,000 tons more than are credited to any other one country. This quantity, however, was 242,145 tons less than the amount of its imports in 1883. It received almost 50 per cent. less of pig-iron. Of railway material the quantity with which it is credited, while probably in a large measure destined ultimately for other countries, was nevertheless not a fourth of the imports in 1883; while its consumption of tinplates has fallen off in the face of an increase throughout the rest of the world. The whole quantity of railway material which stands in its name for last year is little more than a month's average supply to India or one of our colonies. But bad as these results are, we fear that worse will be revealed this year unless things mend very speedily. Last month, for the first time for several years, we did not export a single ton of railway material to the States; and the total of our shipments thither of all kinds of iron and steel did not exceed 26,000 tons.

Considering the prominent position which the United States still occupies amongst this country's customers, in spite of the great changes that have happened within the last two or three years, the following statement of the exports thither will, doubtless, be of interest to our readers:—

Total Exports to the United States.

Descriptions of Iron.	1882.	1883.	1884.	Decrease in 1884 compared with 1883.
	Tons.	Tons.	Tons.	Tons.
Pig-iron	488,970	289,498	157,012	132,486
Bars, angles, &c....	22,445	8,735	4,277	4,458
Railway material	108,275	74,801	17,829	56,972
Hoops, sheets, &c.	37,229	28,897	21,543	7,354
Tinplates ...	214,568	215,442	211,860	3,582
Cast or wrought manufactures ...	6,774	5,152	2,523	2,629
Old iron	95,353	46,013	25,529	20,484
Steel (unwrought)	131,281	28,411	14,231	14,180
Totals ...	1,195,386	696,949	454,804	242,145

At the beginning of last year, when reviewing the exports of iron in 1883, we were able to congratulate the trade upon the fact that the decrease shown was entirely due to the overshadowing influence of the shipments to the States, and that, eliminating these, the rest of the exports showed a considerable improvement. At the present time, unfortunately, such consolation is denied to us. The decline in the quantity shipped to America does not amount to a half of the falling-off in the total exports; in other words, there is a decrease of upwards of 300,000 tons which has to be accounted for in the shipments elsewhere. Of this amount the deliveries of pig-iron to the Continent are responsible for about 140,000 tons. The most noticeable falling-off is in the case of France, whither we exported 69,000 tons less than in 1883. Belgium took 38,000 tons less; Holland, 32,000 tons less; Germany, 22,000 tons less; and Italy, 12,000 tons less; but the year's shipments to Russia show an increase of 33,000 tons. As the decline in the total exports of railway material amounted to almost quarter of a million tons, for little more than a fifth of which the decrease in shipments to America accounts, it is clear that exports to other countries must have fallen off heavily on the whole. The most conspicuous case is that of Italy, to which there were exported 50,000 tons less, a result, if we understand aright, not altogether owing to the diminished requirements of the country, but traceable to the operation of the steel-rail manufacturers' combination. To Mexico the shipments declined by 31,500 tons, an occurrence which will surprise no one; while South Africa and Australasia each took from us less by almost the same quantity. British East Indies and "other countries" are each credited with 25,000 tons less, and British North American imports declined by 21,000 tons. On the other hand, we sent 14,188 tons to Russia, compared with 55 tons only in 1883; and the exports to Egypt, Chili, and Peru increased slightly. The improvement shown in the shipments of tinplates is the result of an increased demand from all quarters, the United States always excepted. France and Australasia have each taken 800 tons more, and British North America 6,400 tons more, while the shipments to destinations not enumerated have grown by some 15,000 tons. In the case of cast and wrought manufactures the increased exports have been very generally distributed amongst our various customers; the most notable improvements having taken place in the shipments to Holland—12,000 tons, and in those to the Argentine Republic—12,000 tons. But to South Africa and Australasia we exported less by 4,000 tons and 6,000 tons respectively.

Taking the total shipments of all classes of iron and steel to individual countries, we find, so far as can be judged from the figures supplied by the Board of Trade, that India has maintained its position the best. The aggregate of the shipments thither is 341,297 tons, or second only to the total for Germany, while the decrease compared with 1883 is but 9,000 tons, but in the case of Russia we have a marked increase, amounting to almost 50,000 tons, the principal details of which have already been given. The positions occupied by our various customers and the changes which have occurred in their consumption will be seen from the following table:—

Total Shipments by Countries.

	1882.	1883.	1884.
	Tons.	Tons.	Tons.
Russia	162,952	153,492	200,613
Sweden and Norway...	10,178	26,138	27,339
Germany	351,887	367,150	341,360
Holland	329,267	262,952	240,473
Belgium	86,554	96,755	58,314
France	205,357	195,287	127,036
Italy	152,596	172,881	111,229
Spain and Canaries ...	32,002	43,999	41,950
Turkey...	9,762	12,047	14,968
British North America	246,516	221,145	171,213
Mexico...	44,011	35,951	4,320
Brazil, Chili, and Peru	80,854	68,876	83,509
Argentine Republic ...	101,225	165,548	174,865
South Africa (B.P.) ...	56,951	57,256	22,298
Egypt	2,573	5,132	11,824
British East Indies ...	274,925	350,381	341,297
Australasia	302,450	345,559	328,414
Destinations not enumerated	603,262	689,611	676,225

The foregoing figures do not include the exports of wire, or of manufactures of steel or steel and iron combined, the details of which are not furnished.

IRON TRADE SUMMARY.

THE HOME IRON TRADE.

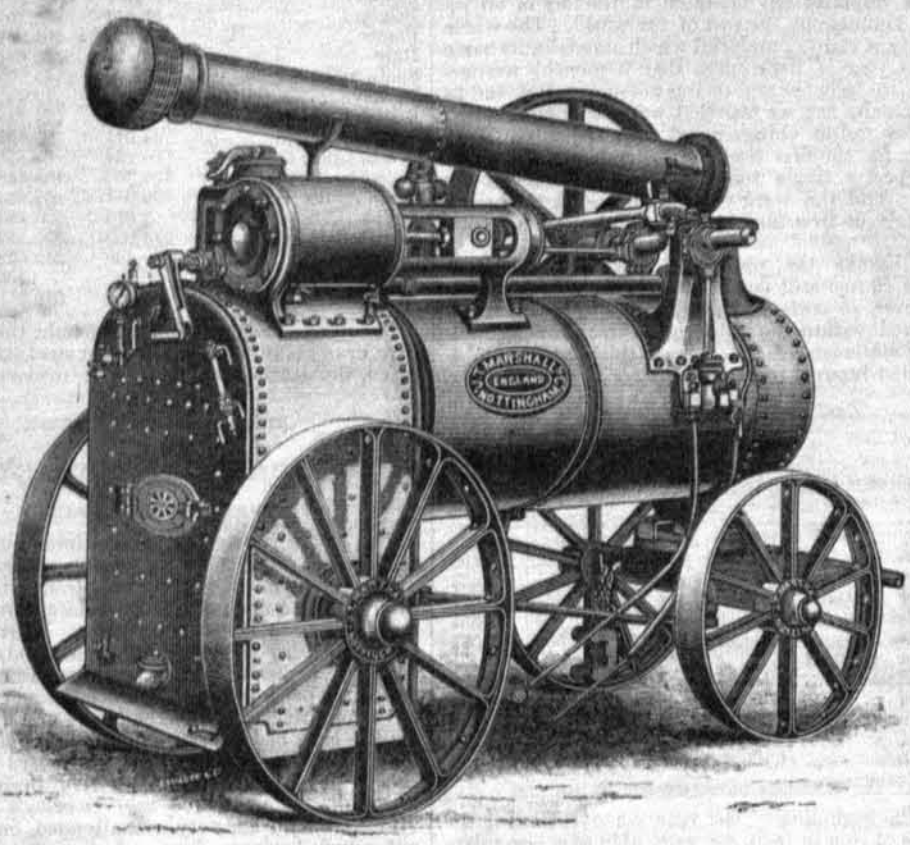
THE English iron market continues quiet, and its tendency is far from being strong. There is as yet a steady tone in the Scotch iron trade; but a rapid drop is looked upon as almost certain, should any decided selling by holders take place. Warrants closed on Wednesday at Glasgow at 42s. 3d. cash and 42s. 5½d. a month with sellers, buyers offering one halfpenny per ton less. There is no change in the tone of the pig-iron market of the North of England. The makers have had a meeting to discuss the matter of restriction, the agreement with regard to which shortly expires; but no positive decision as to continuing it was come to. Tuesday's market at Middlesbrough was very well attended, but there was not much business done. A few transactions at 35s. 3d. for prompt and 35s. 6d. per ton for forward delivery for No. 3 were reported. The average quotation with sellers may be taken as—No. 1, 38s. 6d.; No. 3, 35s. 3d.; No. 4 foundry, 34s. 3d.; No. 4 forge, 33s. 9d. per ton for G.M.B., free on board, prompt delivery. Hematite iron is unchanged at 46s. per ton f.o.b. for mixed numbers east coast brands. There has been a very quiet week at Newcastle in the crude iron business. Exports are small, and home consumers are holding off, purchasing only for immediate wants. Prices are fractionally lower, No. 3 Cleveland pig selling at 37s. 6d. and No. 4 forge quality at 36s. per ton, delivered at Newcastle. The hematite iron trade of the North-West remains in a very quiet and in many respects unsatisfactory position. The hopes of a better demand with the opening of the new year have not been fully realised, and the disposition on the part of users to place new orders has not been very marked. There is a general tendency in the direction of purchases for forward deliveries, which, on the one hand, shows that immediate requirements are small, and, on the other, that buyers are wishful to take advantage of present prices in view of a possible advance in the spring. Makers, however, are meeting this disposition by securing 1s. per ton more for forward than for prompt deliveries. In Lancashire a dull depressed tone continues, and although prices are not openly quoted any lower by makers, there would seem to be an easier tone in the market. Although sellers are again showing more willingness to book pig-iron over the half-year, or even longer, at about recent rates, there is generally a strong disinclination to entertain business on the basis of the prices that buyers apparently have in view. The result is that, although there is a fair weight of business offering at a price, the actual turn is very small. Lancashire pig-iron makers are doing fairly well, and remain firm at 41s. to 41s. 6d., less 2½, as their minimum quotation for delivery equal to Manchester; about the same figures also still remain the average price for good district brands delivered there, although there are sellers at as low as 40s. to 40s. 6d., less 2½, delivered into the Manchester district. Hematites are, if anything, rather easier; for good brands of foundry delivered at Manchester some makers hold out for 54s., less 2½, but there are ready sellers at 53s. to 53s. 6d., less 2½, delivered there. Business in pig-iron is a little more vigorous in East Worcestershire, at about present prices, and the same may be said of the Staffordshire district.

The business doing in the finished iron market is restricted, and, as a rule, consumers have the advantage in price. Scotch works have not sufficient orders to keep them fully employed. In the manufactured iron trade of the Tyne district there is increasing dulness, shipbuilders only taking moderate quantities. Ship plates delivered are easily obtainable at £5 per ton; angle iron realises £4 12s. 6d. to £4 15s.; bars fetch £5 2s. 6d. to £5 5s., and boiler plates £6 to £6 2s. 6d. per ton, less the usual commission. In the North of England generally finished iron is unaltered. There is nothing encouraging in the heavier classes of iron, angles and plates being especially depressed. The bar makers are in many

IMPROVED PORTABLE ENGINE.

BY MESSRS. J. T. MARSHALL & CO., NOTTINGHAM.

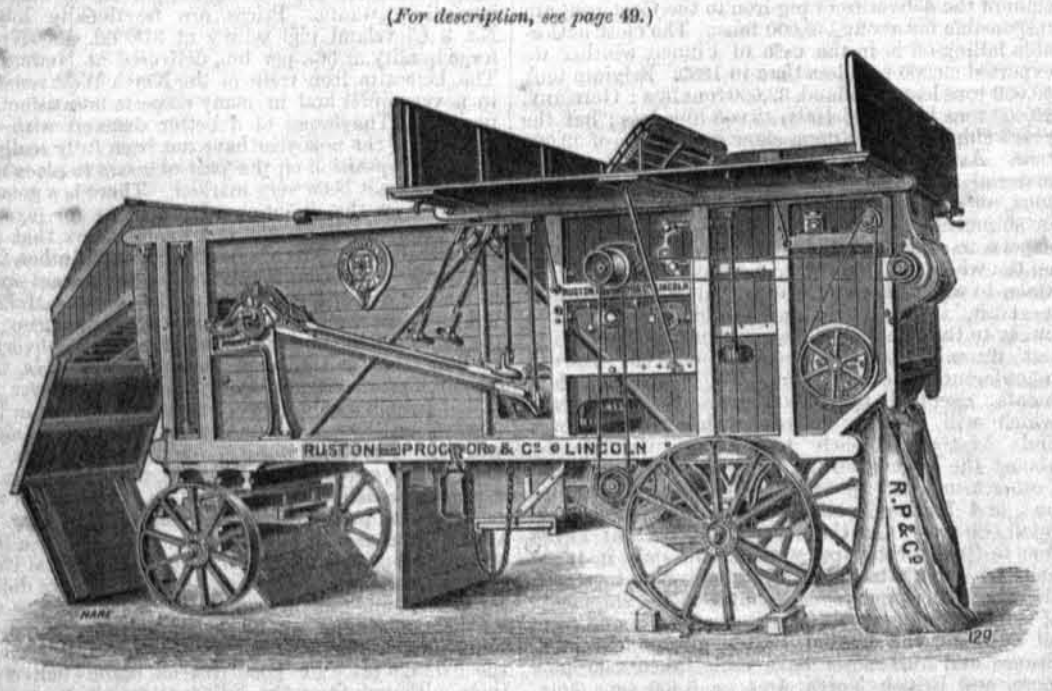
(*For description, see page 48.*)



FINISHING THRASHING MACHINE.

BY MESSRS. RUSTON, PROCTOR & CO., LINCOLN.

(*For description, see page 49.*)



cases doing pretty fairly, especially for the better descriptions of iron. There are still pretty good orders in hand for foundry and general work, including bridgebuilding, waggons, &c., and a Darlington engineering and iron firm have just taken a large order for two bridges and the ironwork for a new railway station in Scotland. The forgeworks are quiet, as a considerable portion of the output is usually for shipbuilding. Quoted prices of manufactured iron are :—Bars, £5 to £5 2s. 6d. ; best bars, £5 10s. to £5 12s. 6d. ; angle iron, £4 12s. 6d. to £4 15s. ; ship plates, £4 17s. 6d. to £5 ; girder plates, £5 5s., less 2½ per cent. In the Lancashire manufactured iron trade orders are coming forward very slowly, and some of the local forges are only very differently employed. A few of of the leading makers still hold to £5 12s. 6d. for bars delivered into the Manchester district, but there are plenty of sellers at £5 10s., and it is only in exceptional cases that much above this figure is being actually got. Local-made hoops are quoted at £6 and sheets at about £7 per ton, delivered into the Manchester district. The outcome of last week's quarterly meetings has not, so far, been to increase very much the volume of business in the finished iron trade of East Worcestershire. The general quotable standard for marked bars is still £7 10s., and the Earl of Dudley's Round Oak brand is priced at the customary extra 12s. 6d. per ton, viz. £8 2s. 6d. The quarterly meeting of the iron trade in Birmingham last week did not develop any new features. The attendance was less than at any recent similar gatherings, and the amount of business done was also less. There were no official alterations in prices, which were weaker than at the previous quarterly meetings. Marked bars were nominally unchanged at £7 10s., but good bars were to be had at fully 10s. less than that figure. Good medium qualities were upon offer at £6 10s., and galvanising were from £7 upwards ; hoops, £5 5s. ; and tube strips, £5 12s. 6d. There appears to be rather more doing in the hardware trades this week, and, if anything, a slightly steadier tone is noticeable in prices, although as yet no improvement whatever can be said to have taken place, and no alterations are reported. Foreign orders for several kinds of goods are more plentiful ; home requirements, however, are nothing extraordinary for the time of year. The demand for tinplates during the week has been quiet in South Wales. A number of works have been stopped for stocktaking, which may slightly benefit the trade. Coke tins and steels have been mostly enquired for, and standard qualities still fetch 14s. to 14s. 3d. I.C. Ordinary cokes have been sold as low as 13s. 9d. I.C., but not in anything like large quantities. The announcement made at the quarterly meeting at Birmingham, that the meetings in future are to be held at Swansea has given general satisfaction in the district. The steel trade shows no change. Steel rails are £4 15s. Shipbuilding continues very slack and unprofitable. The tonnage at present being built on the Clyde is about 100,000 tons less than was on order a year ago. It is hoped that more orders will come to hand in the North of England for new ships now that delivery can be reckoned upon, as the wages of shipbuilding operatives have been arranged. The condition of the engineering trades is about the same as last reported.

THE FOREIGN IRON TRADE.

The tendency in the Austrian iron market has not improved, prices both of pig and manufactured iron being depressed. Although official quotations show but trifling changes, sales have recently been made at under quoted rates. Business is very flat in the Belgian market, makers experiencing the greatest difficulty in getting orders, and almost any price is accepted to secure them. The Belgian imports of iron and steel during the first eleven months of 1884 were 140,890 tons, against 186,957 tons in the corresponding period of 1883, and 175,273 tons in 1882. The exports amounted to 372,298 tons in 1884, 382,096 tons in 1883, and 348,004 tons in 1882. The exports of coal in the first eleven months of 1884 were 4,255,166 tons, against 4,031,777 tons in 1883, and 3,861,586 tons in 1882. The French iron market is extremely quiet. Manufacturers are adding slightly to their stocks, and are also receiving some trifling orders, transactions of any bulk being unknown. Prices, after dropping to the lowest possible point, have been arrested in their fall ; but no improvement is to be expected until greater activity in enquiry sets in. Rolled coke iron is quoted in the Haute-Marne 150 fr., mixed brands 165 fr. The German iron market is weaker, owing to the slackness of enquiry, the supply of pig-iron especially exceeding the demand ; but business is also difficult in finished iron. Values are still receding.

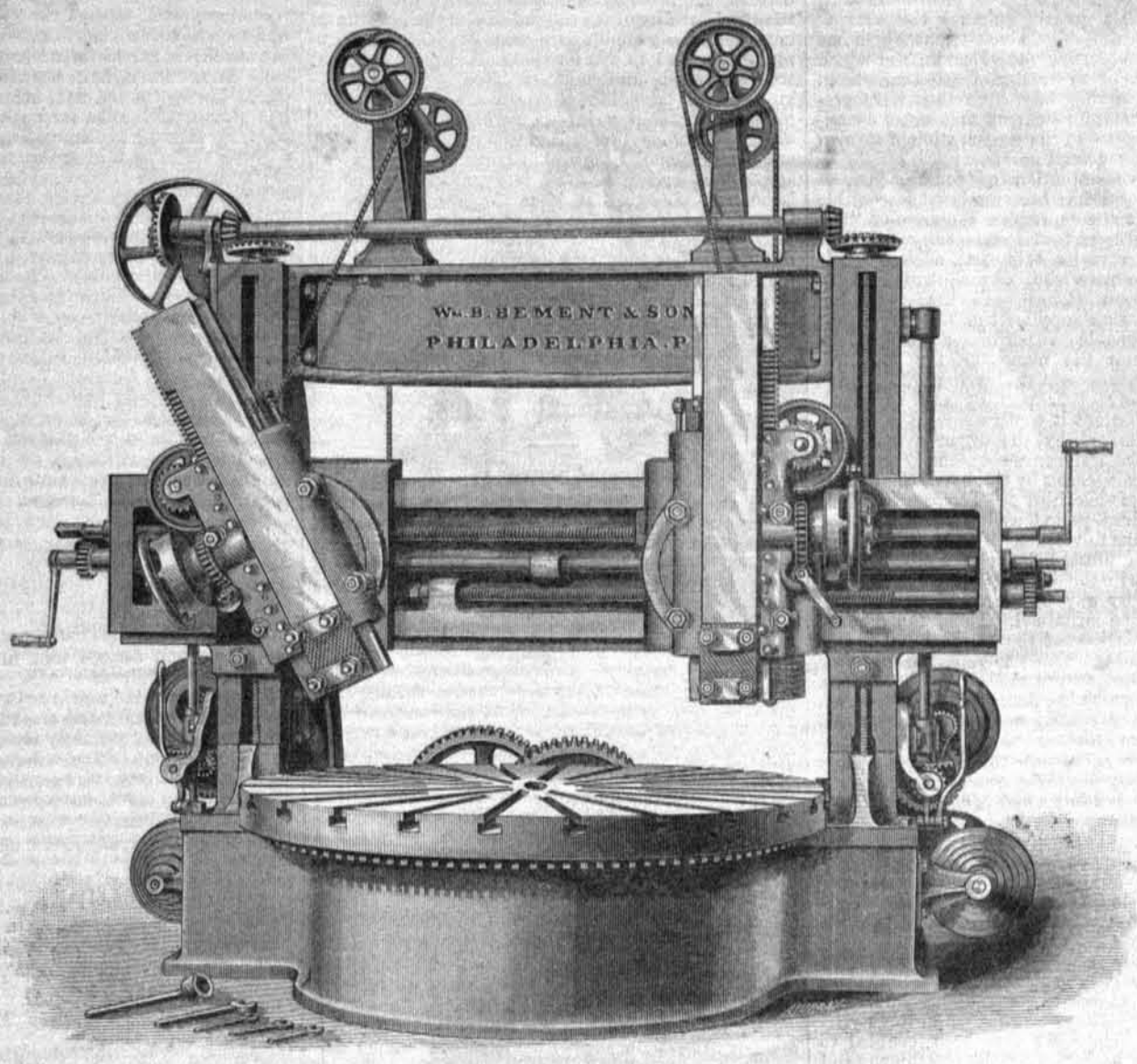
THE MECHANICS OF THE PIANO.

Of all the musical instruments of which modern society has the choice, there is not one so popular, nor one so generally patronised, as the pianoforte, and this notwithstanding its comparative expensiveness. The reason for this is to be found in the circumstance that it is the only instrument capable by its nature of becoming, as it has become, the universal medium for popularising the thoughts of the great composers of the past. But although so popular that scarcely a middle-class home in England but now boasts the possession of one of these instruments, the pianoforte is really a modern creation as compared with many others, including the organ. It was not until the beginning of the eighteenth century that the pianoforte was first heard of, its inventor being Bartolomeo Cristoforo, or, as he is sometimes called, Cristofali, a maker of harpsichords, residing at Florence. In 1711 four specimens of the new instrument are recorded as having been shown by this maker, and two examples of his skill yet exist, and which prove how slow, down to a certain period, was the progress made with the development of his invention. For over 100 year the pianoforte remained practically the same as Cristoforo left it. This slowness of development arose from the fact that of all instruments the pianoforte possesses the most delicate and intricate mechanism. In 1836, however, Mr. John Brinsmead, the founder of the firm of John Brinsmead & Sons, appears to have established a new departure in the manufacture of the pianoforte, and to have inaugurated a new era in the history of the instrument, simply by the introduction of sound mechanical principles into its construction. From that time the progress in the development of the instrument under his hand and that of his firm has been very pronounced and equally rapid. The judicious utilisation of iron and the scientific improvements of the mechanism having been once fairly established, improvement followed improvement in the details in rapid succession until the character of the instrument became thoroughly modified, if not entirely changed. By these means the pianoforte, which, fifty years since, was little better than a harpsichord with hammers, has been made susceptible of a wonderful combination of sound effects. There are other manufacturers of

VERTICAL BORING AND TURNING MACHINE.

BY MESSRS. WILLIAM B. BEMENT & SON, PHILADELPHIA.

(*For description, see page 49.*)



course who have aided in the development of the pianoforte, and have introduced noteworthy improvements, but our present notice will be confined to those of Messrs. John Brinsmead & Sons, whose improvements range practically over the whole instrument, and whose highly finished productions we have recently had the opportunity of inspecting at their rooms in Wigmore Street, London.

During the last twenty years the firm have taken out numerous patents for improvements, each of which represents a solid and distinct advance in pianoforte construction, and all of which are assembled in their latest productions. Generally stated, these improvements consist of the extension of the key-board, the lengthening of the strings, the development of the sounding-board, and the consolidation of the metal frame—qualities calculated to impart increased power of tone; and the check repeater action, and other mechanical improvements, rendering possible the accomplishment of that most important desideratum, a perfect touch. Turning to these improvements, we first notice that a remarkable stride has been effected in the formation of the consolidated metal framing. It is a singular fact that from very early days down to the almost immediate past, the frame, which needs to be the strongest feature of the pianoforte, has, in a relative sense, been the weakest. Even the introduction of iron and the casting of the frame in a single piece left the advance incomplete so long as the wrest-plank, or that portion of the frame which bears the chief strain imposed by the tension of the strings, continued to be made of wood. This defect has been remedied by Messrs. Brinsmead in a very practical manner. Instead of a division between the wrest-plank and the portion of the frame upon which it rests—that is to say, a solution of continuity caused by the use of wood for one and metal for the other—the former now constitutes part of the metal frame, the whole being cast in a single piece capable of bearing an amount of strain far in excess of any that has yet been brought to bear in the most modern development of the instrument. The strength of this frame is further increased by the mode of casting the longitudinal bars, and by such construction of the down-pressure bar as prevents its shifting from its horizontal line. The gain thus accomplished in point of solidity and capacity for wear is of the first importance. It means not only strength to stand more than thrice the period of use without deterioration, but an additional source of durability to enable the pianoforte to resist the changes of climate and atmosphere.

The check repeater action is perhaps one of the most radical and effective improvements ever introduced into a musical instrument. Its object is to lock the hammer after it has struck a blow upon the wire, and this it does most perfectly. It has taken the place of a delicate yet unwieldy apparatus, which was not without its good points, but could never be positively depended upon. It was always liable to get out of order, and, above all things, would not stand wear and tear. Intricacy has been replaced by simplicity, with accompanying qualities of a nature that previously could not have been thought of. The firm hold which this check maintains upon the hammer after the blow has been struck precludes the slightest recoil, thus permitting the string to vibrate freely and produce a clear, uninterrupted tone. For the same reason, it allows a repetition as rapid as the human fingers are capable of producing, even whilst the key is kept down almost to its lowest limit. Furthermore, there being no space between the hopper and the hammer, pressure of the finger on the key is simultaneous with the blow of the hammer on the string, while the absence of a complication of springs, centres, and other pieces of mechanism permits a firm, equable, and elastic touch, which will respond with certainty to the lightest or most powerful degrees of pressure, as we have seen demonstrated. Turning next to the sounding board, we may observe that the arrangement which makers in general have for years been content to use lacks all the qualities for giving effect to the increased dynamic force with which the action has by degrees been endowed. Neither in shape nor extent does it tend to completely augment and expand the sound produced by the vibration of the strings. This, however, is precisely what the sostenente sounding board of Messrs. Brinsmead achieves in the fullest manner. Instead of only partially covering, it wholly covers the back of the instrument, and its entire area is brought into play. Its method of attachment, moreover, is such as to secure the greatest amount of elasticity. In addition to this, it is adjusted to a delicate curve in accordance with true acoustic principles, the effect of which upon the reverberating agency is of vital import. By these methods the sounding board is made to fulfil a perfecting function in the pianoforte, the absence of which will mar the best instrument. It is much more than a mere sound reflector. It takes up the vibrations, and each tone is augmented in richness and volume, the sounds being sustained with remarkable intensity and power, as well as purity of quality. It will thus be seen that in the importance of its results upon the power and tone-sustaining capacity of the pianoforte the *sostenente* sounding board is not inferior to Messrs. Brinsmead's other inventions. We have just alluded to the curvature of form to which the sounding board is adjusted. This finds its analogy in the shape of the belly of a violin, which, as an acoustic example, is governed by a somewhat similar scientific principle. Now, both in the violin and the pianoforte the immense pressure caused by the tension of the strings has the natural effect of depressing the sounding-board. A deterioration of tone results, which in the violin can be obviated by the readjustment of the strings by means of a bridge of greater height, but in the pianoforte such counteraction has hitherto been regarded as impracticable. The impairment has been allowed to take its course, and the wearing out of the sounding-board has consequently proceeded at a rapid rate. It has remained for Messrs. Brinsmead, by a careful study of the nature of this injury, to discover a method by which its progress can be as effectually hindered as in the case of the violin. To effect this a bar is placed across the sounding-board at the furthest extremity from the bridge, and by turning screws which pass through this bar into the sounding-

board the latter can be so compressed at the edge that its centre rises and assumes once more the requisite concave shape. This is the tone-compensator. Similar in arrangement, though different in its operation, is the tone renovator which regulates the pressure of particular strings on the bridges so as to preserve the correct relation of force between the two sections. In each instance the device is so simple that it may be utilised with ease and with perfect effect. Yet, simple as it is, it overcomes an obstacle that has hitherto been regarded as insurmountable. Its application must greatly enhance the wearing capacity of that portion of the instrument which has to support the heaviest amount of strain, and which is necessarily made of the material least calculated to bear it without giving way. We thus have present in the instrument an element that must contribute in no small degree to the preservation of its own special qualities of tone and power.

The wonderful combination of sound-effects of which the pianoforte has been rendered susceptible have earned for it the expressive synonym of "the drawing-room orchestra." If it is fully to merit general recognition under this title, such a result cannot, perhaps, be more readily brought about than by means of Messrs. Brinsmead's tone-sustaining pedal. This invention supplies the very thing that was needed to enable a performer to produce orchestral effects on the piano, *i.e.* the power to sustain certain notes whilst leaving the hands free to play on any other part of the keyboard. To an appreciable extent it confers upon the pianist the advantages derived by the organist from his pedals. The notes themselves are not actually produced by the feet, but, once struck by the hand, the foot is enabled by means of this third pedal to preserve their sound for any desired period, as long, that is to say, as the wires continue to vibrate. The process is that when the pedal is pressed down it holds back by means of loops of wire the dampers which have been raised in the ordinary way by the act of striking the notes required to be sustained. Thus, the damper being the only portion of the action immediately affected, the player is at liberty to repeat the note or chord at will, or prolong the *sostenuto* effect without again raising and depressing the pedal. What a boon this supplies will be readily understood by players whose only resource hitherto has been either to keep the fingers on the keys or to use the *forte* pedal. The former plan naturally limits the command of the keyboard, while the inevitable consequence of the latter was a commingling of discords and utter confusion of sounds. With the aid of the tone-sustaining pedal the rendering of a bass pedal-point becomes an easy matter, while the reproduction of such orchestral contrasts as the unison of *legato* chords with a superstructure of complicated passages is a feat brought within the capacity of the moderate performer.

We have already referred to the consolidated frame and its immediate results in the modern piano, but we have yet to notice some highly important indirect results which have accrued from it. By its adoption Messrs. Brinsmead have been enabled to introduce a further invention for the attachment and tuning of the strings, which in a great measure depended for its practicability upon the wrestplank being made of metal. The importance of the latter arrangement has already been dwelt upon by us, and we may simply mention here that the influence of the new tuning apparatus will, generally speaking, be even more directly felt. We need hardly point out that a grave defect in the ordinary pianoforte has always been its liability to quickly get out of tune—a defect chiefly owing to the fact that the strings are held only by pegs inserted in the wooden wrestplank. These are gradually forced round in their holes by the tension of the wires pulling at them at right angles, with the inevitable result that the instrument speedily gets out of tune. Now, the new appliance does away with the old pegs, and gives the wire its necessary tension by a direct pull. The strings are carried through the solid piece of metal which forms the newly-constituted portion of the iron frame, and are fastened in such a way that is impossible for them to slip, the pull on them being effected by a screw and nut arrangement, the regulation of which is an operation of the easiest character. By this method the wire, being held in a direct line by a force which does not relax, nor (through working against a soft substance) pull round, can be maintained at its proper tension for an indefinite length of time. Even changes of climate and temperature can affect the intonation in only a modified degree, since, as the whole frame consists of metal, its expansion and contraction will be uniform with that of the strings. The facility with which, under the new arrangement, the wire can be tuned to its requisite pitch renders it possible for any person with a good ear to set a doubtful note right, if not, indeed, to tune the entire instrument. It is scarcely necessary to point out the advantage of this in places where the services of a tuner are not readily available. The physical exertion necessary is very small indeed in the new arrangement as compared with that necessary in using the old tuning hammer, which requires a very strong wrist to turn it at all, much less to give it that delicate but powerful touch demanded to perfectly adjust the tone.

Although Messrs. Brinsmead have improved various other details in the pianoforte, we will here only notice their transposing keyboard. This they have introduced in order to facilitate the accompaniment of the voice in whatever key may be wished. It is an ingenious arrangement, by means of which the performer can, by the mere turn of a clock-key, raise or lower the pitch a semitone, a whole tone, or several tones. It is hardly necessary to state that improvements such as we have been describing, tending, as they have, to increase the mechanism and the capabilities of the pianoforte, have necessarily tended to increase the manufacturers' reputation, and to win for them many solid and substantial awards and honours. Not less valuable—although less tangible to themselves, and less palpable to their contemporaries—is perhaps the honour of being the exponents of substantial progress in respect of the most popular musical instrument of the present age, and of having assisted very materially in popularising it. Looking at what the firm have done in the past, it is not too much to expect that the improvements we have noticed are but stepping stones to others which they may develop in the future, and which shall combine to produce instrumental qualities of a still more imposing, perfect, and—to the true lover of music—satisfying nature.

Occasional Notes.

TRADE PROSPECTS.

We are glad to find that the view expressed in these columns, that the coming year bears a more promising aspect than that which is behind us, is shared by men of business. Messrs. J. C. Mounsey & Co., of 7, Laurence Pountney Hill, E.C., state at the close of their review of the past year that, in looking forward to the future, they take encouragement from the fact that prices have now reached the same level as in 1879, when so much depression existed, and it, therefore, seems impossible for any farther decline to take place. Many large buyers evidently take the same view, as there certainly is more disposition in some quarters to take advantage of present rates to cover requirements for the next six months. Should any extra demand set in during the early months of the year, prices are almost certain to rebound, as it requires very little to inspire sufficient confidence to bring about a general improvement in trade. We have been in the habit of looking to America as the starting-point, but the financial position of that country is still too unsatisfactory to render us much assistance at present. Our colonies and India are likely to be good customers in the future, and we may probably anticipate work through the various colonisation schemes at present on foot. This is a matter which should engage the earnest attention of the people of this country, as there is little doubt in future our colonies will have to supply the chief backbone to the trade of this country. Increase in exports and imports means not only trade in the material sent to and from, but also gives work to our shipyards and engineering establishments, as in these days of rapid improvements vessels must be provided of a capacity and speed to meet the exigencies of trade and competition. The £5,500,000 to be spent by our Admiralty over the next few years will benefit the steel manufacurers of this country, but it may be hoped that the strong feeling existing will encourage the government to increase the amount to a very considerable extent. Altogether, therefore, we may look forward with hope to the future, remembering that the iron trade has always been one of surprises.

EXTENSION OF THE TELEPHONE.

There is always a pulling up of roads and side-walks, as the Americans say, going on in London; but for the last six months unusual energy has been displayed in taking up pavements, both in the City and West-end, by those burrowing destroyers of our clothes and tempers. The evil, however, which has been borne, we hope, if not patiently, at least decorously, will not be without its recompense in the additional supply of telephonic communication between the various parts of the metropolis. We are informed that at the end of the present month all the West-end exchanges of the United Telephone Company will be kept open all night as well as during the day. The convenience of this to the district subscribers will be very great, as in the event of any need of communication with a doctor, or with the police, or a fire station, or in any other emergency, the requirements can be satisfied by this arrangement with a rapidity and explicitness unattainable by any other means. In Paris the public call system, which was permitted by the Ministère des Postes et Télégraphes in the like manner with the concession granted by the English Post Office, has already borne fruit. Call stations have been established there, through which, for a small fee, the public can have speaking communication. These call stations are two at the Bourse, and the others respectively in the Rue des Halles, Rue de Grenelle, Saint-Germain, Place de la Madeleine, and at the Grand Hôtel. The night communication in London at the West-end is a step in the right direction, but it cannot be accepted as a reason why, if Paris can avail itself of the public call system, London should be unable to do likewise. The convenience in cities and towns of the telephone over the telegraph is immense, as the business can be discussed and concluded in a few minutes, instead of at least an hour's delay by telegram, and from two to four hours by post.

SYSTEMATIC OVERCROWDING IN PUBLIC CONVEYANCES.

Once more, in this wet and dirty season, a protest ought to be entered, in the interest and for the protection of the travelling public, against the systematic overcrowding which has become chronic in railway carriages, tram-cars, and omnibuses, the degree of crowding moderating in the order given. The chief sinners are still the railway companies, and they will continue to be the principal transgressors of a well recognised rule of public decency and comfort as long as they are not brought within the reach of the law. The cases of overcrowding on railways have been so numerous and so flagrant, especially during the past year, that it appears almost useless to draw attention to them, were it not for the hope that some legislative benefactor will at last take upon himself the task of giving relief to a suffering and helpless public. Although tramway and omnibus companies are not the principal offenders in regard to this question, their way of sinning is far more serious, because they are legalised, that is to say, licensed, to carry a number of passengers in their conveyances for whom there is really not sufficient room. The ordinary tram-car is supposed to give inside sitting accommodation to twenty-two persons, and the common omnibus to twelve inside passengers. Now, we appeal to those who have to use the two latter modes of travelling whether there is sufficient room for more than twenty and ten inside passengers respectively. Tram-cars and omnibuses are, on the whole, well looked after by the police, but this supervision appears almost ridiculous considered along with the fact that, through official oversight, or carelessness, or stupidity, those public conveyances have been licensed to carry more passengers than they can conveniently hold.

PROPOSED SUBWAYS IN THE CITY.

Not a moment too soon the Commissioners of Sewers have taken a practical step towards lessening the dangers attending crossing the most crowded spots of the City thoroughfares. They have referred to a committee the consideration of a scheme for forming a spacious chamber under the roadway opposite the Mansion House, with four subways radiating in various directions, the object being to relieve the congested traffic at that point, and to provide a safe crossing for pedestrians. The chamber is to be in the centre of the roadway, circular in form, and about 20 feet in diameter, with an 8-foot skylight at the top. Around this, on the surface, a pavement 6 feet wide is to be put, forming an effective refuge for foot passengers. The four subways are to radiate from the central chamber to the Union Bank, to the north-east corner of the Mansion House, to the open space in front of the Royal Exchange, and to the Globe Insurance Office. The subways are to be lined with glazed white bricks and lighted by electricity. Considering the extremely dangerous nature of the spot, the scheme deserves to be heartily supported. It ought to be applied also in other crowded localities of this great city.

A LARGE VALVE.

A 56-inch valve has been made by the Eddy Valve Company, Waterford, New York, for the Central Milling Company, Niagara Falls. In the waterworks of several large American cities, 36-inch pipes are used, and a few cities have 48-inch pipes, but no larger. The 56-inch valve under notice is for use at the bottom of a pit or shaft 75 feet deep, and is to be placed between an iron stand pipe and a turbine water wheel, so that the water can be shut out of the wheel case, and the wheel inspected from inside the case, without having to shut off the water at the canal upon the surface of the ground. The opening being 56 inches, the gate of the valve is about 60 inches in diameter, giving an area of 2,827 square inches, and a pressure of 92,000 lb. upon the back of the gate when it is closed. To withstand such a pressure, and be serviceable, requires first-class material and work. The valve is about 6 feet wide and about 11½ feet high over all, and 2 feet from face to face of flanges. It was made specially for the place and purpose named, and is supposed to be the largest valve ever made.

IMPROVED PORTABLE ENGINE.

The engraving on page 46 of our present issue illustrates a well designed and useful portable engine of 3 horse-power nominal, which we found at the late Smithfield Club Show on the stand of Messrs. J. T. Marshall & Co., of Sandiacre, Nottingham. This engine has a cylinder 6½ inches diameter by 9 inches stroke, which really brings it up to more than 4 horse-power. The diameter of the crank shaft is 2⅛ inches; that of the flywheel, 3 feet 9 inches, and it is 5½ inches wide. The total heating surface is 65·39 square feet, and the grate area is 2·39 square feet. The fire-box is of Lowmoor iron, strongly stayed on the top and sides to stand a working pressure of 90 lb. per square inch. The barrel plates are of best Yorkshire iron, and the longitudinal seams are double-rivetted. The

cylinder is cast of selected hard metal, the piston barrel or liner being separate and forced into the main casting, leaving an annular space round the barrel, which forms the steam jacket, thus ensuring an entire jacket of steam, and the absence of cavities for the lodgment of condensed water, mud, and grease. The arrangement of cylinder and connections is novel, and embodies several improvements, the stop, equilibrium, and safety valves being self-contained with the cylinder, the whole, including the steam jacket, being fed from one inlet from the boiler only. The stop valve is of the vertical sliding type, and is placed in a chamber at the back of the steam chest, where it is easily accessible by the removal of a cover. The throttle valve is an improved double-beat equilibrium valve, actuated by a lever connected directly to the governor, and is placed in a chamber which is easily go tat from the top of the cylinder. The steam chest is surmounted by a pair of neatly designed safety valves, of the Ramsbottom type, but in addition to these there is a lock-up safety valve with an easing lever at the other end of the boiler, fixed on the crank shaft saddle. The slide valve is carried by a guide, bolted to the face of the steam chest, and is driven by a variable expansion eccentric. The crosshead is cylindrical, and slides in a cast-iron guide, cast in one piece with the cylinder cover. The governor is of the cross-armed type, loaded with a centre weight and adjustable spring, which by the alteration of a nut can be made to increase or reduce the speed of the engine. The crank-shaft is sufficiently long to carry a pulley at either end. An improved self-locking turn-plate is used, by which the use of unwieldly check chains is dispensed with. Within the boiler is placed an anti-primer, or steam collector, by which it is claimed that the advantage of using dry steam is obtained, and the inconvenience attending the ingress of water to the cylinder prevented. Altogether this little engine, both from its design and construction, is well worthy of notice.

FINISHING THRASHING MACHINE.

IN our notice of the late Smithfield Club Show we briefly referred to the new thrashing machine of Messrs. Ruston, Proctor & Co., of the Sheaf Ironworks, Lincoln, which constituted the chief, if not the sole, novelty in this class of machinery. This machine we now illustrate on page 46 of our present issue. Its novelty consists in the circumstance that the shoe and shaker cranks with all their internal bearings are entirely dispensed with, and in their place one plain straight shaft is used, which drives both shoes and shakers by means of eccentrics on each side, as will be seen from our engraving, the former direct and the latter by means of crossbars passing from side to side. They will run for a very long time without any appreciable wear, special means being taken for securing a thorough lubrication. So efficiently is this done that, after this part of the machine is oiled in the morning, it is found that attention is not required till the close of the day. There are in all six oil cups for these parts, and four small oil holes for the hangers which carry the back ends of the shakers, all accessible from the outside, whereas in the ordinary machine of a similar size there are twelve or thirteen large bearings requiring oil or grease and ten oil holes, most of which are quite inaccessible, and in consequence have scant attention. In a double crank machine there are twenty important bearings, only four of which can be reached from the outside. It is clear that the saving in wear and tear and renewals, as well as in the cost of lubrication, must be very great. Owing also to the reduction in the number of bearings, and the absence of any exposure to dust and dirt inside the machine, the running is much easier than usual. The other parts of the machine are of Messrs. Ruston's usual standard pattern, and it is fitted with their improved smutter for cleaning and polishing the grain, the impurities being led off to a separate spout, thus keeping the sacking end of the machine as clean and free from dust as possible. A creeper is also provided, so that the grain may pass directly from the elevators to the second dressing riddles without going through the smutter; and by a neat arrangement of slides the machine may be changed at pleasure to a double blast, by omitting the action of the separating screen, or to a single blast, using neither this nor the second dressing riddles, by sacking the corn as it falls from the elevators. The entire construction is remarkably simplified, and the machine constitutes a new and important departure in the class to which it belongs.

VERTICAL BORING AND TURNING MACHINE.

A RECENT example of American practice in large machine tools is illustrated on page 47 of our present issue. This tool is a 7-foot vertical boring and turning machine which is one of a series manufactured by Messrs. William B. Bement & Son, of Philadelphia. It is capable of boring, turning and facing a piece of work 7 feet in diameter and 4 feet high. The revolving table, or face-plate, is 6 feet 4 inches in diameter, and receives motion from a cone and gearing at the back of the machine, having abundant power and range of speeds for work from 2½ inches to 7 feet diameter. The construction is such that all the shaft journals are upon the frame itself, no separate or external support being required. The bearing on which the table revolves has the form known as the Schiele curve. A curve of large diameter is used, a suitable portion of its largest diameter being applied to give the required vertical support, while another portion of the same curve, taken at a much smaller diameter, is applied centrally to perform the office of a spindle, and give lateral support and steadiness. The relative self-adjustment of the two parts is perfect, and a bearing of this kind, properly arranged and constructed, runs with great freedom and steadiness, requiring no attention beyond oiling. The cross slide is moved vertically upon the uprights by power, and is of such form as to withstand the strain of the cuts equally well in either direction. The cutter bars are of rectangular section, hollow, and have good bearing surfaces, with ready means of adjustment. Their construction gives them great stiffness, without excessive weight. They have a vertical traverse of 3 feet, and are balanced by weights, which are quite out of the way, and can be separately adjusted to suit the angle at which either may be working, or the greater or less weight of tool which may be in use. The front of each cutter bar is quite clear, admitting of the use of a large square tool or toolstock of any length. The variety of feed is ample for all purposes and materials. Each tool has its own complete and independent feed gear, so that either may be moved in any direction and at any rate of speed, without regard to the direction or rate of the other. The vertical adjustment of either tool may be operated from the end of the cross slide or at the side of the cutter bar, and each has a quick hand-motion by means of a rack and pinion. The machine weighs nearly 17 tons, and this weight of material carefully distributed renders this borer sufficiently strong and rigid to enable it to get through heavy work with rapidity and accuracy.

ENGINEERING INVENTIONS SINCE 1862.*

BORN in the year this institution was founded, and by God's mercy permitted to continue an active worker for more than half a century, I now find myself, by your favour, elected to the presidency. In accordance with established usage I have the privilege, but also, I regret to say, the heavy burden, of delivering an address: a privilege, because by your courtesy I see around me an audience of most distinguished men; a heavy burden, because of my inability to make that address worthy of my audience. I can imagine that in many societies, each president, as he takes office, must find an increase in the difficulty of selecting a subject for his address. He must feel that the area to which he is restricted has been so well trodden by his predecessors that it is hardly possible for him to strike out a new path on untraversed ground; but it seems to me that many years must elapse (indeed I doubt if the time will ever come) when the president of the Institution of Civil Engineers need fear such a condition of things. Our profession is so widespread, it ramifies in so many directions, that successive presidents cannot be embarrassed for want of a subject, but rather must find a difficulty in making a selection among many subjects. I have been determined in my choice by the consideration that our member, His Royal Highness the Prince of Wales, has seen fit to honour the institution by appointing its president to the chairmanship of the executive council of the exhibition of inventions, which is to take place this year at South Kensington. I have, therefore, thought it would be fitting and appropriate, that in my double capacity of your president and of chairman of that council, I should direct attention this evening to some of the matters which will be, or which ought to be, contributed to the exhibition. The exhibition will consist of two divisions very dissimilar in their nature, the one "inventions" and the other "music." Division I. (inventions) is separated into thirty-one groups, and these groups into 165 classes, but to a few of these only will reference be made. In fact, I must restrict myself to such matters as are more particularly connected with civil engineering, which, as defined by our charter, may be summarised as comprising "all engineering other than military." I must, however, make a still further limitation; for engineering, regarded in this sense, is so comprehensive in its scope, that it is difficult to say, what there is of invention, in which the engineer has not an interest. Even a purely chemical invention may not be foreign to our consideration; take as a test of this an invention relating to the manufacture of gas, or to the purification of water, or to the treatment of metals, or to some kindred subject.

I propose, therefore, to devote the very limited time at my disposal to the consideration of some of the most important of those improvements which are obviously and immediately connected with civil engineering. I am aware of the danger there is of making a serious mistake, when one excludes any matter, which at the moment appears to be of but a trivial character. For who knows how speedily some development may show that the judgment which had guided the selection was entirely erroneous, and that that which had been passed over was in truth the germ of a great improvement? Nevertheless, in the interests of time some risk must be run, and a selection must be made; I propose, therefore, to ask your attention while I consider certain of (following the full title of Division I.) "The apparatus, appliances, processes and products invented or brought into use since 1862." In those matters which may be said to involve the principles of engineering construction, there must of necessity be but little progress to note. Principles are generally very soon determined, and progress ensues, not by additions to the principles, but by improvement in the methods of giving to those principles a practical shape, or by combining in one structure principles of construction which had been hitherto used apart. Therefore, to avoid the necessity of having a pause, in referring to a work, by finding that one is overstepping the boundary of principle, and trenching within the domain of construction, I think it will be well to treat these two heads together. If my record had gone back to just before 1851 (the date of the great exhibition), I might have described much progress in the principles of girder-construction; for shortly prior to that date, the plain cast-iron beam, with the greater part of the metal in the web, and with but little in the top and bottom flange, was in common use; and even in the preparation of the building for that exhibition, it is recorded that one of the engineers connected therewith had great difficulty in understanding how it was that the form of openwork girder, with double diagonals introduced therein (a form which was for years afterwards known as the exhibition girder) was any stronger than a girder with open panels separated by uprights, and without any diagonals. But, long before 1862, the Warren and other truss-girders had come into use, and I am inclined to say, that so far as novelty in the principle of girder-construction is concerned, I must confine myself to that combination of principles which is represented by the suspended cantilever, of which the Forth Bridge, only now in course of construction, affords the most notable instance. It is difficult to see how a rigid bridge, with 1,700 feet spans, and with the necessity for so much clear headway below, could have been constructed without the application of this principle.

Pursuing this subject of bridge work. The St. Louis Bridge of Mr. Eads may, I think, be fairly said to embody a principle of construction novel since 1862, that of employing for the arch-ribs tubes composed of steel staves hooped together. Further, in suspension bridges there has been introduced that which I think is fairly entitled to rank among principles of construction, the light upper chain, from which are suspended the linked truss-rods, doing the actual work of supporting the load, the rods being maintained in straight lines, and without the flexure at the joints due to their weight. In the East River Bridge, New York, there was also introduced that which I believe was a novelty in the mode of applying the wire cables. These were not made as untwisted cables and then hoisted into place, thereby imposing severe strains upon many of the wires composing the cable through their flexure over the saddles and elsewhere, but the individual wires were led over from side to side, each one having the length appropriate to its position, and all, therefore, when the bridge was erected, having the same initial strain and the same fair play. Within the period we are considering, the employment of testing-machines has come into the daily practice of the engineer; by the use of these he is made experimentally acquainted with the various physical properties of the materials he employs, and is also enabled in the largest of these machines to test the strength and usefulness of these materials, when assembled into forms, to resist strains, as columns or as girders. I of course do not for one moment mean to say that experimental machines were unknown or unused prior to 1862—chain cable testing machines are of old date, and were employed by our past-president, Mr. Barlow, and by others, in their early experiments upon steel—but I speak of it as a matter of congratulation that, in lieu of such machines being used by the few, and at rare intervals upon small specimens, for experimental purposes, they are now employed in daily practice and on a large scale. In harbour work we have had the principle of construction employed by Mr. Stoney at Dublin, where cement masonry is moulded into the form of the wall for its whole height and thickness, and for such a length forward as can be admitted, having regard to the practical limit of the weight of the block, and then, the block being carried to its place, is lowered on to the bottom which has been prepared to receive it, and is secured to the work already executed by groove and tongue.

It would not be right, even in this brief notice of such a mode of construction, to omit mention of the very carefully thought out apparatus by which the blocks are raised off the seats whereon they have been made, and are transported to their destination. It is no simple undertaking (even in these days) to raise (otherwise than hydraulically) a weight of 350 tons, which is the weight of the blocks with which Mr. Stoney deals. But he does this by means of pulley-blocks attached to shears built on the vessel which is to transport the block, and he contrives to lift the weight without putting upon his chains the extra strain due to the friction of the numerous pulleys over which they pass. The height of the lift is only the few inches needed to raise the block clear of the quay on which it has been formed, and this is obtained by winding up the chain by steam gear quite taut so as to take a considerable strain, but not that equal to the weight of the block, and then water is pumped into the opposite end of the vessel to that upon which the shears are carried, this latter end rises, and the block is raised off the seat on which it was formed, without the chains being put to work to do the actual lifting at all. The vessel, with the block suspended to the shear legs and over the bows, is then ready to be removed to the place where the block has to be laid. A word must here be said about an extremely ingenious mode of dealing with the slack chain, to prevent its becoming fouled, and not paying out properly, when the block is being lowered. This is accomplished by reeving the slack of each chain over two fixed sets of multiple sheaves. A donkey-engine works a little crab having a large drum, the chain from which is connected with the main chain, and draws it round the multiple sheaves so as to take up the slack as fast as the main crab gives it out. The steam is always on the donkey, which is of such limited dimensions that it can do no injury to the chain even when its full power is in vain endeavouring to draw it any further; directly, however, the main crab gives more slack, and the chain between it and the two sets of sheaves falls into a deeper catenary, and one which therefore puts less opposition to the motion of the donkey-engine, that engine goes to work and makes a furthur haul upon the slack, and in this way, and automatically, the slack is kept clear.

A noteworthy instance of the use of pneumatic appliances in cylinder-sinking for foundations is that in progress at the Forth Bridge. The wrought-iron cylinders are 70 feet in diameter at the cutting edge, and have a taper of about 1 in 46. They are, however, at a height of 1 foot above low water (that is, at the commencement of the masonry work of the pier) reduced to 60 feet in diameter; at their bottoms there is a roofed chamber, into which the air is pumped, and in which the men work when excavating, this roof being supported by ample main and cross lattice girders. Shafts with air-locks and pipes for admitting water and ejecting silt are provided. The air-locks

* Address of Sir Frederick Joseph Bramwell, F.R.S., on his election as president of the Institution of Civil Engineers, January 13, 1885.

are fitted with sliding doors, worked by hydraulic rams, or by hand, the doors being interlocked in a manner similar to that in which railway points and signals are interlocked, so that one door cannot be opened until the other is closed. The hoisting of the excavated material is done by a steam engine fixed outside the lock, this engine working a shaft on which there is a drum inside the lock, the shaft passing air-tight through a stuffing box. A separate air-lock with doors, ladder, &c., complete, is provided to give ingress and egress for the workmen. I have already adverted to one Scotch bridge; I now have to mention another, viz. the Tay Bridge, also now in course of construction. Here the cylinders are sunk, while being guided, through wrought-iron pontoons, which are floated to their berths and are then secured at the desired spot by the protrusion, hydraulically, of four legs, which bear upon the bottom, and thus, until they are withdrawn, convert the pontoon from a floating into a fixed structure.

I regret that time will not admit of my giving any description of the modes of "cut and cover" which have been proposed for the performance of sub-aqueous works; sometimes the proposition has been to do this by means of coffer-dams, and with the work therefore open to the daylight during execution, and sometimes by movable pneumatic appliances. Consideration of sub-aqueous works necessarily leads the mind to appliances for diving, and although its date is considerably anterior to 1862, I feel tempted, as I believe the construction is known to very few of our members, to say a few words about the diving apparatus known as the "Bateau-plongeur," and used at the "barrage" on the Nile. This consists of a barge fitted with an air-tight cabin, provided with an air-lock, and having in the centre of its floor a large oval opening, surrounded by a casing standing up above the water-line. In this casing, another casing slides telescopically, the upper part of which is connected to the top of the fixed casing by a leather "sleeve." When it is desired to examine the bottom of the river, the telescopic tube is lowered till it touches the bottom, and then air is pumped into the cabin until the pressure is sufficient to drive out the water, and thus to expose the bottom. This appears to be a very convenient arrangement for shallow draughts of water. Reverting for a moment to Mr. Stoney's work, I may mention that he uses for the greater depths he has to deal with, when preparing the bed to receive his blocks, a diving apparatus which (while easily accessible at all times) dispenses with the necessity of raising and lowering, needed in an ordinary diving-bell, to allow of the entrance and exit of the workmen. Mr. Stoney employs a bell of adequate size, from the summit of which rises a hollow cylinder, furnished at the top with an air-lock, by which access can be obtained to the submerged bell. Beyond the general improvement in detail and in the mode of manufacture, and with the exception of the application of the telephone, there is probably not much to be said in the way of invention or progress in connection with the ordinary dress of the diver. But one great step has been made in the divers' art by the introduction of the chemical system of respiration, the invention of Mr. Fleuss. He has succeeded in devising a perfectly portable apparatus, containing a chemical filter, by means of which the exhaled breath of the diver is deprived of its carbonic acid; the diver also carries a supply of compressed oxygen from which to add to the remaining nitrogen oxygen, in substitution for that which has been burnt up in the process of respiration. Armed with this apparatus, a diver is enabled to follow his avocations without any air-tube connecting with the surface, indeed, without any connection whatever. A notable instance of a most courageous use of this apparatus was afforded by a diver named Lambert, who, during one of the inundations which occurred in the construction of the Severn tunnel, descended into the heading, and proceeding along it for some 330 yards (with the water standing some 35 feet above him), closed a sluice door, through which the water was entering the excavations, and thus enabled the pumps to unwater the tunnel. Altogether, on this occasion, this man was under the water, and without any communication with those above, for one hour and twenty-five minutes. The apparatus has also proved to be of great utility in cases of explosion in collieries, enabling the wearer to safely penetrate the workings, even when they have been filled with the fatal choke damp, to rescue the injured or to remove the dead.

With respect to the subject of tunnelling thus incidentally introduced—in sub-aqueous work of this kind, I have already alluded to that which is done by "cut and cover," but where the influx of water is a source of great difficulty, as it was in the old Thames tunnel (though in this case for water one should read silt or mud), I do not know that anything has been devised so ingenious as the Thames tunnel shield; improvement has, however, been made by the application of compressed air. In the instance of the Hudson River tunnel, the work was done in the manner proposed so long ago as the year 1830 by Lord Cochrane (Earl Dundonald) in that specification of his, No. 6018, wherein he discloses, not merely the crude idea, but the very details needed for compressed-air cylinder-sinking and tunnelling, including air-locks and hydraulically-sealed modes, for the introduction and extraction of materials. I may, perhaps, be permitted to mention that some few years ago I devised for a tunnel through the water-bearing chalk a mode of excavation by the use of compressed air to hold back the water, and combined with the employment of a tunnelling machine. This work, I regret to say, was not carried out. But there are, happily, cases of sub-aqueous tunnelling where the water can be dealt with by ordinary pumping power, more or less extensive, and where the material is capable of being cut by a tunnelling machine. This was so in the Mersey tunnel, and would be in the Channel tunnel. In the Mersey tunnel, and in the experimental work of the Channel tunnel, Colonel Beaumont and Major English's tunnelling machine has done most admirable work. In the 7-foot 4-inch diameter heading, in the new red sandstone of the Mersey tunnel, a speed of as much as 10 yards forwards in twenty-four hours has been averaged, while a maximum of 11⅛ yards has been attained; while in the 7-foot heading for the Channel tunnel, in the grey chalk, a maximum speed of as much as 24 yards forwards in the twenty-four hours has been attained on the English side, and with the later machine put to work at the French end, a maximum speed of as much as 27½ yards forwards in the twenty-four hours has been effected. In ordinary land tunnelling since 1862 there has been great progress, by the substitution of dynamite and preparations of a similar nature for gunpowder, and by the improvements in the rock-drills worked by compressed air, which are used in making the holes into which the explosive is charged. For boring for water, and for many other purposes, the diamond drill has proved of great service, and most certainly its advent should be welcomed by the geologist, as it has enabled specimens of the stratum passed through to be taken in the natural unbroken condition: exhibiting not only the material and the very structure of the rock, but the direction and the angle of the dip of the beds.

Closely connected with tunnelling machines are the machines for "getting" coal. This "getting," when practised by manual labour, involves, as we know, the conversion into fragments and dust of a very considerable portion of the underside of the seam of coal, the workman labouring in a confined position, and in peril of the block of coal breaking away and crushing him beneath it. Coal-getting machines, such as those of the late Mr. Firth, worked by compressed air, reduce to a minimum the waste of coal, relieve the workman of a most fatiguing labour in a constrained position, and save him from the danger to which he is exposed in the hand operation. It is a matter of deep regret on many grounds, but especially as showing how little the true principles of political economy are realised by working men, who are usually well-informed on many other points, that the commercial failure of these machines is due to their opposition. In connection with colliery work, and indeed in connection with explosives, in the sense of a substitution for them of sources of expansion acting more slowly, mention should be made of the hydraulic wedges. The employment of these in lieu of gunpowder, to force down the block of coal that had been undercut, is one of the means to be looked to for diminishing the explosions in collieries. Another substitute for gunpowder is found in the utilisation of the expansion of lime when wetted. This has given birth to the lime cartridge, the merits of which are now universally recognised, but it is feared that trade prejudices may also prevent its introduction. While on this subject of "accidents in mines," it will be well to call attention to the investigations that have been made into the causes of these disasters, and into the probable part played by the minute dust which prevails to so great an extent in dry collieries. The experiments of our honorary member, Sir Frederick Abel, on this point have been of the most striking and conclusive character, and corroborate investigations of the late Macquorn Rankine into the origin of explosions in flour-mills and in rice-mills, which had previously been so obscure. The name of Mr. Galloway should also be mentioned as one of the earliest workers in this direction. At first sight, pile-driving appears to have but little connection with explosives, but it will be well to notice an invention which has been brought into practical use, although not largely (in this country at all events), for driving piles, by allowing the monkey to fall on a cartridge placed in a cavity in the cap on top of the pile; the cartridge is exploded by the fall, and in the act of explosion drives down the pile and raises the monkey; during its ascent and before the completion of its descent, time is found for the removal of the empty cartridge, and the insertion of a new one.

In the days of Brindley and of Smeaton, and of the other fathers of our profession, whose portraits are on these walls, canals and canalised rivers formed the only mode of internal transit, which was less costly than horse traction, and, thanks to their labours, the country has been very well provided with canals; but the introduction of railways proved, in the first instance, a practical bar to the extension of the canal system, and, eventually, a too successful competitor with the canals already made. Frequently the route that had been selected by the canal engineer was found (as was to be expected) a favourable one for the competing railway, and the result was, the towns that had been served by the canal, were served by the railway, which was thus in a position to take away even the local traffic of the canal. For some time it looked as though canal and canalised river navigations must come to an end, for although heavy goods could be carried very cheaply on canals, and with respect to the many works and factories erected on the canal banks, or on bases connected therewith, there was with canal navigation no item of expense corresponding to the cost of cartage to the railway stations, yet the smallness of the railway rates for heavy goods, and the greater speed of transit, were found to be more than countervailing advantages. But when private individuals have embarked their capital in an undertaking, they do not calmly see that capital made unproductive, nor do they refrain from efforts to preserve their dividends, and thus canal companies set themselves to work, to add to their position of mere owners of water highways, entitled to take toll for the use of those highways, the function of common carriers, thus putting themselves on a par with the railway companies, who, as no doubt is within the recollection of our older members, were in the outset legalised only as mere owners of iron highways, and as the receivers of toll from any persons who might choose to run engines and trains thereon—a condition of things which was altered as soon as it was pointed out that it was utterly incompatible either with punctuality or with safe working. This addition to the legal powers of the canal companies made by the acts of 1845 and 1847 has had a very beneficial effect upon the value of their property, and has assisted to preserve a mode of transport competing with that afforded by the railways. Further, the canal proprietors have from time to time endeavoured to improve the rate of transport, and with this object have introduced steam in lieu of horse-haulage, and by structural improvements have diminished the number of lockages. Many years before the period we are considering, there was employed, to save time in the lockages and to economise water, the system of inclined planes, where, either water borne in a travelling caisson, as on the Monklands incline, or supported on a cradle as in the incline at Newark, in the state of New Jersey, the barges were transferred from one level to another; but an important improvement on either of these modes of overcoming a great difference of level is the application of direct vertically lifting hydraulic power. A notable instance of this system was brought before the institution in a paper read on the "Hydraulic Canal Lift at Anderton, on the River Weaver," by S. Duer,* and another instance exists on the Canal de New Fosse, at Fontinettes, in France, the engineers being Messrs. Clark & Standfield, who have other lifts in progress. This system reduces the consumption of water, and the expenditure of time to a minimum.

With respect to canalised rivers, the difficulty that must always have existed when these rivers (as was mostly the case) were provided with weirs to dam up the water for giving power to mills, has been augmented of late years by the change in the character of floods. It has frequently been suggested that in these days of steam motors in lieu of water power, and of railways in lieu of water carriage, the injury done by obstructing the delivery of floods is by no means compensated by the otherwise all but costless power obtained, or by the preservation of a mode of transport competing with railways. It has thereupon been suggested that it would be in the interests of the community to purchase and extinguish both the manufacturing and the navigating rights, so as to enable the weirs to be removed, and free course to be provided for floods. It need hardly be said, however, that if means could be devised for giving full effect to the river channels for flood purposes, while maintaining them for the provision of motive power and of navigation, it is desirable that this should be done. The great step in this direction appears to be the employment of readily, or, it may be, of automatically movable weirs. Two very interesting papers on this subject by Messrs. Vernon-Harcourt and R. B. Buckley were read and discussed in the session 1879-1880. These dealt, I fear exclusively, with foreign, notably with French and Indian examples. I say I fear, not in the way of imputing blame to the authors for not having noticed English weirs, but because the absence of such notice amounts to a confession of backwardness in the adoption of remedial measures on English rivers. An instance, however, of improvement since then has been the construction by Mr. Wiswall, the engineer to the Bridgewater Navigation Company (on the Mersey and Irwell section of that navigation), of the movable Throstle Nest weir at Manchester. It does seem to me that by the adoption of movable weirs, rivers in ordinary times may be dammed up to retain sufficient water to admit of a paying navigation, and water for the mills on their banks, while in time of flood they shall allow channels as efficient for relief as if every weir had been swept away. But the great feature of late years in canal engineering is not the preservation or improvement of the ordinary internal canal, but the provision of canals, such as the completed Suez canal, the Panama canal in course of construction, the contemplated Isthmus of Corinth canal—all for saving circuitous journeys in passing from one sea to another—or in the case nearer home of the Manchester ship canal, for taking ocean steamers many miles inland.

But the old fight between the canal engineer and the railway engineer, or, more properly speaking, between the engineer when he has his canal "stop" on, and the same individual when he has his railway "stop"—(you will see that I am borrowing a figure, either from *Dombey and Son*, where Mr. Feeder, B.A., is shown to us with his Herodotus "stop" on; or, as is more likely, I am thinking of the organs to be exhibited in the Second Division, "Music," of that exhibition of which I have the honour to be chairman)—I am afraid this is a long parenthesis breaking the continuity of my observations, which related to the old rivalry between canal and railway engineering—I was about to say, that this rivalry was revived, even in the case of the transporting of ocean vessels from sea to sea, for we know that our distinguished member, Mr. Eads, is proposing to connect the Atlantic and the Pacific oceans by means of a ship-railway across the Isthmus of Panama. He suggests that the largest vessels should be raised out of the water, in the manner commonly employed in floating docks, and should then be transferred to a trucklike cradle on wheels, fitted with hydraulic bearing blocks (this being, however, not a new proposition as applied to graving docks), so as to obtain practical equality of support for the ship, notwithstanding slight irregularities in the roadway, while he proposes to deal with the question of changes of direction by the avoidance of curves and by the substitution of angles, having at the point of junction of the two sides turntables on which the cradle and ship will be drawn; these can be moved with perfect ease, notwithstanding the heavy load, because the turntable will be floating in water carried in circular tanks. The question of preserving the level of the turntable, whether unloaded, partially loaded or loaded, is happily met by an arrangement of water ballast and of pumping. I cannot pass away from the mention of Mr. Eads' work without just reminding you of the successful manner in which he has dealt with the mouth of the Mississippi, by which he has caused that river to scour and maintain a channel 30 feet deep at low water, instead of that of 8 feet deep, which prevailed there before his skilful treatment. Neither can I refrain from mentioning the successful labours of our friend Sir Charles Hartley, in improving the navigation of that great European river, the Danube. I am sure we are all rejoiced to see that one of the lectures of the forthcoming series, that on "Inland Navigation," is to be delivered by him, and I do earnestly trust he will remember it is his duty to the institution not to leave important and successful works unreferred to because those works happen to be his own. I regret that time does not admit of my noticing the many improved machines for excavating, to be used either below water or on dry land. I also regret, for similar reasons, I must omit all mention

* *Minutes of Proceedings* Inst. C.E., vol. xiv. p. 107.

of ship construction, whether for the purposes of commerce or of war, a subject that would naturally follow that of rivers and of ship railways and canals, and would have enabled me to speak of the great debt this branch of civil engineering owes to the labours of our late member, William Froude, and would have enabled me also to deal with the question of material for ships, and with the question of armour-plating, in which, and in the construction of ordnance, our past president, Mr. Barlow, and myself, as the two lay members of the ordnance committee, are so specially interested.

The mention of armourplates inevitably brings to our minds the consideration of ordnance, but I do not intend to say even a few words on this head of invention and improvement—a topic to which a whole evening might well be devoted—because only three years ago my talented predecessor in this chair, Sir William Armstrong, made it the subject of his inaugural address, and dealt with it in so masterly and exhaustive a style as to render it absolutely impossible for me to usefully add anything to his remarks. I cannot, however, leave this branch of the subject without mentioning, not a piece of ordnance, but a small arm, invented since the date of Sir William's address. I mean the Maxim machine gun. This is not only one of the latest, but is certainly one of the most ingenious pieces of mechanism that has been devised. The single-barrel fires the Martini-Henry ammunition; the cartridges are placed in loops upon a belt, and when this belt is introduced to the gun, and some five or six cartridges have been drawn in by as many reciprocations of a handle, the gun is ready to commence firing. After the first shot, which must be fired by the pulling of a trigger in the ordinary way, the gun will automatically continue to send out shot after shot, until the whole of the cartridges on the belt are exhausted; and if care is taken before this happens to link on to the tail of the first belt the head of a second one, and another belt to this, and so on, the firing will be automatically continuous, and at a rate anywhere between one shot per minute and six hundred shots per minute, dependent on the will of the person in charge of the gun, the whole of the operations of loading, firing, and ejecting the cartridge being performed by the energy of the recoil. This perfectly automatic action enables the man who works the gun to devote his whole attention to directing it, and as it is carried on a pivot and can be elevated and depressed he can, whilst the gun is firing, aim the bullets to any point he may choose.

Since 1862 the power of defending seaports has been added to by the application of submarine mines, arranged to be fired by impact alone, or to be fired on impact when (under electrical control) the firing arrangement is set for the purpose, or to be fired electrically from the shore by two persons stationed on cross-bearings, both of whom must concur in the act of explosion. These mines are charged with gun-cotton, the development of which owes so much to Sir Frederick Abel, while for purposes of attack the same material, not yet in practical use for shells, is taken as the charge for torpedoes, which are either affixed to a spar or are carried in the head of a submerged cigar-shaped body. By a compressed air or by a direct steam impulse arrangement these weapons are started on their course and are directed, and then the running is taken up by their own engines operating on screw propellers, driven by a magazine of compressed air contained in the body of the torpedo. Means are also provided to maintain the designed level below the water surface. The torpedo may either be projected from the war ship itself or from one of those launches which owe their origin to our member, Mr. John Isaac Thornycroft, who first demonstrated the feasibility of that which was previously considered to be impossible, viz. the obtaining a speed of twenty miles and over from a vessel not more than 80 feet long. Experiments have been carried on in the United States by Captain Ericsson to dispense with the internal machinery of the torpedo, and to rely for its traverse through the water upon the original impulse given to it by a breech-loading gun, carried at the requisite depth below the water level in a torpedo-boat. This gun, having a feeble charge of powder at a low gravimetric density, fires the torpedo, and, it is said, succeeds in sending it many yards, and with a sufficient terminal velocity to explode the charge by impact. Also, in the United States, experiments have been made with a compressed air gun of 40 feet in length, and 4 inches in diameter (probably by this time replaced by a gun of 8 inches in diameter), to propel a dart through the air, in the front of which dart there is a metallic chamber containing dynamite. Although no doubt the best engineer is the man who does good work with bad materials, yet I presume we should not recommend any member of our profession to select unsuitable materials with the object of showing how skilfully he can employ them. On the contrary, an engineer shows his ability by the choice of those materials which are the very best for his purpose, having regard, however, to the relative facilities of carriage, to the power of supply in sufficiently large quantities, to the ease with which they can be worked up or built in, and to the cost.

Probably few materials have been found more generally useful to the civil engineer, in works which are not of metal, than has been Portland cement. It should be noticed that during the last twenty-two years great improvements have been made in the grinding and in the quality of the cement. These have been largely due to the labours in England of our member, Mr. John Grant, to the labours of foreign engineers following in his footsteps, and to the zeal and intelligence with which the manufacturers have followed up the question, from a scientific as well as from a practical point of view, not resting until they were able with certainty to produce a cement such as the engineer needed. I do not know that there is very much to be said in the way of progress (so far as the finished results are concerned) in the materials which Portland cement and other mortars are intended to unite. Clean gravel and ballast and clean sand are, I presume, very much the same in the year 1884 as they were not only in the year 1862, but as they were in the year 1. The same remark applies to stone and to all other natural building materials; and, indeed, even the artificial material, brick, cannot in these days be said to surpass in quality the bricks used by the Romans in this island nineteen hundred years ago, but as regards the mode of manufacture and the materials employed there is progress to be noted. The brick-making machine and the Hoffmann kiln have economised labour and fuel, while attempts have been made, which I trust may prove successful, for utilising the clay, which is to be found in the form of slate in those enormous mounds of waste which disfigure the landscape in the neighbourhood of slate quarries. Certain artificial stones, moreover, appear at last to be made with a uniformity and a power of endurance, and in respect of these qualities compare favourably with the best natural stone, and still more favourably having regard to the fact that they can be made of the desired dimensions and shape, thus being ready for use without labour of preparation.

Reverting to natural materials, there remains to be mentioned that great class, timber. In new countries the engineer is commonly glad to avail himself of this material to an extent which among us is unknown. For here, day by day, owing to the ready adaptability of metals to the uses of the engineer, the employment of wood is decreasing. Far, indeed, are we from the practice of not more than a hundred years ago, when it was not thought improper to make the shell of a steam engine boiler of wooden staves. The engineer of to-day, in a country like England, refrains from using wood. He cannot cast it into form, he cannot weld it. Glue (even if marine) would hardly be looked upon as an efficient substitute for a sound weld; and the fact is, that it is practically impossible to lay hold of timber when employed for tensile purposes so as to obtain anything approaching to the full tensile strength. If it be desired to utilise metals for such a purpose, they can be swollen out into appropriate "eyes" to receive the needed connection; but this cannot be done with wood, for the only way of making an enlarged eye in wood is by taking a piece that is big enough to form the eye, and then cutting away the superfluous portion of the body. Moreover, when too much exposed to the weather, and when too much covered up, wood has an evil habit of rotting, compared with the rapidity of which mode of decay the oxidising of metals is unimportant. Further, one's daily experience of the way in which a housemaid prepares a fire for lighting is suggestive of the undesirability of the introduction of resinous sticks of timber, even although they may be large sticks, into our buildings. Many attempts, as we know, have been made to render timber proof against these two great defects of rapid decay and of ready combustibility, and, as it appears to me, it is in these directions alone one can look for progress in connection with timber. With respect to the first, it was only at the last meeting of the institution we presented a Telford medal and a Telford premium to Mr. S. B. Boulton for his paper "On the Antiseptic Treatment of Timber," to which I desire to refer all those who seek information on this point. With respect to the preservation from fire of inflammable building materials, the processes, more or less successful, that have been tried are so numerous, that I cannot even pretend to enumerate them. I will, however, just mention one, the asbestos paint, because it is used to coat the wooden structures of the inventions exhibition. To the employment of this, I think, it is not too much to say those buildings owed their escape, in last year's very dry summer, from being consumed by a fire that broke out in an exhibitor's stand, destroying every object on that stand, but happily not setting the painted woodwork on fire, although it was charred below the surface. I do not pretend to say that a surface application can enable wood to resist the effects of a continued exposure to fire, but it does appear that it can prevent its ready ignition.

Leaving the old-world materials of stone and wood, let us come, not only to the bronze age, but to the iron age, and direct our attention during a few minutes to the improvements which, in twenty-two years, have been made—and first to deal with that form of iron known as steel. I am aware that I am laying myself open to a charge of having committed a most tremendous "bull," but I am prepared to defend my form of speech, on the very strong ground that no one can say, speaking as a metallurgical chemist, when the dividing line is between commercial iron and commercial steel, for it is quite certain there is material which would be currently bought and sold and used as steel, which is more near to pure iron than is other material which would be commercially bought and sold and used as iron. It is now nearly eight years since I delivered, at the Royal Institution, a lecture on "The Future of Steel," and every year that has passed has justified the opinions I then ventured to put forward as to the way in which steel made by fusion would supersede iron made by the puddling process; and I am not afraid to repeat my prophecy that the time will come when the use of iron made by that process will be restricted to the manufacture of the small articles produced by the hand labour of the village blacksmith, for whose art its plastic character and ready power of welding eminently fit it. Probably the first great revelation in steel manufacture was the exhibition of the ingots, with other products shown by Krupp in the '51 exhibition; it soon became known, however, that these exhibits after all gave us no further information than this: viz. that it did not follow because the limit of the charge of a crucible might be 50 or 60 lb, the limit of the size of the ingot must also be 50 or 60 lb.; in fact, the world was shown that more than one pot of steel might be discharged into the same ingot-mould; indeed, that hundreds of pots might be. Do not imagine for one moment I am depreciating this step. It was an enormous one, at the time when the production of fused steel involved the employment of the crucible. But, according to my judgment, the making of steel in crucibles is not so satisfactory a mode of obtaining uniformity in large masses, as is either of the other two great systems of manufacture, I mean the Bessemer and the Siemens, the two processes which have changed the whole complexion of the iron industry. For years after 1862 we had papers at this institution upon the question of steel rails, and we had it solemnly stated that the suggested economy in using these was an apparent economy only, for when interest was taken into account, having regard to the extra cost of steel over iron which must always prevail, it would never pay to employ steel rails, and the true function of steel in the permanent way would be to restrict its use to points and crossings. Now it would be difficult to induce any one to believe that an engineer was serious if he specified for wrought-iron rails, as it would be known that he would have to pay more money to obtain this inferior material. Important as the subject is, time compels me to refrain from further allusion to it, and forces me to conclude this head of my address with the physician (Abernethy's) well-known advice to his patients, "Read my book," *i.e.* my lecture at the Royal Institution, to which, however, I must add one word, and that is I must here refer to the important improvement made since the date of that address by the process of Messrs. Thomas and Gilchrist, by which it has been rendered possible to employ successfully, in the production of steel, iron derived from ores which, prior to the date of this invention, had been found wholly inapplicable for the purpose.

In the manufacture of pig-iron, improvement has been effected by increasing the dimensions of the furnaces, and (thanks to Mr. Cowper in the outset, followed by others) by increasing the temperature of the blast, and by the closer application of chemistry to the industry, by the total closing of the bottom of the furnace, and by the increased use of the waste gases. From these improvements an economy and a certainty of production have resulted, leaving little to be desired; while it is to be hoped that another waste product—that of blast-furnace slag—will be converted to various useful purposes.

I have varied the usual order by taking the iron age before the bronze. To revert to the bronze—the mysterious influences that a very small percentage of some material will exercise upon the quality of the great bulk of another material with which it may be united are well shown in the case we have been considering—that of steel—where a few tenths of one per cent. of carbon added to the iron suffices to change the iron into steel. We are not surprised, therefore, when we find that other metals may have their qualities improved, for many useful purposes, by judicious alloy; and in this way the metal, copper, so long used in its alloyed condition of "gun-metal," has within the last few years been still further improved by alloying it with other substances, and thus making it into the now well-known articles "phosphor-bronze" and "manganese-bronze"—very useful materials to those of our members engaged in the construction of machinery. So closely allied to the consideration of the nature of a material is that of the means of producing it in the desired form, that one naturally passes thereto. As long as small masses had to be dealt with, and as long as those masses were of a plastic character, it was possible to successfully employ the hand-hammer, the sledge-hammer, and, later on, the steam-hammer; but with the increased dimensions of the main-shafts of engines, and of the solid forgings for the tubes of cannon, obtaining at the present day, and having regard to the fact that these are composed of steel, the operations of light steam-hammers are absolutely harmful, tending to produce internal flaws, and the blows of even the heaviest class of hammers are not so efficacious as is pressure applied without blow. I think the time is not far distant when (following the lead of Sir Joseph Whitworth), all steel in its molten state will be subjected to pressure, not with the object of making the metal more dense, but with the object of diminishing the size of any cavities containing imprisoned gases; if this is not done, then some other mechanical means will be employed to get rid of the cavities altogether, and thus to produce (without variations in the constituents of the steel) a casting that shall be practically, if not absolutely, free from blowholes, and so that such casting when afterwards forged by pressure, and not by percussion, may be thoroughly trusted to contain no latent defect. One of the difficulties that was foreseen in the outset of the employment of steel for tires, was the difficulty of welding the ends of a steel tire-bar after it had been bent into the hoop form. I was, I believe, one of the very earliest to suggest the making of tires in the hoop form, and so not only to avoid the cost and risk of welding, but also to avoid the waste upon each tire-bar arising from what was known as the "crop end." I read a paper on this subject before section G of the British Association at the Birmingham meeting in 1865, and I then prophesied, that in a very few years from that time a welded tire would be unknown—a prophecy which has been amply fulfilled; but I also pointed out, that so far from its being the right way to set about the manufacture of a hoop by beginning with a straight bar, then bending it, and then welding it, the manufacture in the hoop form would be the proper one to adopt, even if the object were eventually to produce a straight bar, such as a rail, for if this were done the relling would be continuous, and there would be no "crop end," no waste therefrom, and no fear that in order to render the waste as little as possible, there would be retained at the ends of the rail—its most vulnerable parts—metal of an inferior character. In this same paper I showed that the right way of making boiler-shells and boiler-flues would be by the hoop system and by endless rolling, thereby avoiding the longitudinal seams, which, after the very best has been done that can be done, reduce the effective strength of the boiler-plate by one-fourth or one-third, and commonly reduce it by one-half. I will refer my hearers to vol. xx. of the *Engineer*, p. 200, where the paper and the accompanying diagrams are given.

The subject of steam boilers brings one naturally to the consideration of that which still remains the great source of motive power—the steam engine. Here since 1862 it is difficult to point to any great substantive novelty, but these machines have been more and more scientifically investigated, and the results of such investigation have been practically applied, and have been attended with the anticipated advantages. The increase in initial pressure, the greater range of expansion, the steam-jacketing of the vessels in which the expansion takes

place, have all led to economy, so that double-cylinder non-condensing engines are now currently produced, which work with a consumption of only 2½ lb. of coal per gross indicated horse-power, or 2·7 lb. per horse-power delivered off the crank shaft, equal to eighty-three millions of duty on the Cornish engine mode of computation; and when these high results are augmented by the employment of surface condensation, an indicated horse-power has been obtained for as little as 1½ lb. of coal, and it is commonly obtained, in daily work, for from 2 lb. to 2½ lb. But the engineer using steam as his vehicle in a heat motor still has to submit to the chagrin of seeing the largest portion of the heat pass away unutilised. This defect has for years attracted the attention of scientific engineers. Indeed, we know that more than thirty years ago our lamented friend, William Siemens, devoted his great powers to the production of a regenerative steam-engine by which he hoped to decrease this loss, but at that time he was not successful in producing a practical machine. The labours of those who, following Stirling, have endeavoured, by employing air as the vehicle of heat, to obtain better results, have succeeded in producing very economic machines, and machines of practical utility, but hitherto only applicable where small power is required. There is, however, another form of heat-motor which, while vainly essayed during fifty years, has within the last eight years come into common use, and the application of which in cases requiring anything up to 30 indicated horse-power is daily increasing. I need hardly say that I allude to the gas engine. By a happy change in the mode of burning the mixture, and of utilising the heat thereby generated, the injurious shock of the early forms of gas engine, and the large consumption of gas which caused these earlier forms of engine to be discarded after trial, were obviated, a notable instance being in the engine propelling the fan that ventilates this room, which, after a short time, was pulled out and replaced by an hydraulic engine. According to the *Mechanics' Magazine* of August 10, 1866, page 87, the French engineer who tried a Hugon gas engine found that 74 cubic feet of gas per indicated horse-power per hour were required; this is now replaced by the 20 to 23 feet per indicated horse-power consumed in the engines of the present day. With the low price of gas commonly prevalent in England, this consumption does not cost more than some seven-eighths of a penny per horse per hour. I am aware it may be said that with coal, even at the London price of £1 per ton, I might use a steam engine having the low economy of 8½ lb. of coal per indicated horse-power per hour before I should be called on to spend seven-eighths of a penny per indicated horse-power per hour for fuel; you would be astonished to hear, however, that in an investigation instituted last year by the corporation of Birmingham, when considering whether they should approve of a proposal to lay down power-distributing mains throughout their streets, it was found on indicating some six non-condensing steam-engines taken indiscriminately from among users of power, and ranging from five nominal horse-power up to thirty nominal horse-power, that the consumption in one instance was as high as 27·5 lb., while it never fell below 9·6 lb., and the average of the whole was as much as 18·1 lb. This heavy consumption largely arose from a prevalent defect, one I have frequently pointed out, that of too great cylinder capacity; for unless a non-condensing engine is admirably designed, and made with the object of using very high expansion, there is nothing so wasteful as the employment of that which the buyer of an engine looks upon as an advantage—very great cylinder capacity. The result of such a construction being that the initial pressure of the steam, in the cylinder of the ordinary small power non-condensing engine, is not more than 20 to 30 lb. above atmosphere, a condition of things wholly incompatible with economy. But even assuming that the user of a gas engine were entitled to compare it with a non-condensing steam engine consuming only some 5 lb. of coal per indicated horse-power per hour, and demanding, therefore, at 1s. per cwt. only one half-penny for the purchase of coal, this difference in cost is well repaid by the saving of boiler space, of the wear and tear and of the renewal of the boiler, of the consumption of coal while getting up steam, and during meal times, and the saving in the engineer's or stoker's wages; and on public grounds there are the advantages of freedom from boiler explosion, and of cessation of smoke-production.

I have spoken of gas engines hitherto, as though, like hot-air engines, they were necessarily restricted in their dimensions, but this is not so; engines are now being made to develop 50 horse-power; and further, be it remembered, that when used on a large scale, so that it would pay to have an attendant devoting his whole time, there is no need to work them with illuminating gas from the street mains, they can be driven by producer-made gas on Dowson's system, and when worked in this way, a pound and a half of "culm" will give one horse-power, and one lad is sufficient to manage a gas-producing apparatus of a size adequate to provide for engines developing 300 indicated horse-power. I ventured to say, at the meeting of the British Association at York in 1881, when giving a partial review of that which had happened in engineering in the fifty years from the foundation of the association, that unless some wholly unexpected improvement were made in the steam engine, those who lived to see the celebration of the centenary of the association in 1931 would find the steam engine had become a curiosity, and was relegated to museums, for I could not believe steam would continue to be the vehicle for transmitting heat into work.

A motor has been recently tried where no fuel is employed directly, but where a boiler, being filled with water and steam under pressure, has its heat maintained by exposing caustic soda, contained in a vessel surrounding the boiler, to the action of the waste steam from the engine, the result being that as the moisture combines with the caustic soda, a sufficient heat is developed to generate steam and keep the engine working for some time. The trials have been made with the motor for propelling a launch, and I believe with one for working a tramcar. It may be we have here a source of power, in a portable form, useful for the purposes I have mentioned, and for others analogous thereto. It hardly needs to be said fuel has eventually to be employed to drive off the moisture from the soda, and thus to bring it back to its caustic condition.

I cannot pass away from this brief allusion to heat motors without expressing my gratitude to those lecturers who addressed us on "The Mechanical Applications of Heat" last session, and especially to our member, Mr. William Anderson, for his lecture in that course on "The Generation of Steam and the Thermo-dynamic Principles Involved." Let me tell those of you who do not already know it that Mr. Anderson has still three lectures to deliver out of a course of six lectures which he is giving at the Society of Arts on "The Conversion of Heat into Useful Work," and permit me to advise all those members of this institution who can possibly do so to attend (as I hope to be able to do) the remainder of those most clear and instructive lectures.

There is one indisputable heat motor I have omitted, viz. that wherein power is obtained directly from the sun's rays. Attempts have been made during the last twenty-two years in this direction, but we enjoy so little powerful sunshine in England, and the question is still in such a thoroughly experimental stage, that I think I must not take up your time by any consideration of it. With respect to other motors, viz. those driven by wind or by water, not commonly looked upon as heat motors (although in truth there would be no such agencies without heat), but on these there is not time to say much, I will merely call your attention to the improvement in water-wheels in France, an improvement by which it is asserted that as much as 85 per cent. of all the energy residing in a low fall of water has been converted into power; a result due to the decreasing of the speed of the periphery of the wheel, and to the making of the buckets very narrow and of great depth. In turbines, also, there has been considerable development in these twenty-two years, and they now take their place as very efficient motors, possessing many advantages, where, on the one hand, a very high fall of water has to be utilised, or where, in the case of a low fall, great difference in the working head, and in the level of the tail water, have to be provided for.

With respect to the power of the tide, I, for one, have been very much fascinated with the scope there appeared to be for engineering in utilising tidal power, especially where there was a great ebb and flow, and I have on former occasions expressed some sanguine opinions as to the practical use that could be made of this source of power; but being called upon to look into the question I found, that as in these days of competition very few businesses needing motive power can allow their plant to remain idle for nearly half the working day, and that as there is an objection to remedying this condition of things by working when possible, both during the night-tide and during the day-tide, this was an obstacle in most cases to the use of tidal power. Further, when it was sought to preserve continuity of action by providing a series of reservoirs, the outlay needed was so large that the mere interest on it would pay for the fuel for the steam engine. I am afraid, therefore, that, except for certain cases—such as pumping of water into a reservoir, or charging of so-called storage batteries, or matters of that kind not connected with ordinary manufacture—this source of power is not likely to compete commercially with heat motors until coal is very much dearer. The periodic intermittency being a sufficient bar to the employment of tidal motors, it is not to be wondered at that the (proverbial) uncertainty of the wind causes motors which have to be driven by it to be disregarded as substitutes for the steam engine. I have, however, said elsewhere I think it is well worth considering whether wind motors could not be employed as adjuncts to steam engines, diminishing the load upon them or laying them idle altogether, according to whether there was a light or a strong breeze blowing.

The uncertainty as regards the obtaining a sufficient breeze, which prevents the wind from being a trustworthy source of power, aggravated by the further uncertainty as to the direction in which the breeze would blow when it did come, has rendered the air, as a medium for navigation, even more untrustworthy. During the last few years, however, a new locomotive agent has been prominently brought forward—I mean a balloon capable of being propelled and steered, or, as it has been termed, a "dirigible" balloon. Many persons have fancied that it is impossible to propel a balloon through the air; but this, as I need hardly tell those who understand mechanics, is entirely a fallacy. The reasons why the early attempts to steer balloons failed, were practical and not theoretical, and they have been removed by recent mechanical improvements. The first really successful effort was made by M. Henri Giffard, the ingenious inventor of the injector, all reference to which I have omitted, however, because of its being slightly anterior to 1862. In 1852 this gentleman ascended in an elongated balloon propelled by a steam engine working a screw propeller; and he was followed twenty years later by M. Dupuy de Lome (the Government naval architect of France), who, however, used hand power. The speed through the air in these trials was about six miles an hour, and the steering-power was fully obtained. Taking these and other experiments as data, my friend and fellow member, Dr. Pole, to whom I am indebted for the information on this subject, published in our *Proceedings* in 1882 a full investigation of the problem, which led him to believe that a velocity of 25 to 30 miles an hour might be attained; and since that time further trials have been made in France by Messrs. Tissandier, Renard, and Krebs, who, using electric power, have already accomplished half the predicted speed, with a promise of much further development, when more experience has been gained with the practical details. I fear that the rapid and changeable motion of the medium in which balloons have to move will prevent this mode of locomotion from ever having a wide application, but there may undoubtedly be particular circumstances in which it would be useful, such for example, as the exploration of new countries, or as the present Egyptian campaign. I strongly suspect that if our lively neighbours, instead of ourselves, had been invading the Soudan, they would long before this have had a "dirigible" balloon looking down into Khartoum. Let me refer all those who take an interest in this question to an earlier article by Dr. Pole, which was published in the *Quarterly Review* of July, 1875. This article is still considered a "classic" on the subject.

Next to the subject of motors should have come (had I not been led captive by a balloon) that which I am now about to mention, *i.e.* the transmission of power. Taking this in the restricted sense of the transmission from a part of the machine to another, commonly with the object of varying velocity, one may point to the increasing use of multiple rope-driving gear, in lieu of belts, to inclined spur gear for diminishing noise, and to that kind of frictional gearing to which the name of "nest gearing" has been given. Here the frictional driver being acted on at the two opposing sides, strain is removed from the bearings, and the liability of one of the frictional wheels to stand still, and to be fatally injured by having a flat rubbed upon it is avoided. In that very important branch of transmission, wherein power is taken to long distances, however, we have the development of hydraulic transmission, as is evidenced by the fact of pipes being now laid down through our towns, for supplying water under the 700 lb. on the square inch pressure for motive power; we have companies authorised, if not at work, for laying down pipes to distribute compressed air; we have now by reason of the improvement in gas engines, the ability to lay on power in every town illuminated by gas, which practically means every town and large village; and we have in New York and in some other cities of the United States, high pressure steam, conveyed in mains below the streets, to be used both for power and for heating, for which second purpose, however, it should be remembered the contents of a gas main are equally available. I will not touch upon other modes, except just to mention the rope system at Schaffhausen; but I think we may take it as clearly established that we are, day by day, becoming more alive to the benefit, where little power is required, or where considerable power is required, but only intermittently, of deriving that power from a central source.

Under the heads of motors and of transmission of power (both of them, it is true, eminently subjects for the civil engineer) I have spoken of water, but there is another way in which water is used; the way with which engineers and the public are more familiar, viz. its employment for the supply of our towns, which I have not as yet mentioned. Except in the magnitude of the work and the excellence of the design, of which the new Liverpool waterworks now in progress may well stand as a typical example, there is not much to say as regards progress in those waterworks which are dependent upon storage. Indeed there is nothing very marked to point to in these twenty-two years in the way of progress in pumping machinery. Having visited the United States and Canada twice within the last two years, and having seen the waste of water that takes place in both those countries (a waste which not only causes the mains to be incapable of keeping up the pressure under the excessive draught, but renders sources of supply insufficient which otherwise would be ample for years to come), I cannot but rejoice at the progress that has been made here in the matter of house fittings, by which waste has been greatly checked, and the risk of contamination that formerly existed with certain closet fittings is ended. This question of house fittings has always been a difficult one, and it becomes impossible to be grappled with by water authorities such as those in the United States and in Canada, *i.e.* municipal authorities afraid of offending the voter. We owe it, however, to Mr. Deacon, the engineer of an English municipal water authority, that it is now possible to deal with the correction of household fittings at a minimum of cost, and, what is equally important, with a minimum of annoyance to the householder. By the employment of the waste-water meter, situated under the flagstones of the footway and controlling a group of houses, it is possible to find out the total waste in the whole of those houses, and on the mains supplying them; then to localise that waste so as to attribute its true proportion to the houses that are the offenders, and to attribute the proportion, if any, to the pipes of the suppliers of water. Having ascertained these facts, not only can the suppliers of water cure the defects in their pipe system, but they are enabled to cure the household waste, not by the expensive and annoying process of an inspection of the fittings throughout the whole district, involving the annoyance of say ninety householders whose fittings are in perfect order, to detect the ten householders whose fittings are in a reprehensible condition; but by the mere visitation of those ten who are in default, and who cannot therefore complain of the visitation. With respect to the purity of the water supply, this, although it relates to water, is so "burning" a question that I fear to touch upon it. I believe that in most of our towns the supply is satisfactory, but I do believe, in spite of the alarm raised by the suggestion of double mains, we might do well in many cases, where there is a pure but limited supply, to have a dual system of mains, and thus to distribute the pure water separately, and for potable purposes. I am not about to hold up the water supply of Paris as an example for us to follow on all points, but the Parisians at least have recognised the expediency of thus sorting their supply when that supply is of varying quality and when the best of it is limited in quantity. In cases where there appears to be no thoroughly satisfactory source of water, the experience of the efficacy of iron purification, as practised at Antwerp, does hold out very considerable promise.

Gas likewise has been alluded to under the heads of motors and of transmission of power and of heat, but I now desire to say a few words in connection with it under its more ordinary aspect, that of a distributed illuminant. In the year 1862 the price of ordinary coal-gas in London was from four to five shillings per thousand cubic feet; the illuminating power was such that 5 cubic feet of the gas burnt in a specified burner in one hour should give a light equal to twelve sperm candles, each burning 120 grains in the hour. At that time the consumer was, as it was facetiously called, "protected" by restricting the company to a maximum statutory dividend. Obviously, so soon as this dividend was earned, all incentive

to improvement was removed. One of the few cases in which recent legislation relating to private companies supplying public wants can meet with the approval of the political economist, was that which a few years ago first recognised it would be well for the private company and for the public that the ordinary incentive of increased profit for increased exertion should remain, and that introduced in certain gas undertakings the "sliding scale." This provided for a normal price, and for a maximum dividend, but allowed the company to rateably increase this dividend in accordance with a decrease in price below the normal. Under this wiser legislation, sixteen candle-gas is sold in London for as little as two shillings and tenpence per thousand cubic feet. But illuminating gas has to be considered by the engineer under two distinct heads: one, its manufacture and distribution; the other, its utilisation. This last, it is true, is but to a small extent in the hands of those engineers who have the charge of the first. Considerable progress has, however, been made of late in illumination, largely, it is true, due to a greater liberality on the part of lighting authorities, and the use thereunder of multiple burners in street lanterns, but to a considerable extent due to that much more to be desired improvement, whereby a greater amount of light is obtained from the same volume of gas. The regenerative gas-burners, and other modes of burning, into which time will not permit me to enter, promise to largely increase (it is said, even to more than double) the candle-power per cubic foot of gas burnt. Such improvement as this is undoubtedly of great moment, not only on the score of economy, but on the sanitary ground of diminishing the amount of products of combustion poured into a room in relation to the light therein afforded. It need hardly be mentioned that the decrease in cost and the increase in profits are largely due to the application of chemistry to this manufacture, by which application the former nuisance-creating by-products have been turned into sources of revenue and into fertilisers for our fields. I have also, in the most cursory manner, mentioned gas as a means of distributing heat; but a word should be said about those valuable improvements in gas-furnaces—I do not mean the Siemens furnace—which have enabled coal-gas to be applied to the melting of even very refractory metals, by means of a most inexpensive plant. Nor have I spoken of those other applications, where, either burnt with coke (it may be of the very coal from which the gas itself was derived), or caused to raise incombustible bodies to incandescence, it forms the cheerful and smokeless substitute for a smoky coal fire, or is utilised for the purposes of domestic cookery. In this latter case, however, if absolute cleanliness and ventilation are not preserved, there will (as the unhappy traveller, compelled to temporarily sojourn in the "limited" hotels of the present day finds to his cost) be one universal dirty gas-oven flavour impressed upon all his food, be it the homely leg of mutton or the lordly haunch of venison.

Although it is quite certain that the first suggestion for using liquid fuel (notably tar, to aid in heating gas-retorts) must date long before 1862, yet the great development of the mineral oil industries since that date has led (and especially in Russia, in whose territory such enormous yields of oil are afforded) to the employment of this material as a fuel in furnaces and in steam boilers. Next to the infinitely divisible forms of gaseous and of liquid fuel comes, as I have said elsewhere, the dust fuel introduced by Mr. Crampton. In the use of any of these three forms, regularity of mechanical supply is a condition involved; and any one of these three, therefore, irrespective of all other considerations, is desirable because it is a means of dispensing with that most unsatisfactory form of labour—"stoking," dispensing also with the production of smoke, and with the diminution of maximum effect attendant on the hand-feeding of coals, where the condition of the fuel in the grate and its temperature must be ever varying. Having regard to these advantages which are to be obtained in using oil, and to the cheapness of the material in Russia, one is not surprised to find that there are lines of steamers on the Caspian worked entirely by liquid fuel, and that the same kind of fuel is used to fire the locomotives in many districts.

I have mentioned the improvement in small furnaces worked by illuminating gas; but I am not entitled to bring within my period the regenerative gas furnace, that great invention made by our lamented friend Sir William Siemens, with whose name in this matter should be coupled that of his brother, Mr. Frederick Siemens. This latter gentleman, by a course of study, has recently discovered, and it is an interesting scientific fact, that so far from the heating power of the flame being increased by its confinement within narrow chambers, and by its being brought into contact with the material to be operated upon, such arrangements only diminish that power; and he has further found that this discovery can be usefully applied in practice by keeping the roof of a regenerative gas furnace at such a height above the hearth on which the materials to be heated lie, that the flame can traverse from one side of the furnace to the other, free of contact with the roof above, or with the materials below. Very excellent economic effects and a high heat, it is stated, have been obtained by causing the outgoing products of combustion to give up their heat to the incoming cold fuel. I have seen such furnaces in operation, making steel by the hearth process, and it is the fact that the chimney has been without a trace of red glow within it.

The natural oils which are used as fuel, and to which I have referred, are rarely employed in their crude state as obtained from the wells; but they all undergo more or less refining before use. There is another natural fuel, however, which has been discovered in America, and within the last few years largely utilised—this is the gas obtained from wells in a manner similar to that in which the oil is obtained. It is a marsh gas of high calorific power, and is in certain parts of the United States being used very largely for domestic heating, for the heating of furnaces of every description, including those for the manufacture of plate-glass and of steel; it is also being employed for the manufacture of lamp or carbon black, and for the carbon points for electric lighting. It is stated that within a radius of 20 miles from the town of Pittsburgh, taken as a centre, there are twenty-five wells, each producing 3,000,000 cubic feet per twenty-four hours, and that the produce of the whole of the wells at present opened up is 100,000,000 cubic feet of gas per day. To my mind this is one of the most perfect fuels which can be imagined. It requires no preparation, but can be, and is, used in the same state as that in which it issues under a high pressure from the wells; it can be mechanically controlled with the greatest nicety, and when properly burnt is entirely free from smoke or similar defects. When employed in the Siemens regenerative furnace, the producer, which is necessary where coal is used, is entirely dispensed with.

Probably there is no function of the engineer in which the public feel their interest to be so immediate as when he is engaged in supplying to them their food. Prior to 1862 it is true that steam ploughing and various cultivating and reaping machines were in existence; but they have been much developed since, and if the English farmer is to be saved while growing grain, it will be by reason of his availing himself of the labours of the engineer. Unhappily for the farmer, he has not the monopoly of the engineer's services, the products of whose skill are as fully appreciated for the cultivation of the enormous corn districts of the far west by the farmers there as they are in England. Again, unhappily for our farmers, the engineer, by his railways and by his improved steamships, renders it possible for the grain grown in the United States and in Canada to find its way to our markets at a cost for freight so trifling as not to equal that which, a few years ago, would have been paid for transit from one part of England to another. It would not be right to pass away from improvements in agricultural engineering without referring to that which is a distinctive novelty since 1862. I mean the fast-becoming-general combination with the reaping machine of string sheaf-binding apparatus. I am afraid I cannot claim for the engineer that recent introduction the "silo." He is rapidly turning his attention to the improvement of the details, and is showing how mechanical appliances can be advantageously used in connection with them. By the aid of silos our grass crops may be saved in the green form, notwithstanding wet and unpropitious seasons; but those who still prefer sweet and sound hay may hope that the engineer will devise some practical mode of artificial drying, and thus enable them to obtain it even in the absence of the sun, and may also hope that the adoption of similar means will save our grain crops, although the harvest may be followed by steady and continued rain. But a question may arise, whether, except for horse feed, we need trouble ourselves about silos or hay, having regard to the fact of the great development since 1862 in refrigerating machinery, which renders possible the importation of frozen meat from Australia, and from other countries. I hope for the sake of the English farmer that there will still be many who will be prepared to pay for English grown beef and mutton, and for real milk and real butter, and that they will not be tempted by cheapness to substitute milk of condensation and butter of oleo-margarine. But I hear the poor farmers are now threatened by a flood of steamboat transported milk from Holland. While on the question of food the temptation is great upon me to refer to the wonderful improvements that have been made in "milling" since the year 1862; but I must refrain from this and from all other remarks upon the question of food, except to remind you that if the providing of food is one of the great social problems of the present day, another is how to get rid of sewage. This latter problem, however, has been so fully dealt with by my immediate predecessor, Sir Joseph Bazalgette, as to leave me nothing to say.

There are two other most important subjects involving large commercial interests, and in one of the subjects at all events, great modern invention, upon which, fortunately, I need not say one word, as in respect of the first of these—electricity—I can refer you to the volume of lectures delivered here in 1883; and in respect of the second—tramways—I can refer you to the papers which, with the discussion upon them, have already occupied three evenings of this session. I see that our allotted time is already exceeded, and I am thus compelled to leave unsaid much which I should have liked to have told you, touching many things which almost every one of you must remember (each in his own special line of engineering) as being of general interest, and novel since 1862—railway brakes and signals, for instance; but the subject upon which I have undertaken to speak is so vast, that even with the severe limitation which, as I stated in the earlier portion of my address, I had imposed upon myself, I find omission is inevitable. Just a few words (and they shall be very few) about our institution. You have done me the honour to elect me your president; and I trust it is unnecessary to assure you that during my term of office I will do everything in my power to uphold the dignity, the honour, the usefulness, and the prestige of the institution; but my efforts alone will not be sufficient; I must ask you—each one of you—to help me, as failing this help the president is powerless. If each one of you, in his own way, works to advance our general interests by attending at our meetings, by bringing his quota of information on the subject which is under discussion to enrich our proceedings, by taking care that in speaking to give this information, the time of the institution shall not be wasted, either by bald repetition of platitudes or by fine oratory, and by remembering that his endeavour should be to add to the general knowledge in the simplest and most concise way possible to him, then I hope we shall be able to say at the termination of my period of office that the institution has not retrograded, but that the ends and aim I am sure we all have in view have been materially enhanced. As I have already said, I will do all that lies in my power in the future as I have done in the past to arrive at such a consummation, and I must ask you—all of you—to assist me, feeling sure as I do that such assistance will be cheerfully and gladly rendered.

Obituary.

JACKSON.—By the death of Mr. Thomas Jackson, of Eltham Park, Kent, on January 3, another of the old railway contractors of the type of Brassey, Tredwell, and Wythes, has been removed. Born in 1808, he commenced work at the early age of eight on the Birmingham Canal, with but very little advantages in the way of education, and toiled as a day labourer, amid the greatest discouragements, till in 1827 he undertook a sub-contract on the canal then in formation near Market Drayton. Telford was pleased with Jackson's portion of the work, and the praise then bestowed was an incentive through life to the contractor to maintain his credit for good and trustworthy work. In 1837 his first railway contract was accepted for a part of the Birmingham and Derby Railway near Wichnor; portions of the Chester and Crewe Railway were undertaken in 1840, and the Tame Valley Canal shortly afterwards. His next great work was the renovation of the Caledonian Canal, which, though now so well known as the tourist route to Inverness, had in 1843 become practically unnavigable owing to dilapidation in the locks and want of depth. The government hesitated as to renewal or abandonment. Messrs. Jackson & Bean undertook and successfully carried out the work of renewal at a sum considerably below that to which Mr. Walker, the government engineer, had restricted the outlay. These operations were completed in 1847, and Mr. Jackson then returned to railway work—a large mileage of the lines in the Hull, Malton, and Beverley district being constructed by him. Works at Spurn Point, Shoreham, Luton, and Welwyn were undertaken; and in 1854 the construction of the large Tyne dock near Jarrow was in his hands. In 1847 he commenced the construction under successive Admiralty engineers of the gigantic breakwater at Alderney. The difficulties were unexampled, and for nearly twenty-five years a contest was waged against the whole force of the Atlantic, but the breakwater was at last completed. It extended a mile into the sea, reached a depth three times that of the structures at Plymouth and Cherbourg. The fortifications for the defence of the harbour of Alderney, and the breakwater at St. Catherine's Bay, Jersey, were also successfully built by Mr. Jackson. His latest work was at Harrogate. Of sulphur, saline, and chalybeate springs, Harrogate has an ample supply, but for pure water it is mainly indebted to the enterprise and engineering ability of Mr. Thomas Jackson. Of late years Mr. Jackson lived in comparative retirement, taking a close interest in meteorological and astronomical studies, as well as in scientific and geological questions. By his special desire he was buried at Audlem, the scene of his early labours on the Birmingham and Liverpool Canal.

MONTGOMERY.—Mr. James Montgomery, an American mechanical engineer and inventor, died at his home in Philadelphia on December 28. Mr. Montgomery, says the *American Machinist*, was well known in mechanical circles at one time as the inventor of the boiler that bore his name. He entertained extravagant hopes of the saving that could be effected by lengthening the channels through which the products of combustion had to pass, and the result was disappointment. The boiler received some application, but it was extremely awkward to make, and the inventor's enthusiastic advocacy failed to put it into permanent use. Mr. Montgomery was one of the first to put a partition between the tubes to divide the products of combustion.

CALENDAR FOR THE WEEK.

MONDAY, JANUARY 19.

Royal Institute of British Architects.—8 p.m. Mr. W. White, on "The Fireproof Closing of Openings in Party Walls under the Metropolitan Building Act."
Society of Arts.—8 p.m. Cantor Lectures. Dr. G. V. Poore, on "Climate, and its Relation to Health." Lecture II.—The effects of soil, drainage, and vegetation upon climate.
Victoria Institute.—8 p.m.
London Institution.—5 p.m. Mr. H. H. Statham, on "Form and Design in Music."

TUESDAY, JANUARY 20.

Institution of Civil Engineers.—8 p.m. Mr. A. Hamilton-Smythe, B.A., "A Comparison of British and Metric Measures for Engineering Purposes."
Royal Institution.—3 p.m. Professor H. N. Moseley, on "Colonial Animals: their Structure and Life Histories." Second lecture.
Statistical Society.—7.45 p.m. (At the Royal School of Mines, Jermyn Street.) Dr. R. Giffen, "Further Notes on the Progress of the Working Classes."
Zoological Society.—8.30 p.m. (At 3, Hanover Square.)

WEDNESDAY, JANUARY 21.

Royal Meteorological Society.—7 p.m. Annual general meeting. President's address.
Society of Arts.—8 p.m. Seventh ordinary meeting. Mr. D. Pidgeon, on "Labour and Wages in the United States."

THURSDAY, JANUARY 22.

Society of Arts.—8 p.m. Howard Lectures. Mr. W. Anderson, M.I.C.E., on "The Conversion of Heat into Useful Work." Lecture IV.—The working substances in heat engines—gunpowder gases—coal gas—hot air—steam—the method and cost of preparing the working substances—the theoretical calorific power of fuels, the degree of efficiency to be expected, and the efficiency actually realised.
Royal Institution.—3 p.m. Professor Dewar, on "The New Chemistry." Second lecture.
London Institution.—5 p.m. Professor C. Stewart, "Sketches Marine Life." Third and concluding lecture.

FRIDAY, JANUARY 23.

Quekett Microscopical Club.—8 p.m. Papers by Dr. W. B. Carpenter and Mr. F. Parsons.
Society of Arts.—8 p.m. Indian Section. Mr. E. G. Buck, on "The Agricultural Resources of India."
Royal Institution.—8 p.m. Professor H. N. Moseley, on "The Fauna of the Sea-shores."
Architectural Association.—6.30 p.m. Lecture on "Thirteenth and Fourteenth Century Gothic."

SATURDAY, JANUARY 24.

Royal Institution.—3 p.m. Dr. C. Waldstein, on "Greek Sculpture from Pheidias to the Roman Era." Second lecture.

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NOTICES.

Communications on literary subjects and books for review are to be forwarded to the EDITOR. Anonymous correspondence will be wholly disregarded. The return of rejected MSS. cannot be guaranteed. Correspondents are requested to write on one side of the paper only. Periodicals sent for reference should have the articles marked.

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AN AUTOMATIC SAFETY LAMP.

AT the meeting of the Manchester Geological Society held on January 9, Mr. J. S. Burrows read an important paper on the above subject. The meeting was held in the lecture hall of the Mining School at Wigan, the chair being occupied by Mr. W. S. Barratt, the president of the South-West Lancashire Coal Owners' Association. The meeting was entirely devoted to the discussion of questions connected with miners' safety lamps, and the chairman, in opening the proceedings, said there was no subject in connection with mine engineering that was at present receiving or deserved more attention.

Mr. J. S. Burrows then read his paper, in which he gave the results of experimental trials made with an automatic safety lamp, of which a description was given in our report of the previous Manchester meeting of the society, and he also added some notes on the various methods of locking safety lamps. In the course of his paper Mr. Burrows said Mr. Martin, inspector of mines, the energetic hon. secretary of the society, having forwarded to him for trial a lamp sent by Mr. C. E. Rhodes, had asked him to lay the results of such trial before the members. This he did with great pleasure, only regretting that he had not more information to give. The lamp might be briefly described as an ordinary Clanny lamp, fitted with an extinguisher, capable of closing, when down, the inlet and outlet air holes of the lamp, this again being enclosed by an outer shield, similar to that of the Marsaut lamp. When in use, the extinguisher was propped up by a piece of iron passing up through a hollow standard. The bottom of this piece of iron was formed into a kind of hook, which rested on a piece of thread. The theory of this arrangement was that, whenever the lamp was filled with gas, the thread should burn, releasing the upright piece of iron or prop, and allowing the extinguisher to drop, thus cutting off all communication with the outside air, which, of course, would put out the light. It was needless to point out the advantages of being able to use a Clanny lamp when working, because it gave a good light; was much less liable to go out if tilted on one side than a Muesseler; and if the extinguisher really did its duty in the presence of a dangerous quantity of gas, it was equally as safe, if not safer, than the best lamp known. Unfortunately, he was unable to say definitely from experience that the extinguisher did so come into play when the lamp was placed in a current of gas and air, as he had only been able to watch the behaviour of the lamp in out-of-the-way workings, where gas could be found, and where there was no current. The lamp was first tried with an ordinary gas jet on the surface, but the thread would not burn unless the lamp was so placed that the gas entered on the side where the thread was; but by so placing it, the extinguisher was brought into play, and the light put out. On trying the lamp underground in gas, it went out just as any other lamp would do, but the thread was in no case burnt. In all the trials underground the gas was but little, if at all, diluted with air, and it was his opinion that, if the gas were sufficiently diluted with air so as to burn briskly inside the lamp, the thread would burn, and allow the extinguisher to come into action. With the view of testing whether the thread would break in ordinary use when not required, the lamp was given to colliers and drawers, instead of their own lamp. They were very pleased with the lamp after their own Muesselers, and the thread did not give way in a single instance. If, however, the lamp should prove to be so sensitive in a current of air and gas, it was an open question whether it was an unmixed benefit to be left in the dark when a lamp met with perhaps only a small quantity of gas, such as when a long wall-face was "weighting," or when "prop drawing."

Much attention had of late years been given to the question of safety lamps, but he had not noticed much said about the proper method of securing or locking the lamps when lighted, so as to prevent the flame being exposed, either by accident or design. As this was a very important part of the question, he ventured to take that opportunity of bringing the subject forward. The devices for preventing the opening of safety lamps when at work were:—1. The screw lock, when a short screw was tightened (*a*) against the threads on the lamp bottom, or (*b*) against the lamp bottom below the threads, or (*c*) from underneath through the lamp bottom and against the bottom ring of the lamp top. 2. A hasp attached to the lamp top passed over a projection on the bottom, and secured by a common brass padlock and key. 3. The magnetic lock, as in the Wolf lamp, where the lamp bottom had to be placed over a powerful magnet before the lock bolt could be released to allow of the lamp being unscrewed. 4. The Protector Lamp and Lighting Company's patent, where, on attempting to unscrew the lamp bottom, the wick tube and flame had to pass through a collar held in its place by a simple arrangement with a spring, and which thus extinguished the light. There was a second locking arrangement with a lead rivet as well. 5. Lead rivets, either (*a*) with an ordinary hasp, or (*b*) where two projections in the lamp top and bottom were brought opposite to one another, and the rivet passed vertically through them. In either case the rivets were pressed between two dies, which marked each end of the rivet with some device or initials. With regard to screw locks, they gave no security whatever. Any screw had always a tendency to slacken when there was any jolting or vibration. Again, if, in locking, the end of the screw, instead of locking in its usual hole, was just on the edge, the first knock the lamp received in working probably caused the screw to slip off the edge into its proper place, when it was slack at once. Moreover, the head of the screw lock on which the key fitted wore away rapidly, and it soon became difficult to screw it up properly. Lastly, any one could open the lamp with a key, a nail, and even, if the lock projected, with his teeth, and screw it up again in the same manner, the screw giving no indications that it had been tampered with. With regard to padlocks, they were of the commonest kind, and duplicate keys were easily obtainable. They also told no tales when they had been tampered with. He had never seen the magnetic lock in actual use, but he thought it was a satisfactory means of securing the lamp. The Protector Lamp Company's arrangement was certain to extinguish the light when the bottom was unscrewed if the spring were pushed home and in its place, but a match would relight the lamp, and, were it not for the second lock with the lead rivet, would not show that it had been so treated. The lessening of the flame was effected by partially unscrewing the bottom, and in carrying the lamp the bottom had a trick of coming unscrewed until stopped by the second lock. The system of securing by lead rivets was not open to any of these objections. The rivets were stamped in the morning before the lamps were given out, and remained just as they were unless the head was cut off. The person who defaced the rivet could not replace it unless he possessed a new rivet, and a facsimile of the particular die in use, and the knowledge that, when the lamp was handed in to the lamp room it would tell its own tale, was sufficient to deter any one from meddling with it. At the lamp stations for re-lighting lamps underground this locking or rather stamping arrangement was kept in a lock-up box, the key of which was in the possession of the jigger or other person appointed, and who was the only person allowed to re-light the lamps. Of the two plans, he preferred the one where the rivet was placed vertically through two projections on the top and bottom, as there was then sufficient play in the hasp to allow of the bottom dropping down in case the thread on the lamp bottom was much worn.

This question of securing lamps was very important on two grounds:—1. It was no use having a perfect lamp in use if the light could be exposed by anyone without much difficulty or fear of detection. 2. Managers were exceedingly strict in enforcing the rules as to lamps, which was as it should be, but, on the other hand, they ought to be as particular in seeing that the means of securing the lamps were such as to leave no manner of doubt that they might, as he had tried to show, with screw locks, come loose without any interference on the part of the workman. Contracts to be binding must be mutual, and it was the duty of all concerned, whilst enforcing the rules to the utmost, to take care that it was not possible for an innocent workman to be sent to prison through having an antiquated and unreliable method of locking lamps. In conclusion, Mr. Burrows expressed the opinion that the question of lamps and locking would never be satisfactory so long as the men were made to find and clean their own lamps. He believed this bad system was dying out, but there were many places where it was still in force. A man who was required to find a Davy lamp at one colliery must perhaps find a Muesseler if he moved to the next colliery, and possibly keep two or three other sorts if he wished to extend his movements, and it was only natural that he would buy the cheapest, and therefore the worst, he could. Also he would put off renewing the gauzes as long as they would pass the foreman's cursory inspection when he went to his work. Moreover, it was not easy to make a change of lamps when the men had to find the money for a new lamp, in the choice of which they had no voice, and which might possibly be of no use if they left, or were dismissed a fortnight afterwards.

Mr. Wm. Bryham, in proposing a vote of thanks to Mr. Burrows for his paper, said the subject was one of very great importance, and they were very much indebted to Mr. Burrows for the manner in which he had brought it forward.

Mr. Tonge, in seconding the proposition, said he fully agreed with what Mr. Burrows had said, that the best sytem which could be adopted with regard to lamps, irrespective of any particular form or design, or manner of locking, was that all the lamps should be found by the colliery proprietor; where they had to be found by the men, it led to very defective lamps being used.

The vote of thanks having been unanimously passed, the chairman expressed the opinion that it was very essential that subjects such as had been dealt with in the paper should be brought before a society like that.

Mr. Budenberg, of Manchester, also exhibited and explained the Wolf patent safety lamp—of which a description has already been given in these columns—with the special arrangement for automatic re-lighting without opening the lamp, magnetic locking arrangement, and apparatus for charging and testing the lamps; which attracted a good deal of attention from the members present, and the testing apparatus was employed for trials with other lamps exhibited.

In the discussion which followed, Mr. W. Bryham expressed the opinion that it was not always advisable to give the men too ready a means of re-lighting their lamps, should they have gone out in a highly explosive atmosphere.

The chairman said he was sure the lamps which had been exhibited had been a source of great interest, and the secretary informed him that a future opportunity of going further into the matter would be afforded under probably more favourable conditions for testing the lamps than had been possible on that occasion.

Mr. Winstanley observed that the lamp shown by Mr. Burrows was no doubt a very ingenious arrangement, but it was a question how long a collier would be justified in remaining in an explosive atmosphere before the thread was burnt through; whether the collier would be justified in waiting until he was left in total darkness by the accumulation of sufficient ignited gas in the lamp to burn through the thread.

Mr. Burrows replied that one of the chief objects of the lamp was that under no circumstances could there be any mistake, whether the man was waiting, or whether in fright he ran away and left the lamp behind him. In either case it would be extinguished.

Mr. Martin, inspector of mines, said he had seen the lamp tested at the Aldwark Main Colliery in a velocity of 51 feet per second. The lamp remained burning for a few seconds, and was then extinguished. The extinguishing arrangement had nothing to do with how long a man should remain in his working place in an explosive atmosphere. There were rules which regulated that; the object was that in the case of a person unwittingly getting into an explosive atmosphere the lamp would extinguish itself. With regard to the question of locking lamps, they were all indebted to Mr. Burrows for bringing the matter forward. During the last few months the subject had come frequently under his notice, and he found numbers of lamps, locked with a screw, in the hands of colliers after they had worn quite loose. The question, therefore, was how far it was desirable to have a lamp of such a description placed in the hands of men subject to penalties for unlocking. The locking of the lamp itself had, no doubt, nothing to do with its actual safety. The object in the first instance was that the men should be unable to unlock it without being detected; secondly, that it should not be unlocked inadvertently; and, thirdly, that it should not become unlocked without the action of the collier himself. Mr. Burrows had also made a remark that it was an unsatisfactory system which compelled the men to find their own lamps, and in that he agreed.

Mr. W. Pickard (miner's agent) asked whether, in such lamps as the Marsaut and others—where a shield was introduced—this had not the effect of increasing the temperature of the lamp.

Mr. Burrows said that at their collieries they had 300 of such lamps in use, and the men raised no objections with regard to the heat. He had not found any higher temperature in lamps with the shield as compared with those without.

Mr. W. Pickard said that personally he had a strong objection to the shield on the ground that it tended largely to increase the heat in the lamp.

Mr. Martin said that he had not in his experience, when

carrying a lamp with a shield, found that it got exceptionally hot.

Mr. Pickard said this might not be the case in carrying a lamp, but it would be very different in a stopping place.

Mr. Hall (inspector of mines), in answer to a question, said that with regard to the point raised as to whether the lamps should be found by the mine owners or by the men, both systems were practised, but personally he thought there could be no doubt that there could be no better plan than that the owners should provide the lamps.

Mr. Pickard said he quite endorsed the remarks which had been made on this point. He should like to see the day when every colliery proprietor would feel it his duty to find all the lamps used in his mine. Many of the men had not the proper appliances for cleaning and preparing their lamps, and it was not right that a large body of men in a pit should be made liable to the possible indifference of one man. If every lamp was provided by the colliery, and handed to the men when they went down, properly cleaned and prepared, this would greatly conduce to the safe working of mines.

The chairman said that as a colliery owner he entirely agreed with what Mr. Pickard had said. It was almost an obvious necessity that every colliery should find their own lamps. They then had a uniformity which could not be secured when men bought their own lamps, and there was no doubt that a considerable element of danger was introduced into a mine when men found their own lamps. At their own collieries they had provided the lamps for the men, and he thought they had been repaid in the knowledge of the greater security thus ensured. It also stood to reason that the colliery proprietor in purchasing lamps for use in his mine would get the best he could find, which could scarcely be said to be the case where a collier had to provide his own lamp.

The proceedings were then brought to a close.

THE AMERICAN EXHIBITION (LONDON), 1886.

THE promoters of this exhibition in their recently issued statement thus set forth its scope and objects:—A new departure in the history of exhibitions will be made in the year 1886, precisely 101 years since John Adams, the first minister of the United States who came on a friendly mission to Great Britain, presented his credentials to King George III. An American Exhibition is to be opened in London on May 1, 1886. The United States government, the governors of the most important states and territories, the consul-general in London, the great civic and commercial corporations, and a large number of the most distinguished and eminent citizens, including many of the largest American manufacturers, merchants, and producers (a number of whom have already applied for about 100,000 square feet of space) having expressed approval, a complete representation will be given of the arts, inventions, manufactures, products, and resources of the principal nations of the New World. The advantages of such an exhibition are manifold, in that the friendly relations of the two countries will be strengthened; American inventors, manufacturers, and producers will have for the first time an opportunity to present to Europeans the many improvements made during the past half-century, while visitors to the exhibition from all parts of Europe and the colonies will carry away valuable lessons on the improved modes of production stimulated in America by the dearness of labour. The industrial departments of the exhibition, in all their varied branches, will invite and attract special attention to the wonderful progress made in the United States of America since the Centennial Exhibition of 1876. Besides comprising much of interest that has not yet been seen in Europe, the great improvements made by Americans in all branches of labour-saving machinery, especially for the utilisation of wood and metals, the practical helps for household purposes, the advantages secured by new motors, and the most recently completed appliances for using the telegraph and the telephone, will possess a deep interest for Europeans and visitors from the colonies. Arrangements are also being entered into by which some of the best of the American exhibits from the World's Exposition in New Orleans, 1884-5, and from the International Exhibition of Antwerp, 1885, will be brought over to and warehoused in London, until the opening of the American Exhibition in 1886. The mere announcement that an American Exhibition will be held in London in 1886 has already awakened the keen rivalry of American inventors, and it may be stated with confidence that, as the result, a number of new and entirely original inventions will be exhibited by enterprising Americans. Such an exhibition—the first of its kind—will doubtless attract as many visitors as the Fisheries Exhibition of 1883, and the International Health Exhibition of 1884, and in no better or more economical way can the great advantages of the United States be presented to the public. It must be borne in mind that there is in London a large transitory population, representing all parts of the world, who will, by means of the proposed exhibition, have an opportunity of examining American manufactures, and of introducing them into their several countries. In like manner the attention of foreign capital will be attracted to the great railway and mining interests of the United States. With the co-operation of the governors of states and the principal railway companies it is proposed to arrange the entrance-hall so that the European visitor shall take leave of his native soil, and shall temporarily be in and commence his visit to North America from the harbour of New York, with the Bartholdi statue of Liberty and the striking features of the eastern entry to the United States around him. On leaving New York harbour the visitor's first excursion will be through the various states across the continent to San Francisco—from the Atlantic to the Pacific seaboards. He will pass collections illustrating the wealth and civilisation of the several states from east to west, from north to south. The railway routes and the picturesquely diversified scenery of the agricultural, pastoral, forest, and mining states will be illustrated by paintings, plans, and products. The resources and characteristic productions of the various parts of the vast territory extending between the Atlantic and Pacific coasts will thus be exposed to view almost as fully as to a tourist passing through the country, and with greater facilities of comparison. The "Trip Across the American Continent" will, doubtless, be one of the most instructive and popular features of the exhibition. Interest in the American Exhibition is still further enhanced by the fact that it has been decided to open a Colonial Exhibition in London in 1886, so that there will be a friendly rivalry on the part of Australia, Canada and India with the United States. This new feature in London life will be sure to contribute many thousands of visitors to the large number expected in 1886, and thus bring about an accession of visitors to the American Exhibition; for those who are attracted to London by the Colonial Exhibition will not fail to profit by the opportunity afforded them of paying a visit also to the American Exhibition, and vice versa. The *Times* (London) remarks, in its issue of September 17, 1884, that "there is a certain fitness in the proposal that a great colonial and a great American show will take place simultaneously." The result of concurrently holding these two great exhibitions of collections from the United States of America on the one hand and the British colonies on the other will accordingly be to bring together the whole of the English-speaking world, and to furnish an opportunity for making acquaintance with every part of the earth in which a native of the British Isles would find himself, as it were, among his own people. It is anticipated that the United States government will send a unique collection, representing the Treasury Department, of engraving and printing, the drawings of the coast survey, the models and lights (gas, oil, and electric) of the Lighthouse Board, the varied apparatus of the life-saving services, the weights, measures, and the delicate and ingenious chemical and mechanical gauges of the Customs and Inland Revenue department. From the War Department are expected torpedoes, models, and methods of submarine mining, outfits and appurtenances of military engineer field service, also every variety of artillery, rifles and small arms generally. The Department of Agriculture will be invited to show examples of the maize, wheat, and cotton, the flocks and herds of the great republic, and of the methods employed for raising and improving them. The trappers' art in the wilder regions of the continent will be illustrated, and the Society of American Taxidermists will be asked to contribute a large group of birds with brilliant plumage, of mammals, from the grizzly bear of the Rocky Mountains downwards, and reptiles; while in another department the visitor may learn the taste of canvas-back duck and terrapin soup. The Bureau of Education will have an opportunity of showing the methods of the public and mixed schools by which education in the United States is brought within the reach of so large a body of the population, and in this section it is especially proposed to present the successful efforts of the Department of the Interior in the instruction of the Indian and the negro, as conducted at Hampton (Virginia) under the superintendence of General Armstrong, and also at Carlisle (Pennsylvania), under the charge of Captain H. D. Pratt. The manufacturing department of the exhibition will comprise the development in every branch of that inventive genius which, in the United States, has reached so high a point, and, so far as possible, it is proposed to present the various processes in working order, by the aid of electricity, steam, gas, or hydraulic power. A separate hall (the industrial hall) will be devoted to the handicrafts pursued by white, Chinese, Indian, and negro men and girls. The labour-saving machinery, by which manual toil is reduced to a minimum, will be plentifully exhibited. The systems of working the great trunk railways and canals, the oil wells, and the coal and silver mines will be shown, together with the machinery and organisation by which American manufactures are produced. Not only sight-seers, but manufacturers, landowners, commercial men, farmers, all who are interested in stock-raising, and all who think of emigration, will find much to study in the exhibition. Some of its results will, therefore, certainly be to increase the investments of capital in American enterprises, to attract a higher class of settlers to the United States, and to augment the export trade of America, while affording to Europeans and visitors from the colonies a unique opportunity of obtaining much valuable information of a most varied and useful character. Medals in gold, silver, and bronze, and diplomas of honour will be awarded on the recommendation of juries composed of eminent Englishmen in each profession, trade, and branch of industry represented. Of course the characteristic amusements of the American people will not be forgotten. At an American theatre, it is proposed that performances be given by American actors, and by the negro singers who keep alive the reminiscences of plantation life and minstrelsy. The Art Department, the theatre, and the concert-room will be under the management of eminent artists and impressionists. A number of the best known American artists in Europe and America have undertaken to furnish the fine art galleries, and, amongst many other works, will be portraits of the most prominent personages—soldiers, preachers, politicians, lawyers, bankers, inventors, merchants, writers, and actors—of the United States. There will be in connection with the exhibition such sports as may be practicable, including roller-skating, baseball playing, lacrosse, trotting matches, bicycling tournaments, billiards, and the American variations of every form of recreation which is popular in the old country. The principal phases of American life will be represented in the exhibition from a broker's office in Wall Street to the camp fires of Nevada. A Californian wine shop, Florida fruit stores, an Indian village, Indian canoe makers and mat weavers, ice drink pavilions and bars, restaurants, with the products of the Eastern and Pacific coasts, and of the Northern and the Southern States, characteristically prepared and served by white and coloured male and female cooks and waiters, will help to mark the peculiarities and variety of American social development. Arrangements are being made to include a press pavilion, an Atlantic cable office, an electrical elevated railway, and reproductions of the facades and interiors of remarkable hotels and public buildings. Arrangements are being made for an invitation by the Freemasons of England to delegates of the American Freemasons to appear at the opening ceremonies. Similar proposals are on foot for the holding in England of the moveable meetings for 1886 of American learned societies and other similar bodies. Among the members of many representative associations, a celebrated American regiment, with its band of skilled musicians, and an American fire-engine corps, are expected to pay a visit to London during the exhibition. This, it is believed, will be the first organised trip to Great Britain of an American military force, and it will be made, if possible, to coincide in date with the Wimbledon meeting, in order that the volunteer military services of the two countries may meet together on a friendly footing worthy of the feelings of mutual esteem which characterise the present relations of the two kindred nations. The plan of the proposed exhibition has been received with enthusiasm in America, and is meeting with an amount of practical support there, as in Great Britain, which cannot fail to make the display national and representative in the fullest sense of the terms. The exhibition has already served to stimulate and give expression to the desire which prevails, both in the United Kingdom and the United States, for a more intimate mutual knowledge and appreciation. The international sympathies which have been evoked are neither feeble nor insignificant; and it is to maintaining and enhancing them that we may most confidently look for a continuance of material and moral progress on both sides of the Atlantic.

Correspondence.

"THE RATIONALE OF PRACTICAL METALLURGY."

To the Editor of IRON.

SIR,—I do not know whether it is customary for you to publish criticisms of articles that are supplied to your valuable journal, nor do I, from a chemist's point of view, think it necessary to repudiate what I venture to do with reference to the above; but for the sake of those who are unacquainted with the difficulties connected with analytical work—and who have, in consequence, very little knowledge of what they ought to expect—I venture to beg your insertion of the following remarks. First, I would like you to understand that I am no mere "novice" at the profession, having received a most rigorous training in a laboratory in connection with steel manufactures where the articles—not boiler plates or rails, but articles that have to conform to a more stringent specification—are forged on the strength of the carbon determinations, and being held, so to speak, in check by a most merciless criticism, in the shape of a testing machine for pieces taken from the forged article, and, moreover, confronted by a large and elaborate chemical establishment, where the carbon is determined by the comparatively more expensive and ponderous process of combustion.

Well, sir, to proceed with that which forms the chief reason for my troubling you, viz. the determination of the carbon by Eggertz' method. I would like to be allowed to add my testimony to its worth, and indeed consider it invaluable to the modern steelmaker, although I am under the impression that there is no other process in the whole course of analytical chemistry that has been so grossly abused or maltreated by the profession as has this beautiful process itself; and the writer of the above article adds "yet another" to the many absurdities published thereon. I have taken part in some thousands of determinations by this method, and so am tolerably acquainted with the difficulties connected therewith in the shape of sampling, weighing, and comparing with the normal, and can positively assert that (assuming that he takes and weighs his own samples, as he undoubtedly should do if held in any measure responsible) it is absolutely impossible for anyone, however skilful he may be, to determine, with the degree of accuracy mentioned (probably he would have been more correct had he stated the variance as 0·020 per cent. *or* 0 060 per cent.), anything approaching to the fifty or sixty determinations in a short day. Such tests ought not, in my opinion, to be placed on record as analyses any more than should the rough approximate physical tests of the man at the furnace. It might be as well to state here that some time since a long list of analyses were sent to the laboratory where I am employed for the chief to express an opinion with regard to the discrepancies. These consisted of the same samples, analysed (?) by the same individual at different periods, and the variance was something enormous, even compared with the difference your indulgent writer would not notice as being of any importance. These might possibly have been done by "a skilled assistant" at the rate of fifty or sixty per day; if so, what else could one expect?

Another case of the difficulty connected with getting that which one is aiming at from the converter may be illustrated by the following extract from a paper read before the American Society of Civil Engineers, upon the steel for the Monongahela Bridge, Pittsburgh, Pa:—"The intention was to use Bessemer steel for the compression members; a large lot of Bessemer steel was tested, but few samples were found to stand the desired tests. The difficulty seemed to consist in controlling the uniformity of the steel within close limits for quality and strength. After a while, the attempt was given up, and open-hearth steel was substituted. No trouble was then experienced in getting a uniform grade of steel of prescribed quality." There is, of course, to an extent, an excuse for the carbon not turning out all that could be desired from the converter, considering all circumstances; but I hold that there is not a vestige of excuse for the chemist not

putting the ingots into their right places by an approximately correct carbon determination; which, however, according to the words of the inventor of the process, could not be done at the rate of 50 or 60 per short day. In his description of his process, Eggertz says "that by placing the tube (containing the nitric acid and steel) in boiling water the solution is complete, when all evolution of gas ceases, which is about three quarters of an hour after its introduction." I can assert from experience that steel of the grades your writer mentions, viz. 0·45 or 0·5 per cent., are not completely dissolved in less than half an hour, and nothing approaching to correct results can be obtained by attempts at rapid solution.

I think, sir, that I have said sufficient to convince the majority of your impartial readers that this class of so-called analysis is very liable to deceive the manufacturer and disgust the buyer, as I myself have had innumerable such samples through my hands, utterly different from the reputed composition; and I know of no other reasons than those suggested by the remarks I have offered. In conclusion, I would state that I would not think of using a sample of cast steel for my normal, to compare the steel made by a Bessemer converter as mentioned by the writer of the article; and when in constant use, it is my usual practice to make a fresh normal solution three times a week, which is kept, as much as possible, in the dark.—I am, &c.

An Assistant.

January 12, 1885.

THE PATENT LAW.

To the Editor of Iron.

Sir,—The year of the International Inventions Exhibition has now opened, and upon the use made of the opportunities afforded by the congresses which will be held during that exhibition will depend, in a great measure, the future development of the trade of Great Britain. A good patent law encourages invention; invention creates new industries; new industries create a demand for labour, an increase "by leaps and bounds" in the sums paid as income-tax, and add to the capital of the nation. The object of legislation should be to encourage invention and give security to inventors. This has not hitherto been accomplished. Inventors have been oppressed, sneered at, legislated against, yet, in the face of all this, they have made England what it is. There is no trade which does not owe its prosperity to the efforts of inventors. But what is the position of the inventor? He is allowed to obtain a patent for a very limited period (fourteen years) on payment of fees amounting to £154. In other words, he is permitted on payment of £154 to bring a lawsuit against those who infringe his patent during that period. In America the inventor pays £7 for a patent for seventeen years. The advantages afforded by the American patent laws have induced many of our inventors to patent their inventions in that country before doing so in England. It has been said, and with truth, that "in England a patent creates a lawsuit, in America a property." The inventor is met by demands for fees at every step—on appeal from Comptroller to law officer, £3; on hearing of opposition to patent by comptroller, £1; on opposition to grant of compulsory licence, £5, &c. He has to grant licences at the discretion of the Board of Trade, and the officers administering any department of the service of the Crown, their agents, or contractors may avail themselves of his invention on such terms as may be settled by the Treasury—*i.e.* by the party interested in not granting fair terms to the inventor. The inventor has, as a great favour, been allowed to pay his fees by twelve instalments. This necessitates twelve applications to his patent agents, and patent agents do not work gratuitously by any means. It may be urged that the inventor has had facilities afforded him, by which he is enabled to take out his own patent without employing an agent. What is said of the man who is his own lawyer is trebly true of the man who is his own patent agent. To how many inventors have the worried and over-worked officials at the Government Patent Office within the last twelve months, driven to desperation by specifications, intelligible only to the person who drew them up, exclaimed—"Why don't you employ a patent agent?"

The remedy for inventors' grievances is to be found in union. The general election is at hand; let inventors combine, in order that by their organised force and united influence they may obtain, from whatever government may be returned to power, such alterations in the law and improvements in their position as are absolutely necessary. Let them make a proper view as to the laws affecting patents, a crucial test as to the fitness of a candidate for a seat in Parliament. Among the changes necessary may be mentioned:—1. A reduction of the fees to £10—£3 of which to be paid on filing a complete specification, £7 on the issue of letters patent. 2. An extension of duration of patent to twenty-one years. 3. The abolition of compulsory licences, except to government factories; and in that case the compensation to be paid to the inventor to be decided by arbitration or by a jury. 4. The "infringement of a patent" to be in all cases considered as proved, unless the infringer can show that he has commenced and is actively carrying on a suit for the revocation of the patent said to have been infringed. 5. An international patent law, drawn up in the interest of the public and the inventor, and not in that of the lawyer and patent agent. The fees for patents in all countries to be payable in the country in which the invention is patented. 6 A new building for the Patent Office, suitable to the importance and magnitude of the business which has to be carried on. (N.B. The number of patents applied for in 1884 amounts to 17,012, as against 5,993 in 1883.) 7. The appointment of additional specially trained examiners who understand the subjects on which they have to report.

These are only a few of the subjects which require immediate attention. If inventors prove unequal to the occasion they will miss the opportunity for which they have been so long waiting. It is to be feared that the Inventions Exhibition is being turned into an attractive show for the public, rather than, as was originally designed, an exhibition to set forth the inventions and improvements on previous inventions which have been patented since 1862. This is not to be wondered at, as inventors have been rigidly excluded from the council. The patent act of 1883 is indeed somewhat too well represented on the council, for that act has proved a failure, and has only tended to add enormously to the Chattertons of invention. One statement in conclusion. In consequence of the taxation of science and suppression of native genius, many of our national industries have been driven from the country, and we are now being supplied with cheap and inferior manufactured articles from abroad.—I am, &c.

H. B. Deane, Secretary.

Inventors' Institute, Lonsdale Chambers,
Chancery Lane, London,
January 13, 1885.

Notices of Books.

A Dictionary of General Biography. — Messrs. Longman & Co. announce the fourth edition of this dictionary, by Mr. L. R. Cates. The third edition was brought down to the close of 1880. The present edition contains memoirs and notices of eminent persons who have passed away during the four years 1881 to 1884, and is completed as nearly as possible to the time of publication.

BOOKS RECEIVED.

The Sewerage of the Lower Thames Valley. By Messrs. Shone & Ault, and W. Donaldson, M.I.C.E. E. & F. N. Spon.

Stationary Steam Engines; especially as adapted to Electric Lighting Purposes. By R. H. Thurston, A.M., C.E. New York: John Wiley & Sons. London: Trübner & Co.

Weekly Problem Papers. By Rev. John J. Milne, M.A. Macmillan & Co.

Brass Repousse Work. By Madame Amélie London: 40, North Audley Street, W.

A Catechism of the Steam Engine. By John Bourne, C.E. Longmans & Co.

Martineau & Smith's Hardware Trade Diary and Cash Book for 1885. Second copy.

Mechanical Progress. No. 1. Atlantic Printing and Publishing Co., Manchester.

Science and Art.

The Institution of Civil Engineers.—Dr. William Pole, F.R.S., has been appointed honorary secretary to the institution, in the room of the late Mr. Charles Manby. The office of secretary is filled, as formerly, by Mr. James Forrest. The treasurer is Mr. H. L Antrobus.

South Kensington Museum. — Visitors during the week ending January 10, 1885.—On Monday, Tuesday, and Saturday (free), from 10 a.m to 10 p.m., Museum, 11,189; Mercantile Marine, Indian Section, and other Collections, 2,911. On Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. to 4 p.m., Museum, 1,311; Mercantile Marine, Indian Section, and other Collections, 167; total, 15,578. Average of corresponding week in former years, 18,098. Total from the opening of the museum, 23,660,949.

Whitworth Scholarships —We are requested to state that the Lords of the Committee of Council on Education have caused a medal to be prepared by Mr. Allan Wyon, from designs by Mr. Poynter, R.A., as a memorial of the founding and endowment of the Whitworth scholarships, by Sir Joseph Whitworth. Their lordships have also authorised the issue of a copy of this medal to each of the scholars who have held scholarships and have gone through the prescribed course satisfactorily. Scholars, or the legal representatives of such as are dead, are requested to inform the secretary of the Science and Art Department at South Kensington of the address to which their medals should be forwarded.

Crystal Palace School of Art.—A well-appointed studio has been constructed in extension of the accommodation hitherto provided for art students at the north end of the Crystal Palace. It has a fine north light, has been designed for its special purpose, it is larger than the other studio, and is in all respects of light, ventilation and decoration a very complete work. But the purpose of accommodating the increasing number of art students at the Palace is not the only one that the directors have pursued. A far more important question is the appropriation of a large studio devoted to the students for practice, wherein they may work by themselves at all times when they are not attending the direct instruction of the master in the new studio just opened.

A New International Exhibition.—An international industrial and polytechnic exhibition will be held at Königsberg, Prussia, during the months of May to August of this year, the exhibits including machinery, motors, tools, appliances for mechanics, small manufacturers, &c. The following are some of the heads of groups under which exhibits will be classified, viz.:—(1) Motors; (2) transmission appliances; (3) tools and implements for all branches of manufacture; (4) chemical and physical apparatus; (5) apparatus for technical education; (6) safety and protective appliances; (7) machinery and appliances for household purposes and for innkeepers; (8) agricultural implements and appliances. The exhibition takes place under the authority of the industrial central union of the province of East Prussia, Dr. N. Heinemann, of the New Athenæum Club, 3, Pall Mall East, has been appointed special commissioner of the exhibition for England. He will give all necessary information to intending exhibitors.

The Institution of Civil Engineers.—At the last meeting of the institution it was announced that the council had recently transferred A. E. Carey, R. E. Creswell, K. W. Hedges, J. O. Lawder, and J. Young to the class of members; and had admitted G. C. Badham, P. M. Beaumont, J. L. B. De la Cour, V. W. Delves-Broughton, A. Eartwood, T. W. Franks, N. W. J. Gibson, G. P. Heisch, H. G. Joy, J. Lee, B. G. Lloyd, C. V. Lloyd, P. G. Messent, H. A. Nock, J. S. Pickering, F. E. Priest, H. P. B. Rigby, J. A. Thornton, H. A. Westmacott, and H. Wreathall as students. The monthly ballot resulted in the election of P. D. Bennett, T. A. English, T. Hindmarch, W. C. Hughes, and J. Rochfort, as members; of D. Bonar, P. Dunn, L. F. Eveleigh, S. Henderson, E. Henshall, G. W. Hersey, E. Hopkinson, M.A., D.Sc., G. Kapp, H. F. Perkins, P. Rickard, S. A. Russell, C. W. Smith, H. J. Spooner, H. Townsend, and F. Wiswall as associate members; and of H. Card, J. Rock, and H. B. Willock, Capt. R.E, as associates.

The Institution of Mechanical Engineers.—The thirty-eighth annual general meeting of this institution will be held on Thursday, January 29, and Friday, January 30, at 25, Great George Street, Westminster. The chair will be taken by the president at half-past 7 p.m. on each evening. The annual report of the council will be presented to the meeting. The annual election of the president, vice-presidents, and members of council, and the ordinary election of new members, associates, and graduates will take place at the meeting. Notices have been given of motions to be proposed at the meeting for alterations in the by-laws. The following reports and papers will be read and discussed, as far as time will admit:—Final Report on Experiments bearing upon the Question of the Condition in which Carbon exists in Steel, by Sir Frederick Abel, C.B.; Second Report of the Research Committee on Friction; "Recent Improvements in Wood-cutting Machinery," by Mr. George Richards, of Manchester; "The History of Paddle-wheel Steam Navigation," by Mr. Henry Sandham, of London; "The Tower Spherical Engine," by Mr. R. Hammersley Heenan, of Manchester.

Exhibition of Old Masters.—The exhibition of paintings by old masters at Burlington House this winter consists principally of works by deceased artists of the British school, the remaining works representing early and later Italian, early Flemish, and Dutch seventeenth century pictures. If the present exhibition is deficient in point of numbers, 256, against 316 in 1883, and 369 in 1883, it is not so in regard to variety of painters, nor in the quality of their works. On entering Gallery I., the eye is almost involuntarily attracted by a painting of Sir Edwin Landseer's, "A Fallen Monarch" (22), showing a dead lion, terrible still in death. The other work by the same hand, and in the same room, is "Head of Wounded Boarhound" (35), painted with all the late master's dexterity. A forcible counterpart to Landseer's dead lion in the desert is the "Lioness" of Mr. James Ward, R.A. (58). There are a great number of portraits in the exhibition, nearly seventy, twenty-four of which alone are by Sir Joshua Reynolds. Hogarth, Gainsborough, Turner, and other deceased English painters are also well represented, and if we add that there are a number of pictures of the earlier and later Italian schools, and nearly a room full of early Flemish and Dutch pictures (the latter of the seventeenth century), we have said enough to show that the winter exhibition at Burlington House is well worth a visit.

Climate and its Relation to Health.—The first of a series of Cantor lectures on this subject was delivered on January 12 by Dr. G. V. Poore at the Society of Arts. The lecturer observed that throughout the world the composition of the air was practically uniform, and he came, therefore, to the conclusion that the chemical composition of the open air could have very little to do with health. One of the effects of rain was to raise the temperature of a place, and it had been calculated that the rise in temperature due to the condensation of rain on the west coast of Ireland was equal to half the amount of heat received from the sun. Rain was also a great purifier of the air. Moisture was not a direct cause of disease, but indirectly it was harmful, inasmuch as it favoured putrefaction, the great enemy of health all over the globe. Great heat, joined with great moisture, was undoubtedly injurious to health, because such a composition accelerated putrefaction. It was difficult to say that heat, considered quite alone, was a cause of disease, but it was difficult to separate it from other things, especially its relation to putrefaction. Heat-apoplexy might be produced in the shade as well as in the sun, and it was noteworthy that it could also be brought about by over-crowding and by errors of diet and dress. The extremes of cold and darkness did not necessarily of themselves endanger life, a fact which had been conclusively proved by the experiences of the crew of the *Eira* while in the Arctic regions.

Society of Arts Awards at the International Inventions Exhibition.—The council of the Society of Arts announce that they will award the following gold medals in connection with the International Inventions Exhibition:—Under the Joint Stock Trust, one gold medal for the best application of photography to a permanent printing process; Group XXVI., Class 140; Group XXIX., Class 159. Under the Howard Trust, five gold medals for the best exhibits (coming within the terms of the trust) in the following classes:—One for the best exhibit in Group IV., "Prime Movers," Class 26—Steam Engines and Boilers; one for the best exhibit in Group IV., Class 27—Gas and Air Engines; one for the best exhibit in Group IV., Class 28—Means of Utilising Natural Forces; one for the best exhibit in Group XI., "Hydraulic Machines," &c., Classes 59 to 62; one for the best exhibit in Group XIII., "Electricity," Class 72—Distribution and Utilisation of Power. Under the Fothergill Trust, one gold medal for the most novel and best exhibit in Group XXVIII., "Philosophical Instruments and Apparatus," Classes 148 to 158. Under the Alfred Davis Trust, three gold medals to be awarded in Division II. of the exhibition (Music), Groups XXXII. to XXXIV., Classes 166 to 180. The council propose to ask the juries in each class to recommend for their consideration either two or three exhibits which they might consider deserving a prize. It will not be necessary for any special application to be made in respect of these prizes. The medals are each of the value of £20.

The American Society of Civil Engineers.—The American Society of Civil Engineers contemplates two changes in its manner of conducting its conventions, which seem worthy of note. The first is to require all papers

which are to be presented at the conventions (and presumably reports of technical committees as well) to be handed in to the secretary at least forty days in advance, in order that abstracts may be prepared and sent to each member to enable him to prepare a discussion should he so desire. In this way it is hoped that the interest and value of the discussions will be greatly increased, and the weariness avoided of listening to abstract theoretical discussions which cannot be intelligently followed by the ear alone when so delivered. The second measure is designed to relieve the society from an unnecessary burden of obligation for entertainments, excursions, banquets, and the like, which the members feel bound to attend in courtesy to their entertainers, but which are not generally felt to be the most profitable and enjoyable use of the limited time available. To this end it is proposed to abandon the system of accepting invitations, of a more or less formal character, to hold conventions in certain large cities, but to go instead to some large summer resort—the more retired the better—provided it offers adequate hotel accommodations, where the time not occupied by the sessions of the convention can be devoted to rest, or informal social intercourse, instead of to sight-seeing or formal entertainments. Many members are stated to feel that this measure will greatly add to the attractions of the convention. The changes proposed have been recommended by a committee specially appointed for that purpose, after the last convention at Buffalo had brought the defects of the present method forcibly to the attention of members. They are now offered to members with the approval of the board of direction, and if approved at the coming annual meeting of the society will govern the arrangements for next year's convention.

Metallurgy and Mining.

GOLD COINAGE IN NEW SOUTH WALES.—During the period 1855 to 1883 the gold received for coinage at the Sydney Mint amounted to 13,633,504 ounces, valued at £51,943,991; of which 6,703,357 ounces, valued at £25,657,357, came from New South Wales, and the remainder from Queensland, New Zealand, Victoria, Tasmania, and elsewhere.

STEEL FOR UNDERGROUND COLLIERY PURPOSES.—A novel feature, which may lead to a large demand for steel for underground colliery purposes, has been introduced by the Darlington Forge Company, who are executing considerable orders for large sections of channel steel to be used for roof beams in the place of wood in pit workings, and steel props are also being made for supporting the roofs. The first cost of steel for beams and props is, of course, in excess of the wood supports at present used, but an ultimate saving will be effected in that they can be removed for further use without damage, which to a very large extent is not the case with wood, whilst an additional and very important advantage is secured in that much less space is occupied as compared with the heavy timbering now required, and a better working headway in the mine is obtained.

MINING COMPANIES.—According to a table published by Mr. Edward Ashmead, F.C.A., the number of mining companies registered in 1884 was 148, with a nominal capital of £14,952,207. The total number of British mines registered was 83, with a capital of £4,348,207, the 65 foreign mines having a capital of £10,604,000. Of the British mines 29 were metalliferous, with a capital of £807,707; 45 were coal and iron, with a capital of £3,295,500; and nine were quarries—slate and stone—with a capital of £245,000. Of the foreign mines 54 were metalliferous, with a capital of £9,534,000; and 11 are described as miscellaneous, with a capital of £1,070,000. Some of the companies, it should be stated, were reconstructed from concerns previously existing, as in the case of the Van, the Glenrock, the New South-East Wynaad Estates, the Hoover Hill, the Chile, and the Potosi Companies. Of the foreign companies 14 were to carry on operations in Europe (capital, £1,177,000), three in Asia (capital, £400,000), nine in Africa (capital, £980,000), 23 in North America (capital, £5,117,000), 12 in South America (capital, 2,742,000), and four in Australia (capital, £188,000).

SILVER-SURFACED IRON.—A successful method of giving a silver surface to iron has for some time been employed by a Vienna manufacturer. The plan is to first cover the iron with mercury, and then silver by the galvanic process. By heating to 300° C., the mercury evaporates and the silver layer is fixed. Ironware is first heated with diluted hydrochloric acid, and then dipped in a solution of nitrate of mercury, being at the same time in communication with the zinc pole of an electric battery—a piece of gas carbon or platinum being used as an anode for the other pole. The metal is soon covered with a layer of quicksilver, and is then taken out and well washed and silvered in a silver solution. To save silver, the ware can be first covered with a layer of tin, one part of cream of tartar is dissolved in eight parts of boiling water, and one or more tin anodes are joined with the carbon pole of a Bunsen element. The zinc pole communicates with a well-cleaned piece of copper, and the battery is made to act till enough tin has been deposited on the copper, this being then taken out and the iron ware put in its place. The ware thus covered with tin chemically pure, and silvered, is said to be much less costly than any other silvered metals.

THE DEVELOPMENT OF THE MINERAL RESOURCES OF TONQUIN.—A commission appointed by the French government to consider the best method of developing the mineral wealth of Annam and Tonquin has just issued its report. It lays down a programme for a mining mission, which it has been decided to send out there, and suggest the appointment of two separate missions. The duty of the first of these would be to ascertain whether the metalliferous deposits stated by Annamite documents to exist in two north-western provinces of Tonquin do actually exist there, and how far it would be possible to work them profitably. The second should investigate the copper deposits of the delta, and subsequently extend its labours into Annam. A draft mining law for these regions has also been proposed. Its special provisions are those relating to the mutual rights of the owners of the soil and those who have been granted concessions to work the mines; to adminstrative intervention (which it is recommended should be as rare as possible) with private mine owners. The broad policy laid down by the commission is very liberal, not only to the natives, whose rights or alleged rights are to be scrupulously respected, but also to other nations, whose subjects are, for mining purposes, to be placed on the same footing as Frenchmen. Work, it is said, can take place at once on the coal-measures known to exist on the coast of Tonquin, as well as in the adjacent islands.

HYDRAULIC FORGING.—From a note on this subject in Karmarsch and Heeren's *Technisches Wörterbuch*, we learn that John Haswell was the first to apply hydraulic pressure for the purpose of forging in 1861, when he constructed an 800-ton press for forging parts of locomotives. The advantages of this method are, that the cast-iron dies into which the metal is forced are not so easily damaged as when they are subjected to the blows of a hammer; the forgings may also be of somewhat complex shape, and a very homogeneous forging is produced, as the pressure must distribute itself through the entire mass of metal before it can assume the desired shape. Since the original outlay on the dies is considerable, the process will not prove economical unless at least about ten forgings after the same pattern are produced, while for much greater quantities it is exceedingly remunerative. A 2,000-ton press is fully described and illustrated. There are two plungers of different diameters which are externally rigidly connected by means of crossheads and links. The water under pressure enters above the larger or working piston, which is made to move in a vertical cylinder connected by four pillars with the base. The upper die is attached to the lower end of the plunger, while the lower die is fixed in the base. The small plunger moves above the other for the purpose of raising it after a forging has been completed. This plunger is continually under hydraulic pressure applied below, and when it is desired to raise the large plunger, it is only necessary to release the pressure on it. This is effected by means of valves which are worked by steam pressure. The weight of the plunger causes it to descend until it comes in contact with the forging, when the pumping engines are brought into operation. Details of the process of manufacture in the cases of a crosshead, a wheel in four parts, and a disk-crank are given as examples. To make the manufacture continuous for each press a steam hammer and two heating furnaces are needed. In one day of ten hours twenty-five to thirty crossheads for locomotive engines are manufactured. Figures are given showing a reduction of 65 to 70 per cent. on the cost of making forgings in the ordinary manner with the aid of a steam hammer.

COLLIERIES IN SAXONY.—At a recent meeting of the Mining Institute of Scotland, a paper on "Some Collieries in Saxony" was read by Mr. R. Thos. Moore. The author stated in his paper that all the coal and lignite mines in Saxony are included in the three districts of Zwickau, Chemnitz, and Plauen, near Dresden. In the first of these there are over forty mines, with an output of over 2,000,000 tons per annum, and in each of the other two there are about a dozen mines, with an output of about 500,000 tons per annum. The general characteristics of the strata do not differ much from what is met with in Scotland. All the ores of metals in the country belong to the government, but the coal is the property of the owner of the surface; but before it can be worked, the government has to be consulted on the subject, permission to operate being, however, very seldom refused. There is a government mining council, which undertakes the inspection of mines, the order of procedure being somewhat after the manner that obtains here; but the regulations as to the qualifications of officials in the mines might well in many respects, and with advantage, be copied in this country. There is first a director, who corresponds to the Scotch agent. He requires to pass an M.E. degree in one of the mining colleges, the course of study, which extends over four years, including mathematics, chemistry, drawing, mining, &c. Second, there is the "Obersteiger," or certificated manager, who has charge above and below ground. He must have had a technical education at a mining school, where he learns drawing, surveying, the elements of chemistry, &c., and must hold a certificate of proficiency in these. An Obersteiger, however, cannot become a director unless he takes an M.E. degree. Then there is the Steiger, who corresponds to our overman. Before appointment, he must have attended a mining school, and have obtained all the qualifications for an Obersteiger, to which he may rise. Other sub-officials are selected from the ordinary miners, but they cannot rise to any of the positions named without coming under the required educational stipulations. The working hours are much longer there than in this country. Few colliers make more than 3s. a day; and at a lead mine near Freiberg the men went down and up 250 fathoms of ladders, and worked twelve hours' shift for, it was stated, from 1s. 6d. to 2s. per day—a state of things which, it is hoped, our miners will never be reduced to. Mr. Moore's paper contains a variety of information as to the treatment of the coal after being raised.

STEEL UNIFORMITY.—The *Scientific American* says:—The users of steel for manufacturing purposes, and probably the producers of steel, would welcome any information that would insure uniformity in the product. It appears to be almost a waste of investigating endeavour to argue on the relative merits of steel produced from the iron and that cemented from the bar. The true test of their relative merits is that of use in practice. Yet there seems to be an almost insane desire to turn all our iron into steel, and to produce steel as directly from the ore as pig-iron is produced. An enthusiast recently called attention to some lathe and planing tools, cast from iron melted in the cupola in the regular way, and then submitted to a cementing process of brief duration, claiming them to be true cast steel, or its equivalent. And there are others who assume that all the work of cementation and the after processes may be dispensed with, and good tool steel result. This nonsense will be taken up and repeated by mechanics who may be like the Athenians described in Acts xvii. 21; but there are workers who know steel from carbonised cast iron, and who require for their work all the proper qualities of cast steel. What is needed in regard to steel information is how to make cast steel to-day, to-morrow, and so on indefinitely, the same. We know that iron can be refined, and that its components can be changed, so as to improve its quality, and so that it can assume some of the qualities of cast steel, and be called steel commercially. But what is required is an equable quality of the steel used for tools. This equable quality does not exist among the steels made by the best known manufacturers; they may claim it, but the facts of practice do not sustain the claim. All the differences in working different lots from the same makers, in working different bars from the same lot, in working from the same bar, do not come from the difference in treatment and manipulation. A chart of tests comprehending the steels of five of the best known manufacturers of steels show not only a difference between the products of the different establishments, but a great lack of uniformity in the specimens tested from the same maker. An establishment that makes the production of small steel tools a specialty, and is probably as successful as any other in this country or other countries, has its tools returned for failure in exactly opposite directions—too soft, too brittle. What is to be done? There is the same treatment of, commercially, the same material. The fact is that uniformity in the character of crucible steel is an attainment yet to be reached, and it is time that scientific and practical men devoted their attention to this attainment, instead of arguing on the identity of purified iron, called "Bessemer steel," and cast steel per se.

Electricity and Telegraphy.

ELECTRIC LIGHTING IN THE CITY.—The *City Press* states that the Commissioners of Sewers have accepted the contract of Messrs. Hammond & Co. for lighting the following streets by electricity, viz.:—Old Broad Street, front of Mansion House, Royal Exchange Buildings, Bartholomew Lane, Lothbury, Princess Street, Lombard Street, Birchin Lane, Bishopsgate Street Within, Throgmorton Street, Threadneedle Street, and Gracechurch Street.

A NEW TELEPHONE.—A new form of telephone was exhibited last week, which promises (writes the *Railway News*) to effect a complete revolution in telephonic communication. The instrument does not require any electric or magnetic agency. It consists simply of a small diaphragm fitted in front of a case or box, and to which a wire is attached connecting the circuit within which communication is desired. The substance of the diaphragm upon which the message is sent consists of thin shavings of wood plaited or interlaced, and forming a chequered surface. Any spoken words, musical or other sounds, are at once transmitted distinctly and with perfect accuracy. There is no necessity for applying, as in the case of the existing instruments, the telephone to the ear, as the words or sounds may be heard distinctly in any part of a room or office of ordinary dimensions. The new instrument is called the "Empire Telephone." The new telephone is said to be already extensively used in New York. The cost of the apparatus is very small, and, as there are no cells or battery required for the production of electricity, the whole affair is reduced to the very simplest elements. It is, in fact, the adaptation to practical uses of a toy which, years since, was familiar to every schoolboy. It is added that, no electric agency being employed, the patentees claim that they are excepted from any royalty or licence from the post office.

MODERN VIEWS OF ELECTRICITY.—Two interesting lectures on this subject have just been delivered at the London Institution by Professor Oliver Lodge, F.R.S., of University College, Liverpool, the first on January 1, the second on January 5. The lecturer remarked that it was often said that we did not know what electricity was, and the statement was still largely true, but it was not so true as it was twenty years ago. Some things were beginning to be known about it, and though modern views were tentative, and might well require modification, nevertheless some progress had been made, and it was not unsuitable at the beginning of a new year of progress and discovery to try and set forth the position of thinkers on electrical subjects at the present time. It had been discovered by Faraday and by Clerk Maxwell how like the behaviour of electricity was to that of an incompressible fluid or liquid. One was not thereupon justified in asserting that electricity was a liquid, but it was perfectly certain that it behaved in many respects exactly like one, and it was therefore a step necessary to be made to understand and grasp the analogy between electricity and a liquid—in other words to develop a liquid theory of electricity. Let them imagine a fish in the deep sea; he was surrounded and permeated by water, but must be completely unconscious of its existence. For a fish near the surface even to postulate the existence of water from the effects of currents and waves would be an act of scientific discovery analogous to our discovery of the existence of the atmosphere; but for a fish in the serene depths of the ocean the discovery of water would be an almost impossible one. Now, we were living immersed in electricity in precisely the same way, but we were in a more favourable position for discovering its existence, because it behaved for the most part more like a liquid entangled in some elastic medium or jelly than like a freely moving liquid. Substances in which it could freely move about were called conductors, substances in which it was entangled were insulators or dielectrics. Conductors must be regarded as holes and tubes in the jelly, permitting storage and trans-

fer. The jelly was such as only to resist the motion of electricity; it permitted the free locomotion of ordinary matter. The existence of these two classes of bodies, conductors and insulators, had enabled the human race with difficulty at length to discover the existence of this all permeating liquid. An electrical machine was to be regarded as a pump which could transfer the fluid from one cavity to another; thus charging one conductor negatively, the other positively. Charge was to be regarded as either excess or defect from the normal supply of fluid, causing a strain. Electrical attraction and repulsion were all explicable by the strains thus set up in the surrounding elastic medium or jelly. The increase of the capacity of a conductor by bringing an earth-connected body near it was accurately representable by thinning the elastic coat surrounding a cavity, and a hydrostatic model of a Leyden jar could be easily made with an elastic bag inside a rigid vessel, with pressure gauges for electrometers; this behaved in all respects exactly as a Leyden jar—exhibiting discharge by alternate contacts and everything. Discharge was typified by a relaxing of the strain and by twisting of the dielectric medium in some place. Certain phenomena connected with discharge suggested obscurely that what we called negative charge was not merely a defect of supply, but was a supply of a something of an opposite kind—that there were, in fact, two electricities, positive and negative, which combined together into a neutral liquid. It might be that the other was then composed, and that what we called an electric current was really the simultaneous transfer of the true components of this liquid in an opposite direction, and that strains in dielectrics were due to attempted shear of the other. The phenomena of electrolysis strongly suggested and supported this view. Was any other motion possible to a liquid? Yes, a whirling and a vibration motion. By coiling up a conductor so as to get an electrical whirl we discovered that we had produced a magnet, and all the phenomena of magnetism could be developed on the hypothesis that magnets consisted of such electrical whirlpools. One whirl had the power of exciting another in neighbouring conductors, and these so excited whirls were repelled. In this way could be explained the phenomena of diamagnetism. A disc of copper at the end of a torsion arm was repelled by a magnet until the current induced in it had died away, which was very soon in that particular case; but currents in molecules might, for all we knew, last for ever until actively destroyed. Atoms were already endowed with perfect electricity, why not with perfect conductivity too? Finally, electricity in vibration, if rapid enough, constituted light; and it was easy to see that on this hypothesis conductors must be opaque and that transparent bodies must insulate, which agreed with observation. If a ray of light were passed along a line of magnetic force, it ought to be twisted, as was shown by the pertinacious experimental power of Faraday before the fact could be understood and before the scientific world was ready to receive it. The profound significance of this fact was first perceived by Sir William Thomson and stated by him in a most powerful and remarkable note, and upon this Maxwell founded his electrical theory of light. Professor Lodge concluded his lectures as follows:—"I have endevoured to give you pictorial and mechanical representations of electrical phenomena, and thus to lead you a step in the direction of the truth, but I must beg you to remember that it is only a step, and that what modifications and addenda will have to be made to the views here explained I am wholly unable to tell you. I am convinced they will be many, but I am also convinced that it is unwise to drift along among a host of complicated phenomena without guide other than that afforded by hard and rigid mathematical equations. The mathematical theory of potential and the like has ensured safe and certain progress, and enables mathematicians to dispense for the time being with theories of electricity and with mental imagery. Few, however, are the minds strong enough thus to dispense with all but the most formal and severe of mental aids; and none, I believe, to whom some mental picture of the actual processes would not be a help, if it were safely available. Such a representation I have endeavoured to lay before you, and I hope, if I have succeeded in making myself at all intelligible, that those students of electricity who may be present will find it of some use and service."

Railways and Tramways.

Economical Steam Tramway.—We are informed that the half-year's working account of the Dewsbury, Batley and Birstal Tramway, the first ever constructed in England, and worked by Merryweather 7-inch engines, shows the total cost of the running of the engines to be 2·57d. per mile, and the total expenses of the whole establishment, including locomotive charges, 5·16d. per mile. This is one of the most economically worked lines in the country.

The London and North-Western Railway.—In addition to the men already discharged from the works of the London and North-Western Railway Company at Crewe, orders have this week been given for the discharge of 100 more men. A large number of furnacemen have also received orders that they will be put on short time—namely, four days a week. A general reduction of the staff is being made up and down the system. It is stated that if the depression in trade continues several thousand workmen altogether will be discharged.

The London Tramways.—The half-yearly meeting of this company was held on January 12, Mr. D. P. Sellar in the chair. The chairman had very little to say with respect to the accounts for the past half-year, except to congratulate the shareholders on the increased net profit, which amounted to £2,000 more than at the corresponding period of 1883, which he thought would be considered very satisfactory. On a capital of £430,000, they had made a net profit of somewhat over £30,000 for the half-year, with which he thought the shareholders would be very well satisfied. The report was adopted.

Railway Rates and Fares.—A conference of traders and representatives of chambers of commerce and agriculture, with other associations, was held in London on January 14, for the purpose of considering and determining the action which should be taken in consequence of the private bill notices given in Parliament by various railway companies to increase their rates, especially for short-distance traffic, and for the higher kind of goods. It was resolved to oppose the bills in Parliament, and to ask the President of the Board of Trade to take the earliest opportunity of stating the views of the government respecting the measures in question.

The London and Greenwich Railway.—The report read at the half-yearly meeting of this company, held this week, stated that the available balance for the half-year ending December 31 amounted to £11,849, out of which the directors recommended the payment of a dividend at the rate of £1 7s. 6d. per cent. for the half-year, leaving £3 to be carried forward. The rent of railway from the South-Eastern Railway Company for the half-year ending December 31, amounted to £22,500, making, with transfer fees and interest on deposit account and Great Eastern Railway 4 per cent. debenture stock, £22,571, out of which the general charges and income tax absorbed £713, leaving £21,858, or, with £66 brought forward, £21,924. The report was adopted, and the dividend declared.

English and Foreign Railways.—Advanced copies of that section of the report of the secretary of the British Iron Trade Association which deals with the subject of railways have been issued this week. The report, in consequence of the bills now being promoted by a number of the leading railway companies for revision, and in some cases an increase of the maximum rates and charges, is specially devoted to a consideration of the comparative statistics of English and foreign railways in reference more particularly to mineral traffic. This shows that between 1872 and 1883 the receipts per ton of minerals carried in the United Kingdom declined only from 1s. 11d. to 1s. 9d., although in the interval the quantity of minerals carried on British railways had increased by more than 82,000,000 tons, or about 78 per cent. A large number of statistics are adduced to show that this average reduction on the railways of the United Kingdom is very far from being as much as the reductions conceded within the same interval on continental and American railways. The report shows that the average cost of the construction of English railways was very largely in excess of the average of railways in any other country, and that the increase of cost per mile open in recent years had also been larger in England than elsewhere. Between 1874 and 1881 the average capital expenditure per mile open had increased by £4,000 in England, which is double that of the next greatest increase shown in a tabulated statement embracing eight different countries. The percentage of net earnings on the capital invested in railways was, however, higher in the United Kingdom than in any continental country except France; and attention is called to the fact that the low price of coal, the substitution of steel for iron rails, and the expenditure in respect of repairs and renewals all admitted of a substantial reduction in the average rates of freight charged in this country, more especially when considered in relation to the enormous development of traffic within recent years. Reference is also made to the enormous expenditure incurred by English railways in promoting or opposing bills in parliament, thirteen of the principal lines having spent over £2,250,000 in fighting parliamentary battles within the last eleven years. The statistics, as a whole, justified the presumption that the railways in this country could carry traffic at a lower rate and still receive adequate remuneration. Owing to great pressure on our space this week, the important report has been crowded out, but we intend publishing it *in extenso* in a future issue.

Progress of the Forth Bridge Railway.—From the seventh quarterly report of inspection by Major-General Hutchinson, R.E., and Major Marindin, R.E., of the works in progress for the construction of the bridge over the river Forth, it appears that the first of the large caissons for the Queensferry main piers, that for the south-west pier, has been sunk under air pressure through 41 feet of mud and clay, and the cutting edge at the bottom is now within 3½ feet of its permanent level—viz., 62 feet below O.D. Progress through the last 20 feet of ground has been slower than was anticipated, owing to the very hard and tough nature of the blue boulder clay, which was excavated with much difficulty, and is now being got out by means of hydraulic spades specially designed and admirably adapted for the work. At the present rate of progress this caisson should reach its final level in the course of a few days, when the air-chamber will be filled with concrete or rubble masonry and the air-locking removed. The second caisson, that for the south-east pier, having been loaded with about 3,000 tons of concrete, air pressure was applied on November 22nd, and the mud in the air chamber is being removed by the ejector. The third caisson, that for the north-east pier, has been successfully launched and secured at its permanent site with 3,400 tons of concrete in it, and the fourth caisson has been built up on the launching ways to a height of 43 feet, and will be launched in a few days. The erection and rivetting up of the first of the two deep-water caissons for Inchgarvie have been commenced on the south shore, and the second will be built on the launching ways at present occupied by the fourth Queensferry caisson after the launching of the latter. The number of men at present employed on the works is about 1,850. In conclusion, the inspectors state that they are glad to be able to report that, so far as they are able to judge, there is no falling off in the character of the work, which continues to be very good, and that the completed foundations for the large piers below water, all of which they have personally inspected, are satisfactory. Of these foundations, opened since their last inspection, that for the north-west pier at Inchgarvie is upon the solid rock, and that for the south-west pier at Queensferry is upon a very hard boulder clay similar in character to that upon which the south cantilever pier is founded. As will be seen from a paragraph which appeared in our last issue, since the inspection an accident has occurred to one of the caissons, which has tilted over. This unfortunate incident will cause considerable delay.

Naval Architecture.

LAUNCHES.

Scotch.

Gardenia.—Messrs. D. and W. Henderson & Co. launched on January 14, from their yard at Partick, a steel screw steamer of the following dimensions:—171 feet 6 inches by 27 feet by 12 feet 16 inches; gross tonnage, 450 tons. The vessel has been built to the order of the Glasgow and Londonderry Steam Packet Company.

On January 6, Messrs. J. M'Kenzie & Co. launched from their yard at Leith a wooden steam launch for the Persian Gulf Steam Navigation Company, and intended for passenger service in the Persian Gulf. The dimensions are:—Length 35 feet, breadth 7 feet 6 inches, depth 3 feet 6 inches. She will be supplied by Messrs. Cran & Co., Leith, with compound high-pressure engines, having cylinders 5 inches and 8 inches by 7 inches stroke.

Stern-wheel Steamers for the Nile.—We learn on very good authority that the Yarrow stern-wheel steamers which were built for the Nile Expedition are considered by the military authorities a great success.

Disasters at Sea.—Fourteen British and 12 foreign-owned vessels, chiefly sailing, were reported during the week ending January 7 as actual wrecks, making a total of forty for the present year. Only three (British) were wrecked off the British Isles. Three sank by collision on foreign shores, and two foreign vessels were destroyed by fire. One small British vessel was reported lost with all hands.

Proposed New Docks at Northfleet.—We understand that a proposal is under consideration for the construction of docks opposite the great Tilbury docks. The suggested site of the new scheme is at Northfleet, and would lead to the conversion of both shores of the Thames at that point into immense docks. The main dock is to be 417 yards long and 200 yards wide, and it is proposed that there should be a grand river wall and two large piers or jetties. This would make Gravesend, Tilbury, and Northfleet—all near upon the line of twenty miles from London—the most important shipping station on the river, and the great starting place and terminus of all ocean voyages from and towards the capital.

The Russian Navy.—Interesting information is published concerning the activity of the Russian naval department with regard to the reorganisation of the Russian navy. The number of ironclads in Europe amounts to 318, of which 20 per cent. belongs to England; then comes France. The third place as to number belongs to Russia, with 38 ironclads; the fourth to Germany, the fifth and the sixth to Holland and Turkey. Judging by these figures, it might be assumed that the naval forces of Russia are about a half weaker than those of England; while, by taking into account those ships only having 8-inch armour as a minimum, with a speed of eight knots—according to the improvements that have been progressively effected in the mode of construction in recent years—it is found that England possesses 34 well-conditioned ironclads of the most modern type, and 20 others of a more obsolete construction; France, 33; Germany, 24, of which four are of the old type; and Russia 18, only three of which are of new construction. On the other hand, for long voyages and warfare on the ocean, ships of exceptional dimensions, well provided with artillery and coals, are absolutely required. Europe actually possesses 85 ironclads of that class, and in that respect Russia occupies but the fifth rank among the naval powers, having but seven ships of that type, of which two only are of recent construction.

Wrecks in 1884.—As a result of the absence of stormy or hurricane weather during the past twelve months, in comparison with previous years, there were 411 fewer actual shipwrecks reported than in the year 1883. But although the shipping disasters have not been so disastrous in consequence of weather influences, other causes have been on the increase, among them being losses by collisions. These are alarming in the manner they multiply year by year. The number of disasters by this cause during the year is nearly 200, against smaller numbers in previous years, and of those during last year sunk by this cause over 120 resulted in actual loss. More than 130 British-owned vessels were sunk by collision, the majority being lost off the coast of Great Britain, but some of these latter were recovered. The total actual shipwrecks were 1,589, representing 776 British vessels. Off the coasts of England, Scotland, and Ireland 359 went down, of which 322 were British-owned. The previous year 522 vessels went down off the British coasts, of which 411 were British vessels. The figures given below show a decrease throughout for the last five years, which is explained by the exceptional weather during 1884.

Year.	Number of Actual Wrecks.	British-owned Vessels.	Lost off British Coasts.	Lives lost.
1884	1,589	776	359	3,000
1883	2,000	948	522	4,200
1882	1,790	945	576	4,129
1881	2,039	1,048	826	4,134
1880	1,680	913	480	4,000
Grand totals	9,098	4,630	2,763	19,463

The Decline in the Shipbuilding Industry.—The secretary of the British Iron Trade Association has sent out advanced sheets of that section of his statistical report which deals with the subject of iron and steel shipbuilding. Owing to great pressure on our space, this report

has been crowded out this week, but it will be published in a future issue. The secretary remarks that the past twelve months have been memorable in the annals of shipbuilding for the sudden and severe depression which supervened upon a period of remarkable prosperity. He shows that in the seven principal shipbuilding centres of this country the decrease in the tonnage built in 1884 on that of 1883 was not less than 4,136,000 tons. The total number of hands employed in the shipbuilding trade of the United Kingdom is stated in the census report of 1881 to have been 72,000, which gives an average of about 14 tons of new shipbuilding per man per annum. If the same average is assumed for each of the three following years, the number of hands employed in 1883 would be 95,000, and in 1884 only 59,000, showing a total decline of 35,700 in the number of hands employed. The quantity of iron and steel used in shipbuilding in 1884 is calculated at 311,000 tons less than in 1883, and allowing an average value of £8 per ton over the whole quantity consumed, the loss to the iron and steel trades in 1884, as compared with 1883, is estimated at £2,500,000. The tonnage of new iron and steel vessels classed by Lloyd's Register during 1884 was 793,000 tons, against 1,100,000 tons in 1883, showing a decrease of 306,000 tons; while the tonnage built under the survey of the Liverpool Underwriters for 1884 was 101,000, showing a decrease of 44,800 tons as compared with 1883. The report makes an extended comparison of the circumstances of the shipbuilding industry at home and abroad, and shows that while English shipbuilding has been suffering serious depression, no other country has been making substantial progress in the same industry, both France, Italy, Norway and Sweden, and the United States failing to exhibit anything like a satisfactory return. One of the most serious points to which attention is called in the report is the fact that at the end of 1884 the total tonnage of new vessels under construction in the United Kingdom was only 373,000 tons, being a decrease of 355,000 tons on the tonnage under construction at the end of the previous year.

THE WORKS AT THE PANAMA CANAL.—A correspondent, resident in New York, who has just returned from a visit to the works of the Panama Canal, writes:—The canal is an assured fact. The French seem thoroughly to understand the work before them, and have made admirable preparations to cover all contingencies. They take the greatest care of their employés, and their hospital service is unsurpassed in the world. A force of over twenty thousand men is a good many to handle, and, of course, entails a lot of red tape, but that seems necessary, especially with Frenchmen. But they have a grand chief in M. de Lesseps, and have now a splendid working staff in M. Diggler and his officers. I was very anxious to see the Scotch dredger at work in the harbour of Colon, but it was not in operation during the eighteen days I was there. I was disappointed, as I wished to compare it with our mammoth American dredgers. It cost, I understand, £50,000, and is considered very good for deep-sea dredging, but for actual work I saw nothing there to compare to our American dredgers. I went on board and saw them work on many different occasions, and was highly satisfied. The principle is unique and very ingenious. The tower is iron, 75 feet high; the buckets and chains are of steel, and each bucket will and does take up 1½ ton of earth each lift. The spud, on which the dredge rests and revolves, enables it to take a sweep of 15 metres wide, and each move of the spud moves her forward 18 feet, so that, like a moving machine, she cuts a swathe (to use a farmer's expression) 45 feet wide, 18 feet long, and 9 feet deep on each movement forward. They work perfectly, and it is indeed a grand sight to sit, as I have done, for an hour or two at a time, and watch them working. Rotten coral, roots, stumps of small trees, &c., all come up with the dirt and make no difference. Of course, where rock is struck, or hard coral, or an old petrified monarch of the forest, blasting has to be done by the canal company ahead of us. Otherwise, after the ground is cleared of vegetation, trees, &c., we simply start in and eat—literally eat—our way through with absolutely no other preparation whatever, no men on shore working ahead or any other way. What we take out goes through the dredger's own discharge pipe on to the bank, and forms practically the bank of the canal proper. We have now cut from the sea (the harbour of Colon) three and a half miles of the canal by one machine, and some ten miles up we have two other machines entering from the Chagres river, cutting their way back to meet the first machine. A fourth machine leaves here to-morrow, and will join the others by the middle of January, while eleven more are building, and will follow, one each six weeks or so, until all are fairly at work. Our contract is for 30 million cubic metres, and will probably lead to half as much again, as it is conceded by the canal company and every one in the isthmus that nothing like our machines have been seen or used anywhere. One instance of their capacity I saw myself. A Suez dredger was put to work at a certain spot. After fifty days she was withdrawn, and one of ours took its place, and did in five days as much as the other had done. Our machines cost about $125,000 (say £25,000), and require about twenty men to work them.

General Notes.

HENRY POOLEY & SON.—We understand that Messrs. Henry Pooley & Son, weighing machine makers, of Liverpool and London, have opened a midland depot at Heath Mill Lane, Deritend, Birmingham.

THE CHILLINGTON IRONWORKS.—At a meeting of the shareholders of the Chillington Iron Company, held at Wolverhampton on January 12, it was agreed to have the company wound up. The works were stopped at Christmas owing to bad trade.

ENGLISH AWARDS AT THE NEW ORLEANS EXHIBITION.—The following English firms have received awards at the New Orleans Exhibition:—Agricultural implements, Howard, Bedford, silver; cutlery, Beal, Sheffield, silver; steam engines, Fowler, Leeds, gold; diving apparatus, Siebe, Gorman & Co., gold; fire-engines, Merryweather, gold.

The Home Iron and Coal Trades.

BARNSLEY AND SOUTH YORKSHIRE.—The iron trade in this district is just now at a low ebb, so far as the make of pig-iron is concerned. The business doing at the Thorncliffe works is active, both the furnaces are kept going, and there is a fair amount of animation in the various departments for which the firm is noted. The Yorkshire Steel and Iron Works, Penistone, is also fairly off for work. The house coal trade presents a very curious aspect; although the weather is cold and seasonable, some of the largest collieries in the district have been playing one and two days during the week. The tonnage sent to London is not over the average, whilst prices do not reach the standard of last year. There is still a difficulty in dealing with the competition created by sea-borne coal in the metropolis. The demand for other markets is not more than it was several weeks ago. Although the weather is cold, steam coal continues in fair request, considering that the export season is over. The gas coal trade holds well up, and there is about an average tonnage of locomotive coal sent to the various railway companies. The make of coke is still very large, and as the output of pig-iron in North Lincolnshire, Northamptonshire, and other places is pretty good, the tonnage sent away is large. The greatest possible interest is being taken in the formation of the South Yorkshire Coalowners' Insurance Society against strikes, which is now nearly organised. It is said that contributions will be paid on fully twelve million tons of coal.

BIRMINGHAM AND DISTRICT.—The quarterly meeting of the iron trade in Birmingham last week did not develop any new features. The attendance was less than at any recent similar gatherings, and the amount of business done was also less. There were no official alterations in prices, which were weaker than at the previous quarterly meetings. Marked bars were nominally unchanged at £7 10s., but good bars were to be had at fully 10s. less than that figure. Good medium qualities were upon offer at £6 10s., and galvanising were from £7 upwards; hoops, £5 5s.; and tube strips, £5 12s. 6d. The reports presented at the meeting of the Welsh tinplate trade, which was held the same afternoon, showed that last year's exports had been larger than in either of the two preceding years. Prices, however, were said to be very low, and in consequence of the unremunerative prices obtainable two or three tinplate works had been closed. Common Welsh cokes were quoted at about 14s. per box, and 16s. charcoals. These prices showed a falling off on the quarter of about 1s. per box. Pig-iron quotations were unchanged, medium quality Staffordshire sorts being about £2 7s. 6d., and cinder pig, 35s. to 37s. 6d. Northamptons were quoted at 41s., delivered at works, and Derbyshire, 42s. 6d. There are not many new orders coming to hand as yet in the hardware trades, and there is very little buying for stock. The foreign demand is falling off considerably just now. The nut and bolt makers hereabouts are hoping to benefit by the determination which has been arrived at to bring all outside firms—who live mainly by underselling—into the association. Orders for cultivating tools, tubes, wirework, screws, nails, and ship and cycle lamps. Hollowware makers are not doing very much. Lamp and stove makers have had a poor season owing to the mild weather.

CLEVELAND.—There is no change in the tone of the pig-iron market. The makers have had a meeting to discuss the matter of restriction, the agreement with regard to which shortly expires. The general feeling was in favour of continuing as at present, although there were some who thought it advisable to restrict still further. No positive decision, however, was come to. The market held on Tuesday on 'change was very well attended, but there was not much business done. A few transactions at 35s. 3d. for prompt, and 35s. 6d. per ton for forward delivery for No. 3 were reported. The average quotation may be taken as No. 1, 38s. 6d.; No. 3, 35s. 3d.; No. 4 foundry, 34s. 3d.; No. 4 forge, 33s. 9d. per ton for G.M.B., free on board, prompt delivery, sellers. Warrants are nominally 35s. 3d. per ton, prompt cash. The stocks in Connal's store on Tuesday amounted to 51,929 tons, being a decrease of 180 tons since the previous Tuesday. Hematite iron is unchanged at 46s. per ton, f.o.b., for mixed numbers east coast brands. The shipments of pig-iron from the port of Middlesbrough for the week ending January 10 amounted to 15,916 tons, as compared with 15,447 tons over similar period previous year. The shipments for the current month up till Tuesday, the 13th inst. inclusive, amounted to 25,906 tons, as compared with 28,381 tons to corresponding date last month, and 27,580 tons to the same date of January in previous year. Of the 25,906 tons, 13,565 tons went to Scotland, 1,753 tons to other parts of England and Wales, 1,220 tons to Germany and Holland, and 9,368 tons to other foreign countries. The manufactured iron trade is unaltered. Plates, £4 17s. 6d. to £5; angles, £4 15s.; bars, £5 2s. 6d. per ton, less 2½ per cent. on trucks at manufacturers' works. The steel trade is much the same. Ironfounders are well employed, but prices are low. Shipbuilding is still very slack and unprofitable. Notice has been given at the Cleveland Dockyard of a reduction in wages on ironwork of 5 per cent. on and after the 19th inst. The coal trade is rather brisker. Manufacturing fuel is in dull request. Prices are much the same. Coke is dull. Although two of the largest malleable ironworks have fairly started with the year, the distress chiefly amongst the ironworkers continues unabated. This has been rather increased by the inclement weather driving the unemployed from their temporary work on the Tees embankment.

DERBYSHIRE.—The house coal trade in this district seems to have somewhat improved owing to the cold weather which has set in. The output is, however, so large that prices are still low and orders difficult to obtain. The London coal trade is, of course, the most important, and a good tonnage is being sent from Clay Cross, Staveley, Langley Mill, and other places. Steam coal, gas and locomotive fuel are all in moderate request. The district iron trade is about the same as when last noticed. There is no change to note in the output of pig-iron or in the mill or rail material produced. The foundries are not over well employed; the orders on hand for the most part relate to colliery castings and repairs.

DURHAM.—The iron trade has been in a rather sluggish state, the new year so far failing to give any impetus to the demand, and at the same time prices have been getting weaker in nearly all departments. The outlook is considered rather discouraging the more it is looked at, unless in the spring there should be an improvement, which cannot as yet be foretold. The prices of pig metal are not so good on the whole as they were a week since. Some of the merchants have been selling No. 3 at less than 35s. 3d., though that is the usual quotation for early delivery, while the makers have come down till they quote 35s. 6d. to 35s. 9d. and 36s. forward. The demand for forge pig does not equal the supply, and the price continues relatively weak, being about 33s. 9d. There is nothing, as a rule, encouraging in the heavier classes of the manufactured iron trade, as angles and plates are especially depressed. The bar makers are in many cases doing pretty fairly, especially for the better classes of iron. There are still pretty good orders in hand for foundry and general work, including bridgebuilding, waggons, &c., and a Darlington engineering and iron firm have just taken a large order for two bridges and the ironwork for a new railway station in Scotland. The forgeworks are quiet, as a considerable portion of the output is usually for shipbuilding It is hoped that more orders will come to hand for new ships now that delivery can be reckoned upon, as the wages of shipbuilding operatives have been arranged. The waggon and wheel and axle works are doing fairly. Prices of manufactured iron are—bars, £5 to £5 2s. 6d.; best ditto, £5 10s. to £5 12s. 6d.; angle iron, £4 12s. 6d. to £4 15s.; ship plates, £4 17s. 6d. to £5; girder plates, £5 5s., less 2½ per cent. Puddled bars, £3 5s. net; steel rails, £4 15s. The steel trade shows no change. The cold and stormy weather has quickened the demand for household coals for the inland trade. In other classes of coal and coke there is no change.

EAST WORCESTERSHIRE.—Business in pig-iron is a little more vigorous. Recent quotations have undergone no official alteration, and smelters show a disposition to uphold them with the minimum of concession, even for large quantities of crude iron. The outcome of last week's quarterly meetings has not, so far, been to increase very much the volume of business in the finished iron trade of the district. As the depression has lasted so long, it is hoped that the turning point has been reached, and that business generally will soon show some sort of revival. The general quotable standard for marked bars is still £7 10s., and the Earl of Dudley's Round Oak brand is priced at the customary extra 12s. 6d. per ton, viz. £8 2s. 6d. Current orders are hardly enough to keep the various mills going moderate time. Business on shipping account is dull and depressed, more so, indeed, than it has been for some time past. Orders for the best qualities of shoe and tire iron are fairly numerous. Business in hoops is sparse, necessitating very restricted operations at the hoop mills. Orders for chain iron show a little diminution. There have lately been rather extensive enquiries for rivet iron, but actual orders are limited. Angles and tees show a very moderate business. Makers of nail rods are not, as a rule, well booked forward, and orders for wire rods are few. Sundry requirements in large girder iron on government account have recently been placed with manufacturers in this district. Tinsheets have been more plentifully enquired for of late. The girder and bridge industries keep well in gear. The chain and nail trade are inactive just now. The gas meter trade shows a slight improvement. The coal trade manifests a little accession of energy. Sales of forge and smelting coal are more considerable, and fuel for household uses shows increased sales. A good demand is maintained for fine fuel. "List" quotations are based upon the standard of 9s., 9s. 6d., and 10s. per ton for forge, furnace, and household coal. The firebrick trade does not show much vigour just now.

FOREST OF DEAN.—There has fallen a wet blanket upon the prospect of ironmaking in the Forest of Dean, which has perhaps given the quietus to the first six months' business of the new year. On Saturday morning, just as the first of two draws per diem was about to commence, the cap, or inside lining, of firebrick belonging to Messrs. Henry Crawshay & Sons' hot-air blast furnace at Cinderford, suddenly gave way, and fell into the molten liquid. An immediate blow-out was of course a necessity which would brook of no delay. It was known that the material had worn thin, but such an eventuality as this was not expected. This is regarded as an unmitigated evil. It is not long since that a grievance existed, arising out of local manufacturers of either finished iron or wire neglecting home-produced pig-iron for that of Staffordshire or North of England bars. Tinplate makers were similarly at fault. Recently, however, the reverse has obtained. This unfortunate event will again drive customers to other markets. From the employés' point of view, this is a great disaster, inasmuch as about 300 men will be thrown out of employ for a period variously estimated at from six weeks to four months. The loss to the owners will be considerable, £3,000 being the probable cost of re-fitting the furnace. At Lydney Tinplate Works the forge hammer is again set to work, and a better future seems secured to workmen, who have made rather indifferent time. The other tinplate centres are seemingly well placed, but prices are jealously guarded. Manufacturers are resolved to stand against a fraction less than 14s. per box for coked plates.

The coal trade for a long time has only maintained a sluggish existence. This week, however, severe frosts have greatly shaken off the lethargy, one of the largest colliery concerns experiencing a great rush of trade. Manufactured iron and small rod trade is a trifle more buoyant.

LANCASHIRE.—A dull depressed tone continues throughout the iron trade of this district, and although prices are not openly quoted any lower by makers, there would seem to be an easier tone in the market. There was a moderate attendance on the Manchester iron exchange on Tuesday, and a few orders to cover requirements during the ensuing quarter were reported, but any enquiries of weight are mostly for long period delivery at very low prices. Although sellers are again showing more willingness to book pig-iron over the half year, or even longer, at about recent rates, there is generally a strong disinclination to entertain business on the basis of the prices that buyers apparently have in view. The result is that although there is a fair weight of business offering at a price, the actual turn is very small. Lancashire pig-iron makers are doing fairly well, and remain firm at 41s to 41s. 6d., less 2½, as their minimum quotation for delivery equal to Manchester; about the same figures also still remain the average price for good district brands delivered here, although there are sellers at as low as 40s. to 40s. 6d., less 2½, delivered into the Manchester district. Hematites are, if anything, rather easier; for good brands of foundry delivered here some makers hold out for 54s., less 2½, but there are ready sellers at 53s. to 53s. 6d., less 2½, delivered here. In the manufactured iron trade orders are coming forward very slowly, and some of the local forges are only very indifferently employed. A few of the leading makers still hold to £5 12s. 6d. for bars delivered into the Manchester district, but there are plenty of sellers at £5 10s., and it is only in exceptional cases that much above this figure is being actually got. Local made hoops are quoted at £6 and sheets at about £7 per ton, delivered into the Manchester district. The condition of the engineering trades remains much the same as last reported. In the coal trade, although the recent cold weather has tended to bring forward a more active demand for the better classes of round coal for house-fire purposes, there is still no push for the time of the year, and other classes of fuel for ironmaking and general trade purposes meet with only a moderate enquiry. Prices generally are not more than steady at late rates, and at the pit mouth average about 9s. to 9s. 6d. for best coals; 7s. 6d. to 8s. for good second qualities; 6s. 6d. for common house-fire coals; 6s. steam and forge coals; 4s. 6d. to 5s. for burgy; 4s. to 4s. 3d. for best slack; and 3s to 3s. 3d. for common sorts. Shipping has been fairly good, with steam coal delivered at the Garston Docks or the high level, Liverpool, averaging 7s. 3d. to 7s. 6d. per ton.

LEEDS AND WEST YORKSHIRE.—There is not more than half-time being worked this week in any of the forges in this district. Except that there is on the part of both home and foreign consumers a good demand for various gauges of bar-iron, the production of best Yorkshire iron amounts to very little. At Low Moor and Farnley, the plate mills are pretty well engaged in extra sizes for some engineers who still give a preference to this iron over steel. The makers of steel are well engaged on orders for tires and axles, but a good deal of uncertainty is felt by them as to future prospects. It seems to be a reasonable expectation that at all events they will, during the next six months, have as great a weight of railway work to provide as they have during the six months just expired. The common iron manufacture is at a very low ebb. Merchants' stocks in this district are more than amply sufficient to supply all requirements in the way of sheets, angles, and tees, and some firms are selling large parcels at barely remunerative prices. The year has begun rather badly for some of the smaller engineering establishments. The larger concerns are very full of work, and it will take some months yet to complete the orders at present in hand. Machine toolmakers are slack, but two or three of the oldest firms are likely soon to have some good orders for first-rate specialities. The West Yorkshire coal trade is a good deal brisker, so far as the domestic article is concerned, but no change in prices. Export trade quiet. Slack and coke little firmer in price.

LIVERPOOL.—Generally speaking, there is perhaps rather more activity in the market as regards foreign business, but the home trade is very lifeless. The moderate extent of demand for pig-iron calls for no special notice. The tinplate market is decidedly weaker, and this week ordinary coke tins of B.V. grade can be had at 13s. 6d. per box, if not 13s. 4½d., and picked brands at 13s. 9d. This further fall has a rather ominous appearance, and from being one of the steadiest articles in the iron and metal trade of late, it is now one of the weakest. Manufactured iron cannot be said to be better in price, but the downward movement is slow. Bars, both Staffordshire and Lancashire made, can be had at £5 10s. delivered here. Sheets can be had for less than £7 per ton, and hoopmakers, so long firm at £6, are not proof to the persuasion of firm offers at lower figures. Shipping, perhaps, is looking up a little. Freights are a little better, and more readily attainable. This is leading to some new orders for ships being placed on the Mersey, and two at least of the local builders are now well off for work. The prices being paid for shipbuilding iron are of a very wretched character, and the wonder is that makers should be willing to sell ahead at such low figures as £4 12s. 6d. and £4 17s. 6d. per ton respectively for angles and plates f.o.b. Middlesbrough.

LONDON.—There is a little more movement in the metal markets, but prices remain extremely low. Manufacturers seem to be flooded with stocks, hence the competition to secure orders, and the ruinous quotations made. Iron—Scotch pigs have been fairly active. Makers' iron dull. Copper—There has been a better tone the past week. Chili bars have improved 10s. a ton. Tin—Fairly good business. Fine foreign changed hands at £74 5s. to £74 15s. English ingots £77 10s. to £78. Tinplates—There is a tolerably good demand, but prices obtainable are simply unprecedented. Lead—Improved.

NEWCASTLE AND THE TYNE DISTRICT.—Again we have had a very quiet week down here in the crude iron business. Exports are small, and home consumers are holding off, purchasing only for immediate wants. Prices are fractionally lower, No. 3 Cleveland pig selling at 37s. 6d., and No. 4 forge quality at 36s. per ton, delivered here. In the manufactured iron trade there is increasing dulness; shipbuilders only take moderate quantities when they do buy, and they generally have an advantage in the terms. Ship plates delivered are easily obtainable at £5 per ton; angle iron realises £4 12s. 6d. to £4 15s.; bars, £5 2s. 6d. to £5 5s.; and boiler plates £6 to £6 2s. 6d. per ton, less the usual commission. The iron ore business in Spain is extremely quiet, and imports are nearly all under old contracts; Rubioore, f.o.b. at Bilbao, is quoted 6s. to 6s. 3d. per ton, and other sorts in proportion, the freight to the Tyne being about 5s. 6d. per ton. Little need be said respecting the shipbuilding trade, which remains stagnant and unprofitable. Engine manufacturers are anxious to secure fresh orders, and are doing all they possibly can to obtain them by offers to turn out engines at low figures. There is a feeling that this will be an exceptionally dull year in the trade, as the decreased revenues of most of our great railway companies must tend to lessen their expenditure on new locomotives. The number of marine engines in course of construction on Tyneside is only about one-half of the number in hand twelve or fifteen months ago. Forges and foundries are for the most part inactive. Bolts and rivet works are in the same case. As regards the Northumberland steam coal trade, we have no change for the better. Some contracts for shipment during the year are in course of negotiation, but customers ask higher figures than merchants are willing to concede. The present price is 9s. per ton for the best quality, less 5 per cent.; secondary, 7s. 3d. to 8s.; and small, 3s. per ton, f.o.b. Gas, manufacturing, and nuts are unaltered, the demand for the former being strong. Households go off well, and late values are maintained. Coke is selling rather better, but the very best sorts bring no more than 13s. 6d. to 14s. per ton shipped. The chemical business is quiet; soda ash makes 1⅛d., less 6 per cent.; soda crystals, £2 7s. 6d.; and bleaching powder, £6 5s. Fire-bricks and cement have a small sale at present.

NORTH STAFFORDSHIRE.—Now that the quarterly meetings are over, business has become rather more animated in most departments of the iron trade of this district, and orders from home merchants are coming in somewhat better than formerly; but still the volume of business being done is very much under what was anticipated. The result is that most of the works find a difficulty in keeping their mills at work more than two-thirds time. Shipping lots have come in slowly, though a little more is being done in this department than has been for some weeks past. The home trade remains dull, and there are no signs of any alteration for the better, especially in the demand for plates. So severe is the competition of steel producers—particularly those of the North of England—that the plate mills in this district are not making even half-time. Prices, as may be readily imagined, are not better, but if anything a shade weaker. Pig-iron and ironstone, which received a slight impetus at the Birmingham quarterly meeting, is in better demand, but the contracts made are for very light quantities as compared with corresponding sales on previous quarter days. Stocks of both these commodities are heavy. There is nothing fresh to notice in connection with the demand for coals. The present severe weather is causing the house-fire pits to be somewhat busy, but for manufacturing purposes requirements are much below the average, and prices are practically unremunerative.

NORTH WALES.—The slate ports are well filled with vessels awaiting cargoes, and the slate trade generally is in a healthy state. The ship building yards are busy with repairs, but there are not more than two or three new vessels on the stocks. In the iron trade rates remain unchanged, but at these the works keep employed. So with the collieries. These are well employed, but there is no press of orders or work. So far the collieries have enjoyed an immunity from accident this year, but it is too early to boast. Most of the trades of the district are in a healthy state. One hundred tons of lead ore have also been sold from the Van Mine as the result of six weeks' work, and this parcel fetched a rather higher price than usual. An amalgamation is partly arranged between the different copper mines of Anglesea by means of which it is hoped they may yet be profitably worked.

NORTH-WEST OF ENGLAND.—The hematite iron trade of North Lancashire and West Cumberland remains in a very quiet and in many respects unsatisfactory position. The hopes of a better demand with the opening of the new year have not been fully realised, and the disposition on the part of users to place new orders has not been very marked. There is a general tendency in the direction of purchases for forward deliveries, which, on the one hand, shows that immediate requirements are small, and on the other that buyers are wishful to take advantage of present prices in view of a possible advance in the spring. Makers, however, are meeting this disposition by securing 1s. per ton more for forward than for prompt deliveries. The chances of a marked improvement in the spring are not very assuring. The foreign markets are to a great extent closed against local producers of hematite iron, and where any opportunity of trade presents itself it is curious to find that either the country itself requiring the iron is practically in a position to supply the demand, or that the competition for the contract is so severe as to rob the acceptor of any chance of ordinary and reasonable profit. On home account the demand is also restricted, although it is noticeable during the past few weeks that makers have been able to complete very large deliveries both by rail and by sea, and thereby reduce to a satisfactory extent the weight of iron held in stock at their works and at the store yards at Barrow, Workington, and Maryport. Stocks, however, are large, and are likely to remain so if the consumption of Bessemer qualities is restricted as it has been of late, owing to the indifferent state of activity shown by steelmakers throughout the district. More than usual advantage has been taken by makers of iron of the Christmas and New Year's holidays, and at Barrow work was only resumed on Monday this week. Certainly some of this time has been used for repairs which were necessary in the mills and machinery generally, but the all important reason of the long suspension of activity was the fact that orders are not largely held by makers, although it is generally known that lately work has been secured which will furnish a considerable amount of work for the rail and merchant mills in the district, and possibly keep them fairly employed until the spring orders begin to show themselves. It is pretty certain that little may be expected in the way of new orders for railway material from colonial and foreign buyers during the early part of the new year, as the chief feature of their purchases is for relaying old lines, and there is as great a want of enterprise abroad as at home in the development of new railway systems. No new orders are reported in the shipbuilding trade, but some new contracts are pending, and, generally speaking, at Barrow in particular, builders are better off for orders than was the case last year. Iron ore quiet at from 8s. 6d. to 10s. per ton, net, at mines. Coal and coke quiet. Shipping poorly employed.

SCOTLAND.—There is a steady tone in the Glasgow iron market. There is little business doing, and ther are few changes in prices. At the same time the prospects continue very bad, and if there was any decided selling by holders, the market would probably drop quickly. Though such a large quantity of Middlesbrough iron is coming to Scotland, reports from that district are much worse than from here, and, unless increased restriction is resolved upon, will have an adverse effect upon prices here. Last year prices rose on the Middlesbrough makers agreeing to a restrictive policy, but, immediately it was inaugurated, prices fell lower than ever, and it would not be surprising that, if the makers proceed on the same lines as last year, prices will also follow the same course. On Thursday the market was steady at 42s. 4d. to 42s. 5d. cash. Next day a few lots changed hands at 42s. 5d. to 42s. 3½d. cash. On Monday, 42s. 2½d. to 42s. 4d. cash was paid; on Tuesday, business was done from 42s. 5d. to 42s. 4d. cash; on Wednesday, business was done at 42s. 3d. and 42s. 2½d. cash and 42s. 6d. to 42s. 4½d. a month. Closing sellers, 42s. 3d. cash and 42s. 5½d. a month; buyers, ½d. per ton less. The stock of pig-iron in Connal's store is now 579,677 tons, being an increase for the week of 130 tons. The shipments of pig-iron from Scotland for week ending January 10 were:—Foreign, 3,358 tons; coastwise, 4,218 tons; total, 7,576 tons, against 9,295 tons in the corresponding period of last year. The imports of Middlesbrough pig-iron into Grangemouth last week were 8,545 tons, against 4,845 tons in the similar period of last year. Since Christmas, the imports show an increase of 12,835 tons. The malleable iron trade is very dull just now, and neither the steel nor iron works have sufficient orders to keep them fully going. Though a few new orders have been received for ships, it makes no appreciable effect upon the general dulness. The tonnage at present being built on the Clyde is about 100,000 tons less than was on order a year ago. The coal trade is suffering from the depression in manufacturing.

SHEFFIELD.—It is with but indifferent prospects that trade in the town has again been actually re-opened. There seems but slight encouragement for commercial men to engage in any enterprise. Those owning heavy sums of money decline to speculate on foreign account, as affairs appear unsettled in every market abroad, and at home there is a very strict surveillance as to securities. In which way shall we invest our money? is the cry of the monied men of to day. The reply found is, Not in the old standard trades, which appear almost worn out, but on new ground. The new ground being opened out in this country is the developing further of her mineral resources. By some it may be said that the country is living on her capital; but pointing to South Yorkshire there is a fact apparent—the proposed working of a virgin mineral field. This consists of, as yet, unwon coal and ironstone, which, when brought into the market, will create the small villages of to-day into prosperous towns in that locality. This development of mineral resources may be more rapid and sudden than by some is anticipated. The cutting of the Swinton and Knottingley Railway, under the auspices of the Midland and North Eastern Railways, has more significance than for the moment has been attached to it by many. Those interested in the coal trade will understand the significance of these words. The cost for ordinary-going cast steels is really bad, and only the best samples, together with best Bessemer, are selling freely. Common goods in any description of manufactured iron find a slow market at reduced rates. The cutlery trade was never in a more unpromising state. Australian advices are not of an encouraging character, and requirements from the East Indies, China, and South Africa are only of a nominal character. The South African market was one of the most promising ever lost in the face of British enterprise. The steel wire drawers (for ropes) have consented to a reduction of 20 per cent. in their wages, in order to preserve trade to the town, as against Lancashire competitors. It is the competition of the Warrington makers that has brought this about. In the electro plate and kindred silver branches there is very little doing, and it would be difficult to point to any of the old staple branches that are really active.

SOUTH STAFFORDSHIRE.—The works are getting again into steady occupation where orders are in hand. Angle makers are best off, certain of them reporting themselves booked forward to midsummer, at, however, but miserable prices, such as £6 per ton. Because of the closing, for liquidation, of the Chillington Company, sheets are a shade less weak; yet merchant qualities are quoted as low as £6 12s. 6d. Some good negotiations are still going on in Derbyshire and also in Willingsworth pigs. Derbyshire samples are regulated by the quotation of 42s. and 42s. 6d. The old dispute as to which is the correct quarter day is this week interfering somewhat with the hardware industries. Wolverhampton and district firms, and those also in Birmingham, are mostly paying quarterly accounts and giving out new orders this week, though it

was last week when the ironmasters' quarterly meetings were held. The chief export markets now buying are the Antipodean and South American. Among the industries fairly on are those in the wrought iron tube and the steel tube line—the latter for boilers and for artesian wells.

SOUTH WALES.—There is, unfortunately, no improvement yet observable in the condition of the iron trade; the question of wages is being quietly fought out, and in most cases the reduction insisted upon by masters is being accepted. During the week the workmen at the London Ironworks have gone in on a reduction of 10 per cent. The iron ore trade is still sluggish, the imports, however, have again been large. The demand for tinplates during the week has been quiet; a number of works have been stopped, stock-taking, which may slightly benefit the trade, suffering, as it no doubt does, from over-production. Coke tins and steels have been mostly enquired for, and standard qualities still fetch 14s. to 14s. 3d. I.C. Ordinary cokes have been sold as low as 13s. 9d. I.C., but not in anything like large quantities. The announcement made at the quarterly meeting at Birmingham, that the meetings in future are to be held at Swansea, has given general satisfaction in the district. In the steam coal trade, although the tone still continues quiet, more activity has been displayed in shipments, and more regularity is being shown in work at the collieries. The demand for house coal is far from satisfactory; quotations are unaltered. In the pitwood trade a slightly improved tone has prevailed. The foreign coal exports for the week ending January 10 were:—Cardiff, 129,226 tons; Newport, 27,295 tons; Swansea, 19,802 tons. Iron exports—Cardiff, 740 tons; Newport, 2,160 tons. Iron ore imports—Cardiff, 11,489 tons; Newport, 13,481 tons; Swansea, 2,200 tons. Patent fuel exports—Swansea, 5,125 tons; Cardiff, 3,035 tons. Pitwood imports—Cardiff, 3,718 tons; Newport, 2,830 tons; Swansea, 1,108 tons. Swansea also imported 1,024 tons copper ore, 61 tons blende ore, 165 tons burnt ore, 72 tons sulphur ore, 163 tons mundic, 1,565 tons pig-iron, and 200 tons steel bars. The shipments of manufactured iron during the past year were:—Cardiff, 83,199 tons; Newport, 108,572 tons; and Swansea, 4,979 tons. In the same period the foreign coal shipments were:—Cardiff, 6,967,013 tons; Newport, 1,721,512 tons; and Swansea, 946,526 tons. Coastwise—Cardiff, 980,432 tons; Newport, 1,031,540 tons; and Swansea, 701,517 tons.

The Continental Iron Trade.

AUSTRIA.—The tendency of the Austrian iron market has not improved, prices both of pig and manufactured iron being depressed. The following are the latest quotations for iron and steel per 1,000 kilogrammes, compared with those ruling a month previous:—

	Jan. 10, 1885. Florins.		Dec. 13, 1884. Florins.
Charcoal pig-iron, at works—			
Vordernberg white	50–51	...	50–51
Innerberg white	50–51	...	50–51
Hüttenberg white and mixed	51–52	...	51–52
Hüttenberg grey	54–55	...	54–55
Hüttenberg Bessemer pig	56–58	...	56–58
Other Carinthian and Styrian pig	46–50	...	46–50
Spiegeleisen	—	...	—
Coke pig-iron, at works—			
Schwechat Bessemer pig	49–50	...	49–50
Schwechat white and mixed	44–45	...	44–45
Schwechat grey	49–50	...	49–50
Hüttenberg Bessemer pig	—	...	—
Moravian grey pig	48–49	...	48–49
Moravian white pig	—	...	—
English and Scotch pig, at Vienna—			
Grey Scotch pig-iron	65–66	...	65–66
Clarence grey foundry pig	51½–52½	...	51½–52½
Grey Cleveland pig	50–51	...	50–51
Coltness Bessemer pig	65–66	...	65–66
Manufactured iron, at Vienna—			
Carinthian and Styrian bar iron	125	...	125
Ditto sheet iron	165–185	...	165–185
Bohemian bar iron	105	...	105
Hungarian bar iron	110	...	110
Bohemian, Hungarian, and Moravian sheet iron	155–160	...	160–175
Ditto joists	115	...	115–120
Carinthian and Styrian Bessemer ingots from charcoal iron, at Vienna	95–105	...	95–105
Bessemer steel rails, at works	—	...	—
Old rails, at Vienna	70–85	...	70–85

BELGIUM.—The following figures show the imports and exports of iron and steel into and from Belgium during the first eleven months of 1884, compared with the same eleven months of 1883 and 1882:—

Imports.

	1884. Tons.	1883. Tons.	1882. Tons.
Steel:—			
Crude cast	97	42	130
Rails	540	741	—*
Bars, plates, and wire	3,386	4,504	—*
Manufactured steel	504	815	1,040
Pig-iron	108,666	149,754	144,451*
Scrap-iron	12,105	13,151	8,554
Hammered, drawn, and rolled iron:—			
Wire	5,076	4,653	4,908
Rails	424	369	81
Plates	600	787	1,291
Other descriptions	5,868	6,140	5,542
Forgings:—			
Nails	340	301	1,709
Other descriptions	2,469	2,709	4,420
Castings	815	2,991	3,147
Totals	140,890	186,957	175,273

Exports.

	1884. Tons.	1883. Tons.	1882. Tons.
Steel:—			
Crude, cast	482	654	367
Rails	52,304	62,684	—*
Bars, plates, and wire	9,253	5,892	—*
Manufactured steel	1,441	1,560	3,608
Pig-iron	9,565	12,453	20,488
Scrap iron	9,967	6,850	23,864
Hammered, drawn, and rolled iron:—			
Wire	1,616	2,704	3,247
Rails	17,789	8,663	20,424
Plates	36,048	44,322	38,170
Other descriptions	200,398	194,350	183,787
Forgings:—			
Nails	5,779	6,839	8,984
Other descriptions	18,669	23,949	26,498
Castings	8,987	11,176	18,567
Total	372,298	382,096	348,004

The imports of iron ore during the first eleven months of 1884 were 1,392,158 tons, against 1,472,455 tons in the first eleven months of 1883; the exports, 178,055 and 341,836 tons respectively.

The imports and exports of coal and coke during the first eleven months of 1884, compared with those of the same eleven months of 1883 and 1882, were as follows:—

Imports.

Coal.

	1884. Tons.	1883. Tons.	1882. Tons.
From Germany	391,962	420,892	328,680
England	261,455	269,418	239,192
France	73,962	107,997	96,559
Holland	381,061	348,321	268,634
Other countries	40	243	128
Totals	1,108,480	1,146,871	933,193

Coke.

From Germany	18,143	22,320	8,500
France	9,941	9,580	5,421
Other countries	2,436	222	73
Totals	30,520	32,122	13,994

Exports.

Coal.

To France	4,009,594	3,767,962	3,469,554
Holland	108,697	107,618	88,692
Other countries	136,875	156,197	393,340
Totals	4,255,166	4,031,777	3,861,586

Coke.

To France	713,951	804,413	856,193
Grand-duchy of Luxemburg	66,251	109,490	139,955
Other countries	3,303	4,408	4,199
Totals	783,505	918,312	1,000,347

Business is dreadfully flat in the Belgian iron market just now, and makers have the greatest difficulty in getting orders. Steelworks especially are short of work, and it is said that one of the principal works in the Liége district—Cockerill probably—are making rails in advance of what they may have to furnish to the Belgian State railways not only in 1885, but even in 1886. The Augleur works also want orders rather badly, and would take tires and axles at very low prices, as they cannot sell rails under the prices fixed by the syndicate. It has been rumoured that the steelworks of the Namur and Hainault provinces were going to stop works; but at present nothing definite is known, and the probabilities are against the truth of this rumour. Constructive establishments are rather busier, especially the large firms; but ironmasters and rolling mill proprietors sell their goods at very low prices. New orders have been accepted at 36 fr. for *métis* forge pig-iron; but that price cannot be taken as general, nor the price of 140 fr. for No. 2 plates. These prices are exceptional, and are not to be depended upon except for very large orders. Prices are unchanged as follows:—

	Jan. 14. Francs.	Jan. 7. Francs.
English foundry pig	53	53
Luxemburg foundry pig	50	50
Charleroi foundry pig	67·50	67·50
Charleroi forge pig, "forte"	47	47
Charleroi forge pig, "ordinaire"	44	44
Charlerci forge pig, "métis"	39	39
Luxemburg forge pig	44	44
Bars No. 1 (for export)	110	110
Bars No. 1 (for home consumption)	112·50	112·50
Bars No. 2	120	120
Bars No. 3	127·50	127·50
Joists	120–125	120–125
Angle iron	125–130	125–130
Ship angles	135	135
Plates No. 2 (for export)	140	140
Plates No. 2 (for home consumption)	145	145
Plates No. 3	165	165
Merchant plates	205	205
Fine plates	225	225
Plates No. 4	265	265
Steel rails	130	130
Axles	175	175
Tires	200	200

Coal is rather brisker, as the cold weather has stimulated the demand for household coal. Coke and coking coal are very low, prices being as follows:—

	Francs.
Small coal	7·00
Household coal	13–16
Screened lump coal	20–24
Coke coal	6·25–8
Blast-furnace coke	12·25–13·00
Foundry coke	16–18

FRANCE.—The French iron market is extremely quiet, both for pig-iron and the finished product. Manufacturers are adding slightly to their stocks, and are receiving also some trifling orders; heavy transactions are not known. Prices, after dropping to the lowest possible point, have been arrested in their fall; but there they will remain unless there is a more active enquiry springing up. Rolled coke iron is quoted 150 fr. in the Haute-Marne, and mixed brands 165 fr. There is an utter absence of animation in the Nord; but business is not entirely arrested. Works are restricting their output by stopping for a day or two per week, so as not to increase their stocks. Manufacturers, however, decline any contracts at present prices extending over the end of March or April. Under these conditions a few transactions have been concluded, buyers having to accept immediate delivery. The companies named below tendered as follows, on January 8, for the 7,000 tons of steel rails required for departmental railways:—

	Francs.
Aciéries de France	145·97
Denain-Anzin	146
Le Creusot	151
Terre-Noire	160
Trith-Saint-Léger	165
Jœuf	165
Saint-Nazaire	178
Châtillon-Commentry	185
Longwy	158 and 168 according to destination.

GERMANY.—The business done since the beginning of the year has not been of great weight, and a decline is witnessed both in the demand and prices. In pig-iron the supply exceeds consumption, and manufactured iron is sold only with difficulty. The following are the quotations for iron and steel current at Dortmund, per 1,000 kilogrammes at works (English descriptions per ton at port of shipment), compared with the prices of January 5:—

	Jan. 12. Marks.		Jan. 5. Marks.
White forge pig	47–49	...	47–49
Spiegeleisen	50–53	...	51–53
German foundry pig No. 1	60–62	...	60–62
German foundry pig No. 2	56–58	...	56–58
German foundry pig No. 3	51½–52	...	52–53
German Bessemer pig	47–49	...	48–49
English foundry pig No. 3	37	...	37
English Bessemer hematite pig	44–45	...	44–45
Luxemburg pig	35	...	35
Bar-iron	108–112	...	109–112
Fine-grained iron	132	...	132
Angle-iron	115–120	...	115–120
Joists	110–112	...	112–115
Boiler plates	160–162	...	160–162
Boiler plates, 2nd quality	150–152	...	150–152
Fine plates	150–152	...	150–152
Fine-grained plates	192	...	192
Charcoal plates	220–222	...	220–222
Low Moor plates	250–255	...	250–255
Bessemer steel rails	140–146	...	140–146
Bessemer steel rails (defective)	130	...	130
Bessemer pit rails	118	...	118
Iron pit rails	123	...	123

New Patents.

[The New Applications are arranged alphabetically, and comprise Nos. 168 to 425, being the entries from Jan. 6 to Jan. 12, 1885. The Abstracts of Specifications relating to Metals are placed in the order of their official numbers.]

NEW APPLICATIONS.

Absorbent Pad.—*E. M. Moore, 57, Comeragh Road, West Kensington, London.* [194

Adjusting the Suspending Cords of Venetian Blinds and Curtains.—*R. W. Scaife, 8, Quality Court, Chancery Lane, London.* [328

Alarm Clocks.—A communication—*A. W. L. Reddie, 6, Bream's Buildings, Chancery Lane, Middlesex.* [320

Anti-fouling and Preservative Composition for Coating Ships' Bottoms.—*J. S. Gisborne, 30, Southampton Buildings, London.* [312

Applying Turbines or Motors Worked by Fluids to Utilise the Head Pressure more Effectually.—*G. M. Capell, 22, Southampton Buildings, Chancery Lane, London.* [240

Artificial Flowers and Leaves Made from the Quill.—*E. Vagner and F. Mitchell, 9, Oxford Mansions, Oxford Circus, London.* [334

Atmospheric Water Waste Preventing Apparatus.—*J. T. Julian and T. E. Phillips, 45, Falkland Road, Kentish Town, London.* [414

Attaching Cord or Wire to Corks and Bungs.—*F. W. Russell, 8, Quality Court, Chancery Lane, London.* [198

Attaching Indiarubber Pipes to Metal Pipe Couplings.—*J. H. Wild, 6, Bream's Buildings, Chancery Lane, London.* [416

Attachments.—*R. Crawford, 29, Palmerston Road, Southsea.* [177

Automatic Non-detaching Cut-off for Steam Engines.—*J. B. Pitchford and W. T. Garrat, 11, Wellington Street, Strand, London.* [232

Automatic Self-closing Valve or Tap.—*S. A. Johnson, 24, Glengall Road, Poplar, Middlesex.* [421

Automatic Sights for Turret Guns.—*A. Noble and C. H. Murray, Elswick Works, Newcastle-on-Tyne.* [204

Bait Can for Carrying Bait for Fishing.—*G. B. Read, 9, Southampton Buildings, London.* [213

Bakers' Ovens.—A communication.—*A. W. L. Reddie, 6, Bream's Buildings, Chancery Lane, Middlesex.* [363

Balanced Slide-valves.—*W. Rowntree and G. Temple, 6, Lord Street, Liverpool.* [297

Balancing the Top Rail and Raising and Lowering the Bottom Cone of Roving and Stubbing Frames.—*S. Tweedale, Town Hall Buildings, Halifax.* [395

Ball Castor.—*J. J. Frost, 166, Fleet Street, London.* [199

Barometer.—*J. D. Young, 33, Chancery Lane, London.* [413

Bee-hives.—*C. G. Mason and A. Buchan, 5, Chancery Lane, London.* [409

Beer Taps.—*H. Trott, 55, Chancery Lane, London.* [272

Blowing Engine.—*T. Northfield, 24, Southampton Buildings, London.* [207

Bobbins or Spools.—*J. Holmes and A. Holmes, 1, Commercial Street, Halifax, Yorks.* [366

* These descriptions of steel have been enumerated separately only since January 1883, and they are not given in the returns for 1882; but they are included in the total for that year.

Boiling Water by Gas.—*J. Warburton, Conisburgh, near Rotherham.* [261]
Bolt Cloth Tighteners.—*C. A. Smith, 28, Southampton Buildings, London.* [332]
Bolts, Nuts, and Joints for Railway Metals.—*A. Requilé, 80, Prince of Wales Road, Kentish Town, London.* [192]
Boot and Shoe Cleaning Machine.—*J. Griffin, Rose Cottage, Marlborough, Wilts.* [344]
Boots and Shoes.—*S. F. Feldman, 4, South Street, Finsbury, London.* [284]
Boot Cleaning Apparatus.—*J. O. Spong, 166, Fleet Street, London.* [362]
Bottles and Stoppers.—*G. A. Spencer and S. Spencer, 23, Southampton Buildings, Middlesex.* [234]
Bottle Stoppers.—*B. Weldon, 36, Great Hampton Row, Birmingham.* [401]
Bottle Stoppers.—*B. Weldon, 36, Great Hampton Row, Birmingham.* [402]
Bottle Stoppers.—*J. N. Aronson and C. B. Harnes, 45, Southampton Buildings, London.* [329]
Box and Drawer.—*E. D. Gross and R. I. Barnes, 4, South Street, Finsbury, London.* [246]
Boring Machine.—*R. Stanley, Nuneaton Colliery, Nuneaton, Warwick.* [335]
Braiding Machines.—A communication.—*E. G. Brewer, 33, Chancery Lane, London.* [197]
Brake Blocks for Steam Tram Engines.—*J. Inshaw, Laburnum House, Sutton Street, Aston, near Birmingham.* [224]
Breech Piece or Tube and Appliance for Adapting Fire-arms for Miniature Ammunition.—*R. Morris, 28, Southampton Buildings, Chancery Lane, London.* [285]
Building Bricks.—*P. J. Kellow, Woodleigh, West End, Southampton.* [390]
Buttons.—A communication.—*F. Dittermann, 33, Chancery Lane, London.* [236]
Candle Support for Use when Reading in Carriages.—*W. Lane, 24, Southampton Buildings, Chancery Lane, London.* [249]
Carding Engines for Carding Cotton.—*S. Tweedale, Town Hall Buildings, Halifax.* [396]
Carriages for Heavy Ordnance for Land Defences.—*W. J. Hoyle, Elswick Works, Newcastle-on-Tyne.* [206]
Carrier for Wood-turning Lathes.—*H. Salomo, 28, Southampton Buildings, Chancery Lane, London.* [212]
Cars.—*E. Schultze, 67, Strand, London.* [370]
Case Ammunition.—*T. Nordenfelt, 24, Southampton Buildings, London.* [209]
Casks or Barrels.—*E. G. Leroy, 4, St. Ann's Square, Manchester.* [263]
Centre-boards for Racing Boats.—*W. H. Bifen, 120, Chancery Lane, London.* [398]
Cleansing or Purifying Oils or Grease.—*B. Rhodes, 33, Chancery Lane, London.* [274]
Clearing Tramway Lines of Snow.—*I. F. Cuttler, 70, Chancery Lane, London.* [281]
Clocks and Watches.—A communication.—*R. Vigier, 53, Chancery Lane, London.* [420]
Clocks and Watches for Geographical Purposes.—*W. Morris, 8, Quality Court, London.* [293]
Coating Glass with Liquified Gelatine.—*A. L. Henderson, 9, Southampton Buildings, Holborn, London.* [424]
Combination Pliers.—*J. Lucas and C. Hall, Little King Street, Birmingham.* [387]
Combined Magnets or Coils to be Acted on by Currents or Signals in Electric Telegraph Apparatus.—*J. Scotland, 87, St. Vincent Street, Glasgow.* [354]
Combined Wardrobe, Cupboard, or Book Case.—*W. Heelis, 53, Chancery Lane, London.* [333]
Composition of Desiccated Cocoanut.—A communication.—*K. B. Hambley, 22, Southampton Buildings, Chancery Lane, London.* [241]
Compound Metal Plates.—A communication.—*C. D. Abel, 28, Southampton Buildings, Chancery Lane, Middlesex.* [287]
Compressing Green Crops for Making Ensilage.—*T. Potter, Alresford, Hampshire.* [223]
Condensing the Exhaust Steam of Tramway Engines.—*N. S. Russell, 47, Lincoln's Inn Fields, London.* [195]
Conveying and Burning Gas in Connection with Gas Furnaces of Steam Generators.—*J. Jackson, 4, Rumford Place, Liverpool.* [258]
Corrugated Furnace Shells or Flues of Steam Boilers.—*J. Haythorn, 87, St. Vincent Street, Glasgow.* [380]
Coupling and Uncoupling Railway Carriages.—*J. Farrer, 8, Quality Court, London.* [394]
Cricket Boots and Shoes.—*W. Garrood, 7, Thomas Street, Northampton.* [296]
Crushing and Reducing Stone to Powder.—*J. Foulds and S. Tomlinson, 9, Ann Place, Little Horton Lane, Bradford.* [304]
Cuff or Wrist Bands.—*A. H. Storey, 186, Fleet Street, London.* [360]
Cutting or Reducing Sugar Canes.—*A. Cook, 87, St. Vincent Street, Glasgow.* [353]
Cutting Screw Threads.—*M. Kirby and T. Kirby, Standard Works, Saynor Road, Hunslet, Leeds.* [221]
Detecting Escape of Inflammable Gas.—A communication.—*J. Imray, 28, Southampton Buildings, Chancery Lane, London.* [369]
Device for the Prevention of the Oversliding of Drawers.—*D. H. Dickinson, Portland House, Newcastle-upon-Tyne.* [389]
Dials for Clocks and Watches.—*J. Birkett, Market Place, Keswick, Cumberland.* [385]
Dials of Watches.—*C. Ankers, 21, Cockspur Street, Charing Cross, London.* [407]
Diminishing the Mechanical Friction of Machines by Means of Electro Magnets.—*E. Toynbee and I. R. Culley, 18, Malvern Villas, Willesden.* [209]
Disinfecting Rags in Bales.—*E. A. Cohen, 161, Great Dover Street, London.* [238]
Door Fastenings.—*J. Walker, Lincoln's Inn, Corporation Street, Birmingham.* [264]
Double Power Lever Brake for Railway Waggons.—*S. Houghton, Victoria Terrace, Ward Street, Priestfield, near Wolverhampton, Stafford.* [183]
Drag Lever Brake.—*J. Chew and G. Parkinson, Lambeth Street, Blackburn.* [176]
Drawing or Inserting the Corks of Bottles.—A communication.—*W. R. Lake, 45, Southampton Buildings, London.* [216]
Driving and Reversing Gear.—A communication.—*W. R. Lake, 45, Southampton Buildings, London.* [215]
Driving or Propelling Mechanism for Transmitting Power for Operating Lathes.—*G. R. Postlethwaite, 6, Livery Street, Birmingham.* [352]
Driving the Spindles of Machines for Spinning and Doubling Cotton.—*J. W. Dawson and H. Simpson, 4, St. Ann's Square, Manchester.* [337]
Drying Colour-paste.—*E. Passbury, 67, Strand, London.* [275]
Electric Annunciator.—*F. Walker, 20, Paternoster Square, London.* [376]
Electric Telegraphic Apparatus for Transmitting and Receiving Signals on Board Ship.—*J. S. Gisborne, 36, Southampton Buildings, London.* [311]
Electric Telegraphy.—A communication.—*A. M. Clark, 53, Chancery Lane, London.* [282]
Elevated Tram Car Train and Railway.—*D. Ellis, 21, Great Dark Gate Street, Aberystwith, Cardigan.* [267]
Elimination of Impurities from Vat Liquor.—*T. D. Owen, 9, Falkland Road, Egremont, Cheshire.* [259]
Envelopes.—*J. J. Coleman, 67, Strand, London.* [244]
Excavators.—A communication.—*H. H. Lake, 45, Southampton Buildings, London.* [373]
Eyelet or Stud to Facilitate the Lacing of Boots.—*J. Hall, 1, Commercial Street, Halifax.* [343]
Fabrics for Covering Heated Surfaces.—*H. W. Jones, New York.* [190]
Faced or Coated Bricks.—*R. A. Rossborough, 6, Lord Street, Liverpool.* [340]
Facilitating the Opening of Bottles Containing Aerated Liquids Stoppered with Inward Opening Stoppers.—*W. Edwin and C. Bailey, Dane Street, Brewood, near Parkridge.* [191]
Fastening Buttons.—A communication.—*W. R. Lake, 45, Southampton Buildings, London.* [251]
Fastenings for Shoes.—*H. A. Done, Arcade Chambers, Corporation Street, Birmingham.* [310]
Fastening Windows and Casements.—*F. R. Silk, 40, Newport Road, Sparkbrook, Birmingham.* [384]
Filling Bottles with Syruped or Flavoured Beverages.—*N. G. Wilcocks, N. St. G. Wilcocks, and A. Stockall, 47, Lincoln's Inn Fields, London.* [326]
Filters.—*J. W. Ingham, 373, High Holborn, London.* [319]
Fire Escape.—*T. L. Pulman, 46, Lincoln's Inn Fields, London.* [223]
Fire Escapes.—*J. H. Bowley, 323, High Holborn, London.* [201]
Fire Escapes.—A communication.—*J. E. Walsh, Waterhouse Chambers, Crossley Street, Halifax.* [355]
Fishing Reels and Rods.—A communication.—*A. J. Boult, 323, High Holborn, Middlesex.* [318]
Fixing Adjustable Steps of Velocipedes.—*A. Peddie, 70, Chancery Lane, London.* [405]
Forming Indents in Glass Bottles.—*D. Rylands, Hope Glass Works, Stairfoot, Barnsley, Yorks.* [348]
Fountain or Reservoir Lamps.—*C. Barton, 17, Southampton Buildings, Middlesex.* [317]
"Garnett" or Saw Teeth Employed in Opening and Preparing Fibrous Materials.—*J. Hardy, 1, Commercial Street, Halifax.* [179]
Gas Burners for Heating and Cooking Purposes.—*J. J. Royle, 8, Quality Court, Chancery Lane, London.* [268]
Gear Cutting Machines.—*A. H. Brainard, 67, Strand, London.* [245]
Generation of Pressure and Motive-power.—*P. Smith, R. Wild, and H. Ledger, 8, Victoria Mount, Wilmslow Road, Rusholme, near Manchester* [392]
Glass and Earthenware Jars.—*E. Johnson, 8, Quality Court, London.* [404]
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Governing and Regulating the Speed of Steam-engines.—*W. D. Priestman and S. Priestman, 8, Quality Court, London.* [295]
Governors of Steam or Compressed Air Engines.—*H. W. Pendred, Crohill, Pendennis Road, Streatham, Surrey.* [301]
Gunpowder.—A communication.—*F. B. W. Roberts, 47, Lincoln's Inn Fields, London.* [368]
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Hanging or Hinging the Rudders of Rowing Boats.—*A. T. Frampton, 53, Chancery Lane, London.* [200]
Heating, Cooling and Ventilating.—*J. G. Lorrain, 37, Brook Street, Holborn, London.* [339]
Heating Feed Water of Marine Boilers.—*J. Tweedy, 46, Lincoln's Inn Fields, London.* [359]
Heating the Contents of Feeding Bottles.—*L. White, 1, Redcliffe Place, Clarendon Road, Chorlton-cum-Hardy, near Manchester.* [341]
Hinge for Attaching Rudders to Boats.—*E. Kent, 59, Wood Lane, Shepherd's Bush, Middlesex.* [379]
Holder and Reflector for Incandescent Electric Lamps.—*E. C. Tolter, 727, Wandsworth Road, Surrey.* [188]
Holders for Everpointed Pencils.—*J. Appleby, 36, Lancaster Street, Birmingham.* [345]
Horse-shoes.—*T. Nugent, Albert Villa, Pembroke Road, Walthamstow.* [422]
Indicating Temperature or Pressure.—*J. Murrie, 87, St Vincent Street, Glasgow.* [303]
Indicating Two Systems of Calculating Time on One Dial.—*J. Kendal and M. Laval, 1, Gresham Buildings, Basinghall Street, London.* [20]
Inlaying Glass in Gold and Silver.—*C. Norton, 24, Parkfield Street, Islington, Middlesex.* [411]
Instrument for Setting Out Curves.—A communication.—*W. H. Beck, 115, Cannon Street, London.* [325]
Intermediate or Junction Parts of Trowels.—*J. Lee, 77, Colmore Row, Birmingham.* [314]
Joints for Connecting Metallic Pipes and Tubes.—*T. Birtwhistle, 8, Quality Court, London.* [229]
Kitchen Ranges and Cooking Stoves.—*W. Stobbs, 26, Paternoster Square, London.* [324]
Lamp Protectors.—*J. B. Barnett, 6, Bream's Buildings, Chancery Lane, London.* [280]
Latch or Device for Retaining Doors in their Closed Position.—*M. P. Ismay, 47, Lincoln's Inn Fields, London.* [331]
Lawn Tennis Court Marker.—*R. Moss, 56, Cannon Street, London.* [168]
Laying Natural Rock or Other Hard Asphalte Pavements.—*M. Macleod, 66, Deansgate, Manchester.* [406]
Leg Guards.—*J. Vicars, 8, Quality Court, London.* [292]
Life Rescue Belt.—*J. S. Comrie, 8, Great Winchester Street, London.* [289]
Lifting Jacks for Railway Purposes.—A communication.—*W. P. Thompson, 6, Lord Street, Liverpool.* [308]
Liquid Meter.—*E. Tatham, 6, Lord Street, Liverpool.* [307]
Locks.—*B. Goulton, 8, Quality Court, Chancery Lane, London.* [231]
Locks and Fastenings for Securing Bags.—*J. B. Brooks and J. Holt, 6, Livery Street, Birmingham.* [219]
Looms for Weaving Double Cloth.—*T. Hollings and W. Hall, 4, South Street, Finsbury, London.* [378]
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Machinery for the Manufacture of Potters' Seggars and Crucibles.—*J. Gill, 46, Lincoln's Inn Fields, London.* [187]
Machinery for the Manufacture of Fire Lighters.—*J. Maynes, 33, Blessington Road, Lee, Kent.* [247]
Machinery for Combing Fibrous Substances.—*J. C. Walker, 33, Chancery Lane, London.* [273]
Machinery for Finishing Ordnance.—*A. Greenwood, 8, Bream's Buildings, Chancery Lane, London.* [279]
Machinery for the Manufacture of Safety-pins.—*H. W. Tonks, 4, Cherry Street, Birmingham.* [398]
Machinery for Turning, Boring, Lapping, and Rifling Ordnance.—*A. Greenwood, 6, Bream's Buildings, Chancery Lane, London.* [278]
Manufacturing Steel Tools.—A communication.—*A. M. Clark, 53, Chancery Lane, London.* [375]
Marking the Position of Sunken Vessels.—A communication.—*H. J. Haddan, 67, Strand, Westminster.* [242]
Mechanical Playing of Pianofortes.—*A. P. Hodgson, 53, Chancery Lane, London.* [374]
Mechanical Toys.—A communication.—*H. H. Lake, 45, Southampton Buildings, Middlesex.* [372]
Metallic Bedsteads.—*A. H. Griffiths and E. Smallwood, 7, Staple Inn, Middlesex* [365]
Metallic Pocket Knives.—*H. Hewitt, 7, Staple Inn, Middlesex.* [364]
Mining Machines.—*S. Stutz, 24, Southampton Buildings, Chancery Lane, London.* [316]
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Multiplicate Bracket.—*J. H. Stone, 4, Cherry Street, Birmingham.* [393]
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Wood Block Flooring.—*W. Court*, 172, *Strand, London.* [217

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ABSTRACT OF SPECIFICATIONS RELATING TO METALS

PUBLISHED DURING THE WEEK ENDING JANUARY 10, 1885.

Prepared by PHILIP M. JUSTICE, Patent Agent, 55 and 56 Chancery Lane, London, W.C.

Extracting Metals from Chlorides, &c.—551 (1884). *Groth.* Communicated by R. Gratzel. Metals, such as aluminium and magnesium, are extracted from their combinations with chlorine and fluorine by means of electrolysis with the assistance of a gas having reducing qualities. A metallic melting and decomposing pot is employed, through and into which a reducing gas and the electric current is conducted.

Puddling Furnaces.—3065 (1884).—*G. Morris* and *G. Slater.* A water space is formed in the brickwork at the bottom, of the chimney stack, for the purpose of reducing the heat and so preventing the rapid destruction of that part of the furnace.

Cutting or Shearing Metal Plates.—3965 (1884).—*J. Tinn* and *T. Crew.* The object is to cut and shear metal plates in such a manner that the sides shall be at right angles to each other. A sheet is placed on the table, gripped or held, and advanced to and over a fixed cutter on which it is held, a circular knife then cutting it; the sheet is then released and received between a pair of rolls, each of which carries toward each end a circular knife which shear the sides of the plate, the other end being cut by another knife at the delivery end of the machine.

Gas Producers.—4075 (1884).—*J. Macfarlane.* The gas producer, which is of the Siemens type, has an enclosed hollow bottom, underneath the bottom proper of which are passages connected with perforations. Air is forced into the spaces beneath the bottom, and the air and steam escape by the perforations in the bottom. The object of the invention is to burn dross or small coal.

Treating Copper Ores.—9498 (1884).—*Clark.* Communicated by J. Garnier. The hearth or crucible of the furnace is lined with inert substances, such as oxide of chromium with other bases, such as lime, oxide of iron, &c., mixed with tar. A furnace is described of conical form, the blast being introduced through hollow trunnions, and circulates in a double casing around the lower walls. The copper is produced by a single fusion in a furnace of this kind.

Rolling Mill.—14773 (1884).—*J. Lardon.* The mill train consists of three or more rollers provided with projecting collars, one of the rollers being capable of lateral displacement. Numerous shapes of rolls are described and shown for the purposes of compressing iron shells, gun barrels, &c.

Phosphatic Slags.—15140 (1884).—*C. Scheibler.* The object of the invention is to extract the phosphoric acid as phosphate of lime from Thomas-Gilchrist slags, and to obtain a residue rich in iron and manganese, which can be returned to the blast-furnace. The liquid slag is poured into vessels coated with a bad heat conductor, which vessels are placed in a room until the outer surface of the slag begins to solidify. The inner fluid mass, containing phosphate of lime, is then removed and utilised as manure, the outer crust being returned to the blast-furnace.

Commercial.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, ETC.

Metal Market, City, Thursday, 4 P.M.

METALS AND ORES.

	JANUARY 8.	JANUARY 15.
COPPER (per ton)—	£ s. d.	£ s. d.
Chili, 96 per cent.	47 17 6 to 48 5 0	48 5 0 to 48 10 0
Wallaroo	Nominal	Nominal
Burra Burra	57 0 0	57 10 0	57 0 0	57 10 0
English tough	52 0 0	52 10 0	52 0 0	52 10 0
English ingot, best	53 10 0	54 0 0	53 10 0	54 0 0
Sheets sheathing and rod	62 0 0	62 10 0	62 0 0	62 10 0
Bottoms	68 10 0	69 10 0	68 10 0	69 10 0
Ore per unit	—	—	—	—
PHOSPHOR BRONZE (per ton)—				
Special bearing metal	100 0 0	100 0 0	100 0 0	100 0 0
Other alloys	103 0 0	125 0 0	106 0 0	125 0 0
PHOSPHOR TIN	170 0 0	—	170 0 0	—
TIN (per ton)—				
Straits (cash)	74 0 0	74 7 6	74 5 0	74 7 6
Straits for arrival	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English ingots	77 0 0	77 10 0	77 0 0	77 10 0
English bars	78 0 0	78 10 0	78 0 0	78 10 0
English refined	—	—	—	—
Australian	74 7 6	74 17 6	74 7 6	74 17 6
TIN PLATES (f.o.b. London, per box)—				
I.C. coke	0 14 0	0 14 9	0 14 0	0 14 9
I.X. coke	0 19 0	0 19 9	0 19 0	0 19 9
I.C. charcoal	0 15 6	0 18 0	0 15 6	0 18 0
I.X. charcoal	1 1 0	1 4 0	1 1 0	1 4 0
ZINC (per ton) from No. 9 gauge—				
Sheets, rolled	17 0 0	—	17 0 0	—
Sheets foreign	16 12 6	16 15 0	16 12 6	16 15 0
LEAD (per ton)—				
Soft English pig	11 5 0	—	11 5 0	—
Soft English W.B.	—	—	—	—
Spanish soft	10 15 0	10 17 6	10 15 0	10 17 6
Spanish with silver	—	—	—	—
Patent shot	13 15 0	14 0 0	13 15 0	14 0 0
SPELTER (per ton)—				
Silesian, com.	14 0 0	14 10 0	14 0 0	14 10 0
Rhenish	—	—	—	—
English	—	—	—	—
QUICKSILVER (per bot.)	—	—	—	—

METALS AND ORES.—continued.

	JANUARY 8.	JANUARY 15.
ANTIMONY ORE (per ton)—	£ s. d.	£ s. d.
Australian	39 0 0 —	39 0 0 —
Spanish	— —	— —
French Star	43 0 0 to 44 0 0	42 0 0 to 44 0 0
REGULUS (per cwt.)—		
Crude	— —	— —
NICKEL (per lb.)	— —	— —
BRASS (per lb.)—		
Sheets, 48 by 24	0 0 7½ —	0 0 7½ —
Tubes	— —	— —
Wire	0 0 7 0 0 7½	0 0 7 0 0 7½
Yellow metal	0 0 6½ —	0 0 6½ —
ASBESTOS (per lb.)	0 0 3 0 1 0	0 0 3 0 1 0
PLUMBAGO (per cwt.)—		
Ceylon lump	0 13 6 0 17 0	0 13 6 0 17 0
Ceylon chip	— —	— —
Ceylon dust	0 5 0 0 8 0	0 5 0 0 8 0
COALS (per ton)—		
East Hartlepool	1 4 0 —	1 4 0 —
Lambton	1 6 0 —	1 6 0 —
Tees	1 6 0 —	1 6 0 —
Hartley	1 4 0 —	1 4 0 —
Hetton	1 6 0 —	1 6 0 —
Hawthorn	1 5 0 —	1 5 0 —
Tudstall	1 4 0 —	1 4 0 —

OILS, CHEMICALS, ETC.

	JANUARY 8.	JANUARY 15.
OILS (per ton)—	£ s. d.	£ s. d.
Olive, Galioli	— to —	— to —
Olive, Gioja	— —	— —
Olive, Levant	40 0 0 —	40 0 0	40 10 0
Olive Seville	42 0 0 —	42 0 0	42 10 0
Olive, Corfu	— —	— —
Seal, pale	28 0 0 29 0 0	28 0 0	29 0 0
Sperm head	55 0 0 —	—	56 0 0
Cod	36 0 0 —	36 0 0	—
E. I. fish	— —	— —
Rape, English, brown	26 10 0 —	26 0 0	26 5 0
Rape, refined	28 0 0 28 10 0	28 0 0	28 5 0
Foreign refined	— —	— —
Ground nut and Gingelly Madras	— —	— —
Palm, fine	32 0 0 —	32 0 0	—
Palm, nut	29 0 0 —	28 10 0	—
Linseed	20 7 6 20 10 0	20 5 0	20 12 6
Cottonseed, crude	21 5 0 —	21 6 0	—
Cottonseed, refined	24 10 0 26 0 0	24 0 0	26 0 0
Hull	— —	— —
Lard, English	41 0 0 —	43 0 0	—
Cocoanut, Cochin	32 10 0 33 0 0	33 0 0	33 0 0
Cocoanut, Ceylon pipes	29 0 0 29 5 0	29 5 0	—
OIL CAKE (per ton)—		
Linseed, London	8 10 0 8 15 0	8 10 0	8 15 0
American, barrels	8 12 6 —	8 7 6	—
American, bags	7 15 0 —	7 15 0	—
Marseilles	— —	— —
Rapeseed	4 2 6 —	4 2 6	—
Cottonseed	5 5 0 —	5 5 0	—
TALLOW (per cwt.)—		
P.Y.C. old	2 1 6 —	2 1 6	—
South American beef	— —	— —
North American beef	— —	— —
Australian beef, fine	1 13 6 —	1 13 6	1 14 0
Australianasheep, fine (per ton)	1 14 6 —	1 14 6	1 15 0
PETROLEUM OIL (per gallon)—	0 0 6⅛ —	0 0 6⅛	0 0 7⅛
Refined coal	— —	— —
Naphtha	0 0 8½ —	0 0 7	0 0 8½
TURPENTINE (per cwt.)	— —	— —
French spirits	— —	— —
American spirits	1 3 0 —	1 3 0	—
WHALEFINS (per ton)—		
Davis' Straits	1500 0 0 1800 0 0	1800 0 0	1400 0 0
Arctic	1500 0 0 1800 0 0	1800 0 0	1400 0 0
BRIMSTONE (per ton)—		
Rough 3rds	5 5 0 —	5 5 0	—
Roll	9 0 0 10 0 0	9 0 0	10 0 0
Flour	10 0 0 12 10 0	10 0 0	12 10 0
ACID (per lb.)—		
Acetic	0 14 0 0 17 0	0 14 0	0 17 0
Second quality (per gallon)	— —	— —
Citric	0 1 5½ —	0 1 4½	—
Muriatic (sp. salts, per cwt.)	0 4 6 0 7 6	0 4 6	0 7 6
Nordhausen, 50 per cent.	1 10 0 —	1 10 0	—
Nitros	0 0 3 —	0 0 3	—
Oxalic	0 0 6 —	0 0 6	—
Sulphuric, brown	0 0 0½ 0 0 1	0 0 0½	0 0 1
Tartaric, crystal	0 1 7½ —	0 1 7½	—
Tartaric, powdered	0 1 8 —	0 1 8	—
AMMONIA—		
Carbonate (per lb.)	0 0 5 0 0 5½	0 0 5	0 0 5½
Sulphate, best white (per ton)	13 5 0 13 10 0	13 0 0	13 10 0
ARSENIC (per cwt.)—		
White, lump	1 3 0 —	1 3 0	—
White, powdered	0 12 3 0 12 6	0 12 6	0 12 9
BLEACHING POWDER, 35 per cent.	0 8 3 —	0 8 0	—
BORAX, refined English	2 0 0 2 3 0	2 0 0	2 3 0
COPPERAS green, tierces (ton)	2 0 0 —	2 0 0	—
PORTLAND CEMENT—		
First quality, in casks of 400 lb. gross, including casks, f.o.b. Thames (per cask)	— —	— —
First quality, in sacks of 200 lb. net (per ton)	— —	— —
Sacks extra, 1/6 each.		
CHARLTON WHITE PAINT (per cwt.)	— —	— —
CALLEY'S TORBAY PAINT—		
Brown	— —	— —
Red	— —	— —
LEAD—		
Sugar, English white	1 3 0 —	1 3 0	—
Brown	1 1 0 —	1 1 0	—
Red (per cwt.)	0 13 3 —	0 13 3	—
White, ground	0 18 6 1 0 0	0 18 6	1 0 0
LITHARGE (per cwt.)	— —	— —
LIME (per ton)—		
Acetate, brown	7 0 0 —	7 0 0	—
Distilled	12 0 0 —	12 0 0	—
POTASH (per lb.)—		
Bichromate	0 0 3½ —	0 0 3½	—
Chlorate	0 0 6 —	0 0 6	—
Prussic, red	0 1 11 0 2 0	0 1 11	0 2 0
Prussic, yellow	0 0 9½ 0 0 10½	0 0 9½	0 0 10½
Sulphate, 80 per cent. (per ton)	10 15 0 11 0 0	10 15 0	11 0 0
SALTPETRE (per cwt.)—		
English, refined, kegs	22 0 0 23 0 0	22 0 0	23 0 0
English, barrels	— —	— —
Rough	0 15 0 —	0 15 3	—

PRICE LIST OF IRON AND STEEL.

PREPARED BY

MESSRS. BOLLING & LOWE,

LAURENCE POUNTNEY HILL, LONDON, E.C.

Thursday, January 15.

STAFFORDSHIRE.

Brands at Works. Per Ton.

BARS—
½ in. to 3 in. rounds and squares £7 10 0
1 in. to 6 in. flats 7 10 0

Rounds and squares—
3½ in., 10s. per ton extra.
4 in., 20s. ,,
4½ in., 40s. ,,
5 in., 60s. ,,

Rounds only—
5½ in., 70s. ,,
6 in., 90s. ,,
6½ in., 110s. ,,
7 in., 130s. ,,

Rounds and squares—
7-16 in., 10s. ,,
⅝ in., 20s. ,,
5-16 in., 30s. ,,
½ in., 40s. ,,
3-16 in., 70s. ,,

HOOPS—
1 in. to 6 in. wide by usual gauge £8 0 0
⅜ in. wide up to 20 w. g., 20s. per ton extra.
¾ in. wide up to 20 w. g., 40s. per ton extra.
⅝ in. wide up to 20 w. g., 80s. per ton extra.
½ in. wide up to 20 w. g., 120s. per ton extra.

PLATES—
To 15 feet long by 4 feet wide, not exceeding 4 cwt. £9 0 0
4 to 5 cwt., 20s. per ton extra.
5 to 6 cwt., 25s. ,,
6 to 7 cwt., 50s. ,,
7 to 8 cwt., 75s. ,,
8 to 9 cwt., 110s. ,,
9 to 10 cwt., 120s. ,,
10 to 11 cwt., 140s. ,,
15 to 20 ft. long, 20s. ,,
20 to 25 ft. long, 40s. ,,
4 to 4½ feet wide, 20s ,,
4½ to 5 feet wide, 40s. ,,

SHEETS—
Singles 11 to 20 gauge £9 0 0
Doubles, 30s. per ton extra.
Lattens, 60s. ,,

ANGLES—
1 in. by 1 in. to 8 united inches £8 5 0

TEES—
1 in. by 1 in. to 8 united inches £8 10 0
For each inch above 8 united inches, 10s. per ton extra.
Best, 20s. per ton extra.
Best best, 40s.
Treble best, 60s.

STAFFORDSHIRE, MIDLAND, &c.

Ordinary Brands (at works).

	£ s. d.	£ s. d.
Bars	5 15 0 to 6 5 0	
Hoops	6 0 0 to 7 5 0	
Plates	7 0 0 to 8 0 0	
Sheets	7 0 0 to 8 0 0	
Angles	6 10 0 to 7 0 0	
Tees	7 0 0 to 7 10 0	

Best, 10s. to 20s. per ton extra.
Best best, 20s. to 30s. ,,
Treble best, 40s. to 60s. ,,

CLEVELAND AND NORTH OF ENGLAND BRANDS (at works).

	£ s. d.	£ s. d.
Bars	5 5 0 to 5 10 0	
Ship plates to 8 cwt.	5 0 0 to 5 5 0	
Angles	4 15 0 to 5 0 0	

Best, 10s. per ton extra.
Best best, 30s. ,,
Treble best, 50s. ,,

SCOTCH (at Glasgow).

	£ s. d.
Bars NB crown	5 7 6
Hoops	6 12 6
Ship plates	6 5 0
Boiler	6 10 0
Angles	6 0 0

Best, 10s. per ton extra.
Best best, 30s. ,,
Treble best, 50s. ,,

WELSH (Newport and Cardiff).

	£ s. d.	£ s. d.
Bars	5 0 0 to 5 2 6	
Plates	6 10 0 to 7 0 0	

Best, 10s. per ton extra.

BELGIAN (f.o.b. Antwerp).

	£ s. d.	£ s. d.
Bars	4 0 0 to 7 0 0	
Hoops	6 10 0 to 7 0 0	
Plates	7 10 0 to 8 10 0	
Sheets	8 0 0 to 8 10 0	
Angles	5 15 0 to 6 5 0	
Nail rods	4 10 0 to 6 0 0	

IRON ROLLED GIRDERS—
Narrow flanges 6 0 0 to 7 10 0
Wide flanges . 6 10 0 to 8 0 0

STEEL ROLLED GIRDERS, ANGLES, and CHANNELS, at proportionate differences.

BEST YORKSHIRE (at works).

	£ s. d.
BARS—	
To 3½ cwt.	18 0 0
3¾ to 5¼ cwt	19 0 0
5½ cwt. and upwards	20 0 0
BOILER PLATES—	
To 3 cwt.	21 0 0
from 3 to 3¼ cwt.	23 0 0
,, 3¼ ,, 4 ,,	25 0 0
,, 4 ,, 5 ,,	27 0 0
,, 5 ,, 7 ,,	30 0 0
,, 7 ,, 10 ,,	33 0 0
above 10 cwt.	36 0 0

Plates over 6 feet wide, 40s. per ton extra.

SHEETS 11 to 17 WG. 23 0 0
ANGLES and TEES 20 0 0

Full size Section Sheets on application.

	£ s. d.
Tires to 5 cwt.	18 10 0
from 5 cwt. & upwards	22 0 0
Axles to 5½ cwt.	18 10 0
from 5½cwt. & upwards	21 10 0

RAILS (at port nearest works)

	£ s. d.	£ s. d.
Heavy iron	5 0 0 to 5 5 0	
,, steel	5 0 0 to 5 5 0	
Light iron	5 10 0 to 5 15 0	
,, steel	5 10 0 to 6 0 0	

Steel mining rails, 10 to 15 lb. per yard, £8 to £6 15s.
Fish plates, heavy, 20s. per ton above rails.
Fish plates, light, 60s. to 80s. per ton do.

BOLTS AND NUTS, for Fishes—
Heavy .. 12 10 0 to 13 10 0
Light .... 16 0 0 to 25 0 0

SPIKES—
Heavy .. 13 0 0 to 14 0 0
Light .... 16 10 0 to 19 10 0

PIG-IRON.

Scotch warrants (Glasgow) ..... 42s. 4½d.
Cleveland warrants No. 3 (Middlesbrough) ... 35s. 6d.
Cleveland No. 1 (Tyne or Tees) G.M.B. ..... 39s. 6d.

CASTINGS (f.o.b. shipping port).

SOCKET PIPES (for gas or water)—

	£ s. d.	£ s. d.
1½ to 2 in.	5 0 0 to 5 10 0	
2 to 3 in.	4 10 0 to 5 0 0	
3 to 8 in.	4 5 0 to 4 15 0	
8 to 20 in.	4 2 6 to 4 12 6	
20 to 48 in.	4 0 0 to 4 10 0	
Chairs	3 5 0 to 4 0 0	
Girders	5 10 0 to 14 0 0	
SCRAP—		
Old rails, D.H.	2 15 0 to 2 17 6	
Do. flange	2 5 0 to 2 10 0	
Engineers' heavy scrap	2 10 0 to 2 15 0	
Light do.	1 15 0 to 2 0 0	

WIRE (at works).

	£ s. d.	£ s. d.
Rolled Fencing Wire—		
Nos. 0 to 4	6 0 0 to 7 0 0	
5	6 5 0 to 7 5 0	
6	6 10 0 to 7 10 0	
Galvanised—		
Nos. 0 to 4	11 0 0 to 11 10 0	
5	11 10 0 to 12 0 0	
6	12 0 0 to 12 10 0	
Drawn Fencing Wire—		
Nos. 0 to 6	8 10 0 to 9 10 0	
7	9 0 0 to 10 0 0	
8	8 0 0 to 9 0 0	
9	8 5 0 to 9 10 0	
10	8 15 0 to 10 0 0	
Galvanised—		
Nos. 0 to 6	13 0 0 to 13 10 0	
7	13 10 0 to 14 0 0	
8	13 15 0 to 14 5 0	
9	15 10 0 to 16 0 0	
10	16 10 0 to 17 0 0	
Drawn Bright Wire—		
Nos. 1 to 6	10 0 0 to 11 0 0	
7	10 0 0 to 11 0 0	
8	10 5 0 to 11 5 0	
9	10 15 0 to 11 15 0	
10	11 10 0 to 12 10 0	
Drawn Bright Steel Wire—		
Nos. 1 to 6	10 5 0 to 11 5 0	
7	11 5 0 to 12 5 0	
8	11 10 0 to 12 10 0	
9	12 0 0 to 13 0 0	
10	13 0 0 to 14 0 0	

Galvanised Fencing Strand (B.B)
7 wires.

	£ s. d.	£ s. d.
No. 0	16 10 0 to 17 10 0	
1	17 0 0 to 18 0 0	
2	17 10 0 to 18 10 0	
3	18 0 0 to 19 0 0	
4	18 10 0 to 19 10 0	
5	20 0 0 to 21 0 0	
6	20 10 0 to 21 10 0	
7	21 15 0 to 22 15 0	
8	23 10 0 to 24 10 0	
9	23 15 0 to 24 15 0	

3 wires.

	£ s. d.	£ s. d.
0	15 10 0 to 16 10 0	
1	15 15 0 to 16 10 0	
2	16 10 0 to 17 10 0	
3	17 0 0 to 18 0 0	
4	17 5 0 to 18 5 0	
5	17 10 0 to 18 10 0	
6	18 5 0 to 19 5 0	
7	19 0 0 to 20 0 0	
8	19 10 0 to 20 10 0	
9	21 0 0 to 22 0 0	

STEEL (at works)

Siemens-Martin or Bessemer.

	£ s. d.	£ s. d.
Plates	8 0 0 to 10 0 0	
Sheets	8 10 0 to 10 10 0	
Bars	7 0 0 to 9 0 0	
Angles	7 10 0 to 9 10 0	
Tees	8 0 0 to 10 0 0	
Spring steel	8 5 0 to 10 10 0	
Cast steel for tools	40 0 0 to 60 0 0	

GALVANISED IRON ROOFING SHEETS (at Liverpool).

CORRUGATED SHEETS 5, 6, 7, 8 feet long.

Gauges 16, 18, and 20, £12 to £12 10s.
22 and 24 gauge, £12 10s. to £13 10s.
26 gauge, £14 to £15.
28 gauge, £15 10s. to £16 10s.
Sheets 8 to 9 feet long, 30s. per ton extra.
Sheets 9 to 10 feet long, 40s. per ton extra.
Sheets 10 to 11 feet long, 60s. per ton extra.
Sheets 11 to 12 feet long, 80s. per ton extra.

IRON EXPORTS.

Comparative Exports of Pig and Merchant Iron, Steel and Iron Rails, and Sundries, for the Last Twelve Months.

Ports of Shipment.	1884. Jan.	1884. Feb.	1884. March.	1884. April.	1884. May.	1884. June.	1884. July.	1884. Aug.	1884. Sept.	1884. Oct.	1884. Nov.	1884. Dec.
Pig-iron.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Ardrossan	1,100	1,415	120	3,310	2,520	310	1,504	1,170	5	860	256	1,870
Barrow-in-Furness	2,980	1,800	4,605	7,118	11,429	9,680	8,505	7,476	8,400	5,860	2,898	3,770
Borrowstoness	100	1,050	1,760	1,380	3,001	3,000	950	1,630	—	2,180	410	200
Cardiff	—	20	100	—	—	43	500	—	—	50	50	—
Dundee	—	250	—	—	302	—	100	—	—	—	—	—
Glasgow	10,468	9,029	16,562	13,990	12,313	10,041	11,461	12,578	14,760	14,907	8,733	5,533
Goole	20	11	10	21	20	60	10	79	30	31	41	35
Grangemouth	574	2,899	5,736	4,434	5,251	2,544	3,546	1,775	3,765	—	1,221	4,007
Granton	—	125	—	—	50	—	—	—	60	—	60	10
Greenock	50	160	240	75	—	980	575	145	600	1,831	626	168
Grimsby	318	427	348	1,538	1,458	1,650	755	765	1,459	90	569	331
Hartlepools	719	2,307	3,091	4,010	5,494	7,329	2,360	3,335	5,480	6,218	4,559	555
Hull	272	490	888	732	546	415	552	189	671	891	88	465
Liverpool	6,988	6,025	8,997	10,819	10,000	7,221	6,755	6,093	5,130	7,557	5,501	2,952
Middlesbrough	27,086	23,901	47,793	47,509	46,556	47,323	42,636	41,205	53,574	52,932	24,737	21,599
Newcastle-on-Tyne	2,566	1,520	3,705	4,420	6,599	10,150	5,453	6,910	9,275	6,836	3,633	2,931
Newport	5	—	—	—	—	—	—	—	20	—	10	700
North Shields	300	10	—	—	40	—	—	—	—	100	—	36
Port Glasgow	—	—	—	—	—	—	—	—	—	—	—	—
South Shields	5	32	—	500	—	115	50	63	—	—	25	—
Stockton	—	30	—	90	—	—	100	—	80	—	—	—
Sunderland	—	—	—	—	—	300	100	—	—	50	—	—
Swansea	—	—	—	—	—	10	—	—	—	—	—	50
Troon	—	240	40	—	1,689	—	1,465	715	853	200	—	2,150
Whitehaven	4,550	2,250	2,930	4,190	2,037	4,950	6,870	10,960	3,860	4,875	4,220	1,550
Merchant Iron.												
Ardrossan	—	—	11	28	—	—	3	—	10	3	14	6
Barrow-in-Furness	—	—	—	—	—	—	—	—	—	—	—	—
Blyth	—	—	—	—	—	—	—	—	—	—	—	—
Borrowstoness	—	—	—	—	—	—	—	—	—	—	—	—
Cardiff	3,777	4,382	2,671	1,789	945	5,637	838	806	3,962	3,543	785	4,147
Glasgow	2,530	1,726	2,483	1,779	3,893	2,571	3,569	3,433	4,943	3,396	3,242	3,782
Goole	—	—	—	—	—	—	—	—	—	31	—	—
Grangemouth	—	—	—	27	—	—	—	—	—	—	13	7
Granton	—	—	—	—	—	—	—	—	48	68	49	106
Greenock	3	—	5	62	—	—	—	23	10	—	—	—
Grimsby	—	—	—	—	—	—	—	—	—	—	—	—
Hartlepools	317	473	197	55	61	49	33	240	94	22	14	230
Hull	1,048	888	1,144	1,309	1,083	1,611	1,912	1,671	1,888	2,088	1,858	932
Liverpool	10,852	9,506	10,993	11,938	12,089	9,252	13,320	12,125	17,529	15,201	11,228	13,168
Middlesbrough	2,667	1,376	662	523	4,589	1,001	1,715	573	242	1,863	1,330	774
Newcastle-on-Tyne	617	163	402	535	328	656	368	352	606	927	408	428
Newport	—	5	—	—	733	—	—	—	150	—	40	—
North Shields	—	—	—	—	30	—	—	—	9	—	—	—
South Shields	80	69	126	225	116	190	179	—	66	107	87	78
Stockton	—	—	14	190	—	—	—	100	—	—	—	139
Sunderland	—	—	—	—	—	—	—	—	—	—	—	—
Swansea	—	378	22	225	21	—	—	17	25	—	—	—
Whitehaven	—	—	—	—	—	—	—	—	—	—	—	—
Iron and Steel Rails.												
Ardrossan	—	3	—	—	—	—	2	—	2	2,157	33	2,156
Barrow-in-Furness	4,382	5,524	1,699	3,166	4,221	4,740	2,771	3,350	2,539	5,623	2,709	2,500
Borrowstoness	—	—	—	—	—	—	—	—	—	—	—	—
Cardiff	421	5,054	3,715	5,243	5,822	2,929	7,890	4,073	2,866	3,366	1,210	1,783
Dundee	—	—	—	—	—	—	—	—	—	—	—	—
Glasgow	—	—	—	—	—	—	77	—	3	15	4	53
Goole	—	—	200	—	—	—	—	—	955	—	1,800	780
Grimsby	—	—	—	45	—	—	—	—	255	698	—	—
Hartlepools	—	—	5	50	12	—	—	255	225	—	4	—
Hull	13	1	—	13	208	—	—	17	—	11	4	3
Liverpool	12,401	12,672	11,582	12,277	6,243	7,683	9,349	6,553	6,964	12,297	7,300	7,541
Middlesbrough	4,418	1,155	6,971	8,824	9,619	12,911	8,701	6,972	5,622	2,896	527	2,807
Newcastle-on-Tyne	—	4	—	5	20	—	—	—	—	—	34	7
Newport	4,996	5,304	6,679	15,555	14,917	8,030	10,443	9,114	2,490	5,610	3,656	4,486
North Shields	—	—	—	—	—	—	300	—	—	109	—	—
South Shields	—	—	—	—	—	—	—	—	—	—	—	—
Stockton	—	—	—	—	—	—	—	—	—	—	—	—
Sunderland	—	—	—	—	—	—	—	—	—	—	—	—
Swansea	—	—	—	—	—	—	—	—	—	—	—	—
Whitehaven	—	2	14	—	98	—	—	100	—	—	78	309
	—	—	500	642	—	—	1,450	—	—	—	—	—
Sundries. *(Including all Iron and Steel Manufactures not comprised under the above headings.)*												
Ardrossan	—	—	—	—	—	—	—	—	—	—	—	—
Barrow-in-Furness	102	355	70	68	88	120	237	98	34	241	157	275
Cardiff	124	482	406	1,123	740	202	491	507	1,828	190	370	186
Newport	2,252	185	475	778	1,979	951	3,355	410	1,868	2,328	400	518
Stockton	—	108	160	343	1,281	906	1,0.5	1,095	1,448	1,437	283	943
Sunderland	24	—	31	172	1	10	—	—	15	120	—	—
Swansea	636	195	21	328	2	62	513	469	28	872	399	275
Whitehaven	—	—	—	—	—	—	—	—	—	—	—	—

COAL AND COKE EXPORTS

To Foreign Parts from the Principal English Ports in the Months of December 1883 and 1884.

Ports of Shipment.	Coal. Dec. 1883.	Coal. Dec. 1884.	Coke. Dec. 1883.	Coke. Dec. 1884.
	Tons.	Tons.	Tons.	Tons.
Alloa	7,638	11,630	—	—
Amble	8,260	8,040	—	—
Ardrossan	7,831	3,037	—	—
Ayr	3,098	4,041	—	—
Blyth	4,322	21,824	—	—
Borrowstoness	15,879	17,730	—	—
Cardiff	554,368	443,709	1,852	3,443
Dundee	985	1,194	—	—
Glasgow	40,824	35,191	344	192
Goole	32,525	33,260	—	200
Grangemouth	16,919	39,282	100	—
Granton	3,504	10,213	—	—
Greenock	7,543	3,502	—	—
Grimsby	28,322	25,463	177	—
Hull	33,117	34,804	—	21
Irvine	280	—	—	—
Liverpool	59,781	41,691	359	414
Llanelly	4,835	4,307	—	—
Middlesbrough	1,290	1,715	1,800	1,675
Newcastle	318,259	334,241	17,180	16,180
Newport	125,274	141,611	102	103
North Shields	24,860	23,728	600	270
Port Glasgow	—	4,455	—	—
Seaham	2,880	5,111	—	70
South Shields	17,230	20,161	—	695
Stockton	—	—	—	—
Sunderland	83,966	92,055	642	970
Swansea	70,787	67,475	728	180
Troon	5,623	10,685	—	—
West Hartlepool	30,304	37,290	4,440	5,420
Whitehaven	—	—	—	—

Shipped for English Ports from the undermentioned Ports in the Months of December 1883 and 1884.

Ports of Shipment.	Coal. Dec. 1883.	Coal. Dec. 1884.	Coke. Dec. 1883.	Coke. Dec. 1884.
	Tons.	Tons.	Tons.	Tons.
Alloa	1,360	422	—	—
Amble	5,275	10,910	—	—
Ardrossan	10,508	12,637	—	—
Ayr	33,397	30,242	—	—
Blyth	2,050	1,626	—	—
Borrowstoness, including Charlestown, Inverkeithing, and St. David's	3,140	3,024	—	—
Cardiff	76,823	77,684	60	—
Dundee	—	—	—	—
Goole	3,897	15,149	—	—
Granton	3,245	3,164	—	—
Grimsby	2,866	1,604	—	—
Hartlepool	37,656	42,472	—	—
Hull	1,733	1,257	—	—
Irvine	10,174	5,582	—	—
Liverpool	47,942	59,733	—	—
Llanelly	13,488	6,657	—	—
Middlesbrough	140	1,100	—	35
Newcastle	298,816	317,780	879	540
Newport	76,595	80,016	62	—
North Shields	—	—	—	—
Seaham	45,058	64,046	—	—
South Shields	38,150	43,265	—	—
Sunderland	206,296	215,125	—	130
Swansea	62,297	45,764	102	7
Troon	21,640	14,960	—	—
Whitehaven	11,810	11,063	—	—

RATES OF FREIGHT.

The current rates for coal and iron are :—

	Newport, Newcastle or Sunderland.	Newport, Cardiff, or Swansea.		Newport, Newcastle or Sunderland.	Newport, Cardiff, or Swansea.
	s. d.	s. d.		s. d.	s. d.
Aden	—	15 0	Messina	7 0	7 6
Alexandria	—	10 9	Montevideo	—	21 0
Alicante	—	10 0	Montreal	6 0	—
Ancona	—	10 0	Muscat	—	—
Athens	—	—	New Orleans	—	11 0
Bahia	17 0	16 6	New York	—	—
Barbadoes	—	13 0	Naples	—	11 6
Barcelona	—	12 9	Odessa	—	10 3
Batoum	—	—	Oporto	8 0	—
Bermuda	—	11 0	Padang	—	23 0
Bombay	18 0	19 0	Palermo	7 6	9 3
Brindisi	—	10 6	Panama	—	25 0
Buenos Ayres	—	23 6	Para	—	17 0
Bussorah	—	20 0	Penang	—	21 0
Cadiz	8 6	—	Pernambuco	—	15 6
Cagliari	11 0	11 6	Port-au-Prince	—	—
Calcutta	—	16 0	Porto Rico	—	11 0
Callao	—	24 0	Port Said	—	10 9
Cape de Verde	—	10 0	Reunion	—	25 0
Cape Good Hope	20 0	19 6	Rio Grande do Sol	—	47 6
Cardenas	—	—	Rio Janeiro	20 0	20 0
Carthagena	—	9 6	Rosario	—	30 0
Cienfuegos	—	12 0	Saigon	—	22 0
Civita Vecchia	10 0	11 3	St. Catherine's	—	25 0
Coconada	—	—	St. Jago de Cuba	—	—
Colombo	18 0	19 6	St. Lucia	—	—
Colon	14 0	16 0	St. Paul de Loando	—	20 0
Constantinople	—	10 6	St. Thomas	—	9 6
Corfu	—	11 0	San Francisco	18 0	18 6
Demerara	—	14 0	San Sebastian	—	—
Fayal	—	13 0	Santos	20 0	21 0
Fiume	—	—	Savona	—	11 0
Galatz	—	7 6	Sebastopol	—	6 0
Genoa	—	11 0	Seville	—	—
Gibraltar	—	7 6	Seychelles	—	—
Havana	—	—	Shanghae	—	29 0
Hiogo	—	—	Sierra Leone	—	17 6
Hong Kong	—	22 0	Singapore	19 0	20 0
Iquique	19 0	22 6	Smyrna	—	12 0
Jamaica	—	8 6	Spezzia	—	—
Java	19 0	19 6	Syra	—	—
Kertch	—	—	Taganrog	—	—
Kurrachee	—	16 0	Tarragona	—	11 0
Leghorn	—	10 9	Teneriffe	—	9 6
Lisbon	5 9	5 9	Tientsin	—	—
Madeira	—	10 6	Trieste	9 6	—
Madras	—	20 0	Trincomalee	—	19 0
Malaga	8 6	—	Trinidad	—	11 6
Malta	—	9 0	Valencia	10 0	10 0
Maranham	—	15 0	Valparaiso	—	21 8
Marseilles	11 6	fr. 13	Venice	10 6	11 6
Martinique	—	—	Yokohama	—	—
Mauritius	—	—	Zanzibar	—	23 0

NEW COMPANIES.

American Exhibition, Limited.—This company was registered on the 1st inst., with a capital of £100,000, divided into 500 preferred shares and 500 deferred shares of £100 each, to purchase upon terms of an agreement of the 1st inst., from Mr. John Robinson Whitley, of 7, Poultry, and General Charles B. Norton, of Boston, U.S.A., the goodwill and benefit of a scheme for holding in or near London an exhibition of American products and manufactures.

Anglo-American Tannery Improvements Company, Limited.—This company was registered on the 3rd inst., with a capital of £20,000, in £5 shares, of which 600 are preference shares, for the manufacture of tannery apparatus, and for tanning purposes. The company will purchase the English letters patent, No. 11,442, of August 19, 1884, and the United States patent No. 142,421, of September 6, 1884, granted to Caesar Kraestner, of Magdeburg.

Barancannes Copper Mining Company, Limited.—On the 6th inst. this company was registered, with a capital of £100,000, in £1 shares, to acquire and work the Barancannes mine, situate at Huerta de Revisa, near the town of Almadova, Portugal.

Beatty & Blackham, Limited.—The company proposes to carry on business as iron and steel and waggon and implement manufacturers, and will take over certain businesses referred to in an unregistered agreement of August 19, 1884. The company was incorporated on January 5, with a capital of £225,000, in £50 shares.

British Congo Company, Limited.—On the 7th inst. this company was registered, with a capital of £500,000, in £5 shares, to form and carry on trading stations and depots in Africa or elsewhere.

Corytton Manganese Company, Limited.—Upon terms of an unregistered agreement of November 27, between Henry Martin and James White, this company proposes to purchase leasehold premises, manganese deposits, and other property therein referred to. It was incorporated on the 3rd inst., with a capital of £35,000, in £5 shares.

Jablochkoff and General Electricity Company, Limited.—This company was registered on the 7th inst., with a capital of £20,000, in £100 shares, to carry on the business of an electrical company in all branches.

London, Ham Hill and Doulting Stone and Lime Company, Limited.—This company purposes taking over the business and property of Messrs. Staple & Hann, quarrymen, stone merchants, masons and lime factors, of Ham Hill, Doulting and Shepton Mallet, Somerset. It was registered on the 1st inst., with a capital of £20,000, in £10 shares.

Mawddach Gold Mining Company, Limited.—This company proposes to acquire leasehold interest in mines at Gwynfynydd, parish of Trawsfynydd, in the county of Merioneth. It was registered on the 1st inst., with a capital of £60,000, in £1 shares.

New Ferry Brick Company, Limited.—This company proposes to purchase the goodwill and property of the New Ferry Brick and Tile Works, situate on the shore of the River Mersey, at New Ferry, Chester. It was registered on the 2nd inst., with a capital of £30,000, in £5 shares.

EXPORTS OF IRON, ETC., FROM BRISTOL CHANNEL PORTS TO UNITED STATES AND CANADA

For Month ending December 31, 1884.

Destination.	Rails.	Tin-plates.	Crop Ends.	Canada Plates.	Black Taggers.	Sheet Iron.	Coke.
	Tons.	Boxes.	Tons.	Boxes.	Boxes.	Bdles	Tons.
New York	—	122,253	—	—	—	842	—
Philadelphia	—	25,913	—	—	—	—	—
Baltimore	—	19,173	—	—	—	—	—
Charleston	—	—	—	—	—	—	—
Victoria, Vancouver Island	2,200	—	—	—	—	—	—
San Francisco	—	—	—	—	—	—	1,631
Totals	2,200	168,339	—	—	—	842	1,631

There were also exported to New York 100 boxes of ferro-manganese, 1,961 ingots of type metal, 16,000 fire-bricks, 853 casks of arsenic, 48 casks of Dinas fire-bricks, 17 pigs of lead, and 555 tons of phosphates; to Philadelphia, 15,000 fire-bricks; and to Charleston, 1,000 tons of superphosphate.

Colour of New South Wales Gold.—The gold of New South Wales is usually of fairly deep yellow, being rather lighter than Victorian and not so light as much of the Southern Queensland gold, but occasionally specimens of very pale and of very dark gold are met with. The quantity of silver present greatly affects the colour of the metal.

Prices Current of Manufactured Goods

OF

BIRMINGHAM AND DISTRICT.

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January 14.

There appears to be rather more doing in the hardware trades this week, and, if anything, a slightly steadier tone is noticeable in prices, although as yet no improvement whatever can be said to have taken place, and no alterations are reported. Foreign orders for several kinds of goods are more plentiful, especially from the New Zealand, Cape, and South American markets; home requirements, however, are nothing extraordinary for the time of year.

ABRIDGED LIST.

AMERICAN WIRE HOBS.—1 lb. 42/6; 1½ lb., 36/6; 2 lb., 33/6; 2½ lb., 31/6; 3 lb., 30/6 per cwt.

ANCHORS.—Common, 1 to 10 cwt. 13/ per wt, in 2-ton lots.

ANVILS.—Common, 17/6 per cwt.; best anvils, not warranted, 19/6 per cwt.; best warranted anvils (bicks tied in 1 to 5 cwt.), 21/6 per cwt.

AUGERS.—Shell, ½-inch to 2-inch, 11/ to 44/ per doz., less 55% and 2½, screw, ½-inch to 2-inch, 16/ to 64/ per doz., less 55% and 2½.

AXES.—Ship carpenters', 0/4½ to 0/5½ per lb.; Kent and house carpenters' ditto, 0/4 to 0/5; ditto, steel polished, 0/5 to 0/6; felling axes, 0/4½ to 0/4½; bright and blued, solid steel, 0/7 to 0/8. American felling or wedge axes, steel, polished, 0/11 per lb.

AXLE PULLEYS.—Iron, 7/9 to 26/, 1½-inch; brass face ditto, 26/ to 46/, 1½-inch.

AXLES.—37½ % to 50 %.

BACK BANDS.—3 lb. and larger, 16/ per cwt.; ditto, smaller, 2/ per cwt. extra; double swivel, ditto, 1/ per cwt. extra.

BASINS.—Bright tinned, shallow, 8-inch 2/3; 9-inch, 2/6; 10-inch, 3/1; 11-inch, 3/9; 12-inch, 4/3; 13-inch, 4/9; 14-inch, 5/9; 16-inch, 8/ per doz.; galvanised ditto, 8-inch, 2/; 9-inch, 2/3; 10-inch, 2/9; 11-inch, 3/6; 12-inch, 4/; 13-inch, 4/6; 14-inch, 5/6; 16-inch, 7/3 per doz.

BASTARD BELLOWS.—52½ %; best extra nailed bastard bellows, 47½ %; best improved long Bristol, 42½ %; common smiths' bellows, 62½ %; best warranted extra, double nailed, 45 to 50 %; ditto, with movable pipe for shipment, 52½ %.

BATTERY KETTLES.—12/ per cwt.; brass jelly pans, with bails, 0/9½ to 0/9½; without bails, 0/10½ to 0/10½; Maalin kettles, cast, 4 to 16-inch, 0/9 to 0/9½ per lb

BED SCREWS.—London, black heads, 6, and 7-16, and ½-inch, 8/3 to 10/3 per gross; London heads, with bright turned collar, 6 and 7-16, and ½-inch nuts, 11/6 to 12/6; black welded heads, 9/ to 9/; common slit heads, 6, and ½, and ½-inch, 8/6 to 9/6; bright turned notched heads, 6, and 7-16, and ½-inch, 12/ to 18/; black notched heads, 10/ to 11/ per gross.

BEDSTEADS.—Cheap stamp, 6-foot by 3-foot 6-inch, 7/3 to 9/3 each; cheap French, 6-foot by 3-foot 6-inch, 8/3 to 10/3 each, rising 0/6 tor every 6-inch.

BELLS.—House brass, rough 0/7½ to 0/9½ per lb.; turned edge 0/8 to 0/10 per lb.; turned and lacquered on edge, 1/4 to 1/9 per lb.; cattle and sheep bells, with brass loops, 1/ to 1/2 per lb.; clock bells, 1/4 to 1/5 per lb.

BELL STAPLES.—Fine tinned, ½-inch, 0/1; ¾-inch, 0/1; 1½-inch, 0/1; 2-inch, 0/1½; 2½-inch, 0/1½ per gross, net.

BLACKSMITHS' TONGS.—23/ per cwt.

BOLTS.—Solid end tower, 75 to 77½ %; ditto, solid end barrel, 70 to 72½ %; best solid tower bolts 75 %; japanned Scotch tower bolts, 55 %.

BOLTS AND NUTS.—Black, ¼, and 5-16 to 2-inch and under, 2/9 and 3/4; ⅜-inch, 4/9; 7-16-inch, 5/10 per gross. ¼ and 9-16-inch, 21/; ⅜ and 11-16-inch, 18/; ½ to 1¼-inch, 17/ per cwt. 2½ to 3-inch, ½, 3/3; 5-16-inch, 5/0; ⅜-inch, 5/0; 7-16-inch, 7/1 per gross. ¼ and 9-16-inch, 19/; ⅜ and 11-16-inch, 17/; ½ to 1¼-inch, 16/ per cwt. Square heads, round necks, square nuts, 2½ and 3-inch × ½, 4/; 5-16-inch, 4/7; ⅜-inch, 6/; 7-16-inch, 7/4 per gross; ½-inch, 20/; ⅝-inch, 17/6; ¾-inch, 16/6 per cwt. Bright engineers' hexagon nuts, ⅜-inch, 10/; ½-inch, 11/; ⅝-inch, 14/; ¾-inch, 19/; ⅞-inch, 20/; 1-inch, 32/ per gross. Black nuts, square, hank, ¼-inch, 14/; ⅜-inch, 12/6; 1-inch, 12/6; 1¼-inch, 14/6 per cwt. delivered.

BOX IRONS.—Real fine wrought iron, 20 to 25 %; fine cast, 60 %; middle cast, 50 to 60 %; Victoria charcoal box irons, 45 to 50 %; ordinary charcoal ditto, 60 to 65 %.

BRASS.—Rolled, 2 to 12-inch wide to 30 W.G., 0/6½ per lb. Brass sheets, 24 and 28-inch, 8 lb., and upwards, or 27 W.G., 0/7½ per lb.

BRASS CORNICE POLE RINGS.—Light, middle, and strong, 45 %.

BRASS HEAD NAILS.—87½ to 65 %; star head, 50 %; brass plated countersunk head, 30 to 35 %.

BRASS SHOE BILLS.—0/8½ per lb.; brass scale pans, 1/4; brass toddy kettles, 20 to 25 %.

BRASS SHUTTER KNOBS.—55 %; brass cupboard turns, 55 %; brass draw knobs, 55 %; brass ashpan knobs, 55 %; brass range knobs, 40 to 45 %.

BRASS WIRE.—0/5½ per lb. up to No. 20 W.G.

BRUSHES.—Painters', 50 to 75 %; best ditto, 15 to 50.

CARPET RINGS.—1/ to 1/4 per gross.

CART TRACES.—9 to 12 links to foot, 15/6 to 18/ per cwt.

CAST-HEADED BILLS.—¾ by 8-oz., 12/ to 14/; fine round cast bills, ⅝-inch, 11/ to 15/; strong round ditto ⅝-inch, 12/6 to 14/; cast slate pegs, 10/ to 12/.

CHAIN.—Machine made, wire, single link, "iron," 62½ %; double link ditto, 60 %; machine-made wire chain, single link, "brass," 60 %; registered ditto, 55 %; close link brass chain, 55 %; oval link brass chain, 62½ % brass clock chain, 60 %; short link tested (rigging) chain, 3-16-inch, 19/6; ¼, 18/; 5-16, 14/3; ⅜, 13/9; 7-16, 12/9; ½, 12/; ⅝, 10/10; ¾, 10/6; 1-inch, 10/ per cwt.; well chain, twisted or straight link, ¼-inch, 26/3; 3-16, 18/6; ¼, 15/6; 5-16, 14/3 per cwt. delivered; japanned pillar chains, 1 yard, 16 by 6, 5/6 to 6/4 per dozen; japanned manger chains, 1¼ yard, 16 by 6, 7/ to 8/3; japanned rack, 1 yard, 18 by 6, 8/ to 9/; japanned dog, 1¼ yard, 12 by ⅞, 5/6 to 6/6; 2 yards, 14 by 6, 10/ to 11/; cowties, 6/6 to 8/6; open ring, 6/6 to 8/6; close ring, 5/6 to 6/6 per doz; japanned watering chains, 14 by 6, 4/ to 5/; tinned ditto, 4/6 to 5/6; bullock chains, ¾-inch hook at each end, 14/3 to 15/.

CHAIR NAILS.—Brass, lacquered, or gold colour, No. 1 to 12, 2/ to 7/6 per 1000; machine polished, 1/9 to 7/3 per 1000; lacquered or gold coloured, 2/ to 1/2½ per lb.; discount per 1000, 55 %; per lb., 5 %, delivered.

CHAIR WEBBING.—No. 9, 4/8; 10, 4/8 C2, 4/1; C10, 4/6 per gross of 60 yards.

CHEST HANDLES.—Improved japanned, 82½ %; broad plate, strong and extra strong, 15 to 65 %.

CHIPPING CHISELS.—Solid cast steel, 0/6 per lb.

COACH BOLTS AND NUTS.—Round or cheese heads, square necks and nuts, black, 3-inch by ¼, 3/9; ⅜, 4/1; ½, 4/9; ⅝, 5/3; ¾-inch, 5/9 per gross; bright, 3-inch by ¼, 4/4; ⅜, 4/10; ½, 5/4; ⅝, 5/10; ¾-inch, 6/4 per gross; black, 3-inch by 5-16, 4/4; ⅜, 4/10; ½, 5/4; ⅝, 5/10; ¾-inch, 6/4 per gross; bright, 3-inch by 5-16, 5/1; ⅜, 5/7; ½, 6/1; ⅝, 6/7; ¾-inch, 7/1 per gross, delivered.

COACH SCREWS.—Patent bright pointed, 2-inch and under, ¼-inch, 2/7; 5-16, 3/2; ⅜, 4/0; 7-16, 4/10 per gross; ½-inch, 24/; ⅝-inch, 21/; ¾, 20/ per cwt.; 4½ to 6-inch long ¼-inch, 24/6; 7-16, 23/; ½, 19/; ⅝, 17/; ¾, 16/ per cwt.; above 6-inch, ¼-inch, 23/6; 7-16, 22/; ½, 18/; ⅝, 16/; ¾, 15/ per cwt.; 1/ per cwt. extra for hexagon heads delivered.

COACH SPRINGS.—40 % to 45 %.

COCKS.—Brass range cocks, ½-inch, 30/; ⅝, 42/; ¾, 53/6; ⅞, 64/; 1 inch, 75/ per doz., less 33 % discount; brass racking cocks, fast key, 1 inch, 11/; 5-16, 13/; ⅜, 15/; 7-16, 18/; ½, 23/; 9-16, 34/; ⅝, 38/; ¾, 47/; ⅞ 89/; 1-inch, 66/ per doz.; loose key, 1/ to 18/ per doz. extra; discount, 60 %.

COFFEE MILLS.—Square box, 30 to 60 %; common post, 30 to 40 %; best brass bushed, 40 to 45 %; London, 40 to 45 %.

COFFIN FURNITURE.—Registered, 55 %; ditto, common, 80 %.

COFFIN NAILS.—Black, 55 to 60 %; white, 45 to 55 %; black coffin bullens, 50 to 55 %; white, 40 to 45 %.

COPPER BOAT NAILS.—½-inch to 2-inch and above, 1/6 to 0/11 per lb.; copper boat rovets, ½ to ⅝-inch and above, 1/4 to 0/11 per lb.; cut copper nails and tacks, ½-inch to 1-inch and above, 0/10½ to 0/9½

COPPER BRADS AND BILLS.—0/9½ per lb.

COPPER NAILS AND TACKS.—Wrought, 1-inch, 1/0½ per lb.

COPPER SCALE PANS.—1/8 to 1/9 per lb.

COPPER WIRE.—0/8½ per lb. up to No. 20, W.G. delivered.

CORNICE POLES.—2½-inch, brass, best burnished, 4/6 per foot, less 45 %; ⅞ covered brass poles, 1/2 per foot, less 45 %; 2½-inch real birch cornice poles, polished, self or mahogany colour, with ends and rings complete, 0/8 per foot; 2½-inch real mahogany cornice poles, with ends and rings complete, 1/7 per foot; 2¼-inch birch rings, polished, self or mahogany colour, 19/ per gross; 2½-inch real mahogany rings, 28/ per gross net.

CURTAIN RINGS.—Brass, 45 to 50 %.

CUT NAILS.—Clasp, rose, and clout, 3 to 9-inch, 8/6; 2½ and 2⅞-inch, 9/; 2 and 2½-inch, 9/6; 1⅞-inch, 10/; 1½-inch, 10/6; 1¼-inch, 11/6; 1-inch, 13/6; ¾-inch, 15/9 per cwt.

DISH COVERS.—Blue japanned wire, 3/3 to 5/6 per set of 6.

DOOR SPRINGS.—X, 85 %; XX, 77½ %; XXX, 72½ %; XXXX, 65 %; brass circular and iron circular, 55 to 65 %; brass reliance, 10 to 20 %; climax, 20 %; universal, 55 to 60 %; paragon, 20 %; O'Connor's patent lever hinge springs, 10 to 20 %. O'Connor's vertical spring hinge door spring, 15 to 25 %; Gerish's spring hinges, iron, 20 to 25 %; brass, 10 to 20 %.

FENDERS.—Light kitchen, 5-inch, assorted, 2-foot 6-inch to 3-foot 6-inch black fronts, 28/ to 30/ per doz.; bright fronts, 31/6 to 34/; Manchester pattern kitchen fenders, 5-foot, 1-inch, top, black front, 2-foot, 9-inch, to 3-foot, 3-inch 37/6 to 40/ per doz.; 3-foot, 9-inch, 42/6 to 47/6 per doz.

FILES.—57½ % the list.

FIRE-IRONS.—Kitchen, in sets, 0/5 to 0/6 per lb.; tongs, 0/5½ to 0/6; pokers, 0/4½ and 0/5

FISHHOOKS.—Best, 40 to 45 %; common, 60 to 65 %.

FLOOR BRADS.—2-inch, 8/9; 2½-inch, 8/6; 2½-inch and larger, 8/3.

FRY PANS.—7½-inch to 17-inch, oval, bright, 12/ to 55/ per doz.; tinned, 14/ to 59/ per doz.; fry pans, 5½-inch to 10-inch round, bright, 10/ to 26/ per doz.; tinned, 11/6 to 29/ per doz.; fry pans, 10½-inch to 15-inch round bright, 30/ to 60/ per doz.; tinned, 33/ to 64/ per doz.; all fry pans, 77½ % and 5 %. delivered.

GALVANISED BUCKETS.—10-inch, 38 lb. to the doz., 4/3; 11-inch, 4/9; 12-inch, 5/9; 13-inch, 6/9; 14-inch, 8/3; 10-inch, 42 lb., 5/3; 11-inch, 5/9; 12-inch, 6/9; 13-inch, 7/9; 14-inch, 9/3.

GALVANISED WASHING TUBS.—Oval, 16 to 30-inch, 11/6 to 24/ per doz.; ditto, extra deep and strong, 14/ to 31/ per doz.

GALVANISED WIRE NETTING.—1½-inch mesh and larger, 70 % and 5 % and 5 %; 1½-inch to ⅝-inch, 75 % and 5 % and 5 %; ½-inch and ⅜-inch, 80 % and 5 % and 5 %, delivered.

GIMBLETS.—50 %.

GIMP PINS.—Best black iron wire, ⅜ by 18, ½ by 18, ⅝ by 18, all 0/5 per lb.; 19 gauge, 0/1 per lb., extra; coloured, 0/1 extra; best bright iron panel pins in 1 lb. packets, ⅝, ¾, and ⅞, by 17-inch, 0/3; 1 and 1½ by 16-inch, 0/3; 1½ by 15-inch, 0/3 per lb.; tinned, 0/1½ per lb., extra; brass panel pins, 0/9 per lb., all sizes; copper ditto, 1/ per lb., all sizes; brass escutcheon pins, ⅜ by 16, ½ by 15, ⅝ by 15, ¾ by 14, ⅞ by 14, 1½ by 13-inch, 0/2 per lb.; brass gimp pins, 19 gauge, 1/0 per lb.; ditto, 18 gauge, 0/11 per lb.

GRID IRONS.—London pattern, fluted, 72½ %; light, ditto, 80 %, hanging round bar, 62½ %; doublet, 47½ %; round bar, 0/1½ per bar, 70 %; best fluted bar, 70 %; flat bar, 70 %; common flat bar, 70 %; common gridirons, 0/1, 0/1½, and 0/2, per bar less, 67½ % to 77½ %.

HAMMERS.—Cast steel stone breaking quarry, 28/ per cwt.; solid cast steel engineers' hand, 1½ lb. each and above, 0/7½ per lb.; solid cast steel boiler makers' hand hammers, 1½ lb. each and above, 0/7½ per lb.; iron and steel boiler makers' sledge hammers, 6 lb. and above, 17/ per cwt.; iron and steel sledge hammers, 6 lb. and above, 18/6 per cwt.; solid cast steel sledge, 28/ per cwt.; platelayers' keying, 28/ per cwt; holdfasts, japanned, 18/ to 20/ per cwt.; common Kent hand hammers, 55 %; patent hasps and staples, 20 to 25 %.

HINGES.—Patent, edge butts, 60 to 70 %; patent Scotch butts, 55 to 60 %; broad and narrow, same discounts; patent table, bed, and back-flap hinges, 57½ %; patent chest hinges, 57½ %; patent strap hinges, 57 %; H hinges, 55½ %; HL hinges, 55 %; japanned and Garnett hinges, double washered, light and strong, 40 %; best best London or Lancashire patent tees, 70 %; patent light japanned Scotch tees, 70 %; light patent hook hinges on plate and to drive, 30 to 35 %; weighty Gothic, 20/ to 24/; scolloped edges, not japanned, 22/ to 24/; Scotch japanned tees, double washered, 20/ to 23/; Gothic Scotch japanned tees, 19/ to 22/; Gothic Scotch tees, self colour, 17/ to 24/; light "patent" broad Butts, polished joint, No 200, 50 %; ditto, No. 564, 35 %; box hinges, 50 %; light Parliament hinges, best strong, 47½ %; best best ditto, 37½ % off list. Wrought hinges, common, 55 %; best, 52½ %; best best, 50 % off list. Heavy wrought hinges, common black, 13/6 per cwt.; ditto, common bright, 18/ per cwt.; filed edges, 17/6; japanned Gothic fancy, 15/6 to 18/; common bright, broad eye, 17/ to 18/; japanned, broad eye, fancy, 18/6; best bright, 21/ to 23/; best broad eye, 21/ to 23/ per cwt.; cast hinges, polished joint, light patent tariff butts, 200, 55 %; 333, 40 %; 564, 47½ %; pressed hinges, common, 65 to 70 %; best, 57½ to 62½ %; common brass, butt hinges, 1½ inch, 14/ per gross pairs net; very light, 8/6.

HOLLOWWARE.—Best, 50 %; common, 60 and 55 %; enamelled ditto, best, 35 %; common, 40 %.

HORSESHOES.—Fullered fore, 16/ to 18/; fullered hind, 17/ to 19/; stamped fore, 16/6 to 18/6; hind, 17/6 to 19/6.

IRONFOUNDRY, GENERAL.—Ash grates, 7/9 to 9/ per cwt; air bricks, 2/9 to 3/6; half-single, 3/3 to 3/6; double, 5/6 to 6/; bars and bearers, 7/3 to 8/3; barrow wheels, 8/; bake pans, 8/6 to 9/6; camp ovens, 9/; cooking stoves, 9/ to 10/6; cellar grating, 8/6; clock weights, 7/6; Dutch stoves, 8/6 to 10/; dumb bells, common, 7/ to 9/; best best japanned, 15/ to 17/6; furnaces up to 50 gallons, 1/3½ to 1/4; galvanised ditto, 0/7 to 0/9 per gallon; furnace doors, 9/6 to 12/; furnace grates, 8/6; heaters for box irons, 6/6 to 7/6; heaters for urns, 8/6 to 9/6; oven doors and frames, 8/6 to 10/6; three legged pots, Danish and plumbers', 9/; plumb bobs, 10/6; pudding pans, 10/6 to 11/6; pump spouts, 10/6 to 13; sash weights, 4/6; ditto with pulleys, 7/ to 8/6; shoe anvils, 8/6; Italian irons, 50 %.

KETTLES.—Round copper, bare rivets, 1/6 to 1/8 per lb.; light round covered rivets, 1/6 to 1/6 per lb.; loaded, 1/4 to 1/6; oval copper kettles, bare rivets, 1/9 to 1/10 per lb.; oval bare rivets, raise down, 1/10 to 2/0 per lb.

KEYS AND BLANKS. 50 to 65 %; extra strong plate, 30 to 37½ %; extra strong, Banbury pinned keys, 35 to 40 %.

KNITTING PINS.—Iron, 0/2½ to 0/3 per lb.; steel ditto, 15 to 18 W. G., 1/8 to 1/9 per gross, brass ditto, 1/1 per lb.

LADLES.—Melting, 2-inch to 8-inch, 2/ to 16/ per doz., less 20 %; pitch, 3-inch to 6-inch, 3/6 to 12/ per doz., less 10 %.

LATCHES.—Norfolk, common, 82½ %; Suffolk, 75 %; best ditto, 55 %.

LOCK FURNITURE.—Brass, 67½ %; chain lock furniture, 37½ to 45 %; ebony lock furniture, 2½-inch.

NAILS.—Patent forged nails, "iron or steel," strong rose (flat points), 1-inch, 4 lb., 45/6; 1¼-inch, 6 lb., 28/; 1½-inch, 7 lb., 30/; 1¾-inch, 8 lb., 34/6; 2-inch, 10 lb., 32/6; 2¼-inch, 12 lb., 31/; 2½-inch, 17 lb., 28/6; 2¾-inch, 20 lb., 28/; 3-inch, 23 lb., 27/9 per cwt.; fine rose (flat points), 1-inch, 2¼ lb., 72/6; 1¼-inch, 3¼ lb., 58/6; 1½-inch, 4 lb., 54/6; 1¾-inch, 5 lb., 48/6; 2-inch, 7 lb., 45/6; 2¼-inch, 8 lb., 41/6; 2½-inch, 10 lb., 37/9; 2¾-inch, 14 lb., 34/; 3-inch, 17 lb., 32/ per cwt; coopers' rose (sharp points), 1½-inch, 7 lb., per m., 2/4; 1¾-inch, 8 lb., 2/7; 2-inch, 10 lb., 3/; 2¼-inch, 12 lb., 3/5; 2½-inch, 17 lb., 4/5½; 2¾-inch, 20 lb., 5/1; 3-inch, 23 lb. 5/11 per m.; fine clasp (sharp points), 1¼-inch, 4 lb., per m., 2/4; 1¾-inch, 5 lb., 2/4; 2-inch, 7 lb., 2/10; 2¼-inch, 8 lb., 3/0½; 2¾-inch, 10 lb., 3/6½; 3-inch, 14 lb., 4/4½ per m.; best Canada (sharp pointed), 1¼-inch, 4 lb., per m., 2/; 2-inch, 7 lb., 2/9; 2¼-inch, 8 lb., 3/0½; 2½-inch, 12½ lb., 4/0½; 3-inch, 14 lb. 4/4½ per m.; pound nails, 6 dy, 2¼-inch, 23/6; 8 dy 2½-i ch, 27/; 10dy, 3¼-inch, 23/6; 20dy, 4-inch, 23/ per cwt.; discounts 52½ % off iron, 47½ % off steel; nails, cast lath, 9/ per cwt.; wall nails cast, 8/6 per cwt.; wrought, best, countersunk clout and cone head nails 1-inch, 29/3; 1¼-inch, 24/6; 2-inch, 21/9; 2¾-inch, 19/ per cwt.; best fine Swedish iron countersunk horse nails, stamped, 6 lb. per m., 49/6 per cwt.; 8 lb. per m., 46/; 10 lb. per m., 43/3 per cwt.; 12 lb. per m., 41/6 per cwt., or subject to 47½ % Derby list; wrought rose and deck head spikes, 4-inch, 11/6; 5-inch, 10/3; 6-inch, 9/6; 7-inch, 9/3 per cwt.; galvanised, 4/9 per cwt extra; wrought rose nails, flat or sharp points, 2-inch, 20/3; 2½, 19/3; 2¾, 17/6; 3, 16/ per cwt.; wrought nails, May, 1822, list, 45 to 50 %; wrought Bromsgrove nails, March 1878 list, 30 to 35 %; composition sheathing and slating nails, ¾-inch, 3/8½ list, per lb.; copper slating nails, cut, 1 to 1¼-inch and upwards, 0/9 to 0/9½ per lb.

PICKS.—Iron and steel excavators, 0/3 to 0/5 per lb.

RAILWAY BEATER PICKS.—20/ to 22/6 per cwt., delivered in London or Liverpool. Rakes, light garden, 50 to 60 %; light solid end rakes, 47½ to 52½ %; bolstered teeth garden rakes, 50 %; solid end, bolstered teeth garden rakes, 40 to 45 %.

RIDDLES.—Common ½-inch by 18, 21/ per doz.; do., foundry of gravel, ½-inch by 18, 27/ per doz., less 55 %

RIVETS.—Copper hose, ⅝-inch by 8 and above, 0/9½ per lb.; machine-made wire No. 6, 16/0 per cwt.; iron boot rivets, 17/6 to 19/ per cwt.; brass ditto, 0/7½ per lb. Ship, tank, and girder rivets, ½-inch, 15/; ⅝-inch, 12/6; 7-16-inch, 12/; ½-inch, 11/3 per cwt. Best boiler rivets, 1/ per cwt. extra.

SAD IRONS.—Common, 7/6 to 8/ per cwt., delivered; best japanned, 12/6 to 13/6 per cwt.; best best japanned, 15/6 to 18/6 per cwt.

SASH CHAIN.—Copper, 55 %; iron prepared ditto, 50 %.

SCALES.—Copper, 72½ to 77½ %.

SCREWS.—Iron wood screws, 75 %; brass ditto, 62½ % and 10 %; copper wood screws, 35 %; stove ditto, 65 %; dowel ditto, 70 %; brass heading screws, 40 %; "German" wood screws, 75 %, and 2½ % delivered.

SCREW STOCKS and DIES.—57½ % off list.

SHIP AND TURRET BELLS.—1/4 per lb.

SHIP SCRAPERS.—Black steel blades 50 to 55 %; bright, 47½ to 52½ %; cast steel black, 47½ to 52½ %; bright, 42½ to 47½ %; best cast steel black, 40 to 45 %; bright 30 to 40 %.

SHOVELS.—Common iron, round back, dust, 4-inch to 8-inch, 1/9 to 6/ per doz, less 25 %; socket handles, 1/ per doz. extra; Bell mouth shovels, 7-inch to 10-inch, 2/ to 4/ per doz., net; ditto, japanned, with wood handles, 3/4 to 5/6 per doz., net; shovels, all steel, crutch handles, No. 2, 14/6; No. 3, 15/6; No. 4, 17/6 per doz; No. 5, 17/6 per doz.; eye handles, 1/ per doz. extra; riveted ditto, 2/ per doz. extra; spades and shovels, common, 62½ %; second, 52½ %; best, 47½ % to 37½ % discount off the list.

SIEVES.—Brass and iron, 55 % off list.

SOFA SPRINGS.—"Bright," 8 by 5-inch, 6/6; 8 by 6-inch, 6/9; 8 by 7-inch, 7/9; 8 by 8-inch, 9/0; 8 by 9-inch, 9/3; 8 by 10-inch, 10/6 per gross. "Coppered," 1/ per gross extra up to 8 by 8-inch; all above, 1/6 per gross. Coiled, 0/6 per gross extra, delivered.

SPINDLES.—Wilkes', 18/ per doz. sets; sham ditto, 8/ to 9/ per doz. sets.

SPLIT COTTERS.—70 % off list. **American wire tacks, 70 % off list.**—W. Gorse and Son, Icknield Square, Birmingham.

SPOKES.—Steel bicycle and perambulator, tinned, cut to lengths, and headed, No. 6, 27/6; 7, 28/; 8, 28/6; 9, 29/; 10, 29/6; 11, 30/; 12, 31/6 per cwt. Bright, 9/ per cwt. less.

STAIR RODS.—Turned ends, 85 %; ditto, solid fancy ends, 77½ %.

STAPLES.—Wire fencing, ½ to 2-inch, No. 6, 11/; No. 7, 11/3; No. 8, 12/; No. 9, W.G., 12/6 per cwt., delivered in London.

STEEL TOYS.—10 to 30 % off the list.

STEELYARDS.—65 %.

TACKS.—Fine cut, in 1 and 7 lb. parcels, ¼-inch, 29/6 ⅜-inch, 28/6; ½-inch, 19/9; ⅝-inch, 18/3; ¾-inch, 17/6; ⅞-inch, 16/9; 1-inch, 16/9 per cwt.; tinned, 6/ per cwt. extra; in ¼ cwt. bags, 1/ per cwt. less.

TINPLATES.—Best charcoal I.C., 21/ per box; 2nd quality ditto, 20/ per box; best coke, 18/; coke 17/ per box.

TIP NAILS.—In 1 and 5 lb. parcels, ½-inch, 16/; ⅝-inch, 14/6; 1-inch, 13/6; 1½-inch, 13/; 1¼-inch, 14/; best iron, 1/; charcoal, 2, per cwt. extra.

TRAPS.—Bow spring, sham Dorset and real Dorset rabbit traps 45 to 65 %, list prices; common traps, 4-inch, 5/6 to 8/ per doz. net; run traps, 2½-inch, 4/ to 8/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45 %; hawk or pole traps, 50 to 60 %; wrought mole traps, japanned, 2/6 to 3/9; galvanised, 3/ to 4/9

TUBES.—Iron gas, 80 %; fittings, 80 %; galvanised iron gas tubes, 60 %; fittings, 65 %; lap welded boiler tubes, 52½ %, delivered; bell tube, zinc, 33/ to 35/ per cwt.; patent cased tube, 60 to 67½ %, cut to lengths if required; polished and lacquered twisted brass tube, 52½ %; patent cased taper iron tube, 40 to 45 %; patent taper iron tube, 40 to 45 %; parallel iron brased tube, 40 to 45 %; twisted iron parallel tube, 40 %; patent cased parallel tube, 42½ %; brass tubes, plain rough, ⅛ inch and above, 0/8½; other shapes 0/9½ to 0/10 per lb.; bell copper tube, ⅛ inch and upwards, 0/11 to 1/ per lb.; brass ditto, 11d. to 1/1; locomotive and marine boiler tubes, seamless, 1½ to 3½ outside diameter, to 14 W.G., /11 per lb.

VICES.—Best warranted, "black" staple, solid box, 26/6 per cwt., best warranted "bright" staple, solid box vices, 28/3 to 30/6 per cwt.; vice boxes and pins, 60/ per cwt.

WASHERS.—Light iron, 77½ %; heavy washers, 13 to 6 W.G., 11/6 per cwt.

WOVE WIRE.—Brass and iron 55 % off list.

WIRE.—Best best iron, bright, No. 0 to 6, 7/6; 7, 7/9; 8, 8/; 9, 8/3; 10, 8/6; 11, 9/; 12, 9/3; 13, 9/9; 14, 10/9; 15, 11/3; 16, 11/9; 17, 12/3; 18, 13/; 19, 14/ per cwt. Galvanised, No. 0 to 6, 2/6 per cwt. extra. Best annealed drawn fencewire, oiled, No. 0 to 6 £8 2/6; 7, £8 7/6; 8, £8 12/6; 9, £9 per ton. Galvanised, No. 0 to 6, £10 10/; 7, £10 15/; 8, £11 5/; 9, £11 15/ per ton. Steel fence wire, round or oval, 5/ per ton extra. Black rolled fence wire, 4 or 5, £7 per ton. Tinned bottling wire, No. 22, 31/; 23, 33/; 24, 35/ per cwt., cut in lengths and made up in 7lb. parcels. Fine galvanised iron wire, No. 23, 32/6 per cwt. cast steel wire, 0/5 per lb.; charcoal iron wire, 3/6 per cwt. extra; tinned ditto, 8/6 per cwt. extra, delivered in London, 7/ per ton extra in Liverpool.

METROPOLITAN BOARD OF WORKS.

RETURN *of the Testings made at the Gas Testing Stations during the Week ending January* 13, 1885.

Company and District.	Illuminating Power. (In Standard Sperm Candles.) Max.	Min.	Mean.	Sulphur. (Grains in 100 cubic feet of Gas.) Max.	Min.	Mean.	Ammonia. (Grains in 100 cubic feet of Gas.) Max.	Min.	Mean.	Sulphuretted Hydrogen.
Gas Light and Coke Company.										
Notting Hill	17·0	16·6	16·9	10·1	8·8	9·4	0·3	0·0	0·1	None
Camden	16·8	16·3	16·6	13·7	9·7	11·0	0·2	0·0	0·1	
Dalston	17·3	16·2	16·6	16·7	13·2	14·9	0·6	0·0	0·1	
Bow	17·7	16·3	17·0	12·3	9·0	10·9	0·1	0·0	0·0	
Chelsea (Fulham)	Station closed for repairs									
Kingsland Road	17·0	16·4	16·7	11·9	8·5	10·3	0·1	0·0	0·0	
Charing Cross	16·7	15·8	16·2	14·7	10·9	12·7	0·6	0·3	0·5	
St. John's Wood	17·1	16·1	16·8	16·1	12·6	13·7	0·5	0·3	0·4	
Westminst'r (cannel gas	21·3	20·6	20·9	14·8	11·0	13·1	0·4	0·4	0·4	
South Metropolitan Gas Company.										
Peckham	18·3	16·4	17·1	12·7	10·6	12·0	0·6	0·0	0·2	
Tooley Street	18·2	16·2	17·2	11·2	8·3	10·1	0·4	0·0	0·1	
Clapham	16·7	16·1	16·5	16·9	14·3	15·4	0·4	0·0	0·1	
Lewisham	17·5	16·3	16·9	18·4	12·5	15·5	0·1	0·0	0·0	
Commercial Gas Company.										
Old Ford	17·1	16·4	16·7	7·7	5·6	6·9	0·5	0·4	0·5	
St. George-in-the-East	16·8	16·4	16·6	10·2	8·8	9·3	0·9	0·6	0·7	

The pressure of the gas supplied by the Gas Light and Coke Company, as tested in Haggerston Road, on 12th instant, at 9 p.m. was 2·8 inches.

W. J. DIBDIN, F.I.C., F.C.S.

NOTE.—The standard illuminating power for common gas in the metropolis is 16 sperm candles, and for cannel gas 20 sperm candles. Sulphur not to exceed 22 grains in the 100 cubic feet of gas. Ammonia not to exceed 4 grains in the 100 cubic feet of gas.

Pressure between sunset and midnight to be equal to a column of 1 inch of water.

Pressure between midnight and sunset to be equal to a column of 0·10 inch of water.

IRON.

No. 628.

LONDON, FRIDAY, JANUARY 23, 1885.

MINERAL FUEL IN MADRAS.

THE Presidency of Madras has hitherto suffered from the reproach of having no coal or other mineral form of fuel within its borders proper. There is, however, reason to believe that this reproach may, to some extent, be removed by the discoveries of lignite which have been made of late, and concerning which rumours have been occasionally circulated during the past two years. These deposits form the subject of an interesting communication which has been made by Mr. W. King, the officiating superintendent of the geological survey of India, to the records of that survey. It would appear that an extensive and thick deposit of lignite occurs between Pondicherry and Cuddalore, and the proposition is to compress this substance into bricks or to manufacture with it a patent fuel, and with this view a company has been formed, the engineer to which is M. Poilay, who is in fact the discoverer of the deposit. During some of the artesian boring operations in the alluvial flat between Cuddalore and Pondicherry, two thick beds of a dark brown or black deposit were struck, the substance being more a carbonaceous mud than a lignite. Subsequent borings were carried out at Bávur, Koniakovil, and Aranganur, three villages at the corners of an acute triangular area, having its longest side, of about five miles, between Bávur and Koniakovil. At Bávur this carbonaceous deposit was struck at a depth of 275 feet, and was found to be 35 feet thick. At Aranganur, nearly two miles north-north-east of Bávur, a similar deposit was met with at a depth of 203 feet, and which was about 27 feet thick. At 94 feet deeper another bed 5 feet thick was found. This last bed would seem to correspond with a very thin streak which was met with at Bávur some 30 feet below the thick seam. At Koniakovil, which is a little over five miles to the north-east of Bávur, a bed of lignite 50 feet thick was met with at a depth of 330 feet.

With regard to the probable yield of this deposit no accurate estimate has been arrived at, but intermediate borings have been made, which, it is assumed, have struck the main bed, and which fairly lead to the inference that the deposit is continuous over the whole triangular area. This being so, it is approximately estimated that there are several hundred million tons of fuel ready for treatment. As to the character of this fuel, it is to be observed that many analyses have been made both by French chemists and by the official chemical examiner for the Bengal government. Some of the original analyses give by calcination 6 per cent. of ash, 49 per cent. of volatile matter, and 45 per cent. of coke, presenting a dullish black blistered appearance, friable with an unequal fracture and without woody texture, thus indicating a promising material to work upon. The elementary analysis gave—carbon, 59·9: hydrogen, 5·78; oxygen and azote, 28·32 = 94·0. The calorific power as determined by M. Philaire is 4,182, with a density of 1·183. Subsequent examinations by French chemists have given a mean, over seven samples, of 8·35 of ash and 91·65 of volatile matter and coke. The trials made by Mr. King and his colleague, Mr. F. Mallet, in the survey laboratory, showed:—Moisture, 22·0; volatile matter (exclusive of water), 23·90; fixed carbon, 21·60; and ash, 32·50 = 100·00. The latest examination of the Bávur lignite is that made by Mr. Waddell, the officiating chemical examiner for the Bengal government, whose analyses produce yet other results. The following table gives the results of analyses of three samples of this material tried by Mr. Waddell, his separate tables for calorific power and chemical composition being run into one:—

	Samples.		
	No. 1.	No. 2.	No. 3.
	Lignite, macerated and mixed with water and allowed to dry in block.	Lignite mixed with tar and allowed to dry in block.	Lignite in its natural condition.
Calorific effect ...	5047	6382	5318
Water	9·750	9·145	16·276
Volatile Hydro-carbons	34·210	30·353	38·551
Coke { Carbon, fixed	23·090	29·402	37·720
Coke { Ash	32·950	31·067	7·451
Total ...	100·000	99·997	99·998
Loss ...	—	·003	·002

The practical value of these results, however, is questionable. On the face of it the substances are incongruous in their condition, their calorific power, and their amount of ash. Moreover, it is not clear whether they have been procured from the same portion of the lignite bed; indeed, it is more clear that they have not been so selected, and, therefore, they are hardly worth consideration as giving comparative values. On the whole, sample No. 3, which remained free from treatment in any way, is the best fuel of the three; and Mr. King observes that he should not be at all surprised to find that it is a specimen from a band, or seam, or pocket, of more perfect lignite in the main thick bed. The calorific power of this sample (No. 3) is also comprehensible; but such is not the case with No. 2, which, with less fixed carbon and 23 per cent. more of ash, gives nearly 1,000 more units of heat. Another very remarkable feature about all the assays is this, that when once an artificial brick is made, the ash increases enormously. In any case samples 1 and 2 are very poor, in spite of the calorific power attributed to them; and it is inconceivable how a locomotive or a steamboat could be benefited by carrying about fuel containing 31 to 32 per cent. of ash. The fact is, further assays and trials of average specimens of the lignite itself, and the bricks made from it must be made before any fair estimate of the capabilities of the deposit can be arrived at. The problems to be solved in the development of this discovery as indicated by the experiments now extant are, how to get rid of an enormous amount of ash and moisture, and how to consolidate the bricks by a medium the price of which shall not handicap the working of the deposit. This done, a new and important field of industry opens up for the district, the effects of which will be beneficially felt throughout the whole presidency.

IRON TRADE SUMMARY.

THE HOME IRON TRADE.

THE improvement in the English iron market so much hoped for is not only not coming, but its advent appears to become farther removed as weeks roll by. The pig-iron trade has again been losing in stability since our last report, and the market is once more giving way. A dull, languid feeling is still prevailing in the Glasgow warrant market. Scotch makers find a difficulty in effecting sales, and are offering their brands at low prices; but the heavy stock of Middlesbrough iron in Scotland is a drag on the cheaper native brands. Warrants closed on Wednesday at 42s. cash and 42s 2d. a month with buyers, sellers asking one halfpenny per ton more. In the North of England, pig-iron has experienced a further decline in price, transactions having been done at 35s. 1½d. and 35s. for prompt, also at 35s. per ton for forward, delivery for No. 3 G.M.B. f.o.b.; for No. 4 forge 33s. 6d. per ton f.o.b. has been accepted. On Tuesday the market at Middlesbrough was very quiet, with sellers of No. 3 G.M.B. at 35s. per ton for prompt and buyers at the same price for forward delivery. Hematite iron is quiet at 46s. f.o.b. for mixed numbers of east coast brands. The pig-iron trade of the Tyne district has been quiet this week, and another decline in price of 3d. per ton is recorded. No. 3 Cleveland pig is bought at 37s. 3d. per ton, and No. 4 forge quality at 35s. 9d. Exports are only small from there as yet. In the North-West the trade in hematite pig-iron is quiet, but there is a fair all-round enquiry for Bessemer forge samples of pig-iron. Makers, for the moment, are keeping up prices, and users are endeavouring, so far as is possible and practicable, to resist this upward tendency. Notwithstanding this fact, makers have sold a few parcels of iron at fuller prices than were ruling a month ago, and it is probable that the improved value, which now may be quoted at 46s. per ton, net, at works for mixed parcels of Bessemer iron, will at any rate for some time represent the sale value of iron in the district for immediate delivery, with 47s. per ton for parcels for forward delivery. Lancashire pig-iron makers are kept going with small orders, and they are still firm at 41s. to 41s. 6d., less 2½, for forge and foundry qualities delivered equal to Manchester. There are, however, very low figures spoken of in the market for some of the district brands, and there are sellers of forge Lincolnshire who would readily take 40s. per ton, less 2½, delivered equal to Manchester; but the leading makers generally hold for 41s. to 42s., less 2½, as their minimum for forge and foundry qualities delivered there. The pig-iron market of East Worcestershire shows a pretty good amount of current business at steady quotations. Deliveries are proceeding on account of fresh contracts, but some arrangements have yet to be finally completed. Current prices for all-mine best pigs range from 60s. to 65s. per ton; medium pigs, 45s. to 47s. 6d.; common pig-iron, 37s. 6d. to 40s. per ton. In Staffordshire, pig-iron is inactive. Matters have not changed for the better in the finished iron trade, the market remaining in its previous lifeless condition, with a downward tendency of prices. Scotch manufacturers are very slack. The Northern manufactured iron trade is in a weak and unsatisfactory condition. Prices are much the same as last week, although there is a tendency in favour of the consumer. Common bars are £5 to £5 2s. 6d.; best bars, £5 10s.; ship plates, £4 17s. 6d.; girder plates, £5 2s. 6d. to £5 5s.; boiler plates, £6; ship angles, £4 12s. 6d.; engineering angles, £4 17s. 6d., less 2½ per cent. Mr. Waterhouse has certified the average net selling price per ton for the past two months to have been £4 19s. 9·36d., being a reduction of 1s. 11½d. per ton, At Newcastle, ship plates can be bought at £5 per ton, with a good discount; angle iron makes £4 12s. 6d. to £4 15s.; common bars sell for £5 2s. 6d. to £5 5s.; and boiler plates make £6 to £6 2s. 6d. The Lancashire manufactured iron trade business continues extremely slow, and at some of the forges orders are not coming forward to keep the works employed. Prices remain about the same, but the position continues weak. For good ordinary qualities of bars delivered into the Manchester district £5 10s. is about the average figure. Hoops are quoted at £6, but could be got at a trifle less, and local made sheets average about £7 per ton. There is little change in the finished iron market of East Worcestershire. The demand has been somewhat more encouraging in Staffordshire; but it seems impossible to stay the downward tendency. In South Staffordshire, sheets (singles) are quoted £7 to £7 2s. 6d., but in some directions they are selling freely at 5s. per ton under these figures. Doubles are £7 10s.; marked bars stay at £7 10s., but they attract scarcely any buyers. What business is being done is in the £6 10s., the £6, and even the £5 15s. qualities. Trade in nearly all branches of hardware continues in a very quiet state, with low prices. There appears to be no immediate prospect of improvement either in demand or price. The tinplate trade continues quiet, and the prospects of a forward movement, which a little while back appeared more cheerful, have, for the present, again been upset by the American bank failures. Works in South Wales are in full employ, and it is surprising that nothing has yet been done to lessen production—the only available remedy for staying the downward tendency of prices. The shipments of tinplates at Bristol Channel ports during the past year were:—Swansea, 1,311,665 boxes; Newport, 250,333 boxes; Bristol, 223,883 boxes; and Cardiff 30,581 boxes. There is no sensible change in the steel trade, but works appear to be a little more busy than they were, not only on rails, but also on merchant classes of steel. At the first annual meeting of the international syndicate held in London on January 15, the report read congratulated the members on the success which had attended the operations of the association during the short time of its existence. The report stated at the same time, however, that the prices fixed by the syndicate are very little higher than the cost of production, and that railways need not expect to buy their rails at lower rates, as the latter are much below the average of recent years. The shipbuilding trade appears to be picking up more orders; but the process of reanimation is painfully slow. The opening of the year shows but unsatisfactory prospects as regards the engineering trades generally.

THE FOREIGN IRON TRADE.

The unpromising condition of the Austrian iron market during the latter part of last year has continued into the new one, and there is no prospect whatever of a near improvement. Business is still very difficult in the Belgian iron market, as prices are too low to allow other firms than those in absolute need of work to sell their products. The production of pig-iron having been so largely reduced, the crude material is rather firmer. Makers of finished iron and steel being almost without orders, these articles are weak. The French iron market continues weak, as both buyers and sellers do not appear to feel inclined to abandon their present reserve, and trade is consequently dull. But it is not very likely that prices will recede much more. The French imports of iron and steel during the first eight months of 1884 were 205,887 tons, against 299,587 tons in 1883, which is a decrease for the former year of 93,700 tons, or more than 30 per cent. The imports of iron ore for the first eight months of 1884 were 889,201 tons, against 1,092,653 tons in the corresponding period of 1883; last year consequently showing a diminution of 203,452 tons, or over 20 per cent., as compared with the preceding year. There has been but little alteration in the German iron market since last week; but where a change has taken place, it has been in the wrong direction. Pig-iron is not better in tone, and manufactured iron is in a still worse position than crude iron, with prices tending downwards.

INDUSTRIAL PROBLEMS.

"THE destitution in Birmingham is assuming very serious proportions. The poverty of the working classes is more widespread than it has been for many years, owing to the depression of trade." "A crowded meeting of unemployed artisans and labourers was held last night in the Bermondsey Town Hall, to call upon the government to provide employment for the large number of unemployed workmen who are at present in the districts of Southwark and Lambeth." "With an increase of less than 11 per cent. in the number of earners (in the United Kingdom), there has been an increase of 24·64 per

ENGINES OF THE S.S. "HENRY WRIGHT."

BY MESSRS. ALEX. WILSON & CO., LONDON.

(*For description, see page 70.*)

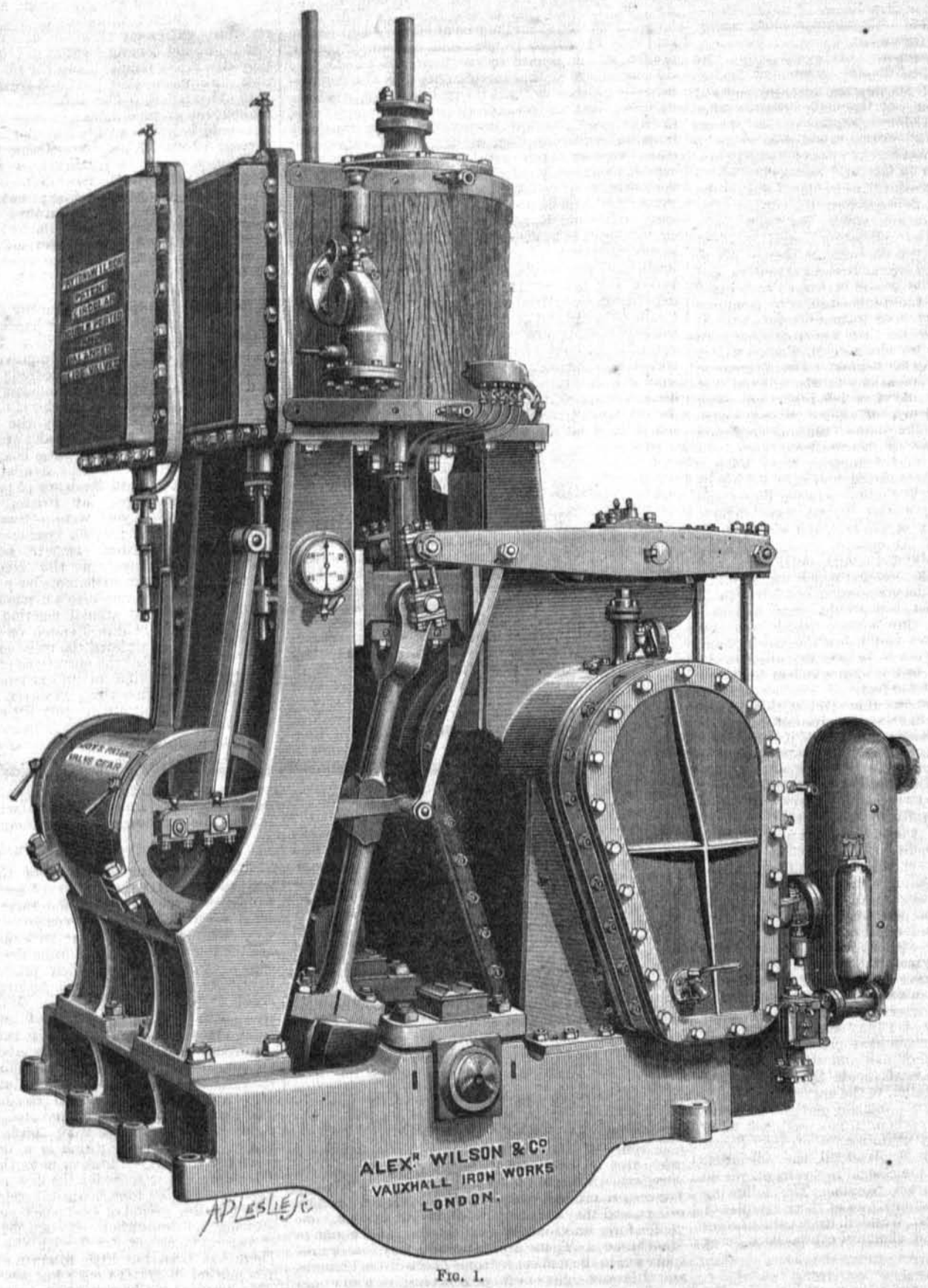

Fig. 1.

cent. in the amount of earnings; the average earning per head having increased from £38 in 1867 to £42 14s. in 1884, or in the proportion of 12·37 per cent." Such are the apparently irreconcilable statements which have appeared in the newspapers during the past few days. The first two sentences are samples of the reports from nearly every part of the country which are only too prevalent just now. Distress amongst the labouring population is not confined to Birmingham or London; the pinch is felt as keenly in the north-eastern districts of England and in the West of Scotland. The last sentence quoted describes the conclusion at which Professor Leone Levi has arrived as the result of the enquiries, into the wages and earnings of the working classes, which were instituted by him at the instance of Sir Arthur Bass. It may be urged that the different statements refer to circumstances which do not coincide in point of time; that the destitution is a fact of the present moment, the improvement in the earnings of the labouring population a matter which must of necessity refer to a period of time elapsed. But such destitution as is alluded to above is not developed in a week or a month: its causes are of slower growth, and in fact have been at work while Professor Levi was prosecuting his investigation. It was stated by the delegates of the unemployed who waited upon the Mayor of Birmingham that men had been out of employment for eight, nine, and even twelve months. How is it then that, notwithstanding this, we are told the earnings of the working classes have increased, and now amount to a sum which, if evenly distributed, would give to each family an income of 32s. per week, which Professor Levi assures us would place them in a better economic condition than the labouring population of any other country? It must be borne in mind that the instances of destitution referred to are not solitary, but are only phases of the widespread depression existing in the labour market. If such demonstrations had taken place after a long period of reduced wages, when earnings had been greatly lessened, there would have been some consistency; but, as things are, there is no logic in the situation.

It seems to us that this anomaly is only part of the much larger one which has troubled philosophers for ages past, viz. the growth and spread of wealth side by side with the continuance of poverty. If statistics count for anything, the working classes are now better paid, better clothed, and better fed as a body than

they have ever been before. But in spite of this, poverty presses upon individuals and groups as heavily as it ever did. It would almost appear as if it were decreed by one of those inexorable laws of nature, which we can but dimly understand, that the poor shall be always with us, and that, while the general mass of the working population advances in wealth and civilisation, individual members, in the struggle for existence, or whatever you like to call it, are pushed aside and left behind. It is a favourite theory with a certain class of political economists that the lower ranks of society are always forced to bear the first brunt of falling prices and depression of trade. To such people we would point out, in passing, the deduction which Professor Levi draws from the results of his investigation. He says that, although the present depression has already affected, and may yet operate more injuriously upon, certain industries, still its effects hitherto have been visible more in reduced profits than in lessened production—in other words, diminished employment; so that the influence of the depression has not made much impression on the total income of the working classes. Many attempts have been made to solve the problem of the continuance of poverty in spite of national progress, and endless remedies have been proposed, but, it is needless to say, without avail. Emigration has been tried, but in spite of the millions that have left our shores, we hear as much as ever about lack of employment for those that remain. Co-operation, or giving the workers an interest in the industry in which they are employed, does not seem to have made much headway. The fact is, all these proposed remedies touch only one part or another of the question; none of them embraces the whole. To say that overproduction is at the root of the evil, while it may explain the cause of low prices and some other of the effects visible, certainly does not afford sufficient reason for the want of employment. Lessened production would of course mean work for fewer hands, or work for the same number for a shorter time; but it is next to impossible to say whether the enhanced price which reduced production might lead to would enable makers to pay higher wages by so much as to compensate for the diminished hours of work.

While the problem is thus surrounded with difficulties, and amidst the many impracticable proposals advanced by the champions of the labouring population, we are glad to observe that a section of the working classes approaches the matter in a business-like manner, and, while accepting the inevitable, endeavours to assist in mitigating future recurrences of depression by advocating a policy which will tend to consolidate and extend trade with our colonies. Whatever may be the other causes of the present depression, there can be no question that it is partly the result of the loss of foreign markets for our manufactures. Other countries, recognising the advantage of a varied and extensive industry, have sought to build up such for themselves by the assistance of protective tariffs, which, whatever their faults from an economic point of view, and notwithstanding the abuses they give rise to, can certainly claim the merit of having proved effectual. It has thus come about that this country's colonial possessions are now the great outlet for its manufactures, and it is to the development of our trade in such directions that our chief hope in the future lies. What may be the best means of securing such an end, it is not within the scope of the present article to discuss, but it may safely be asserted that this desirable object will not be furthered by the policy of a certain school of politicians whose aim appears to be to accomplish the disintegration of the empire.

Occasional Notes.

THE PROPOSED NEW RAILWAY RATES.

NOTHING could have placed the issue between the railway companies and the public in a clearer light than the letter addressed to a contemporary by Mr. E. Clements, the secretary of the Railway and Canal Traders' Association, an organisation, which, by the way, deserves the full support of the iron trade. That gentleman cites the increase in rates on agricultural produce proposed to be levied, the legislature permitting, by the London, Brighton and South Coast Railway. That company want to raise their rates to an extent varying between 50 and 250 per cent. above present charges, not only by introducing terminal charges, but also by increasing their mileage rate, it being shown that the long distance traffic would suffer quite as much as the short. We know that even the present tolls exacted by railway companies weigh as heavily upon manufacturers—iron manufacturers in particular—as upon agriculturists, and the spirit of energy displayed by the association is by no means out of place, as the railway companies would make us believe. United action was all that is required to counteract the effects of the companies, and by promoting their bills they have raised a whirlwind of opposition which it will be difficult for them to lay. It is useless, in fact, for them to persevere. By their past action they have opened the eyes of the public to the degree of abuse to which a monopoly may be put, and will consequently make the people, and through them the legislature, more wary in granting greater privileges and more freedom of action to railway companies, a result unexpected, probably, by the companies, but one upon which we can only congratulate the public. It is, moreover, very essential in the present position of trade and commerce that the railway companies should take special heed to their ways; otherwise, they may provoke further attention to the problem of water transport, which is now in course of solution by Manchester.

SHARP RAILWAY CURVES.

THE report presented by Major-General Hutchinson, R.E., on the three accidents which occurred on November 20 and 21 on the Metropolitan Railway, if it does not contain anything very novel as to the causes of those mishaps, at least points a moral, namely, that railways cannot be subjected to too stringent a supervision by government officials. General Hutchinson states that these three accidents, in each of which the left leading bogie wheel of the engine mounted the left tongue of a siding trailing point joining the outside rail of a sharp curve close to the west end of Mansion House Station down platform, were, no doubt, due to the speed being in each case too high for the excessively sharp and somewhat irregular curve through which the engines were running when the bogie wheels left the rails at almost the same spot. The actual radius of the curve of the outer rail was found on measurement to vary between 3½ and 4 chains, and that of the inner rail to vary between 4 and 5 chains, at and immediately close to the points, the super-elevation of the outer rail varying between 1¼ inch and 1⅜ inch, the gauge being from ⅜ inch to 1 inch slack. The speed round such a curve, according to General Hutchinson, should certainly have been a very slow one, more especially as the check rail had, on account of the siding point, to cease before the curve terminated. Although there is no reason to assume that the speed of either train was appreciably higher than usual, it was evidently too great in each case for the nature of the curve. The government inspector further says that, since the completion of the Inner Circle, the down trains have been running into this station at greater speed than used to be the case, and adds that it has been found possible to alter the radius of the curve to one of about 7½ chains. He blames the former engineer for altering the curve, and for not submitting the altered siding points for inspection.

THE ACCIDENT ON THE HIGHGATE CABLE TRAMWAY.

THIS accident is another illustration of how the non-observance of government regulations may have the most disastrous consequences. From the facts gathered at the enquiry held, it appeared that, until recently, the practice had been for the cars, after leaving the depot, to proceed down to the foot of the hill, and commence the day's work by a journey uphill. About a fortnight ago, however, in order to avoid a profitless journey, and to accommodate the passengers from the top of the hill, this practice had been so far deviated from that the first car in the morning had been moved from the depot by gravitation to a point where it could grip the cable, and proceed thence to the starting-point at the top of the hill. Now, this practice, as intimated by the Board of Trade inspector, was a distinct breach of the regulations. About eight o'clock on the morning of January 8 the driver and a fitter were preparing to catch the up cable when the car began to glide down the hill. The brakes were applied, but, owing apparently to the severe frost and to the slippery condition of the rails, they skidded along the metals. The rate of descent increased, and it was then found that the car had no sand. A cushion and a large piece of wood were thrown on to the track, but these were swept on one side by the guard rail in front of the car. Gathering momentum, the car went down the hill at a rate estimated by some at from twenty to thirty miles an hour. The driver and the fitter, finding they could do nothing more, had jumped off, the former falling on to the roadway; but neither sustained any serious hurt. At the bottom of the hill, where the car ran beyond the metals, it ran broadside into a cart before the man in charge could get it out of the way, smashed one of the

ENGINES OF THE S.S. "HENRY WRIGHT."

PAYTON & WILSON'S SLIDE VALVE.

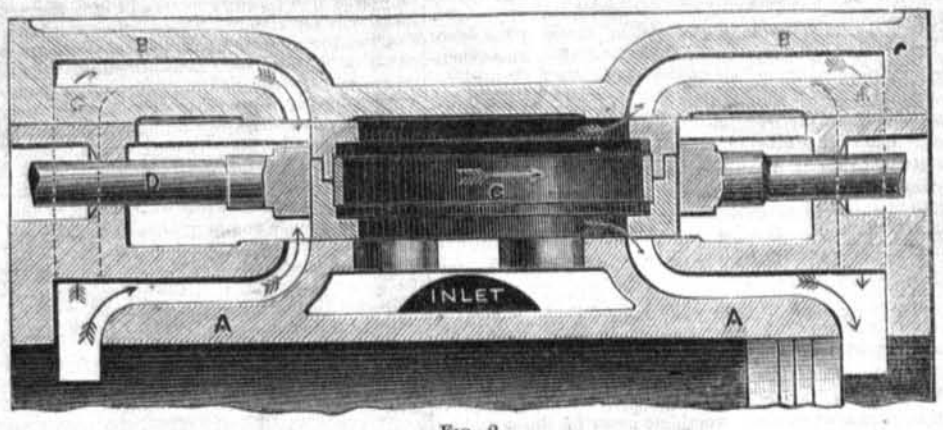

FIG. 2.

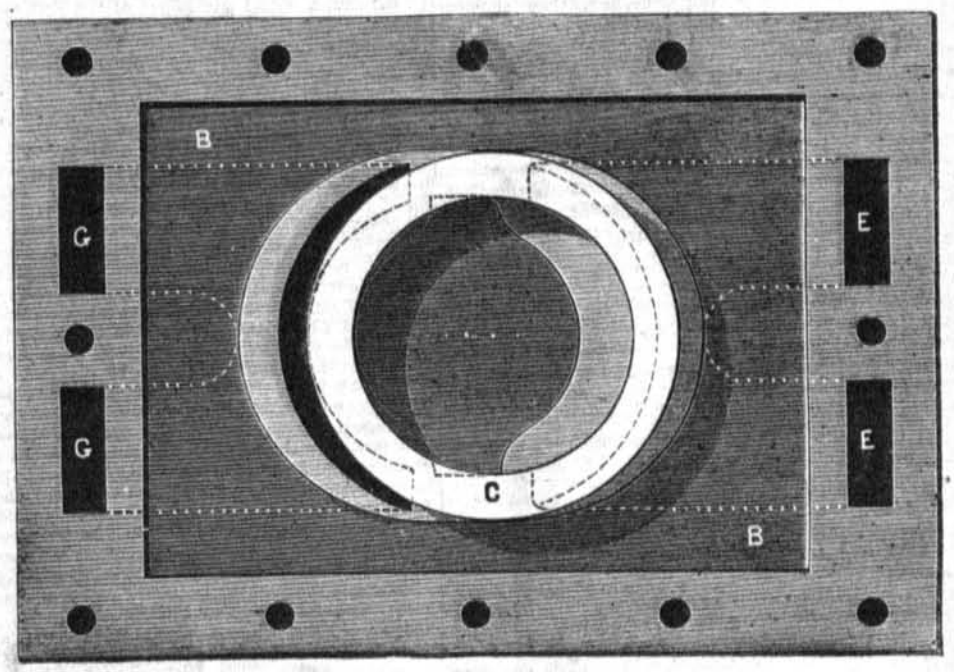

FIG. 3.

wheels, and drove the cart for some yards in front of it without doing further damage. The car itself sustained very little damage. General Hutchinson will present his report shortly; but whatever its tendency may be, there is no escape from the fact that precise regulations, laid down with a view of preventing such accidents, were entirely and wilfully ignored.

THE STRUCTURAL CHANGES OF IRON.

Dr. Collett, the state geologist of Indiana, has been experimenting upon the theory that the best of iron, when subjected to continuous strain, would undergo changes in its structure which would, after a time, render its use dangerous, and that these structural changes were the explanation of many otherwise inexplicable accidents, particularly to railway bridges. According to the *American Machinist*, that enquirer has lately undertaken a systematic investigation, which has resulted in a confirmation of the theory. For experiment he took from the Wabash dam, at Delphi (Indiana), a number of bolts and spikes, which were, when the dam was constructed, of the best quality of malleable bar iron, as is shown by the battering of the head when they were put into the structure. Of these bolts and spikes, he found that 70 per cent. of the whole number were as weak as cast iron, while 90 per cent. of those which were near the bottom of the dam were worthless; yet of those which were rotten, the tips, where inserted in immovable rocks, were fibrous and strong. When broken, they showed polished ends to the connecting fibres, indicating that the continued vibrations of many years had polished and rounded the points of fibrous structure. A similar effect is found in "the parting on "horsebacks" in coal mines, which become polished and striated by the continuous quiver and motion of the crust of the earth. Dr. Collett says that all car axles, after a reasonable run, become crystallised two-thirds of the length from the hub and one-third from the outside extremity, rendering them worthless. On one Indiana railroad bridge he found that the bottom parts of the vertical strain pieces were crystallised for from 2 to 4 feet in length, and, as a precaution against what would inevitably have caused a great catastrophe, they were replaced. The matter is one of great interest to railways, and the specimens which Dr. Collett has collected in his experiments are to be sent to the Stevens Institute of Technology, where an investigation of the subject has been in progress for several years by a scientist connected with the institute.

ENGINES OF THE S.S. *HENRY WRIGHT*

The Church Missionary Society have in their service at Zanzibar a steam yacht named the *Henry Wright*, which was built by Messrs. R. & H. Green, of Blackwall, and engined by Messrs. Alex. Wilson & Co., of the Vauxhall Ironworks, Wandsworth Road, London. The vessel is 80 feet long by 16 feet beam, composite built, and her engines, which embody several special features, are illustrated at fig. 1 on page 68 of our present issue. They are on the compound principle, and have cylinders 16 inches and 30½ inches respectively in diameter, with a 21-inch stroke. The slide valves are Payton & Wilson's circular-balanced and double-ported type, actuated by Joy's valve gear. Fig. 2 of our engravings on page 69 shows a longitudinal section, and fig. 3 a plan of the valve and underside of the cover. These valves form a distinctive feature in these engines. Circular slide valves are not new, but hitherto they have always been used in combination with cylinders provided at each end with one inlet port only, and in order to give a sufficiency of port opening, such a combination has compelled the use of valves having a long travel, and the dimensions of which, owing to their circular shape, have been excessively large as compared with rectangular valves of equal capacity. These excessive dimensions have been found in practice difficult to deal with constructively, as they have necessitated the use of large, unsightly, and disproportioned valve chests, unduly heavy and expensive to construct, and they have, by adding weight to the valve, and by exposing it, even when partly balanced, to a large amount of back pressure, so greatly impaired its freedom within its driving hoop and the efficiency of its turning action as to have materially lessened in many cases the benefits expected to be gained by its use.

In order to meet the various objections named, Messrs. Payton & Wilson designed the present valve, in which the object aimed at has been the construction and combination of the several parts of circular valves in such a manner as to largely decrease their dimensions, and at the same time by reducing their weight, their travel, and the pressure upon them, to lessen their friction to such an extent as to ensure their freedom within their hoops, and the efficiency of their turning action upon their seats. The combination illustrated by us has been found by actual practice and extensive use to perfectly accomplish that object. It will be seen that the valve is made in two parts or rings, the outer surfaces of which are alike, and form similar but opposite valves, one of which moves upon the cylinder port face and the other upon the inner surface of the valve chest cover, both of which are provided with similar and opposite ports and passages leading to the ends of the cylinder. As the valve in its motion uncovers two opposite ports at the same moment it is obvious that they only need to be one half the area required when only one port is used, and the travel of the valve and its dimensions may be correspondingly reduced. It will also be seen that the valve is, by the method of its construction and without any especial provision for the purpose, formed into a balanced valve of the simplest and most perfect kind. Unlike ordinary valves the exhaust takes place on the outside of the valve into the valve chest, and steam from the boiler is always present inside the valve, where it presses upon the inner projecting edges of the rings with just sufficient force to keep them in contact with their seats, and any escape through the valve is prevented by the steam expanding the ring covering the junctions between the two parts of it. As the valve is thus subject to little or no pressure the enormous loads, common to ordinary valves, are done away with, and it is, therefore, capable of being moved with the least possible amount of power, and its freedom to turn upon its seats is as great as it can be. Exhausting into the valve chest has the effect of largely increasing the freedom of the exhaust from the fact that curved ports always have a much larger area opened by a circular valve on its outside than is opened inside of it. It also has the advantage of removing a considerable amount of pressure from the cover of the valve chest, a point of much importance in large engines. It is satisfactory, too, to be able to add that these valves have been thoroughly tested in a large number of engines, and have been applied to cylinders ranging from 4 inches up to 33 inches in diameter, and their working has given every satisfaction to those using them. These valves are also peculiarly well adapted for colliery and mine winding engines, reversing roll engines, and, in fact, in all cases where prompt reversing is required.

IMPROVED GAS PLIERS.

However useful gas pliers of the ordinary make are they possess one defect, which is never so fully realised by the gas-fitter as when he has to unmake an extra tight or an old rusted joint. He then frequently finds that, notwithstanding the corrugations, his pliers slip, and it sometimes requires all the strength he can command to get them to bite. This is owing to what, by the light of a recent invention, is seen to be a constructive defect, inasmuch as the teeth are set perpendicularly to the jaws of the pliers, and hence a slip when an extra resistance is offered. Were the teeth set after the manner of those of the shark it will readily be seen that a very perfect grip could be obtained with a far less expenditure of power than is required with the ordinary pliers. The principle of the shark's teeth is, in fact, the idea which suggested itself in connection with the gas pliers to Mr. H. C. Gilchrist, of 70, Atlantic Road, Brixton, and which idea he has put in practice in the pliers we have now to notice. We have said that in gas pliers as at present constructed the teeth are perpendicular to the jaws, but in Mr. Gilchrist's pliers, the teeth in one jaw have an inclination towards the nose of the pliers, whilst those of the other jaw incline in the reverse direction. The one set of teeth thus act contrary to the other set, and prevent all tendency to slip. It will be seen that the principle of the invention lies in forming the teeth at two opposite angles—the angle being that of 45°—which produces a mitre. The gas-pipe, or other object to which the pliers are applied, can, therefore, be held more firmly than with the old form of teeth. Mr. Gilchrist further makes gas pliers with two holes for different diameters of pipes; the holes, instead of being separated from each other by a bridge as in the ordinary two-hole pliers, are joined together—that is, the rear part of the front hole joins the front part of the rear hole. These pliers are made 7, 8, and 9 inches long, the smallest size being made with a cutter. The single hole pliers are made for pipes of from 2 inches to 4 inches in diameter by gradations of half an inch. An examination of these pliers convinces us that we have in them a valuable improvement in a widely-used tool. The invention is certainly meritorious, and cannot fail to supersede pliers of the ordinary construction, especially when we add that the cost is only slightly increased as against those of the old pattern. We may add that the pliers are under trial at the works of one of the Metropolitan Gas Companies, the engineer of which approves of them.

SIDE ARMOUR *VERSUS* ARMOURED DECKS.

A paper on "Side Armour *versus* Armoured Decks, from a Naval Point of View," was read on January 21, before the United Service Institution, by Captain C. C. FitzGerald, of the Royal Naval College, Greenwich. Confining himself entirely to the consideration of protection against artillery fire, and without touching upon protection against the ram and torpedo, Captain FitzGerald assumed at starting that the primary use of all armour was to keep the ship afloat; secondly, to protect the magazines, boilers, and steering gear; and, thirdly, to protect the guns and their crews. With all possible respect for the opinions of those who had substituted armoured decks for side armour, he ventured to think that they were wrong, and that they had arrived at their conclusions in error and without assigning their proper value to the various requirements of a war ship, and of the projectiles which would be used for her destruction. This was plain speaking, but he was not afraid of offending anyone, as his remarks were only offered with the view of arriving as near to the truth as was possible without the actual experiment of war. He denied Sir William Armstrong's contention that "every improvement in guns and projectiles tends to lower the value of armour." The improvement in machine-gun fire and the new six-pounder, firing from ten to fifteen rounds a minute, had, he maintained, a directly contrary tendency. The decision to abandon, either partially or entirely, side armour, arrived at in consequence of the impossibility of keeping out heavy solid shot which struck directly with any practicable thickness of armour, appeared to him to be erroneous, for the following reasons:—First, it seemed to him to ignore the fact that armour which would not keep out solid shot would keep out large capacity shell of the same calibre with heavy bursting charges, which, if allowed to enter the ship, would do far more damage than any shot; secondly, it seemed to ignore the fact that in actual warfare the great majority of the enemy's projectiles would not strike the ship at right angles, nor at point-blank ranges; thirdly, it appeared to under-estimate the extreme rapidity and terribly destructive effect of the fire of light guns and machine guns, every shell from which would enter and burst inside the unarmoured part of the ship. It must not be supposed that he advocated doing away with heavy guns in ships, and carrying a large number of light guns instead. He had no intention of proposing anything of the sort. He thought that both heavy and light guns would have their respective parts to play, and one would support the other; but what he proposed were the following points:—That in view of the recent development of light and machine-gun fire, no iron ship was fit to go into action at all, or to be called a man-of-war, which had not got a complete water-line belt of some sort of armour, and that an armoured deck was no substitute for such belt. Secondly, that a water-line belt of only 3-inch steel would keep out about two-thirds of the projectiles likely to be fired against a ship in action, for it would keep out all the machine-gun fire and most of the light gun fire, which struck obliquely and at long ranges. He submitted, too, that from a naval point of view it was a grave, if not a fatal, error to leave two-thirds of the water-lines of our line-of-battle ships absolutely unplated, and, therefore, certain to be penetrated in a hundred places by the terrible hail of light and machine-gun fire which would be poured upon them in action, seeing that in this condition their stability and seaworthiness would be at least doubtful. And, finally, he submitted that even now, at the eleventh hour, the whole of our so-called citadel ships should be altered immediately, no matter what it might cost; the whole of the armoured decks taken away, except patches to cover the crowns of the magazines; and, if necessary, some other weights taken out—coal, or even guns and ammunition—so as to enable them to be given a complete water-line belt of whatever thickness was found to be practicable, but at least thick enough to keep out light and machine-gun fire. No naval officer, he made bold to say, would have the slightest objection to be sunk by the shot from a 100-ton gun if it hit in the right place; but to be sunk or disabled in a supposed ironclad by the fire of every popgun carried by every foreign gunboat would be more than the honour of the British navy could survive. As a matter of history, our fathers did not rule the waves in tin-pots with numerous holes in them; and, as a matter of speculation, he did not think we should do so.

In the discussion which followed, Sir Spencer Robinson, having regard to the part played by the ends of a ship in maintaining it as a fighting machine, did not hesitate to say that the contrivances for the protection of those ends did not give the same proportion of security to citadel ships as armourplate.

Colonel Hope said there appeared to him to be one error in these discussions, and that was that attention seemed to be concentrated in the endeavour to keep out the enemy's shot. This was, of course, extremely desirable; but it seemed equally important to keep out the water. It was almost impossible to hope to keep out the shot all round in the face of the guns of great calibre and power which would undoubtedly be brought to bear in any future naval action. He thought the water might be kept out by bringing the armour 4 or 5 feet inwards into the vessel, and filling the space with compressed fibre, which would be practically self-blocking.

Captain Colomb, R.N., thought the whole question was one of experiment.

Sir George Elliot agreed with the lecturer in his views in regard to the centre citadels and unarmoured ends. If side armour was to be used, there were numerous reasons why it should be continued fore and aft. He adhered most strongly to the advantages which could be obtained from deck protection, if properly carried out.

Captain Wilson remarked that the paper was a thoroughly sensible and seamanlike one.

Sir E. J. Reed, M.P., thought that the naval constructor was made a great deal too much of in these debates. It was his duty to design the ship which the naval officer required. There could be no doubt that the Admiralty staff, as constituted for many years, was perfectly capable of designing any ship which the naval officer required, and therefore if wrong ships were introduced into the navy, it could only be because the naval officers, of whom there were many within the Admiralty, somehow fell short of their duty, and gave too much scope to the constructor in turning his office into a place for the invention of ships of his own, instead of building the ships wanted. The only thing he had ever contended for in public was that the officers and men of the British navy should not be condemned to go to sea and into battle in ships where the citadel was left too small to keep the whole structure upright. Even now, he thought the danger of ships capsizing was not understood. He did not think it was understood in the Italian marine, for no man in his senses would have designed such a ship as the *Italia*, if he had realised the danger of its capsizing. It was the most preposterous thing in the world to build ships with a great deal of armour for the protection of their boilers and a couple of guns, and then to leave them at the mercy of any gun to turn them upside down for want of stability. Could madness go further than that? If they made an error, let them, he said, make it on the right side, and put on too much rather than too little.

Mr. White defended the Admiral class of ships, and argued that they possessed initial stability, even supposing the whole of the ends were thrown open to the sea.

Captain FitzGerald having replied, the proceedings terminated.

THE AMERICAN IRON TRADE IN 1884.

The year 1884 has been a bad year for the American iron trade, rendering necessary a general reduction of wages and the closing of many manufacturing establishments. The new year opens with no promise of immediate improvement. If the farmers of the West could dispose of

their wheat and corn and other staple products at higher prices than now prevail, there might soon be an increased demand and better prices for iron and steel, but until the farmers' prospects improve, better days are not expected for the American iron and steel manufacturers, nor for some other manufacturers. The country at large, it is said, cannot be prosperous if the farmers are not. The demand for all leading classes of iron and steel was less in the United States in 1884 than in 1883. The Americans made less pig iron and bar iron, fewer steel rails, less steel for miscellaneous purposes, and fewer kegs of nails. Prices fell as the demand receded, and only in steel rails has there been any recovery from the lowest prices of the year, and even there the recovery has been but slight. Steel rails commenced the year at $34 and fell to $26 50 in September, since which time they have rallied to $28 in December. No. 1 anthracite foundry pig-iron at Philadelphia brought $20.50 at the beginning of the year, and only $18 at its close. Best bar iron at Philadelphia sold at 2 cents per pound in January, but it has for many months sold at 1·8 cent per pound, or $40.32 per gross ton. This is a lower price than was quoted during the panic years, except for a short time in 1879. The store price of cut nails at Philadelphia was $2.60 per keg in January, from which there was a steady decline to $2.10 in October, which is the present price. The price during the panic years did not fall so low until March 1879, but from this low price there was a speedy recovery.

The production of pig-iron in the United States in 1884 is estimated to be at least equal to the production in 1880, which was the year of the boom. The production in that year was 4,295,414 net tons of 2,000 lb., or 3,835,191 gross tons of 2,240 pounds. It is believed that, when the official figures are received and tabulated, the estimate formed will be found to be substantially accurate. The stocks of pig-iron on hand and unsold at the close of the year did not exceed the quantity on hand at the beginning of the year, namely, 533,800 net tons. The following table gives the production of pig-iron in each year from 1873 to 1884, the latter year being an estimate :—

Year.	Net Tons.	Year.	Net Tons.	Year.	Net Tons.
1873	2,868,278	1877	2,314,585	1881	4,641,564
1874	2,689,413	1878	2,577,361	1882	5,178,122
1875	2,266,581	1879	3,070,875	1883	5,146,972
1876	2,093,236	1880	4,295,414	1884	4,295,414

The American imports of pig-iron in 1884 greatly declined as compared with the years 1879, 1880, 1881, 1882, and 1883, but were still above the imports of 1878 and several previous years. From the best data at command, it is concluded that the imports for 1884 amounted to about 225,000 net tons. The following table gives the imports of pig-iron in the last thirteen years, 1884 being estimated :—

Year.	Net Tons.	Year.	Net Tons.	Year.	Net Tons.
1872	295,967	1877	66,871	1881	520,835
1873	154,708	1878	74,484	1882	604,978
1874	61,195	1879	340,672	1883	361,366
1875	66,457	1880	784,968	1884	225,000
1876	83,072				

Almost the whole of the American importations of pig-iron in 1884 consisted of spiegeleisen and best Scotch brands of foundry iron. The consumption of pig-iron of domestic manufacture in 1884 was equal to its production, and was greater than the consumption of both domestic and imported pig-iron in any year before 1880. It was almost equal to the consumption of both domestic and foreign pig-iron in that year.

According to the *Bulletin* of the American Iron and Steel Association (from which the data contained in this report have been taken), there is ground for encouragement, and no reason for discouragement, in the facts stated. The Americans are consuming all the pig-iron they make, and they made in 1884 as much pig-iron as in the year of the boom, 1880—a year that was so remarkable for its productiveness and activity. The discouraging signs appear when the fact is considered that the prices obtained by American pig-iron manufacturers constantly declined throughout the whole of the year 1884, until, at the close of the year, they had almost reached the lowest figures at which pig-iron was sold after the panic of 1873. At the beginning of 1884, No 1 anthracite foundry pig-iron at Philadelphia sold at $20.50 ; the price at the close of the year was $18. At the beginning of the year good mill iron at Philadelphia brought $18.50 ; the present price is about $16. The following table gives the yearly average prices of No. 1 anthracite foundry pig-iron at Philadelphia since 1873, the yearly average being obtained from monthly averages :—

Year.	Average.	Year.	Average.	Year.	Average.
1873	$42.75	1877	$18.88	1881	$25.12
1874	30.25	1878	17.62	1882	25.75
1875	25.50	1879	21.50	1883	22.38
1876	22.25	1880	28.50	1884	19.88

The lowest average monthly price of No. 1 anthracite foundry pig-iron that has ever been reached was in November 1878, when it was $16.50. It will be seen that between this price and $18, the price at the close of 1884, which was the lowest at which sales were made during the year, there is still a difference of $1.50. In mill irons the present price of $16 at Philadelphia is still about $1 above the lowest price in 1878.

IRON AND STEEL SHIPBUILDING IN 1884.

WE have received for publication the following excerpt from the annual statistical report on iron and steel shipbuilding in 1884, prepared by the secretary of the British Iron Trade Association :—

The past twelve months have been most memorable in the annals of shipbuilding for the sudden and severe depression which supervened upon a period of remarkable prosperity. This depression has not affected the shipbuilding trade alone, although that industry has felt it more keenly perhaps than any of its collaterals, but it has applied to marine engineers, to manufacturers of iron and steel castings and forgings, to boilermakers, and to the iron trade as a whole. At a time when the condition of the shipbuilding industry is a matter of serious national concern, it is appropriate that an effort should be made to throw as much light as possible upon its development and prospects at home and abroad, and statistics have been collected for this report with that end in view. The following figures show the tonnage of new shipbuilding launched in seven of the principal centres of the trade in each of the years 1883 and 1884.

TABLE I.—*Shipbuilding Tonnage launched in* 1883 *and* 1884 *at Seven of the Principal Ports of the United Kingdom.*

Shipbuilding Ports.	1884.	1883.	Decrease in 1884.
Clyde	296,854	419,664	122,810
Tyne	124,221	216,573	92,352
Wear	99,589	212,313	112,724
Hartlepool	30,963	67,065	36,102
Tees	30,336	81,795	51,459
Dundee	12,062	25,276	13,214
Leith	5,500	13,722	8,222
Totals	599,525	1,036,408	436,883

Selecting the first five of these centres of the trade for special comparison, inasmuch as they have furnished about 80 per cent. of the total tonnage of shipbuilding launched in each of the last few years, it appears that the results shown have been as under :—

	Gross Tonnage Launched.
1879	462,238
1880	597,905
1881	781,053
1882	945,919
1883	997,410
1884	587,463

It would appear from the foregoing figures that, while the gross total tonnage launched in 1883 was 409,947 tons, or 41 per cent., more than in 1884, the tonnage launched in the latter year was only 10,442 tons under that of 1880, and it was, speaking roundly, 135,000 tons more than the tonnage launched in 1879, so that, practically, the condition of the trade in 1884, with respect to the actual tonnage launched—apart, of course, from its future prospects—was on all fours with that of 1880. In 1881 the total number of hands employed in the shipbuilding trade of the United Kingdom was ascertained by the census enumeration to be 72,000, which corresponds to an average of about 14 tons of new shipbuilding per man per annum. If the same average is assumed for each of the three following years, it would follow that the total number of hands employed has varied as under :—

1882	88,600 persons;
1883	94,900 ,,
1884	59,200 ,,

from which it would appear that the number of hands employed in the shipyards of the country has declined during 1884 as compared with 1883 to the extent of 35,700. This does not, of course, mean that that number of hands has been quite unemployed during the year, but that the reduced quantity of work done has been equivalent to the labour of that number, assuming the amount of work done in the way of repairing, &c., to have been the same during each year. It is not quite an easy matter to calculate what has been the reduction in the quantity of iron use for shipbuilding in 1884, compared with 1883. The problem is complicated by such disturbing elements as the thickness of plates used for the hull, the varying weight of the forgings and engines per ton of hull, &c. ; but assuming the same data as that specified in our report for 1882,* whence it appears that 1 ton of iron and steel together is used per 1·7 gross tons of hull, the quantities of those metals employed in the shipbuilding industry of this country in each of the last four years would be approximately as under :—

	Tons.
1881	571,795
1882	723,230
1883	770,000
1884	459,000

According to these figures, the quantity of iron and steel used in 1884 would be 311,000 tons less than in 1883 ; and allowing an average value of £8 over the whole, it is manifest that the loss to the iron and steel trades, from the great depression of shipbuilding in the former year as compared with the latter, has been not less than £2,488,000 sterling. This serious decline of consumption has, of course, been most seriously felt by manufacturers of plates, angles, and bulbs, of which 1 ton is required to every 1·9 gross tons of shipbuilding constructed. The use of steel instead of iron plates, &c., has made considerable progress again during the past year. On the principal shipbuilding river—the Clyde—the total tonnage launched in steel during 1884 was 133,670 tons, against 129,651 tons in 1883 ; but, reduced to their centesimal proportions, the difference between the two returns becomes far more striking, inasmuch as the percentage of the total tonnage launched which was built of steel, was 45 per cent. in 1884 against only 30 per cent. in 1883. It is worthy of notice that the whole of the twenty-one vessels, having a total tonnage of 24,016 tons, which were built by Messrs. Denny, of Dumbarton, in 1884, were constructed in steel, including ten cargo barges. The following is a statement showing the number, tonnage, and description of new vessels classed by Lloyd's Register of British and Foreigh Shipping during the year 1884 :—

Description.	Steel.		Iron.		Wood.		Total.	
	No.	Tons (Gross).	No.	Tons (Gross).	No.	Tons (Gross).	No.	Tons (Gross).
Steam	79	120,081	417	517,459	14	1,074	510	638,614
Sailing	13	12,376	98	143,742	102	12,976	213	169,094
Totals ..	92	132,457	515	661,201	116	14,050	723	807,708

To the above returns may be added those of the vessels built to the survey of the Liverpool Underwriters' Registry, viz. :—

	No.	Gross Tonnage.
Steamers—Iron	31	52,304
Steel	7	14,533
Sailing vessels—Iron	17	30,611
Steel	2	4,349
Total	57	101,797

The gross tonnage of vessels of iron and steel built to the survey of Lloyd's and the Liverpool Underwriters' Association during each of the last two years has been :—

	1883. Tons.	1884. Tons.	Decrease in 1884. Tons.
Lloyd's	1,100,202	793,658	306,544
Liverpool Underwriters ...	136,627	101,797	34,830

So that the decrease in the latter year would appear to have been 341,374 tons. To this tonnage must be added a certain unascertained proportion not registered in either of these two leading societies, and the estimation of which would probably bring up the total falling off for 1884 to between 400,000 and 500,000 tons, as compared with 1883.

ENGLISH AND FOREIGN SHIPBUILDING COMPARED.

The immediate future of the shipbuilding industry has been, and still is, a cause of much concern not only to those directly engaged in it, but to all who are in the remotest degree dependent upon it. It is more than whispered in some quarters that the home trade is affected more or less seriously by foreign competition, and that English shipbuilders are relatively losing their position in consequence of various circumstances, among which high wages at home and the payment of foreign bounties abroad are among the most frequently and prominently insisted on. There are several ways of answering apprehensions of the kind just stated. One of the most obvious is to point to the tonnage of vessels built by us for foreigners in recent years, relatively to the tonnage built for ourselves. This data appears in the following Government return :—

TABLE II.—*Tonnage of Vessels built in the United Kingdom in each Year from* 1869 *to* 1883.*

Years.	For Home and the Colonies.	For Foreigners.	Total.
	Tons.	Tons.	Tons.
1869	354,287	33,805	388,092
1870	342,706	51,651	394,357
1871	354,355	36,703	391,058
1872	392,971	81,747	474,718
1873	370,666	82,877	453,543
1874	521,203	82,664	603,867
1875	420,551	51,507	472,058
1876	360,365	17,655	378,020
1877	433,650	17,269	450,919
1878	428,245	42,474	470,719
1879	356,835	49,156	405,991
1880	403,841	69,055	472,896
1881	501,184	107,694	608,878
1882	667,275	115,776	783,051
1883	768,576	123,640	892,216

It would appear from the foregoing statistics as if the proportion of the total tonnage of vessels launched in the United Kingdom, which we have built for foreigners, had steadily increased from year to year, with occasional but generally inconsiderable backward variations. In 1869 that proportion was only 9·3 per cent., but in 1883 it had increased to 16 per cent., so that within the period embraced by the returns, the percentage proportion of the ships built in the United Kingdom for other shipowning nations had very nearly doubled. The extent to which other nations compare with our own in shipbuilding may be estimated approximately by the additions made to the merchant navies of different countries from year to year. The principal disturbing element in such a calculation lies in the fact that some of the foreign countries in question have a certain varying proportion of their vessels built in this country ; and if only the smallest possible allowance is made for such a circumstance, the actual extent of shipbuilding as well as shipowning in the countries referred to would seem to be very small by comparison with our own.

TABLE III.—*Gross Tonnage of New Ships added to the Merchant Navies of the Principal Shipowning Nations of the World between* 1875 *and* 1883.

Years.	Additions in Gross Tons to the Registers of—			
	Great Britain.	United States	Germany.	France.
1870	391,381	259,953	—	63,372
1875	502,585	263,226	107,009	64,209
1876	427,982	190,052	90,895	58,719
1877	493,932	339,245	82,520	50,900
1878	464,511	355,000	82,642	44,859
1879	410,804	150,030	105,372	43,728
1880	411,736	126,409	92,941	46,830
1881	561,750	252,459	104,000	55,944
1882	714,521	264,200	99,335	135,206
1883	751,950	—	—	—

* Report to the British Iron Trade Association for 1882, p. 58.

* The tonnage here stated would in all cases appear to be net and not gross tons.