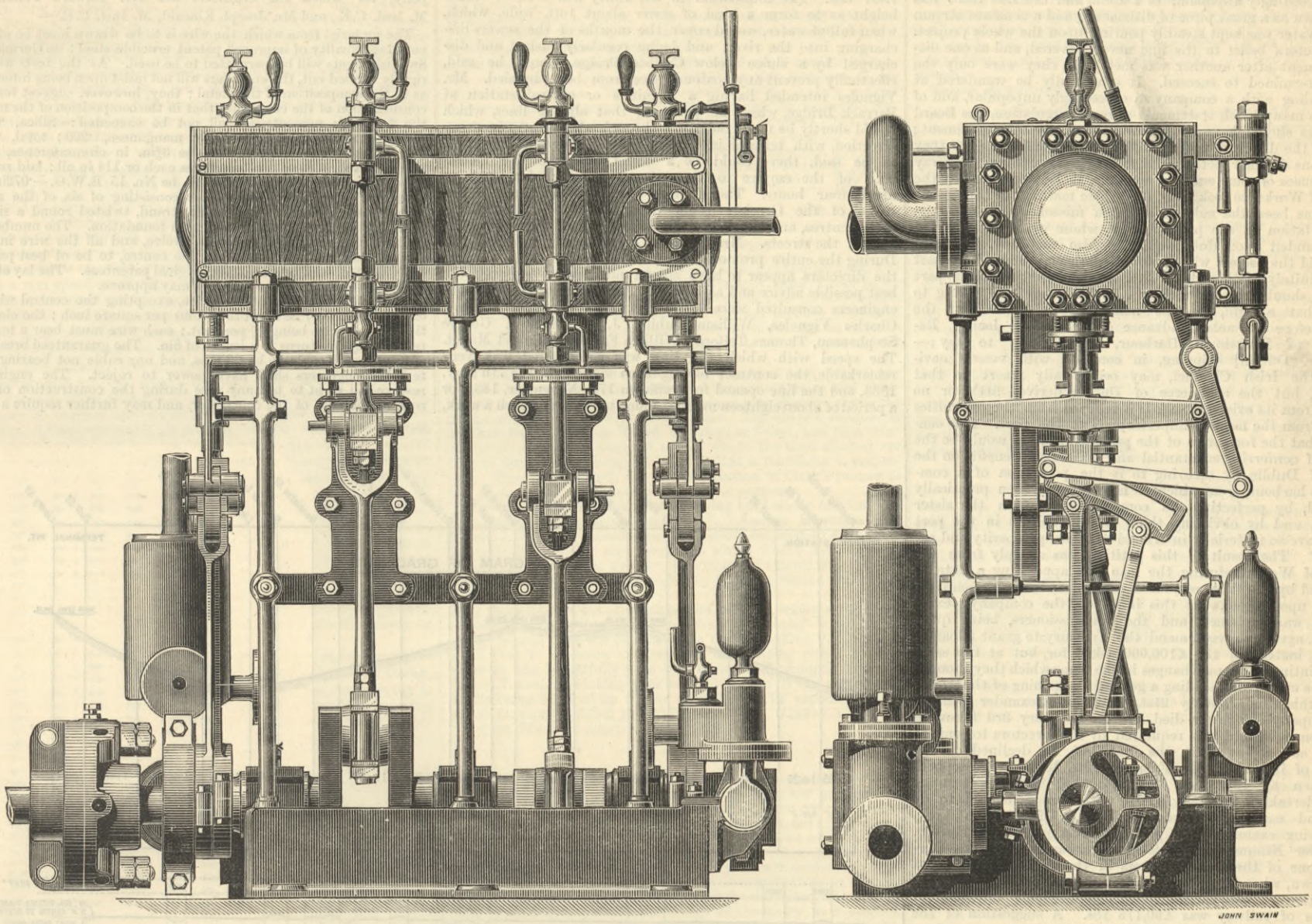
COMPOUND HIGH-SPEED LAUNCH ENGINES.

MR. A. MUMFORD, COLCHESTER, ENGINEER.



ELEVATION

END VIEW

JOHN SWAIN

MUMFORD'S MARINE ENGINE.

We illustrate above a small compound condensing launch engine, manufactured by Mr. A. G. Mumford, Culver-street Ironworks, Colchester. The high pressure cylinder is 4in. diam.; low, 7in. diam.; stroke, 5in. The design and construction of this engine is exceedingly light, but very strong, points which are of the greatest importance to builders of steam launches aiming at securing a high speed. The cylinders are mounted on steel columns, turned and polished, and the crank shaft with solid excentrics, the connecting rods, and piston-rods with solid crossheads, are all of the best forged steel. The cylinder covers and valve chest covers are pressed out of steel plates, turned and polished, to avoid the extra weight of cast iron covers. These give the engines a very neat and strong, though light appearance. Two gun-metal feed-pumps are fixed to the bed-plate at the forward end of the engine, and are worked by means of a dog-link and die from the end of the crank shaft. The air-pump, which is of gun-metal and single-acting, is fixed at the after end of the engine, and is worked by an excentric from the outer end of the crank shaft. Connections which are easily accessible are made from this pump to the condensers, which consists of two copper tubes with closed ends, one of which is fixed outside the boat on either side of the keel and form perfect surface condensers. The feed-pumps to the boiler are arranged to pump either from the hot well or from the sea, and the exhaust steam can be turned either into the condensers or into the funnel, so that the engine may work condensing or non-condensing as desired. The boiler working pressure is 120 lb., and these engines being thoroughly well made, run at 420 to 450 revolutions per minute, and will indicate 18 H.P. Mr. A. G. Mumford has made a larger number of this class of engine in various sizes with double high-pressure cylinders for the Admiralty, with the best possible results as to speed and horse-power. These engines are typical of the great advance which has been made in small marine machinery. The difference between them and the older class with cast iron framing must be seen to be understood.

A HISTORY OF THE DUBLIN AND KINGSTOWN RAILWAY.

We have received a copy of an excellent and, to engineers at least, interesting paper, read on the 1st ult. before the Institution of Civil Engineers of Ireland by Mr. Thomas B. Grierson, C.E., one of its members, the title of the paper being, "The Enlargement of the Westland-row Terminus, with a Sketch of the Early History of the Dublin and Kingstown Railway." The author prefaces his paper by expressing his thanks to the secretary of the railway, Mr. Joseph Pim, for his kindness in allowing him access to all the important documents connected with the original construction of the line. The circumstances suggesting the formation of this line were that, at the close of the last century, while the Irish metropolis was in communication with the provinces by means of some splendid canals, the trade with England was seriously hampered and obstructed by the want of proper facilities for shipping to carry the cross-channel traffic. The history Mr. Grierson puts before his readers is instructive in more ways than one, because it not alone records mistakes made in the actual construction of the line, but it also shows what formidable obstacles can be put in the way of progress and enterprise by ignorance and prejudice, and how they can be overcome by resolute energy. At the end of the last century the mouth of the Liffey scarcely deserved the name of a port, being so filled with sandbanks that no vessel of any pretension to magnitude had water deep enough to float her anywhere above the Pigeon-house, a place almost on the sea-board, and fully two miles from the Custom House. Farther down on the southern coast of Dublin Bay was the harbour of Old Dunleary, or, at all events, the nucleus of what is now Kingstown Harbour. Mr. Grierson says:—"Splendid canals had been cut at immense cost, opening up a large portion of the country, and bringing it into convenient communication with the metropolis; but the facilities for exporting the Irish products from, or for importing English or foreign commodities into, the city were still very inferior. This was mainly owing to the natural disadvantages of the port of Dublin, the improvement of which port and harbour Mr. Rennie, in 1802, in his report to the 'Directors-General of Inland Navigation,' said was 'one of the most difficult subjects which had ever come under the consideration of the civil engineer,' and he goes on to say, 'The majority of the plans which have been of late projected are on the principle of the impossibility of executing any works in the present harbour.' After great consideration, Mr. Rennie seems to have been driven to the conclusion that the best plan would be to make an entirely new harbour at Dunleary, and cut a ship canal—80ft. wide at bottom, 160ft. wide at surface of water, and 20ft. deep—from thence to the new extension of the Grand Canal Docks at Ringsend. Dunleary Harbour was to have a depth of 14ft. at low water, with an inner harbour or basin, into which several vessels could enter at a time. It was proposed that vessels entering this canal could come directly into Dublin, and either remain in the Grand Canal Docks, or through them obtain access to the river Liffey, and discharge at its quays, thus avoiding the dangerous bar, with its 5ft. of water at low water at the entrance to the port." He gives detailed estimates of the cost of the proposed works. Other schemes of a like nature were proposed not only by Mr. Rennie but by other eminent men also. The above was, however, considered as the best. "The plan in its entirety was not, however, adopted, but subsequently Mr. Rennie, actuated by the Admiralty, commenced the present Royal Harbour of Kingstown in 1816, and it was finished by his son, Sir John Rennie, in 1859, at a cost of about £825,000. The area enclosed by the east and west piers is about 250 acres, the width of the mouth is 760ft. and the length of the east and west piers respectively 3500ft. and 4950ft. The general depth of the harbour is 15ft."

Mr. Grierson then proceeds to point out how useless a harbour, however fine, will be to a city so long as no good means of communication exists between them, and this fact again brought up the canalisation project. The amount of capital necessary, however, exceeded the powers of private purses, and Sir John Rennie therefore attempted to get a Bill through Parliament, but without success. No wonder then that the introduction of railways into England suggested a new way out of the difficulty, and the Dublin merchants at once resolved to make a railway between Dublin and the new deep-water harbour at Kingstown. For this purpose a company was formed with a capital of £200,000 in 2000 shares of £100 each, with further powers to raise £70,000 on mortgage or by annuities, and the sum of £78,000 was subscribed. Plans were prepared by the late Mr. Alexander Nimmo, to carry out which the company obtained an Act of Parliament—1 and 2 Wm. IV., cap. 69—which received the Royal Assent 6th September, 1831. This was the first railway Act passed for Ireland, and the second for the kingdom, and is entited "An Act for making and maintaining a Railroad from Westland-row in the City of Dublin, to the Head of the Western Pier of the Royal Harbour of Kingstown in the County of Dublin, with branches to communicate therewith."

It would appear as if in their early days railways were looked upon, especially by landed proprietors, as absolute destroyers of public peace as well as property, and as injurious to everything with which they came into contact. In no other way can we account for the virulence with which some of them were opposed, notably the Dublin and Kingstown. Everything which could be said or done to prevent the project from being carried out appears to have been tried. The newspapers of the day teemed with letters and articles characterising the whole board of directors as devoid of common-sense, and stating that it was utterly impossible, owing to the shortness of the line, that it could ever pay a dividend, and had the promoters been men of lighter calibre they would have been overwhelmed in the storm of ridicule and vituperation to which they were exposed from all sides.

It was originally proposed that the line should be brought nearer to the centre of Dublin by having the terminus in Brunswick-street, but various things led to Westland-row being fixed upon. In the face of the greatest opposition the promoters succeeded in raising three-fourths of the estimated necessary capital, and then went to Parliament for a Bill; but this being the first railway proposed to be made in Ireland, the Parliament of that day thought it necessary, perhaps under the promptings of prejudiced Dublin influence, to protect the public by the insertion of some very stringent provisions. Of which, perhaps, the most serious was that, "in the event of a ship canal being made from Kingstown to Dublin, the Railway Company were not to claim compensation" from any person or persons . . . . provided such canal shall not cross, touch, or injure the said intended railroad, or lands, works, or tenements thereto belonging." The success of the Liverpool and Manchester Railway gave a fresh stimulus to the promoters of the Dublin line. The first report of the Committee of the railway showed that the passengers between Liverpool and Manchester had increased fivefold since the opening of the railway. In the following year, from 12th Feb., 1831, to 13th Feb., 1832, the traffic showed an increase of 30 per cent. all round. In the subsequent records was to be found this statement referring to Mr. James Pim, of the firm of Messrs. Boyle, Low, Pim and Company, bankers, who acted as secretary until a clerk of the company was appointed. "The present favourable prospects of the line are principally owing to the great personal exertions of Mr. James Pim." But the course of railway projects often resembles that of true love, and for somewhat similar a reason, "it does not run smooth," for in May, 1832, it was resolved to apply to the Board of Works for a loan of £100,000. In reply to this application the Board Commissioners said that "it did not appear to them that the construction of a railroad from Dublin to Kingstown for the purpose of expediting the conveyance of passengers between these places would be a work of sufficient public utility to warrant them in recommending the issue of so large a sum by way of a loan from the funds placed

at their disposal." They also added that they thought the works should be carried on to some extent before asking for public aid. Nothing daunted by this rebuff, the directors immediately replied, stating that they were willing to do anything the Board of Works might recommend, and, if they preferred it, to leave the actual sum open to discussion. At this time the directors were exceedingly unpopular in Dublin, and the line itself was cried down as a great piece of dishonesty, and a constant stream of cold water was kept steadily pouring upon the whole project. The directors' belief in the line never wavered, and as one discouragement after another was met with, they were only the more determined to succeed. It can hardly be wondered at that, dealing with a company so exceedingly unpopular, and of which so many harsh statements were in circulation, the Board of Works should have been slow to give any encouragement; and this the directors appear to have felt themselves, for they said in one of their petitions that they were willing to defray the expenses of some eminent engineer, to be appointed by the Board of Works, to look into the whole matter, 'as the undertaking has been the subject of much misconception and misrepresentation on the part of those whose opinions have not been founded upon due inquiry.' Also they say, 'without public aid the project will, if not altogether abandoned, at least be indefinitely postponed. . . . . Anxious that on their part nothing should remain undone . . . . . they are willing to agree that a sum, to be named, be expended on the works before the actual advance of the public loan.' Referring to Kingstown Harbour, they go on to say:—'Its [*i.e.* Dublin] shipping, in common with vessels navigating the Irish Channel, may occasionally resort to that harbour, but the commerce of Dublin derives little or no benefit from its existence, nor is it relieved from the difficulties arising from the natural imperfections of the port. It is conceived that the formation of the proposed railway would be the means of conferring substantial and permanent benefits on the trade of Dublin by securing to it the possession of a commodious harbour, from which it has hitherto been practically excluded, by perfecting its communication with the sister country, and by obviating those natural defects in the port which have so materially interfered with its prosperity and extension.' The result of this petition was a reply from the Board of Works refusing the loan, but appointing a date, as suggested by the directors, for a deputation from the company to wait upon them. At this interview the company's exact position was explained, and the Commissioners, being quite satisfied, agreed to recommend the Treasury to grant a loan of £75,000, instead of the £100,000 asked for, but at the same time pointing out some changes in the plans which they thought advisable and recommending a general cheapening of the works. About this time, January 21st, 1832, Mr. Alexander Nimmo, the company's engineer, died, and on February 3rd following Mr. Thomas Telford was requested by the directors to come to Ireland and report upon the line, but he declined on the ground of ill-health. On February 10th Mr. George Stephenson, then at Liverpool, was requested to 'report upon the undertaking generally.' Mr. Stephenson agreed to do this, and came over, accompanied by Mr. Joseph Lock, and having examined the plans and sections of the late Mr. Alexander Nimmo, met Colonel—afterwards Sir John—Burgoyne, one of the Commissioners of the Board of Works, at Kingstown, when the whole subject was fully discussed to the satisfaction of all parties. Mr. Stephenson's estimate for 5⅝ miles of railway was £90,175 18s. A suggestion of the directors that they would be willing to pay the expense of an independent engineer, to be appointed by the Board of Works, seemed to have been acted upon, and Mr. Killally was selected, but he died before he had time to report. Mr. Charles Vignoles was then chosen, this being his first connection with the line, when he was appointed—about 13th April, 1832—by the Board of Works. His report to the Commissioners being considered satisfactory, and his suggestions to the company valuable, the directors appointed him as the company's engineer. In his report, dated 15th June, 1832, he estimated the entire cost of the works, evidently including land, at £150,000. His next movement appeared to have been to satisfy the Commissioners of the Board of Works as to the proposed method of constructing the line, for in a letter to the directors, dated 29th June, the Commissioners said that Mr. Vignoles had quite satisfied them; they also gave him great praise for his ability, but advised, at the same time, a general cheapening of the work, adding—'With regard to the extent of assistance which the Board can feel justified in recommending to be advanced for this work, they must observe that when the project was first made known to them, they were impressed with the very general opinion that it was a private undertaking, unlikely to be beneficial to the country, or to afford reasonable security for an advance of any magnitude. . . . If managed with economy, regularity, and judgment, it may turn out profitable . . . and prove advantageous to the city of Dublin. And they propose to lend the company £50,000, at 4 per cent., the principal to be paid off in 25 years by equal yearly instalments, commencing not later than five years after the date of advance.' On the 28th August in the same year the Board of Works agreed to grant the entire sum of £75,000. Having advertised for tenders for the execution of the works according to Mr. Vignoles' plans and specifications, several offers were received, of which that of Mr. William Dargan, for £83,000, being the lowest satisfactory tender, he was declared contractor on 26th January, 1833."

The entire paper is well worth reading by all who are either interested in railway history or who are desirous of benefitting by the experience of others. The promoters of the line and their administrative and executive staffs encountered, and had to contend against very great opposition, and to overcome many obstacles; but success crowned their efforts, and the completion and prosperity of the line is at least one proof of what Irishmen can do when they set themselves earnestly to work. Mr. Vignoles, who had much to do, in common with Mr.—afterwards Sir John—Burgoyne, with the construction of the line, proposed in 1835 an extension of the line from Westland-row through the city, and across the entire country to Valentia on the West coast, with a suitable harbour for the purpose of securing what is now possessed by Ireland, namely, the American mail traffic going through Ireland.

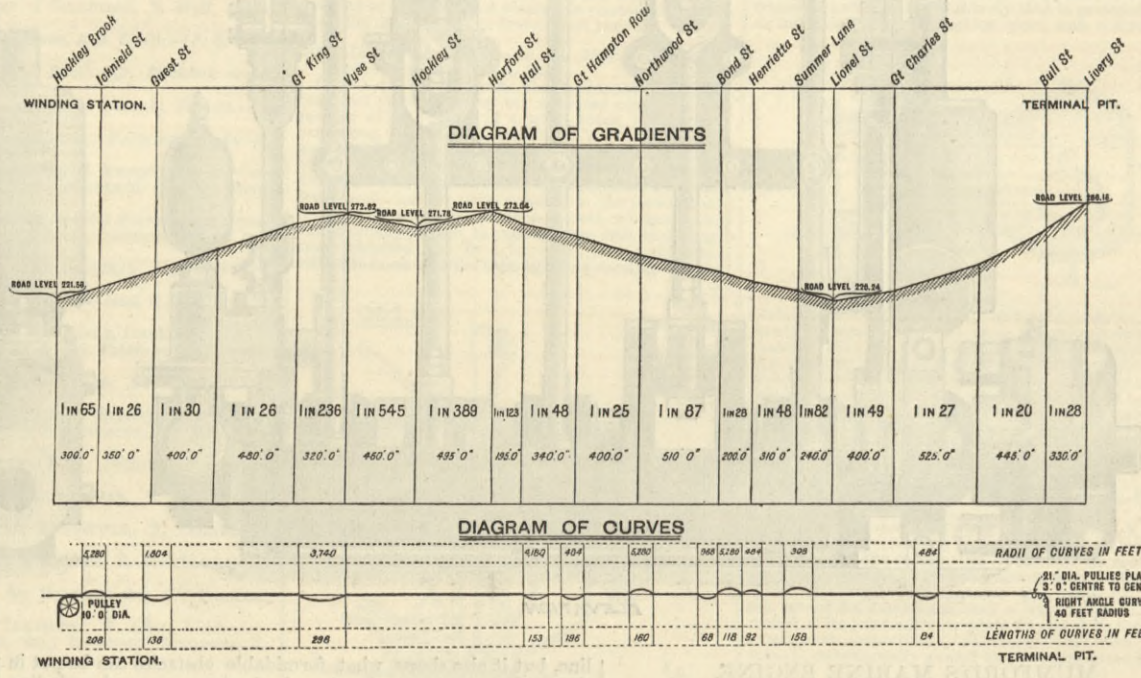
The directors took up the idea very warmly, and opened a subscription list—14th May, 1835—to defray the cost of the survey, and asked one of the London banks to co-operate; but notwithstanding their most strenuous efforts, the project fell through, the scheme being too much for Irish enterprise at that time. The intention was to make the trunk line, leaving the towns near which it passed to make the branches. In 1838 Mr. Vignoles again proposed a scheme for a high level railway through the city from Westland-row to Barrack Bridge, which was laid before the Railway Commissioners with his report on the proposed Southern (Irish) Railways, and it was arranged to be worked by horses if the engines were objected to. As this scheme was much spoken of at the time, it is here given. The route was across Westland-row, and proceeding along the rear of the houses in Great Brunswick-street, and just clearing Clarendon's Riding School, it crossed Townsend-street, Hawkins-street, D'Olier-street, Westmoreland-street, to Aston's Quay, where it ran along above the footpath on the river side, with one row of columns resting upon the footpath kerb-stone, and the other about 20ft. from the quay wall founded upon the river bed. The foundation in the Liffey was to be of such a height as to form a kind of sewer about 16ft. wide, which, when full of water, would cover the mouths of the sewers discharging into the river, and being regularly flushed and discharged by a sluice below Carlisle Bridge, would, he said, effectually prevent any noxious gases from being inhaled. Mr. Vignoles intended having a terminus or central station at Barrack Bridge, where he proposed that all the lines, which would shortly be made radiating through the country in every direction, with termini in Dublin, should converge, and then, as he said, there could be a direct run from the metropolis of the empire to its extreme western boundary in ninety-four hours. The design of the superstructure was to be of the Grecian Ionic order, the intercolumniations 30ft. centres, and the rails at a general level of 20ft. above the level of the streets. Mr. Vignoles' estimate was £150,863 16s. During the entire promotion and carrying out of the project, the directors appear to have spared no expense to obtain the best possible advice and assistance. Amongst the names of the engineers consulted were the following:—Alexander Nimmo, Charles Vignoles, William Cubitt, J. V. Rastrick, George Stephenson, Thomas Telford, William Fairbairn, Robert Mallet. The speed with which the line was constructed was very remarkable, the contract having been signed on the 7th May, 1833, and the line opened for traffic on 17th November, 1834, or a period of about eighteen months, much too short for such a work, and leading to many failures in masonry bridges, &c. A very curious provision, and one that would be strongly objected to in these days of "eminent" contractors, was that Mr. Dargan was strictly bound to give his entire time to the undertaking. Also, Mr. Vignoles, who received £3500 for plans, and £1500 for inspection, undertook to give one-third of his time to the line, and was not permitted to make any alteration involving the extra cost of more than £100 without the sanction of the directors. He appears, however, owing to extra work in Parliament, &c., to have received about £1000 more than the £5000 above mentioned. In concluding our notice of this portion of the paper, it was not too much to say that but for the great courage, determination, and sound judgment of the promoters of the Dublin and Kingstown Railway, who so bravely led the way, Ireland would not have enjoyed the benefits of railways so early in their history; and "the fact brought out in clearer light the public spirit of those men when we find out that for exactly ten years there was no other railway in this country, until 1844, when the Dublin and Drogheda was opened for traffic, followed, in 1846, by the Great Southern and Western to Carlow, and the Midland Great Western in 1847." One very curious feature about the inception of the Dublin and Kingstown Railway is that its promotors thought of it only as a means of transport for goods; the probable value of the passenger traffic was not at all considered, yet the irony of unthought-of influences operated very quickly to show that the goods traffic would virtually be *nil*, while the line would be a brilliant success by its passenger traffic. It might be said to have ruined the dwelling-house property at the north side of Dublin, and made fortunes for all owners of building property along the line from Merrion to Killiney. In fact the Dublin and Kingstown Railway, especially after its connection with Dalkey, first by the atmospheric railway of two miles, and subsequently by the removal of this and the construction of a regular railway to Wicklow and Wexford, brought about in Dublin the now prevailing practice of men working in town daily, and spending their leisure with their families in the purer air and pleasanter prospects afforded by localities showing scenery by land and sea scarcely, if at all, outdone by any scenery in the world. The wonderful improvements effected by degrees for many years in the port of Dublin by dredging operations, which maintain a navigable channel now even at the lowest tides, as well as the construction of docks, sea walls, and the erection of powerful cranes and lifting tackle, and of sheds, as well as the extension of the Midland Great Western Railway to the North Wall, and the connection of the latter with the Great Southern and Western Railway at its Kingsbridge terminus, all combine to render the port of Dublin quite independent of Kingstown, its chief drawback being a prevalence of fogs at certain seasons. We are not exceeding truth when we say that Mr. Grierson's paper, giving, as it does, a record of difficulties overcome, of financial statements of costs of a variety of classes of work involved, of specifications and the methods taken to carry them out, of miscalculations of the effect of a stormy sea on massive walls, is a valuable addition to the literature of railway inception and construction.

STEEL CABLES FOR THE BIRMINGHAM TRAMWAYS.

The following is from the specification for the manufacture, supply, and delivery of two steel wire cables at the Hockley Brook depôt, Birmingham, of the Birmingham Central Tramways Company, for which the engineers are Mr. Edward Pritchard, M. Inst. C.E., and Mr. Joseph Kincaid, M. Inst. C.E.:—

The material from which the wire is to be drawn must be of the very best quality of improved patent crucible steel; no German or Swedish ingots will be permitted to be used. As the tests will be rigidly carried out, the engineers will not insist upon being informed as to the composition of the metal; they, however, suggest for the consideration of the contractor that in the composition of the metal the following percentage shall not be exceeded:—Silica, ·012; phosphorus, ·030; sulphur, ·045; manganese, ·200; total, ·287. The cables—"laid rope"—shall be 3⅜in. in circumference, containing six strands of nineteen wires each or 114 in all; laid round a hemp centre core. The wire to be No. 15 B.W.G.—·072in. in diameter. Each strand has a core consisting of six of the nineteen wires contained in the whole strand, twisted round a single wire specially annealed and used as a foundation. The number of wires for the outer covering to be twelve, and all the wire in the strand, except the single one in the centre, to be of best patent crucible steel wire by one of the original patentees. The lay of the rope shall be such as the engineers may approve.

The tensile strength of each wire, excepting the central wire of each strand, shall be equal to 95 tons per square inch; the elongation of such wire being 1¾ per cent.; each wire must bear a torsion test of fifty-five turns in a length of 8in. The guaranteed breaking strain of each cable to be 33 tons, and any cable not bearing this test the engineers shall have power to reject. The engineers reserve the right to test any wire during the construction of the rope at the cost of the contractor, and may further require a test to be made from each bundle of wire. They also reserve the right to make a test of each cable, and also of the wire of which the cables are made after delivery. The cables to be supplied are to be two in number, each being 4666 yards in length, and each cable will be required to be made and delivered in one piece upon a reel, properly mounted, with steel centres, so as to be fixed in the permanent winding machine, as shall be determined by the engineers. The length given represents approximately the total length of each cable without making allowances for deflection; therefore the contractor shall take all such measures as he may consider necessary upon the ground to determine accurately the required lengths, and this shall be done at his cost and upon his responsibility. The cable will be driven by a pulley 10ft. in diameter, the system of driving being known as the Gordon plane, the cable nearly forming a figure 8, or approximately covering two-thirds of the periphery of the driving pulley. The smallest diameter curve pulley, where the cable travels round one-half of the periphery, will be the pulley at the terminal pit, the diameter of the pulley being 7ft. 8½in. The cables will be supported by carrying pulleys 28ft. apart, and they will travel in a conduit, and will not be directly exposed to the weather. The cables will travel round one severe curve in Colmore-row and Snow Hill, but upon all curves there will be special pulleys fixed. The velocity of the cable will be six miles per hour, and it is intended, with a few exceptions, to run single cars upon bogie frames. The contractor shall, at his own cost, make the necessary splicings of the cables when placed in their position. The cables shall be completed in every respect in a first-class manner, and after inspection by the engineers, shall be protected by castor oil, tar, or other approved coating. There shall also be provided and fixed in the rope lead, over the incoming cable, a mechanical arrangement, whereby such castor oil, tar, or other material, may be properly applied when running. An approved automatic tell-tale shall also be applied to the incoming rope, which, when stranded, would signal to the engine driver by ringing a bell. The mechanical arrangements for coating and tell-tale shall be such as the engineers may approve. Annexed to this specification is a diagram giving the approximate curves and gradients of the tramway. It must be understood that this diagram is only submitted for the purpose of giving the contractor a general idea of the road to be worked, and the contractor must satisfy himself as to the effect any deviations or differences therefrom will have upon the cable.



GRADIENTS AND CURVES OF THE BIRMINGHAM CABLE TRAMWAYS.

Beaumaris Sewerage Works.—A dispute between the contractor for the sewerage works—Messrs. Hughes and Lancaster, of Chester—and the Corporation of Beaumaris, has been before the Court of Queen's Bench, and ended in an order of reference having been made by the judge, Mr. Edward Pritchard, C.E., of Westminster and Birmingham, having been appointed sole arbitrator in connection with this matter; and from what we hear he will shortly hold an inquiry in Beaumaris to receive evidence thereon.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—John. C. Weeks, fleet engineer, to the Northumberland, to date August 8th; Robert Pattison, staff engineer, to the Crocodile; John Hobbs, staff engineer, to the Hotspur, to date August 8th; Isaac E. Hurst, engineer, to the Urgent, additional, for service in Jamaica Dockyard; Frederick M. Cottam, engineer, to the Pembroke, additional, for service in Jamaica Dockyard; James T. Willoughby, assistant engineer, to the Swiftsure; and Frederick H. Dart, assistant engineer, to the Northumberland.

COMPOUND ENGINES AT OLYMPIA.

We illustrate on page 132 the engine-room of the electric light installation at Olympia, Kensington. We have already fully illustrated and described the beautiful roof of the Great Hall, 440ft. long by 250ft. wide. This hall is lighted at night by fifty-two Brush arc lamps, arranged in nine groups of six lamps each, working in parallel. There are besides four large arcs outside the building, and about 1000 incandescent lamps. Current is supplied by four compound wound Siemens slow-speed dynamos, of the new "Half H.B." type. The field magnets are placed below the armature. The machine in some respects resembles an Edison machine, with very short field magnets, turned upside down. The output is 600 ampères., at 66 volts at the terminals, speed 390 revolutions per minute.

The two pairs of engines are of the horizontal compound type, with Paxman's automatic expansion gear. The high-pressure cylinder is 18in. diameter, the low-pressure 28½in. The stroke is 2ft. The indicated power about 200-horses. They make 100 revolutions per minute. Each engine drives two dynamos direct by double leather belts 12in. wide without countershafting. The two fly-wheels on each engine weigh three tons each, and run with a rim speed of 2200ft. per minute.

Steam is supplied by three marine boilers; space was very limited and nothing else could be used. They are a very good job in every respect. They are made of mild steel, manufactured by the Steel Company of Scotland by the Siemens-Martin process. The finished size of the shell of each boiler is 9ft. 6in. diameter, and 8ft. 6in. long, with two furnaces in each boiler. The furnace-plate consists of a single plate, 10ft. 6in. diameter, flanged to receive the double-rivetted shells. These are, we believe, the largest boiler-plates ever rolled. The specified test actually applied to the plates of the boilers is a tensile strength of not less than 26 or more than 30 tons to the square inch with a stretch of 20 per cent.; and, as a precaution against hardening in working, strips cut from the plates were required to stand the following test:—To be heated to a cherry red and quenched in water at a temperature of 82 deg. Fah., and afterwards to be capable of bending cold in a press to a curve, the inner radius of which is one and a-half times the thickness of the plate, without fracture. The stays for stiffening the end plates and tube plates have an aggregate section of not less than one square inch for every 9000 lb., when the whole internal surface is pressed to 200 lb. per square inch. The tubes are iron, solid drawn, of 3in. external diameter.

The whole of the electrical installation was designed and carried out by Mr. Farquharson. It is now in charge of Mr. Carey, engineer to the Olympia Company, and we need scarcely say is maintained in perfect order, although unfortunately the building is not open. Steam is got up once a month, and the whole installation run for a few hours to keep everything in perfect order.

The construction and materials of engines and boilers leaves nothing to be desired, and the whole installation may be regarded as one of the best in the kingdom.

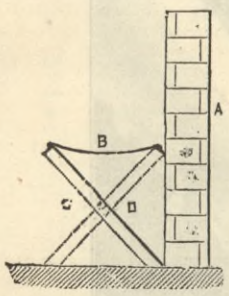
LETTERS TO THE EDITOR.

[We do not hold ourselves responsible for the opinions of our Correspondents.]

STRESSES ON A CAMP STOOL.

Sir,—A correspondent recently asked in The Engineer a sensible question enough about the stresses in a camp stool. To him reply three mathematicians, men possessed, no doubt, of technical education. "R. W. M. M." supplies nearly a third of a column of equations, and the other two are not far behind.

I have found it impossible to read these letters without laughing. They all supply different answers to the problem. Two-thirds of the solutions must therefore be wrong, even if one were right; as a fact, however, they all are wrong. All three correspondents have neglected the friction of the legs of the stool on the ground, which at the high angle of thrust of the legs must be very considerable. Assuming the co-efficient to be high, we have simply a braced strut, the conditions being just the same as though the legs of the X were tied together at top and bottom, in which case there is no shear on the central pivot and no cross stress of any kind on the legs. To make this clear to your correspondents, I give a little sketch. Here A is a wall, and B a seat secured to the wall, C a strut. It will be at once admitted C is subjected to no stress save one of compression. Take away A and replace it by the strut D, shown dotted. The conditions will remain unaltered, and D also will be in compression.



If the legs rest on a slippery surface, or are provided with wheels, the conditions will be altered, and a shear will be put on the central pin, but its amount depends always on the co-efficient of friction between the legs and the ground.

In practice the central pin will usually be submitted to some slight shear, because the legs will probably move a little on the ground, which will yield slightly, but the stress may be just as well up as down, the sagging of the seat tending to pull the legs together at both top and bottom.

All this does not affect the fact that your three correspondents are all wrong, because they have neglected an important working condition. It is ever thus with mathematicians. I am not one. Nothing more, in fact, than a

London, August 8th. Common Mechanical Engineer.

Sir,—Your correspondent will probably be more "puzzled" than before by the variety of results of those who have attempted to solve his problem. The three solutions give respectively 270 lb., 484 lb., and 896 lb., as the weight which would raise the bending strain in the legs to the limit of their strength.

As pointed out by all, the data of "Puzzled" were not sufficient to define the case. Taking the assumptions made to complete the statement of the problem, the method of "E. K." is the correct one, although there are errors in its application. If the one angle is 18 deg., the other must be 42 deg., which would give a lever arm of 8in. The limiting tensile strength of 7½ tons is not allowable, as the leg will commence to break under the limiting compressional strain. This we cannot take at more than 6 tons. These two errors tend to balance each other, and the correct value of P, 219 lb., is very near the one obtained. I do not know if "E. K." has obtained his assumption of a dip of 2in. of the seat by observation. Without a direct observation, I should imagine that a seat firmly nailed would not give so much under the weights in consideration, the stool being put down on rough ground, so that there is no slipping; and it is necessary to point out that a dip of only 1in. would cause the breaking strain with a weight less than 120 lb. It wou'd be interesting if "Puzzled" would give us his calculation of the strength of the bars to which the seat is nailed in the case of his stool. These parts are often of inferior wood, and it may turn out that they are the weakest part of the stool. Our only conclusion can be that the ordinary camp stool is essentially a weak structure, and likely to be speedily broken in the service of any other than light weights. There is always the contingency of the user's weight falling as supposed, although usually it would not so fall.

The letter signed "B. J. Hall," besides making the unwarranted assumption that we may neglect the effect of other forces besides the vertical ones, employs ratios of bending moments in a way which is far from the truth. This correspondent should note that a bar of section 1in. square is not of the same strength against bending as one of section 2in. by ½in.

The remaining correspondent, "R. W. M. M.," applies intricacies of calculation altogether unsuited to the looseness of his original assumptions. Taking his result of 896 lb., has he noticed that the bending moment of the forces which he has neglected, taken about the pin, amounts to 4480 inch-pounds? The stool-leg cannot be in equilibrium, as he has assumed, thus: The difference to be made in the value of the modulus of rupture to allow for the force of compression in the leg is small, and therefore should not be used to complicate the equation.

August 8th. Scrutator.

SOFTENING FEED WATER.

Sir,—We have read your interesting article of the 1st July, and noticed the several letters which follow in later issues of your paper on this subject. In reference to the letters of your correspondents W. J. Cooper and Professor Wanklyn, we may perhaps be allowed to mention that we have recently made an important advance in the successful application of Clark's process to the treatment of the river water for dietetic uses.

At Egham, for increasing the water supply of that district, the Porter-Clark process has been adopted for the softening and filtration of the water drawn from the Thames near Staines, above the intake of the London Water Companies. The water is reduced in hardness from 15 deg. or 16 deg. to 4 deg. or 5 deg., and then what matters in suspension have not settled out in the time allowed are filtered through the precipitated chalk that is remaining in suspension. This is, we believe, the first application of Clark's process to the treatment of river water for domestic purposes.

In considering the question of softening hard water for domestic purposes, your correspondents "C. J.," Andrew Howatson, and Messrs. J. W. Grey, should have given your readers their experience in treating water for such purposes, which would have been of more assistance to the subject than drawing attention to what is being done with lime and soda for treating water for steam boilers.

By those who do not understand the subject, water softening is commonly called "treating water with chemicals," which could hardly be said to be the case in using only clear lime-water, which is all that is necessary or desirable for treating either Thames water or the beautifully pure but hard water pumped from the Severn Tunnel. Thinking your valuable notice on this subject was hardly being followed up in the direction to be expected is our reason for now troubling you with this. Gimson and Co.

Vulcan Works, Leicester, August 9th.

Sir,—In your issue of the 29th July your correspondent "C. J.," of Cardiff—to whom we shall be happy to show our process if he will call—refers to the fact that we have for some years softened our feed-water, but that details of the process have never been published. The fact is we have little to publish, as we simply mix the softening agents, lime and soda, with the water, and allow the precipitate to settle in our feed tanks. Anyone with moderately large feed tanks can do the same with a little care and attention to a few small precautions, which cannot be briefly described, but which a little experience or a slight knowledge of chemistry soon teaches. To avoid, however, all trouble of experimenting, and to simplify the process as far as possible, we have designed an automatic apparatus which will receive the water in the hard state and deliver it softened with no further attention from anyone than to supply fresh lime and soda at intervals of a week or so.

The advantages to all steam users of softening their feed-water are very great. Not only is a saving of fuel and of labour in cleaning effected, but also the life of the boiler is prolonged by its not being subjected either to hammering to remove the scale, or to deleterious mixtures introduced to prevent its formation.

Southwark Park-road, Bermondsey, B. Donkin and Co.
London, S.E. August 9th.

Sir,—Referring to the letters in your issues of 29th ult. and 5th inst., on the subject of the purification of water, although the results are far in excess of what I should have judged to be possible, still, if it be allowed that the apparatus mentioned has done all which Messrs. J. W. Gray and Son claim for it, I am very anxious to learn, and I am sure your readers will be equally glad to know, if it is also possible to treat water which very largely contains mud or sediment in that form.

We read in this morning's papers that the town water supply to manufacturers at Llanelly has been discontinued, owing to the scarcity of the rainfall, which has also been keenly felt in many other places, and that their hands must consequently be thrown out of work.

At the best the supply by water companies is expensive, but if the mud so prevalent in canals and streams could be dealt with, a large number of factories could then obtain an independent supply, while in those cases where well water is used, the hardness, which is generally very excessive, could be also taken out before entering the boiler, a saving at the same time being effected in dispensing with the water company.

I feel sure that under the above-mentioned circumstances manufacturers would largely avail themselves of the use of such a machine, and any light which can be thrown on the subject by the aid of your columns will be generally appreciated.

Sunbury-on-Thames, August 10th. T. W. Kennard.

MONITORS AND TURRET SHIPS.

Sir,—In your article of the 29th ult., under this heading, you arrive at some conclusions which I am surprised have been allowed to pass unchallenged.

Your first proposition is that the four heavy guns which form the Inflexible's main armament could be more efficiently carried in four separate ships. The answer to this appears to be that four ships each carrying an 80-ton gun, and as well protected as the Inflexible, would require an aggregate displacement of over 24,000 tons, would cost at least a million and a-half, and would require some 1400 men to man them. For the same outlay we might have two Inflexibles. Moreover, what was gained in "separate baskets" would be lost in power of concentration.

The next statement calls for graver comment. You say, "In one word, the Ericsson monitor above water supplies the *beau ideal* of what a warship ought to be." Now, I venture to think that of all designs that have ever been produced, the Ericsson monitor would be most absolutely at the mercy of the modern type in its fullest development. The Sicilia could destroy a whole fleet of them with almost absolute impunity. With their low speed and wide expanse of exposed deck close to the water, but unprotected by it, with their own guns so low as to be utterly useless against the submerged deck of the barbette ship, with no quick-firing or machine-guns to attack her unarmoured sides, they would offer an almost unresisting target to the four 110-ton guns, carried 32ft. above the water. It must be remembered that the British turret-ships of the Dreadnought class differ widely from the monitor type, in that the turrets are placed, not on the monitor deck, but on the armoured breastwork or citadel some 6ft. higher, while in the Inflexible type the citadel rises from the submerged deck to an equal height above water. It way be safely said that for fighting purposes, as well as seaworthiness and habitability, the monitor is eminently unsuited to modern requirements, a statement which is confirmed by the description of the new American ironclad in the same number of The Engineer, which vessel is of a totally different type.

As to the deck structures on which you comment adversely, I would only remark that in the Dreadnought and Inflexible types they serve the important purpose of carrying the auxiliary armaments, and that in all recent ships there is nothing over the heavy gun station, the sides of the ship being carried up between the turrets to form a battery with spar deck over it on which the boats are stowed. G. W. Cobb.

Brecon, August 6th.

[Our correspondent is disposed to think that we have pronounced a complete approval on the American monitor, whereas we have done nothing of the kind. The arguments which he has advanced against the type are matters of opinion, and as such worth discussion.—Ed. Engineer.]

ELECTRICAL LAUNCHES.

Sir,—In your issue of August 5th, page 111, under "Miscellanea," you refer to a yacht propelled by electricity as being the first one built in the United States, and run by storage batteries. As your information is erroneous, I take pleasure in righting a journal of your prominence. About three years ago there was constructed, at the works of C. H. Delemeter and Co., a monitor for submarine and surface torpedo duty under the patents of Mr. Tuck. The boat was equipped with storage batteries, charged from a dynamo, and the motive power was the stored electricity transmitted to the propeller shaft through a small dynamo. A high number of revolutions to the shaft was given, but the power was unsatisfactory, and is now replaced by improved machinery other than electrical. I personally christened the boat the Peacemaker, and ran her the first few trips she made. The Brush Co., of Cleveland, supplied the electrical equipment. A. B. Frenzel.

St. George's Club, August 7th.

THE L.N.W.R. BRAKE.

Sir,—The enclosed gem from the *Evening Standard* of this date is too good to be missed. Cannot some one give us an explanation how this happened? I always thought the L.N.W.R. vacuum brake was immaculate, and that it was impossible for it to fail.

Narrow Escape of an Express.—A Perth correspondent telegraphs:—This morning the Euston mail train had a narrow escape from being wrecked owing to the brake failing to act. Fortunately, the train was turned into a siding to the west of the station proper, with the result that it came in collision with another engine. The front carriage and engine of the mail train left the rails. With the exception of the buffers of the engine being destroyed, little damage was done. No passengers were injured.

Perhaps some of the authorities will favour us with details, which I am sure would interest others besides

August 9th. H. C. W. Borrie.

ROLLER MILLING.

Sir,—Your articles and correspondence under this head have interested me much as throwing light on the impossibility of getting good bread in large towns, and the risk that such will vanish ultimately from our country villages also. It seems that the whole aim of roller milling is to produce a flour fit for pastry and fancy rolls only, and therefore it was a relief to hear that some of the small country mills are still able to compete locally.

W. A. S. B.

MR. WILLIAM HALL, SHIPBUILDER.

On the 9th inst. Mr. William Hall, sen., of the renowned shipbuilding firm of Messrs. A. Hall and Co., Aberdeen, died at his residence in that town, at the ripe age of eighty-one. The deceased served an apprenticeship with his father, who was also a shipbuilder, and afterwards proceeded to sea as a carpenter for three years. When about thirty years of age he joined his brother in the shipbuilding concern subsequently formed for the production of clipper-bow vessels, for long known as Aberdeen clippers. In 1846, when British shipowners and builders first directed their efforts to the construction of clipper vessels intended to rival the highly successful American ships engaged in the coasting trade of China, and in the still more lucrative opium trade, Messrs. Hall were commissioned to build the first of these. This was the schooner Torrington, which proving a success, was followed by others of larger dimensions. While the American vessels for some time continued superior in speed, it was discovered that they were inferior in strength, and as some of them had landed cargoes in a damaged state, shippers encouraged the building of vessels of superior strength, at the same time striving after increased speed by improved models. Messrs. Jardine, Mathieson, and Co. commissioned Messrs. Hall to build a vessel with lines as fine as those of any American ship, but of superior strength. The Stornoway—the first of the renowned Aberdeen clippers—and the Chrysolite were produced, which, though proving very fast for their size, were still no match for the Americans which were double their dimensions. The Cairngorm, however, another vessel built for Messrs. Jardine by Messrs. Hall in 1853, proved equal in speed to any of her foreign competitors; and by delivering her cargo in superior order, obtained a preference. Thereafter the ships of British build, led by the Aberdeen clippers, won special reputation for speed and weatherly qualities, beating the fastest American vessels on long ocean voyages, and gradually obtaining an ascendancy in the China trade, which was only interrupted by the growth of steam navigation. Mr. Hall was much esteemed by a large circle of old-time shipbuilders and engineers, as well as by the inhabitants of Aberdeen. A marble bust of him was recently obtained by public subscription and placed in the Aberdeen Art Gallery. Mr. Hall is survived by several daughters and two sons, partners in the shipbuilding business.

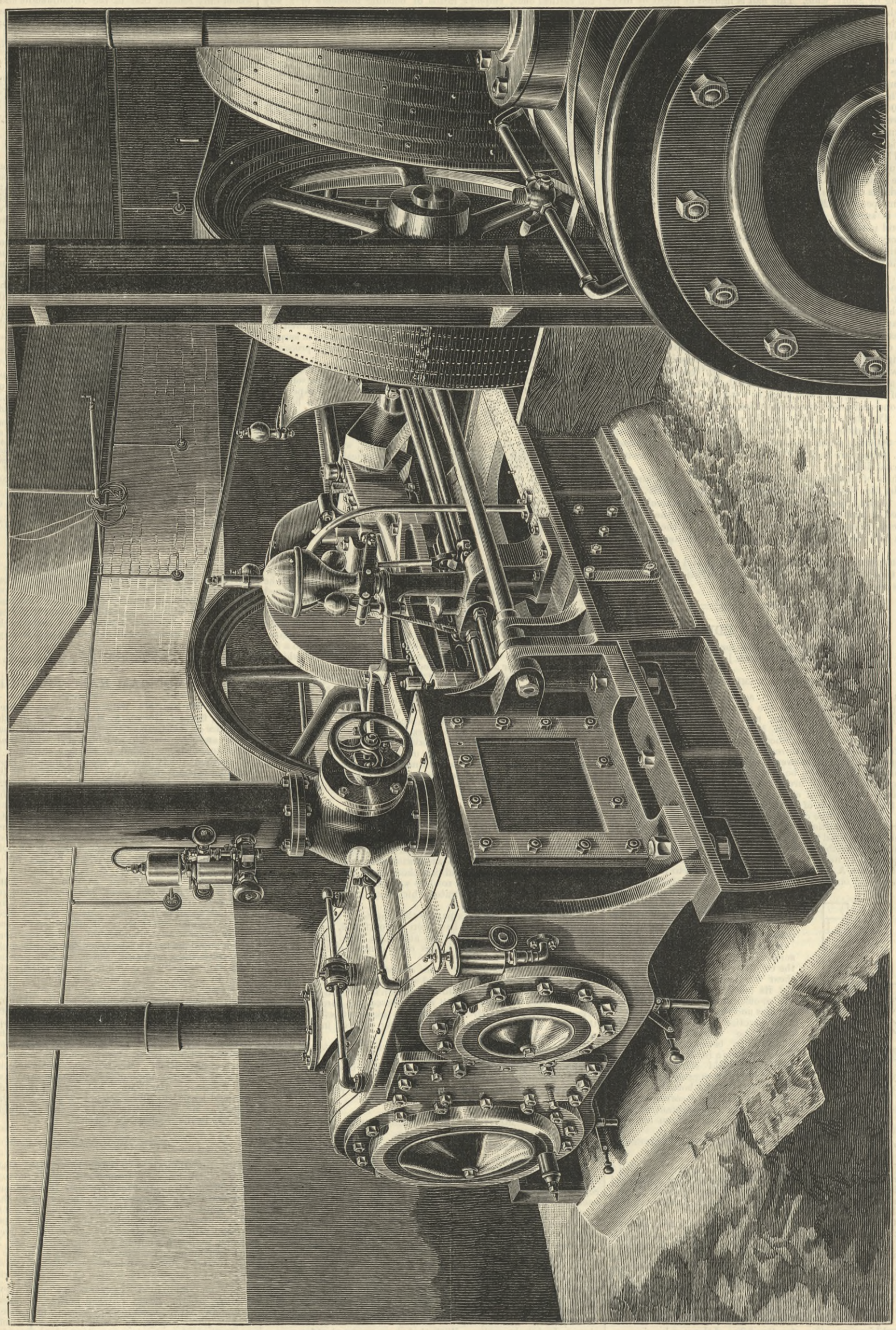
The Birmingham and Gloucester Ship Canal.—The committee which has been formed in Birmingham to arrange for the construction of a ship canal between Birmingham and Gloucester have decided not to proceed with the scheme in the next session of Parliament. Practically they are waiting for the report upon the subject which the Birmingham Corporation is expected to issue in October. In the meantime every effort will be made to extend the scheme to South Staffordshire, with which view Mr. Keeling has been appointed to examine and report upon the canal system of that district. Assistance in the promotion of the scheme is invited from the Corporations of Bristol, Cardiff, Newport, and Swansea.

A New Light for Instantaneous Photographs.—At a recent meeting of the Berlin Physical Society, Professor C. W. Vogel communicated the most recent discovery in connection with instantaneous photography, by which it is now possible to obtain instantaneous photographs, not only at night, but also in the darkest places. Messrs. Goedicke and Miethe have prepared a mixture of pulverised magnesium, chloride of potash, and sulphide of antimony, which when ignited produces an explosive, lightning-like illumination of such intensity that by means of it an instantaneous photograph can be taken. The speaker then gave a demonstration of the discovery by taking photographs of several persons present. He used the artificial light, of which each flash lasted one-fortieth of a second, and in a few minutes produced a picture during the meeting. The powders, as prepared by the discoverers, cost only a few pfennigs each, and will hence readily come into general use.

COMPOUND ENGINES, ELECTRIC LIGHT INSTALLATION, OLYMPIA

MESSRS. DAVEY, PAXMAN, AND CO. COLCHESTER, ENGINEERS.

(For description see page 131.)



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CONTENTS.

TO CORRESPONDENTS.

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*** *All letters intended for insertion in* The Engineer, *or containing questions, should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

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*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a 1d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice can be taken of communications which do not comply with these instructions.*

J. B. W.—*We fail to find anything new in your brake tackle.*

A. G. (Rodley).—*Yours is apparently a modification of the duck's-foot propeller. It will work, but not efficiently. The idea is very old; as old, in fact, as the duck.*

F. A. V. (Oporto).—(1) *Messrs. Troughton and Simms' address is Fleet-street, London.* (2) *Faija, "On Portland Cement," "Notes on Concrete," by Newman, published by Messrs. Spon, Charing-cross, London.*

Improver.—(1) *It is a matter of opinion whether steam drums should be put into up-takes or not; they need very careful watching for corrosion.* (2) *There is no special rule against superheaters, but they are looked on with suspicion, as possible sources of danger. Each case must stand on its own merits.*

A Constant Subscriber.—*The word "kinetics" is derived from the Greek kineo, to move, and deals with motion without regard to the causes producing that motion; therefore "kinetic energy" may be read "motion energy." Thus the energy stored in a flying shot is kinetic. Rankine has defined dynamics thus:—"To determine the direction and amount of motion which any system not in equilibrio will impress on a point or body under any given circumstances is the province of dynamics."*

PEARL BUTTON MAKERS.

(To the Editor of The Engineer.)

Sir,—Will any reader please send me the name and address of a few firms of pearl button makers? D. J.

Grange Town, Cardiff, August 8th.

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Advertisements cannot be inserted unless Delivered before Six o'clock on Thursday Evening in each week.

Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. George Leopold Riche; all other letters to be addressed to the Editor of The Engineer, 163, *Strand.*

MEETINGS NEXT WEEK.

Association of Municipal and Sanitary Engineers and Surveyors.—Northern Counties District Meeting, to be held at Newcastle, on Saturday, the 13th of August, 1887. The members will assemble in the Council-chamber at the Town Hall, at 11.30 a.m., by kind permission of the Mayor. Business: To elect district secretary; the following paper will be read and discussed, "The Floating Hospital of the Tyne Port Sanitary Authority," by W. G. Laws, city engineer, Newcastle. The members will afterwards adjourn to the Exhibition, where, in the north court, a model will be seen of the floating hospital.

THE ENGINEER.

AUGUST 12, 1887.

TECHNICAL INSTRUCTION.

It appears that a determined attempt is to be made to force the Technical Instruction Bill through the House of Commons before Parliament rises. This is much to be regretted. On Tuesday night the Bill was read a second time, after a discussion which was curiously inadequate to the importance of the subject. Sir W. Hart Dyke moved the second reading, but he was unable to supply any proof that technical instruction was wanted, or any information as to what was really to be taught. Indeed he had already admitted that concerning this part of the matter he was in total ignorance. It is noteworthy that he disclaimed any intention of teaching trades. It is impossible that at the fag end of the session the measure can receive adequate discussion. There is, indeed, good reason to believe that very few members of Parliament have troubled their heads about the question. The Bill has no political value whatever; it cannot conveniently be used for party purposes, and no one will take the pains to ascertain what it really means, or what its consequences may be. The circumstance that it contemplates what may cause a large increase of taxation is forgotten. Another point in much favour of the Bill is that people fear to identify themselves with any movement which is even apparently opposed to the spread of education. It is the fashion to teach, and he who ventures to urge moderation is apt to be denounced as an opponent of progress. Nothing can be more erroneous, of course, than such a charge may be, but, nevertheless, few have the strength of mind to care to risk it.

Our objections to the Bill are that if it comes into operation it will do no good, provided it is so moderate in its operation that the expenditure involved will be small. If, on the other hand, the working of the Act is to be effectual, it will involve a very large outlay on the one hand, while it will, on the other, necessitate changes in the existing systems of doing work and carrying on manufacturing operations of a sweeping character, the end of which it is impossible to foresee. We have already pointed out many of the objections to the Bill; we make no apology for further elucidating the question involved. The theory on which the Bill is based is that English workmen, being deficient in technical education, England, as a nation, suffers from foreign competition. This is not true; but even if it were, the Technical Instruction Bill would be entirely inadequate to cope with the difficulty. That it is not true, should be and is patent to every manufacturer, and every trader who has any experience at home and abroad. If our readers will turn to the "Abstracts of Consular Reports," which we publish from week to week, they will find there set forth a vast mass of information concerning the reasons why our competitors oust us from one market after another; but they will find nothing said about technical education. It is currently reported, and, we believe, with truth, that certain United States capitalists have formed a species of Chinese syndicate, which cannot fail to have a very bad effect on English trade in China. The "arrangement" will probably, for example, have the effect of throwing the construction of Chinese railways wholly into American hands. Is this a result of technical education, or of the want of it? Germans are known to be better salesmen than we are. Can it be believed that technical education, or the reverse, has anything to do with this? The most that technical instruction can do for the workman lies in the circumstance that it enables him to produce better work; but the foreign markets now open to us, do not, for the most part, want better work. They want what they are accustomed to use, and the insane attempts which have been made in this country to force on the foreigner what he does not like, because forsooth it is better, has done us nationally a great deal of harm. If a Wallachian peasant wants a rude wooden plough, and is quite willing to buy and pay for it, why should we insist on sending him iron ploughs of improved construction about which he cares nothing? We undertake to teach, when we ought to sell. Our German and American antagonists care nothing about the regeneration of the world; but they care a great deal about doing a good trade. Take, for example, the business done in American clocks. It is something fabulous in its proportions. Why is it that England has done nothing in the same direction? The answer is that English clocks are all good, substantial and expensive, while the American clocks are cheap rubbish. In point of fact, although they are cheap they are not rubbish; but let this pass. We have missed a great opportunity simply because we did not try to meet the public fancy. But technical education has had nothing to do with the matter in any shape or way. Indeed, it appears to us that technical education would rather hinder the development of such a trade than promote it. A man who had been fully impressed with all the principles of horological science would not dream of turning out alarum clocks at 3s. 9d. each. Their want of accuracy of construction would "pain him very much." And so we might go on to cite instance after instance where trade has been pushed and originated and developed, while education of the technical kind has simply been ignored, pushed on one side, and told to get out of the way. During the debate on Tuesday night, those who hold that technical education has done much for foreigners could only cite little Switzerland as an example of beneficent results, and urge that Germany was more successful than England, because her people were better linguists. It does not appear, however, that German is to be taught in the technical instruction schools. In support, furthermore, of the Bill, the authority of Professor Huxley was cited. Professor Huxley is a very able man; as a biologist, none but his enemies admit that he has a rival. His monograph on the anatomy of the frog is perfection. But as an authority on trade matters or commercial questions, his opinion is not worth more than that of the Llama of Thibet or the Archbishop of York.

Let us consider once more what the technical instruction schools are going to do. They will either teach children, or young men, or both. What they are going to teach we do not know; no one has explained this part of the programme. Let us assume, however, that it is the artisan who is to be taught, although this has been denied. Now in most large manufacturing establishments commercial success can only be secured by the division of labour. The man becomes a machine, an automaton, doing the same thing over and over again, until he does it to perfection. Technical education can in no sense or shape help this man. It is exceedingly deplorable that anyone should be reduced to the level of a machine, but so are a hundred other things which we see around us. It is possible that they may be amended, but not by technical instruction in Board Schools. The levelling down of the man to the machine is the result of an irresistible law; it is difficult to make the uninitiated understand how great the subdivision of labour is in certain trades—for example, the man who makes the case of a watch does not make the hinges of that case. It may be urged, however, that technical instruction is intended for a different class of operatives—for instance, for fitters, let us say. What then is the fitter to be taught? To file straight? To run a lathe? to erect a portable engine? The fitter who had learned to do these things in a technical school would find himself as far from being able to earn a livelihood as if he had never been taught anything. The trades unions have to be accounted with first. If technical education were adequately given in such schools—assuming an impossibility to be possible, for the sake of argument—a vast social system would be broken up, and the consequences would be far more widespread and dangerous than appears at first sight. So obvious, however, are many of the defects of the scheme and the objections to it, that we cannot think that they have been overlooked, and we are therefore driven to the conclusion that there is no intention of teaching trades or having so many thousand Government apprentices, but that technical instruction is to be interpreted in the South Kensington sense, and that pupils in the new schools are to be taught "Science," save the mark!

If, now, it is honestly stated that in the opinion of Sir William Hart Dyke and his supporters it is good that the rising generation should have to learn science in addition to the other evils that the young endure, well and good. Such a proposition may be argued on its merits, and the discussion may be narrowed. But when it is asserted that a vague something called "technical instruction" is to work untold good to Great Britain in some unexplained and inexplicable way, then we have something to deal with which resembles very closely a false pretence. Against technical education of the proper kind, imparted in the proper way, to those who can benefit by it, we have, of couse, nothing to say. Nay, we would go so far as to admit that there would be nothing very outrageous in asking the taxpayer to contribute moderately to the support of institutions employed in imparting such instruction. But this is entirely a different matter from the formation of schools where children or young men will be taught that which will never be of the smallest value to nine hundred and ninety-nine out of every thousand pupils, on the plea, forsooth, that the country is going to the dogs and that only South Kensington can save it. Finally, we assume that it is the bounden duty of the promoters of this scheme to establish a case, and to set forth sound tangible arguments in its favour. We all know what promises were made when State Education was first mooted. The British taxpayer knows how these promises were kept. If we have survived as a nation so long without technical instruction, it is probable that we can last another year as a nation; and it will be matter for congratulation if the Technical Instruction Bill is held over for another year. Let us hope that in this matter, at least, wise counsels may for once prevail.

THE STANDARD OF LIGHT.

The statute law which requires that the gas supplied to the public shall be of a certain illuminating power is necessarily based on the presumed fact that some means exist by which light shall be measured. In London common gas, consumed at the rate of five cubic feet per hour in a specified burner, is required to yield a light equal to that of sixteen sperm candles of six to the pound, each burning 120 grains per hour. Default in this particular subjects the company to a penalty. The history of the subject serves to show that for at least half a century the sperm candle has simply been tolerated as a convenient standard, while it could not be trusted as a correct one. How far it erred, and in what direction, might be a matter for dispute, but that it did err was undeniable. It is more than a hundred years since candles were proposed as a photometric standard, and for some time there was a difference of opinion as to what kind of candle should be used. The introduction of coal gas as an illuminant gave commercial importance to the question and stimulated the ingenuity of inventors in producing improved methods for the measurement of light. Much in the same way as our forefathers were perplexed amid the relative claims of wax, tallow, paraffin, stearine, and sperm as the material for the candle, so in later days there has been a prolonged controversy as to more scientific devices. The French "Carcel" lamp, burning colza oil, dates from 1800; Keates' sperm oil lamp appeared in 1869; Harcourt's pentane, or air-gas flame, in 1877; Methven's screened Argand flame, in 1878; and Sugg's 10-candle test, in 1882. Six years ago a Committee appointed by the Board of Trade to investigate the subject reported in favour of Mr. Harcourt's air-gas flame as a standard, but the correctness of this conclusion was strongly disputed by Mr. Keates and Mr. Methven. In 1883 the Council of the Gas Institute being dissatisfied with the Board of Trade report, appointed a Committee of their own to conduct an elaborate series of experiments,

the result being that the gentlemen so appointed arrived at conclusions exactly opposite to those of the Board of Trade. Soon afterwards the Metropolitan Board placed the subject in the hands of Mr. W. J. Dibdin, the chemist and superintending gas examiner to that body, who proceeded to carry out a considerable number of experiments bearing on the question. Mr. Dibdin's conclusions, founded on these experiments, differed considerably from those presented to the Gas Institute. Among other things, Mr. Dibdin reported that candles were not only untrustworthy, but showed a tendency to give less light than in former years, thereby giving a fictitious value to the gas. Substitutes for the candle were not difficult to find, for almost anything was better than this defective and fluctuating test. But Mr. Dibdin refrained from a final verdict as to which of several methods would be the best. In his opinion the observations were incomplete. He dwelt on the fact that the only satisfactory method of accurately comparing the power of various standards of light would be by means of a three or four-way photometer—that is to say, an instrument with three or four photometer bars arranged radially, so that one central light should be simultaneously tested by the competing standards, one at the opposing end of each bar. Mr. Dibdin regretted that the space and apparatus at his disposal precluded the adoption of such an arrangement. Happily, the Metropolitan Board saw fit to authorise a further investigation, conducted with the proper apparatus, and the result is now embodied in a report of singular completeness and interest.

This last investigation conducted by Mr. Dibdin includes 2120 experiments, involving more than 20,000 recorded observations. The Special Purposes Committee of the Metropolitan Board have laid the report before the general body, and in so doing have summarised its contents by saying that the result arrived at is to confirm the views of the Board of Trade Committee on photometric standards, to the effect that the pentane air-gas flame, as designed by Mr. Vernon Harcourt, is best adapted to be the standard of light. Two authorities are thus united in opinion, and it will be universally admitted that Mr. Dibdin's conclusion rests on a basis so broad and comprehensive that it is difficult to see how it can in any degree be shaken. The only contingency that can be expected to affect the result achieved by Mr. Dibdin is the appearance of some new standard hitherto entirely unknown. Science at a future day may provide a means for measuring light superior to any that Mr. Dibdin has been privileged to examine. But this is a mere speculation, and, taking things as they are, there is ample material for a practical decision. The Committee of the Metropolitan Board are so satisfied with the data before them that they have recommended the Board to take such action as may be necessary for securing the adoption, with as little delay as possible, of the pentane air-gas standard devised by Mr. Harcourt, as the legal standard of light for testing the illuminating power of gas. At the last meeting of the Board it was proposed that the Committee should at once be authorised to carry out their own recommendations. This prompt action has, however, been prevented by a resolution to refer the matter to the Works and General Purposes Committee for "further consideration." This latter Committee consists of the whole Board; but whatever happens, we cannot suppose that the Board will do otherwise than act in accordance with the able and exhaustive report presented by their chemist. The experiments have occupied a large amount of time, and in conducting them Mr. Dibdin has received the assistance of a numerous staff well qualified for the purpose. The report which embodies the results will take its place as a scientific record of lasting value. Probably we shall see nothing equal to it, unless, as we have signified, some hitherto unknown and remarkable test of lighting power is devised. At the same time, the subject is one of so much importance that caution and deliberation may very properly be exercised, providing there is no fastidious or half-hearted delay. It is eminently desirable that the gas companies should approve of the proposed change, and for this purpose their co-operation should be sought. On both occasions when Mr. Dibdin has been experimenting on the standards of light, the Chartered Company has provided gas for the purpose free of charge, and has granted the use of a suitable gasholder. The companies have no proper reason to object to a correct standard, and for their own credit's sake they ought not to appear as demurring to any method whereby the illuminating power of gas can be duly measured. Of course, they have to see that the standard is not raised against them. It is intended that the standard light furnished by the pentane apparatus shall be equal to one candle. Thus a fixed standard has to be founded upon one that is notoriously unsettled. Care will doubtless be taken that the balance is properly struck. When 16-candle gas was first prescribed by Act of Parliament, in place of 14-candle gas, there was at the same time a change prescribed in the standard burner which was to consume the gas. The result of the change was to make the so-called 16-candle gas only about half a candle better than the former gas of 14-candles. We may trust Mr. Dibdin and the Metropolitan Board to see that we start fair with the new standard. Mr. Dibdin states that the relative value of the pentane air-gas flame and candles was fully discussed in his first report, and that "there is every reason to believe the result then arrived at was correct."

That the change now contemplated ought to have taken place long ago is strikingly shown by one paragraph in the present report. It is there stated that in making use of sperm candles the results were so erratic that a total variation of 10 per cent., or 1·6 candles, on ordinary 16-candle gas was nearly a normal result, while "far greater differences were of common occurrence." In the pentane testings a total variation from the mean of more than 2 per cent. was an exception. It was a curious circumstance that candles now and then, "as if by accident," gave uniform results; but pentane was characterised by remarkably steady and trustworthy indications. The pentane air-gas flame is arranged to give the light of one candle, but the pentane lamp has been devised to afford a higher standard. Mr. Dibdin remarks that many practical photometrists are of opinion that a standard of light of more than one candle is desirable for several purposes. Consequently he recommends that when the legal substitution of the pentane unit for the present candle comes to pass, the Board of Trade should be empowered to sanction and authorise the use of such other standards and substitutes as the Board may deem fit and proper to be used in place of the pentane air-gas flame, and after comparison with it. Mr. Dibdin states that a 10-candle standard can be readily and conveniently obtained by the use of pentane in the form of air-gas burned in a lamp. It will be remembered that there was a time when the pentane method appeared unsuitable for ordinary testings. A further examination of its capabilities has proved the contrary. The result is the more valuable seeing that coal-gas, in the opinion of Mr. Dibdin, cannot be accepted as the standard combustible. Sperm oil in the Keates lamp has yielded good results, but there is a practical difficulty in the use of the lamp which makes it inferior to the air-gas method. After a controversy extending over ten years, Mr. Vernon Harcourt's pentane test now appears to have beaten all competitors, and it is to be hoped that the improved system thus rendered available will soon be legalised. It is certainly time, in this scientific age, that we had some means of determining the lighting power of gas within a narrower limit of variation than is afforded by the long-endured "sperm candle."

DOMESTIC COOKING APPARATUS.

Once more the smoke abatement people have been urging their wild career, and it is not the fault of one member of the House of Lords that a Bill has not been passed compelling every householder in London so to alter his cooking-range that it shall consume its own smoke, under a heavy penalty for non-compliance with the law. The inconvenient question might be asked, how is the cooking-range to be made to consume its own smoke? and we are told that the solution of the problem is easy, and that the expense would not exceed £1 or £1 10s. Unfortunately, however, we have not been told anything concerning the nature of the proposed alteration; but this is a small matter. The Smoke Abatement Exhibition held years since at South Kensington served one good purpose if no other. It proved to demonstration that no scheme of a practical nature had been invented which would permit bituminous coal to be burned under domestic conditions without producing smoke. The whole subject has now been relegated to oblivion for another year, we suppose, and we need say no more on the legislative aspect of the matter. But a good deal may be said concerning cooking appliances in general, and it may perhaps serve a useful purpose if we call attention to a few facts which are commonly overlooked. There are two systems of cooking in every-day use in ordinary houses—one is by gas, the other by coal. Now with gas at its present London price there can be no question that the advantage is all on its side. The drawback is that servants, like other people, have a strong predilection for a cheerful fire in winter, and the practical result is that as servants in middle-class houses have nowhere else save the kitchen in which to sit, a range burning coal has to be employed in the winter. In summer gas is all that is required, and the gas companies now hire gas cooking-stoves at such nominal rents that no difficulty can arise between landlord and tenant as to who is to pay the first cost, which may be anything between £20 and £3. We shall consider gas cooking-ranges first, and the ways of their makers.

The first consideration with the maker is to produce something which will cook—that is to say, there is an oven which serves for roasting, and over it certain rings of burners, &c., which supply heat for boiling, broiling, frying, &c. This is all very laudable, and most of the ranges do their work very well. Here our commendation ends. Hardly any makers bear in mind that it is not only essential that the gas apparatus should cook, but also that it should be cleaned. The top is more or less inaccessible, because of bars and burners, and such like. Grease collects on this top beneath the bars and burners, and then when the oven is heated the whole house is pervaded with abominable smells, and the gas stove is voted a nuisance. All this might be avoided by forethought. Another defect is that no allowance is made for the circumstance that many of the bars and appliances on the top become red-hot; water boils over on them, and then they are broken, being of cast iron. This causes very much trouble. We have seen a gas stove almost a ruin after three months' fair usage from this cause. The last thing thought of by the average gas stove maker is that his work will be submitted to heavy wear and tear, and that every part of it liable to be burned out or destroyed should be readily replaced. For example, it is very usual to find a cast iron grate standing above the oven, under which grate are rings of atmospheric burners of various sizes. This grate is all in one piece. If a single bar is broken, the whole must be renewed. It is only quite recently that we met with a gas cooking stove made by a North-country gas engineer, in which the bars are all loose, dropping into a frame. The result is, first, that the bars being free at both ends will not break; and, secondly, that when burnt away they can be replaced by new bars for a few pence. The sides and door of the oven are made double, the intervening space being filled with some non-conducting material. We have seen the inside lining made of thin wrought iron plates, which twists into all manner of shapes, and of thin cast iron, which cracks and falls down. In one instance, the fall was followed by a discharge of silicate cotton, which effectually ruined the joint being roasted. It may be urged that we are speaking of cheap stoves. Nothing of the kind. We recently took the trouble to examine a large number of gas cooking stoves of all prices from £20 down, and we found that some of the cheaper stoves were in all respects better made than the dearer. We do not for a moment imply that there is any dishonesty in the matter. In nine cases out of ten the defective construction is due to pure ignorance. The makers sell their stoves to ironmongers, who sell them again to the user, and the maker knows next to nothing of how they turn out, and the users do not state the facts. It is really cheaper in many respects to make a gas stove which will last than one which will wear out. Another defect in gas cooking stoves which might easily be avoided is that much more gas is used than need be. Servants want to boil say a kettle. The boiling is done, and the kettle is taken away, but the gas is not turned down; it is forgotten. Now it is quite practicable to fit to every ring burner a simple weighted lever, which, being kept down while the kettle, &c., is being heated, will rise the moment the kettle is taken off and turn down the gas, or, better still, put it out all but a pilot light, which will re-light the ring as soon as anything needs to be heated. Not half enough has been done to make gas cooking popular, and even those makers—we must not for obvious reasons name them—who have given much thought to this subject, and so have placed on the market fairly satisfactory apparatus, are overweighted and injured by the defective appliances which are made and used by persons alike ignorant of what a gas cooking apparatus may be, and of what it must be, if it is to receive that extended adoption of which the system is capable.

If we turn our attention to the coal-burning cooking range, we find that many of the defects common to gas stoves are present. There is the same oblivion manifested as to questions of wear and tear and replacement. The arrangements are in their nature faulty to begin with, and the difference between bad ranges and worse lies entirely in the greater or less success met with in trying to get rid of defects inherent, as we have said, in the system. That system consists in using a very small fireplace, in which coal is burned with a sharp draught, and produces an intense localised heat. There is not the least difficulty in melting brass in a crucible in almost any modern "kitchener" when the family joint is being cooked. The fireplaces are usually about three-fourths of a cubic foot capacity, and every householder knows at what a rate they can swallow up coal. They are lined with so-called fire tiles, which as a rule last about a month, when they have to be replaced. If, on the other hand, really good fire tiles are used, these become clinkered until the fireplace will scarcely hold any coal at all; then the clinker is broken away, and with it the fire tiles. Once more, we have to explain that we are not dealing with cheap or low-priced ranges. We are speaking of such as may be found by thousands in London. They cost from £8 to £10 each, and there is a large profit on them, because, being almost wholly of cast iron, they cost very little to make. The middleman probably absorbs most of the profit. These stoves are produced by dozens of makers, who all endeavour to do with a localised intense fire what ought to be done with a much larger fire burning with less draught. There are a few exceptions, and those who are fortunate enough to possess what may be termed, for the sake of contrast, a slow-combustion stove, know that they have got something very different from the ordinary thing. The intense heat is rendered necessary by the defective way in which it is applied. As an example of faulty construction, we may mention that one maker, with a very good reputation, fits a falling cast iron door in front of the grate-bars. The result is that after about a week the hot door, being allowed to slap down on a stop close to the hinge, break across at the hinge; but we have never known one to break in this way until it had served the purpose of burning out the front fire-bars, as is to be expected, seeing that they are shut in a furnace, with a temperature of about 2500 deg.

The subject we have dealt with is homely, and it may be said almost too homely to be dealt with in our pages. Such a proposition we dispute. A vast multitude of persons are directly or indirectly—mostly directly—interested. The generation and utilisation of heat in our homes depends on common-sense and scientific principles. The whole practice of the art is now defective, and it must remain defective until some one speaks out who can speak with some knowledge of the subject. What we have written is not based on superficial observation, but on extended inquiry and experience. There are, as we have said, makers in the kingdom who turn out very good and satisfactory apparatus, but they are very few and far between, and only too often their wares are passed over in favour of meretricious and showy stoves which have almost every defect it is possible to name. This is not as it should be. If we have succeeded in convincing our readers that the defects which are now present in gas and coal cooking-ranges can be remedied they will be remedied, but if the public rests content with what is supplied to it, no improvement will be effected. If every man buying a stove asked in the first place, not how will it cook? but how long will it last? there would soon be a change for the better in methods of construction and design.

CLYDE SHIPBUILDING FOR JULY.

During the month of July the output of new shipping in the Clyde has been exceptionally small, even considering that the returns for this, and for the corresponding period in other years, are always limited, owing to the ten or twelve days' cessation at Fair holiday time. The figures, indeed, have not been so low for thirteen years, although once or twice the same depth has been almost reached. Only six steamers, aggregating 6460 tons, were launched, two having left the stocks of Messrs. Stephens and Sons, of Linthouse, aggregating in themselves as much as 5000 tons. The others contributing to the total were two steamers of 400 tons each from the yard of Messrs. Lobnitz at Renfrew, one of 480 tons from the stocks of Murray Bros., Dumbarton, and a small screw tug of 12 tons from the yard of Mr. W. S. Cumming, of Blackhill Dock. It is noteworthy that in the Greenock and Port Glasgow districts no launches have taken place during the month, a circumstance which has not previously occurred for many years, if, indeed, at all. Notwithstanding the unparalleled smallness of the output, the present condition of the Clyde shipbuilding industry is more encouraging than it

THE DREDGING OF THE LOWER ESTUARY OF THE CLYDE.[1]

By Charles A. Stevenson, B.Sc., F.R.S.E., Assoc. M. Inst. C.E.

Clyde estuary.—From the year 1768 to the present time the river Clyde has been converted from a fordable stream into a maritime canal, capable of taking up to Glasgow in one tide vessels of 5000 tons, drawing 24ft. of water. This almost unique work has been accomplished chiefly since 1836 by dredging and widening the channel. It is, however, with the works and plant employed in improving the lower estuary of the river, namely, the reach between Port Glasgow and the sea, that the present paper deals. This portion of the river was placed under the jurisdiction of the Clyde Lighthouses Trustees in 1871; and in the following year they instructed their engineers, Messrs. D. and T. Stevenson, to make a survey of the estuary, and to report what works were necessary for its improvement. Their report, recognising the importance and difficulty of the subject, as there were weighty interests involved—including the navigation of the river to Glasgow and the other important harbours to which in its course it affords access, especially those of Port Glasgow and Greenock—recommended a line of channel which would not interfere with any of these interests, and advised that the first work to be undertaken should be the removal of the foreshore of Garvel Point, with the view of easing the bends at this part of the navigation. The work was begun in 1873, and carried on with hired plant till 1880, when the Trustees resolved to push on more expeditiously, and for this purpose applied for borrowing powers to the extent of £80,000. The work authorised in 1880 was the same as that of 1872, so far as the line of channel was concerned, but with the more costly mode of improvement by dredging alone, instead of by low-water training-walls as originally recommended by Messrs. Stevenson, whose experience of similar works which they had carried out at other places had satisfied them that the cost both of construction and of maintenance would thereby have been diminished, owing to the increased scouring power which would have attended the use of training walls.

Scheme of improvement.—The scheme of improvement, as shown in the accompanying plan, Fig. 1, was to dredge a channel 18ft. in depth at low water, from the "Tail of the Bank" at the Albert Harbour, Greenock, up to Port Glasgow, hugging the shore the whole way; and in the centre of this channel to form a cut 5ft. deeper or 23ft. in depth at low water, and 200ft. in breadth, from the Albert Harbour to the entrance to the James Watt Dock immediately above Greenock. As shown in the transverse section, Fig 2, the 18ft. channel is 600ft. in breadth at low water, with slopes of 3 to 1, making its breadth at bottom 492ft. In 1881 powerful plant was obtained from Messrs. Simons and Co., of Renfrew, which comprises one steam screw dredger costing £19,250, and three screw hopper-barges, costing in all £22,571. The employment of a fixed dredger was decided upon, in preference to hopper dredgers which themselves convey the dredged material to the place of deposit. This decision was arrived at from the experience already gained at the site of the dredging operations, in the working both of the hopper-dredger Greenock, and also of the fixed dredger Greenore; from which it was apparent that for this work it would be cheaper and more expeditious to adopt the fixed-dredger system. In certain cases, however, especially where the cessation of dredging is imperative during a portion of the day—either to permit of traffic, or from the state of the tide interfering with dredging—the hopper dredger may be cheaper, because during the idle hours of dredging she can go away and discharge her cargo.

Dredger.—Hull of dredger.—As shown in the longitudinal section, Fig. 3, one-sixteenth full size, the dredger has a single ladder working through a well amidships. The length over all is 164ft., breadth 30ft., depth 10ft., and draught of water 9ft. aft. She is clinker-built, except the well, which is carvel-built; the plating varies from $\frac{3}{4}$in. to $\frac{7}{16}$in., and the frames are of angle-irons 3in. by 3in. by $\frac{3}{8}$in., spaced 21in. apart. The floor beams are 13½in. in depth, one to each frame; as are also the deck beams, which are of bulb iron, 6in. wide by 7in. deep. Elm fenders, 16in. deep by 7in. wide, extend round the vessel; and four keels of greenheart, 12in. wide by 6in. deep, run along the bottom. Two sister keelsons extend the whole length, and a main keelson runs fore and aft of the well. The vessel is divided into five water-tight compartments, with bulkheads $\frac{3}{8}$in. thick. The bunkers hold about 30 tons of coal. The bottom of the vessel up to the upper turn of the bilge is plastered with Portland cement. The decks are of pitch pine 3½in. thick. The main framing is constructed to carry the top tumbler at a height of 24½ft. above the deck. The framing and shears are of box form, measuring 14in. on each side, and built of $\frac{3}{8}$in. plates and angle irons 3in. by 3in. by $\frac{3}{8}$in. Davits of 4½in. diameter are placed at both ends for shifting anchors. The accommodation consists of two cabins for master and engineer, and fourteen berths for crew.

Engines.—The engines are compound surface-condensing, and work up to 350 indicated horse-power with 80 lb. steam. The cylinders are 23in. and 44in. diameter, with 30in. stroke, and make 65 to 70 revolutions per minute. The condenser has brass tubes $\frac{3}{4}$in. diameter, giving 950 square feet of surface. The valves are worked by link motion, fitted with expansion gear on the high-pressure cylinder; there is a fly-wheel and governor. The starting gear is on the deck level; the clutches are arranged so as to engage and disengage the engines from the propeller and dredging machinery respectively. The piston-rods, connecting-rods, and cranks are of best selected scrap iron, and the bolts of Lowmoor iron.

Boilers.—There are two circular multitubular boilers with horizontal iron tubes, working at 80 lb. steam pressure per square inch, and tested to 160 lb. Each has two furnaces with 1500 square feet of heating surface and 60 square feet of grate area. They are connected by a cylindrical steam chest overhead, provided with valves so that either boiler can be used. The plating in contact with the fire is of Lowmoor iron, and the remainder of Staffordshire; the shell and ends are double-riveted.

Machinery.—There are two donkey engines arranged to draw from the bilge, wash the decks, and drive the two crab winches; and an auxiliary engine in the engine-room, for driving the hoisting gear and stern crane, and turning the main gearing and buckets when doing repairs. A strong treble-power crab winch is placed at each end of the vessel, adapted for working straight on end or by side cutting at pleasure. The bow crab has three independent barrels driven either by the main engines or by the donkey, and having friction change gear for hauling in 10ft., 15ft., or 25ft. of mooring chain per minute. The stern crab also has three separate barrels. The two crabs work either separately or conjointly.

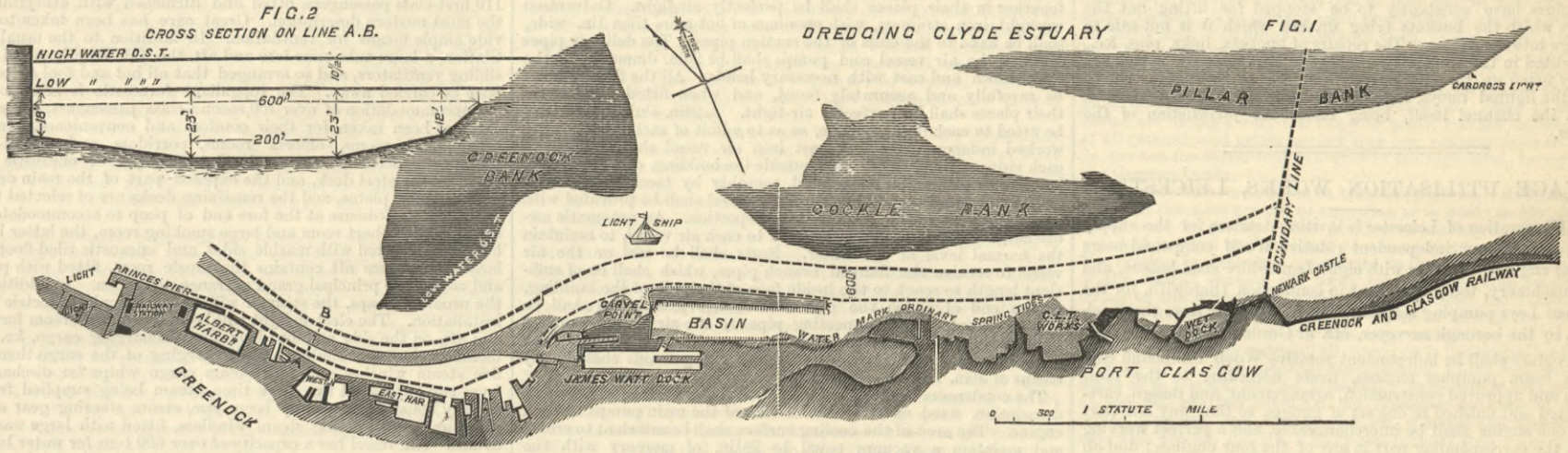
Bucket gearing.—For driving the buckets the first motion wheels at the engine are grooved friction wheels, and the motion is conveyed to the top tumbler by means of an upright shaft and bevel and spur gearing. In addition to the friction gearing, there is also a friction clutch, 7ft. diameter, which can be tightened or slackened as required, and is used in ordinary working for relieving the engine and buckets in the event of the buckets coming against a heavy boulder or anything which might cause a breakdown. The spur and pinion wheels are interchangeable, so as to give the two speeds of ten and fifteen buckets per minute. The upper tumbler is five-sided, the body being of cast steel with steel shaft, and the journals working in brass bushes with cast iron covers. The five sides are covered with hard steel plates 2½in. thick and solid at the angles, bolted on and secured with 2½in. square rings shrunk on at the end. The lower tumbler is six-sided, having cheeks of cast iron 3in. thick with cast steel bars; the shaft is of wrought iron, with steel thimbles working in cast iron bushes.

Buckets.—The dredger is provided with two sets of buckets, those for the hard stuff having only 7 cubic feet capacity, and those for the soft stuff 20 cubic feet; the smaller are discharged at the rate of ten per minute, and the larger at the rate of fifteen per minute. After many trials of different forms, the buckets are now made as follows:—The backs are of cast steel, the quality of which is of the very greatest importance. If a good quality is got, the buckets should never break. The mouths are of steel, 13in. wide and 1¼in. thick at the peak. The bottoms are now being made of steel plate. The buckets are shaped somewhat conical, so as to discharge themselves more readily into the shoots, which are at a slope of 60 deg. The pitch of the bucket chain is 36in. The links are of the best malleable scrap iron, bored out and finished at the works, only the forgings being got from the manufacturer. They are bushed with double-shear steel. The pins are of forged steel, and can be welded a number of times.

Ladder.—The ladder is 83ft. in length, formed of two plate girders 5ft. deep at the centre and 2ft. at the ends, very strongly braced diagonally and vertically. Its upper end is centred upon a strong forged iron shaft, which is fitted to the pedestal frame of the upper tumbler. The lower end is suspended by chain tackle from the shears; the upper sheaves stand on the shears, and the lower are fitted to a strong crosshead connected with the ladder by side-rods 6in. diameter. The lifting chain is 1⅜in. diameter, and winds on a grooved barrel which is driven from the main engine through the friction change gear, whereby the lower end of the ladder is raised at the rate of 8ft. per minute. The winding barrel is under the control of a friction brake with compound lever for holding the ladder or lowering it as required. When the angle of the ladder is 45 deg., the lips of the buckets are 41ft. below water level.

Hopper barges.—The three barges are each 153½ft. in length, 26ft. in breadth, and 13ft. in depth, with a draught of 11ft. aft when loaded. The hopper is 65ft. long, 20ft. wide at top, and 9ft. at bottom, having a capacity of 11,000 cubic feet, equivalent to 523 tons of dredged material. A box girder spans the hopper fore and aft for carrying the door chains, which are worked by winches; there are twelve doors, which are made of elm 7in. thick, and are weighted to prevent them from floating up and jamming the chains. There are two cabins for captain and engineer, and six berths for crew and firemen. The engines are inverted-cylinder compound surface-condensing, working up to 250 indicated horse-power; the cylinders are 19in. and 36in. diameter, with 24in. stroke. The condenser has 630 square feet of tube surface. The boilers are circular multitubular, with horizontal iron tubes, and like the engines are constructed for a working pressure of 80 lb. per square inch. They have two furnaces, and 1000 square feet of heating surface and 40 square feet of grate area. They were tested with cold water up to 160 lb. per square inch. When loaded, the barges can steam at the rate of 9 knots per hour.

Results of working.—During one year's working in soft stuff the



MAP OF THE CLYDE ESTUARY.

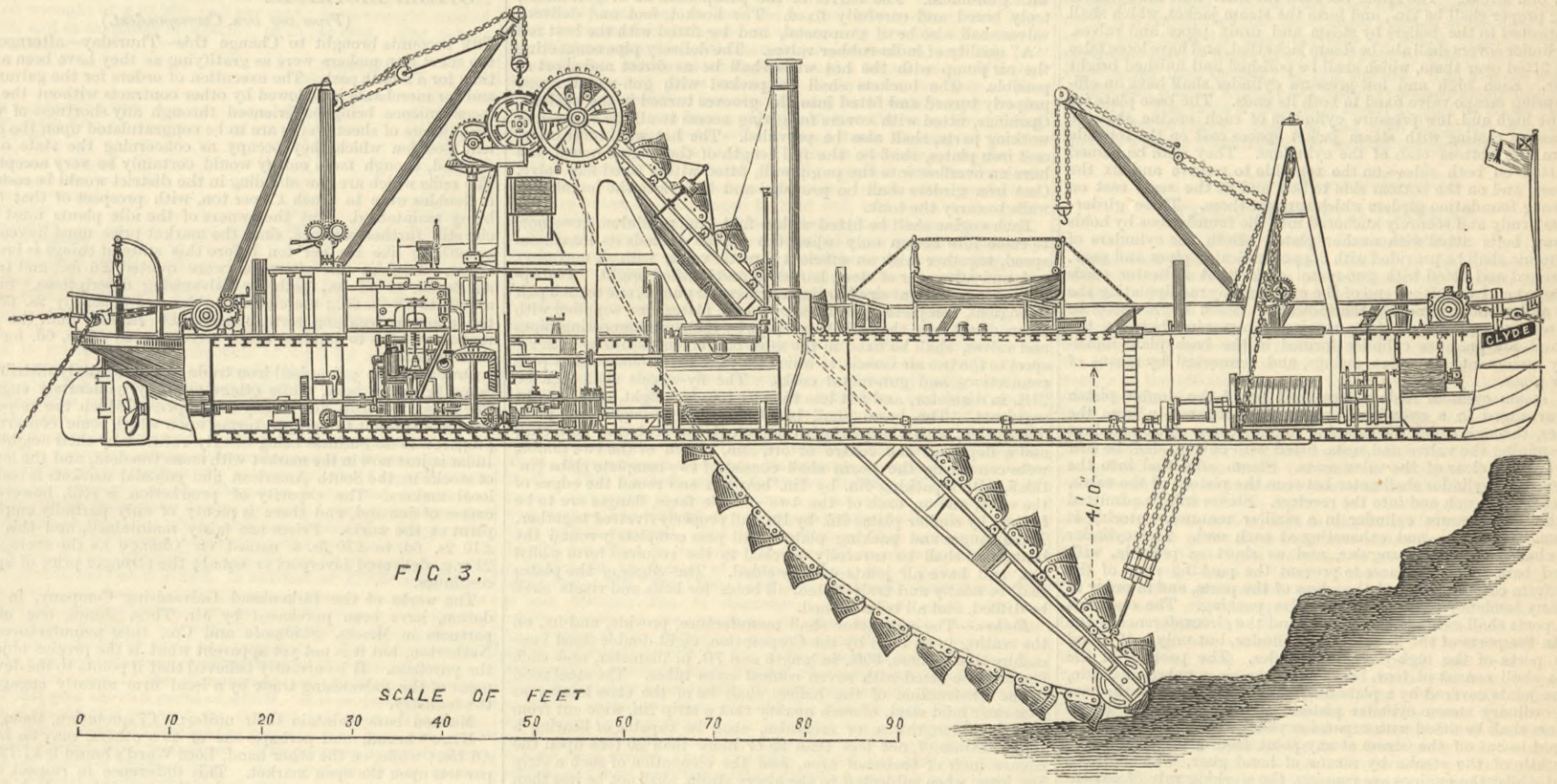


FIG. 3.

DREDGER USED IN THE CLYDE ESTUARY.

[1] Paper read by the Inst. Mech. Engineers at Edinburgh.

dredger removed 408,895 cubic yards at the rate of 212 cubic yards per engine hour, and at the cost of 2·54d. per cubic yard, including repairs, &c., and interest and depreciation at 10 per cent. Conveying and depositing the stuff in Loch Long, seven miles distant, cost 2·47d. per cubic yard. The total cost of dredging and depositing was therefore 5·01d. per cubic yard. During four years' working the average rate was 166 cubic yards per engine hour. In clay and sand the work for many days consecutively has been 3500 tons per day of ten hours, or at the rate of 350 tons per hour; but with careful manipulation 500 tons can be raised in fifty-one minutes easily, and this has once been accomplished in forty-five minutes. In dredging the "hard" of Garvel Point, however, which is a very stiff clay packed with boulders—presenting the most severe ordeal that a dredger could be put to—the work fell as low as 57 tons per hour, costing 18·03d. per cubic yard, or more than three times what it cost to dredge the soft. In the present instance the dredger being specially designed for this heavy work has been performing it without any complete breakdown, although the engines have constantly to be stopped for lifting out the boulders which the buckets bring up, but which it is not safe to discharge into the barges. The repairs of buckets, links, pins, &c., are executed in the trustees' workshops at Port Glasgow, which are specially fitted up for this purpose, as well as for making gas to supply the lighted buoys, fog signals, engines, &c.; all of these, as well as the channel itself, being under the jurisdiction of the Trustees.

SEWAGE UTILISATION WORKS, LEICESTER.

The Corporation of Leicester is inviting tenders for the supply and erection of four independent rotative Woolf compound beam pumping engines, together with eight Lancashire steel boilers, and other machinery, tools, and plant in connection therewith, for the Beaumont Leys pumping station. The following is from the specification by the borough surveyor, Mr. J. Gordon, M.I.C.E.:—

The engines shall be independent rotative Woolf compound condensing beam pumping engines, made according to the most modern and approved construction, arrangement, and design, carefully fitted and finished to one set of gauges, so that any one part of any one engine shall be interchangeable, and a perfect working fit with the corresponding part in any of the four engines; and all parts shall be finished bright which are usually so finished in first-class waterworks pumping engines by the best makers. The engines are to be employed in lifting and forcing sewage through a double line of pipes of 30in. diameter, 2980 yards in length, and delivering it into distribution tanks situated upon the sewage farm at Beaumont Leys. The surface of the sewage in these tanks will be 162·42ft. above the invert of the outfall sewer at the pump wells, and the working head upon the pumps, including friction, when the maximum quantity of 600,000 gallons per hour is being pumped by three engines through the two 30in. pipes will be about 173ft. The engines are to be designed for a working boiler pressure of 80 lb. per square inch, and to permit of being worked to a varying speed of from eight to eighteen revolutions per minute. Each engine shall, as set forth in Clause 9, be capable of delivering into the distribution tanks at the sewage farm 200,000 gallons per hour when running at twelve revolutions per minute.

The dimensions of the cylinders shall be as follows:—High-pressure, 28in. diameter by 6ft. stroke; low-pressure, 46in. diameter by 8ft. 6in. stroke. The space between the liner and the cylinder casting proper shall be 2in., and form the steam jacket, which shall be connected to the boilers by steam and drain pipes and valves. The cylinder covers shall also be steam jacketted, and have loose false covers fitted over them, which shall be polished and finished bright all over. Each high and low-pressure cylinder shall have an efficient spring escape valve fixed to both its ends. The base plate for both the high and low-pressure cylinders of each engine shall be one massive casting with steam jacket spaces cast on the top side to form the bottom ends of the cylinders. They shall be planed and fitted on both sides—on the top side to receive and fix the cylinders, and on the bottom side to bed and fit the seats cast on the strong foundation girders which support them. These girder-shall be firmly and securely anchored into the foundations by holds ing-down bolts fitted with anchor plates. Both the cylinders of each engine shall be provided with copper indicator pipes and gear, so arranged and fitted with gun-metal cocks that indicator cards may be taken from either end of the cylinders by manipulating the cocks, and without removing the indicator. Each engine shall be made with an equilibrium steam receiver intervening between the high and low-pressure cylinder formed in the base plate immediately underneath the valve casings, and connected by means of copper pipes.

The steam cylinder slide valves shall be of the double piston type, arranged in a cylindrical casing cast separately from the cylinder, through which the escaping steam passes. Two openings for examining the valves and seats, fitted with covers, shall be cast in the casings clear of the valve seats. Steam admitted into the high-pressure cylinder shall enter between the pistons of the valve, and exhaust at each end into the receiver. Steam will be admitted into the low-pressure cylinder in a similar manner, entering it between the pistons, and exhausting at each end. The cylinder ports shall be cast rectangular, and as short as possible, with inclined bars across the faces to prevent the packing rings of the valves from catching against the edges of the ports, and in order to avoid any tendency to grooving the valve packing. The openings of the ports shall extend two-thirds round the circumference of the valve in the ports of the low-pressure cylinder, but only half round in the ports of the high-pressure cylinder. The packing of the pistons shall consist of four broad cast iron rings cut at one side, and the joints covered by a plate fixed on the inside, as in the case of an ordinary steam cylinder piston. The high-pressure steam cylinders shall be fitted with expansion piston valves, designed and arranged to cut off the steam at any point from three-quarters to one-eighth of the stroke by means of hand gear, which can be worked whilst the engines are running, the working rate of expansion being clearly indicated by an automatic arrangement of pointers and scales. The low-pressure cylinders shall also be fitted with expansion piston valves, designed and arranged to allow of the cut-off being varied between 0·25 and 0·5, and the point of exhaust between 0·75 and 0·96 of the piston stroke, the working rate being automatically indicated as in the case of the high-pressure cylinders. All regulation of speed shall be effected by manipulation of the expansion gear alone, full boiler pressure steam being always admitted to the high-pressure cylinders.

The crank pins shall be of forged steel, turned and finished bright all over, forced into the cranks by hydraulic pressure, and rivetted over cold into the counter-sunks at the back of the cranks. The diameter and length of the pins shall be as 1 to 1½, and proportioned so that the maximum working pressure shall not exceed 500 lb. on the square inch. The main pump connecting-rods which form the connection between the beams and the pump crossheads shall be forked at both ends, at the top end to span the beam, and at the bottom end to clear the crank and its connecting-rod. They shall be made of Bessemer steel, machined, fitted, and finished bright, and must be swelled towards the centre of their length, and fitted at both ends with properly proportioned adjustable hard gun-metal bearings, straps, gibs, cotters, and lubricators. The main pump rods shall be of Bessemer steel. The main pumps shall be of the double-acting plunger type, and worked by means of connecting-rods, one end of which is attached to the fly-wheel end of the beams, and the other to the pump crossheads. The plungers shall be 26¾in. diameter, and have a stroke of 6ft.; they shall be cast of hard metal, and accurately turned and fitted. The suction and delivery valves shall be of the flap character, faced with leather, and the hinges bushed with gun-metal, fitted with india-rubber cushions, and the seats carefully planed and fitted similar to those used at the Chelsea pumping station, fixed in valve-boxes having covers at the top for the ready examination or withdrawal of the valves. The area of the waterway through the valve openings shall be such that the velocity of the water through them shall not exceed that of the rising mains when the whole of the engines are running at eighteen revolutions per minute. The pump barrels, delivery valve chambers, and lower end of the condensers shall be provided and fitted with 6in. cast iron drain pipes, having planed flanges and the necessary branches, together with the requisite gun metal fitted sluice valves, for the purpose of draining off the same into the suction pipe channel to facilitate examination or repairs. Each pump shall be provided with two heavy cast iron girder supports to which they shall be carefully bedded upon planed and fitted seats, and secured by bolts. These girders to be firmly built into the masonry, and secured in their places by bolts furnished with anchor plates.

The suction pipes shall be 36in. diameter, of the form shown, and cast with all necessary branches, bends and blank flanges. All the flanges shall be carefully and accurately faced, and when fitted together in their places shall be perfectly air-tight. Galvanised wrought iron strainers, with openings of not more than 1in. wide, shall be fixed to the ends of the suction pipes. The delivery pipes between the air vessel and pumps shall be 26in. diameter, of the form shown and cast with necessary bends. All the flanges shall be carefully and accurately faced, and when fitted together in their places shall be perfectly air-tight. A 24in. sluice valve is to be fitted to each delivery pipe, so as to admit of each engine being worked independently. A cast iron air vessel shall be fitted to each rising main, immediately outside the building, cast in suitable lengths, which shall be jointed together by faced flanges with drilled holes and turned bolts. Each vessel shall be provided with a manhole and cover, to admit of inspection. An automatic air-discharging apparatus shall be fixed to each air vessel, to maintain the normal level of the water. Seats shall be cast on the air vessel to receive the flanged branch pipes, which shall be of sufficient length to reach to the inside face of the walls of the building, to the end of which the gun-metal gauge glass cocks shall be properly fixed. The connecting pipes to the air charging pumps shall be provided, and fitted with gun-metal stop valves. The connection of the air vessels with the rising mains shall be by means of 30in. four-faced sluice valves.

The condensers shall be of the multitubular surface condensing description, fixed on the suction side of the main pumps of each engine. The area of the cooling surface shall be sufficient to create and maintain a vacuum equal to 28½in. of mercury with the barometer standing at 30in. when the temperature of the circulating water is 60 deg. Fah. The condensers to consist of cast iron casings, resting on massive base plates, fitted with brass tubes 2in. in diameter, secured to the tube plates by screwed gun-metal bushes, through which the exhaust steam is intended to pass. Manholes shall be provided for inspection, and inlet and outlet branches 26in. diameter shall be cast on the body of the condenser; the inlet side shall also be provided with a sluice valve and branch pipe to connect it to the 36in. suction main. The exhaust pipes from the cylinders to the condensers shall be as short and direct as possible. The end chambers of the condensers shall be provided with branches and end covers, as shown on the drawings. The air pumps shall be of the single-acting type, and worked direct from the lower end of the high-pressure cylinder piston-rods, to which they are to be attached by box couplings provided with cotters. The body of the pump shall be fixed to and form part of the condenser casing, the covers shall be turned on the face and edges and finished bright, and the stuffing-boxes and glands shall be bushed with gun-metal. The barrel of the pump shall be of gun-metal, truly bored and carefully fixed. The bucket, foot and delivery valves shall also be of gun-metal, and be fitted with the best red "A" quality of india-rubber valves. The delivery pipe connecting the air pump with the hot wells shall be as direct and short as possible. The buckets shall be packed with gun-metal rings, properly turned and fitted into the grooves turned in the buckets. Openings, fitted with covers for giving access to all the valves and working parts, shall also be provided. The hot well, built up of cast iron plates, shall be the full length of the engine house, and have an overflow into the pump well, fitted with a faced flap valve. Cast iron girders shall be provided and built into the foundation walls to carry the tank.

Each engine shall be fitted with a first-class pendulum governor, to come into action only when the engine exceeds its maximum speed, together with an efficient throttle valve, with all necessary rods and valve gear of steel, hardened and finished bright. Two approved independent air-charging engines and pumps, one to each pair of engines, complete upon their own base plates, and supplied with steam direct from the main steam pipe by their own connecting pipes and valves, shall be fixed in the most convenient positions with respect to the two air vessels, to which they are to be connected by pipe connections and gun-metal cocks. The fly-wheels shall each be 21ft. in diameter, and not less than 21 tons in weight, cast in eight segments. The beam shall be of the built wrought iron plate description, with a length between the extreme centres of 26ft. 6in., and a depth at the centre of 5ft. 4in. Each of the two double webs composing the beam shall consist of two complete slabs ¾in. thick, with a packing 4in. by 1in. between and round the edges of the webs, and on each of the two outside faces, flanges are to be formed by similar plates 4in. by 1in., all properly rivetted together. These flanges and packing plates shall pass completely round the beam, and shall be carefully blocked to the required form whilst hot, and have all joints solid welded. The edges of the plates shall be neatly and truly fitted, all holes for bolts and rivets shall be drilled, and all bolts turned.

Boilers.—The contractor shall manufacture, provide, and fix, on the seating to be built by the Corporation, eight double-flued Lancashire steel boilers, 30ft. in length and 7ft. in diameter, and each flue shall be fitted with seven conical cross tubes. The steel used in the construction of the boilers shall be of the class known as Bessemer mild steel, of such quality that a strip 2in. wide cut from any plate, lengthwise or crosswise, shall be capable of bearing a tensile strain of not less than 25 or more than 30 tons upon the square inch of sectional area, and the elongation of such a strip 8in. long, when subjected to the above strain, shall not be less than 20 or more than 25 per cent. of its length; and further, that a strip 1½in. wide, after being heated to a low cherry-red heat, and cooled in water at a temperature of 80 deg. Fah., shall be capable of being bent back cold without showing signs of fracture until the radius of the curve of the inner side of the strip shall not exceed one and a-half times the thickness of the steel. All angle irons and rivets shall be of steel of equal quality with the above.

LAUNCHES AND TRIAL TRIPS.

Messrs. John Cran and Co. launched on the 3rd inst. a steel steam launch, the Florida, 60ft. by 11ft. 6in. by 7ft., for Mr. T. A. Walker, Westminster, for service at Buenos Ayres new harbour works. She is to be fitted by the builders with compound surface condensing engines of 80-horse power.

On Friday, August 5th, Messrs. Edward Withy and Co. launched from Middleton Shipyard, West Hartlepool, a steel screw steamer, built to the order of Messrs. Steel, Young, and Co., of London and West Hartlepool. This is the 147th vessel on the builders' books, and the twenty-fifth they have built for the same owners. She is a handsome type of cargo vessel, 300ft. long, and of a large deadweight carrying capacity, built on the cellular bottom and web frame system, dispensing with beams in the lower hold, and with large hatchways so arranged that she can carry torpedo boats, guns, machinery, boilers, and bulky cargo of the largest description. The vessel has a topgallant forecastle and long bridge-house extending to the fore side of the foremast, long raised quarterdeck, and short poop aft. The bulwarks, rails, decks, &c., are of iron. She will be fitted with four steam winches, one direct steam windlass, two donkey boilers, and steam steering gear, and will be rigged as a two-masted topsail schooner. The steamer has been built to Lloyd's 100 A1 class, and under the personal superintendence of Mr. Steel. She will have triple expansion engines, with two single-ended boilers by the well-known firm of Messrs. Richardson and Sons, Hartlepool. It is interesting to note that the owners of this vessel were the first to adopt triple-expansion engines on the north-east coast, and so far back as 1880 they had the steel steamer Cyanus, built by Edward Withy and Co. On leaving the ways the vessel was christened Roddam by Mrs. W. Young, of London.

On Saturday afternoon, August 6th, Messrs. C. S. Swan and Hunter, Wallsend-on-Tyne, launched the Elingamite, the third steel screw steamer built for Messrs. Huddart, Parker, and Co., of Melbourne and Sydney. The following are the dimensions and particulars, viz.:—Length, 320ft.; breadth, 40ft. 9in.; depth, 22ft. 3in., giving a cubic capacity of 4000 tons. The vessel has a long, full poop, under which there will be a very handsome saloon the full width of the ship; large airy state-rooms, to accommodate 110 first-class passengers, fitted and furnished with everything of the most modern description. Great care has been taken to provide ample means for ventilation. In addition to the usual ventilation, a large tube runs fore and aft the full length, fitted with sliding ventilators, and so arranged that all hot and foul air can at once be carried away. The topgallant forecastle is arranged for the accommodation of over 100 second-class passengers, and every care has been taken for their comfort and convenience. In the saloon, state-rooms, officers' rooms, corridors, and second-class passengers' accommodation, the floors are all of encaustic tiles fitted on the steel deck, and the exposed part of the main deck is of chequered plates, and the remaining decks are of selected teak. There is a deck-house at the fore end of poop to accommodate the captain, with chart room and large smoking room, the latter being handsomely fitted with marble sides and encaustic tiled floor. A large deck-house aft contains the music room, fitted with piano, and covers the principal grand entrance to saloon. In addition to the usual oil lamps, the steamer will have a complete electric light installation. The electric light will be in every state-room forward and aft, on the side and on deck for discharging cargo, &c. To facilitate the rapid loading and discharging of the cargo there are five steam winches and four steam cargo whips for discharging from two hatches at the same time, steam being supplied from a donkey boiler of unusually large size, steam steering gear amidships, and direct-acting steam windlass, fitted with large warping drums. The vessel has a capacity of over 600 tons for water ballast in a cellular double bottom. The engines are on the triple expansion principle, and are built by the Wallsend Slipway and Engineering Company, Wallsend, and are capable of indicating about 1800-horse power, and it is intended to propel the vessel fourteen knots an hour. The Elingamite will be classed 100 A1 at Lloyd's and have a Board of Trade certificate for foreign-going passengers, and is placed on the Admiralty list of transports. This vessel has also been selected by the Victorian Government to be fitted as an armed cruiser in time of war. The gun foundations are now being fitted. She will carry two 36-pounder Armstrong guns on forecastle and two on poop, together with several rapid-fire guns amidships. Two large steel lifeboats are fitted, and several boats have the most approved life-saving apparatus applied.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(*From our own Correspondent.*)

The accounts brought to 'Change this—Thursday—afternoon by the sheet iron makers were as gratifying as they have been at any time for a month past. The execution of orders for the galvanisers and for merchants is followed by other contracts without the least inconvenience being experienced through any shortness of work. Proprietors of sheet works are to be congratulated upon the excellent position which they occupy as concerning the state of the demand, though more money would certainly be very acceptable. The mills which are now standing in the district would be restarted if doubles were to touch £7 per ton, with prospect of that figure being maintained. But the owners of the idle plants must exercise still further patience, since the market price must increase by something like 15s. per ton before this state of things is brought about. Doubles this afternoon were quoted £6 5s., and trebles £7 2s. 6d. to £7 5s., both for galvanising descriptions. Singles are £6 to £6 2s. 6d.; merchant doubles are generally 2s. 6d. per ton above galvanising sorts, namely, £6 7s. 6d., and the same remark applies to lattens, which were quoted £7 7s. 6d. for merchant purposes.

Orders in the galvanised iron trade are irregularly distributed. Some firms are busy, while others are only moderately engaged. The reason for this lies chiefly in the prices which the respective firms are content to accept—terms upon which some concerns are prepared to do business being utterly refused by their neighbours. India is just now in the market with more freedom, and the lowness of stocks in the South American and colonial markets is assisting local makers. The capacity of production is still, however, in excess of demand, and there is plenty of only partially employed plant at the works. Prices are fairly maintained, and this week £10 2s. 6d. to £10 5s. is named on 'Change as the average for 24 w.g. delivered Liverpool or equal; the stronger price of spelter continues.

The works of the Birkenhead Galvanising Company, in liquidation, have been purchased by Mr. Thos. Jones, one of the partners in Messrs. Skidmore and Co., tube manufacturers, of Netherton, but it is not yet apparent what is the precise object of the purchase. It is currently believed that it points to the development of the galvanising trade by a local firm already engaged in the industry.

Marked bars maintain their uniform £7 quotation, though the "Mitre" brand, and perhaps one or two others, may be had at £6 15s.; while, on the other hand, Lord Ward's brand is £7 12s. 6d. per ton upon the open market. This difference in respect of his lordship's iron is, however, a merchant's commission. It is in the second qualities that the marked bar firms are doing most business, and for which the figure is £6 per ton, and as to the "Mitre" brand, again, £5 15s. The condition of the marked bar makers, though it must be described as quiet, is yet somewhat better than earlier in the year.

Prices of unmarked finished iron are preserved fairly well as times go, makers declining to consent to further concessions in the face of a stronger raw material market. Merchant bars are £5 10s. to £6 per ton, ordinary qualities £5, and common £4 12s. 6d. to £4 15s. Hoops are without change, at £5 to £5 5s., and gas tube strip is £4 15s. per ton upwards. Some makers are trying the strip consumers for a little more money, but they are not generally successful. The demand for nail strip, however, is so good, that in this branch makers ought to legitimately command an increase in selling price. Hinge strip is quoted £6, but may occasionally be had in actual business at £5 15s. per ton.

The demand for finished iron for local consumption is of good extent, and the bareness of stocks in buyers' hands is sufficiently indicated by the communications which ironmasters continue to receive freely for deliveries. It is one of the strongest causes of congratulation to Staffordshire ironmasters, in considering the future of their industry, that we are in the midst of a great hardware manufacturing community, who must ever be demanding large supplies of iron and steel for working-up purposes. Steel is admittedly rapidly encroaching upon the domain, in this connection, formerly occupied by iron, and the new metal is found to answer the needs of the hardware manufacturers very satisfactorily, but if the preference should extend, Staffordshire can easily maintain her prosperity by the rolling of steel in merchant sections instead of iron. Sheets, bars, hoops, and strips, can as easily be supplied in the one form as in the other.

Steelmasters this (Thursday) afternoon reported no decline in the buoyancy which has of late characterised the demand. Enquiries and orders continue to arrive more rapidly than they can be executed. At some of the works production is being increased, and additional plant is contemplated in one or two directions. The recent authoritative pronouncement in favour of basic steel at the Institute of Naval Architects is regarded with much satisfaction here where the basic process is being worked. It is questioned, however, whether the declaration of Mr. James Riley, of the Steel Company of Scotland, that the system must be amalgamated with the open-hearth process to make it a complete success, will not prove to be in excess of the necessities of the case. Prices keep up well at, for basic material, bridge and tank plates, £6 15s. to £7; best boiler, £7 5s.; bars and angles, £6 5s.; channel steel, £6 5s. to £6 7s. 6d.; and blooms and billets, £5. Welsh Bessemer blooms are £4 10s., delivered here, and billets £4 10s. to £4 12s. 6d. Tin bars are £5, delivered.

The pig iron trade is slightly improved this week by reason of the better condition of things in Scotland and the North of England. Yet the effect is not very marked. Salesmen representing Derbyshire and similar class houses are less disposed than ten days ago to accept terms offered by buyers. Purchasers, on their part, are not anxious that their offers should be accepted, and the extent of business doing is not large. There is a good deal of variation in prices, according to the position of the different makers' order books. Old customers are being allowed more favourable terms than are quoted in the open market. Derbyshires are this week 36s. 6d. to 37s. delivered to works; Northamptons, 35s. 9d. upwards; and Lincolnshires, 39s. 6d. to 40s. at stations.

Imported hematite pigs maintain their price well in consequence of the large call which makers are experiencing from the steel trade. Some West Coast brands are advanced 1s. this week. The figures are, however, too high to allow of very much business being done on these exchanges. Good Welsh hematites are quoted 52s. 6d., and West Coast ditto 55s., delivered here. Some old customers are getting contracts accepted by Cumberland firms at 53s. 6d. Offers for extended deliveries, *i.e.*, for a twelvemonth or so ahead, are being refused by sellers.

Staffordshire pigs keep at about 29s. to 30s. for cinder sorts and 50s. to 52s. 6d. for hot blast all mine. Messrs. A. Hickman and Son report that so satisfactory is the demand that last month they reduced their stocks by some 1000 tons.

Pig iron makers are gratified at the termination of the strike on the Midland Railway. The pig firms in this district are largely dependent for their supplies of coke upon the Derbyshire ovens, and the minerals are conveyed over the Midland line. Consumers have no stocks whatever in hand, and have to rely upon the daily arrivals from Derbyshire. Numerous ironmasters at the close of last week reported that they should have to damp down their blast furnaces on Monday or Tuesday unless the traffic were resumed. Fortunately this necessity has been averted.

Local manufactured iron masters note with satisfaction that, judged by the Government export returns for the past month just issued, several branches of the iron trade have been more active, and in one or two cases very satisfactory increases have taken place, so far as the quantity exported is concerned; but prices keep very low, so that the value in proportion to the quantity turned out is small. Our total iron and steel exports in July last increased, compared with July, 1886, by 51,063 tons, or 15 per cent. in quantity, and £281,784, or just over 14 per cent., in value. In railroad iron there is an increase of £117,510, or 28 per cent.; in cast and wrought of £10,269, or 3 per cent.; in unwrought steel of £81,304, and in tin-plates of £55,671, or 15 per cent. The details are as here:—

	Month of July. 1886. £.	1887. £.
Pig and puddled iron	223,067	210,857
Bar, angle, &c.	119,187	114,690
Railroad	409,336	526,846
Wire	44,767	47,525
Cast and wrought	316,495	326,764
Hoops, sheets, &c.	259,802	253,602
Steel, unwrought	99,561	180,365
Tinplates	363,647	419,318
Machinery	337,679	715,152
Steam engines	576,273	225,828

The Sandwell Park Colliery Company have made a profit upon the last year's operations of £10,983. The directors propose that a dividend of 5 per cent. per annum should be paid. A balance of £1687 will, after meeting various other claims, then be left. The directors remark that they have endeavoured to meet the fall in prices by the reduction of working expenses. The demand has been such as not to require the use of the new plant, but it is available for immediate operation when needed.

A committee, numbering nearly fifty, including several local merchants and the president of the Chamber of Commerce, has been just formed at Gloucester, to promote the proposed improvement of the waterway between Gloucester and the Bristol Channel. The committee have resolved to recommend the Corporation to purchase the property of the Sharpness Docks and Gloucester and Birmingham Navigation Company, with a view to improve the canal and its approaches. It is understood that the Mayor will bring the matter before the Corporation in a week or two.

The Midland Railway Carriage and Wagon Company have made a profit for the year of £13,078. A balance of £1790 is brought forward from last year, and the directors propose to pay a 4 per cent. dividend on the ordinary shares and the 6 per cent. preference dividend; £5000 is set aside for depreciation of wagons and £512 for depreciation of plant and machinery. The directors consider the report satisfactory, bearing in mind the state of trade.

The balance-sheet of the Birmingham and Midland Tramways for the past year shows a profit of £5730. It is proposed to pay an interim dividend at 3 per cent. for the first half-year. The traffic receipts, which were £12,592 for the previous year, have amounted to £18,271 for the year just closed. This increase is satisfactory, but the net result is disappointing. The directors do not recommend a dividend for the current half-year.

The introduction of steam trams into the narrow thoroughfares of Birmingham is just now causing an outcry on the score of the dangers attending their running. Three young children have just been killed on the steam lines within the short space of ten days. Many consultations by the Town Council have taken place with a view to minimise the danger, and it is but a short time since various protective measures were agreed to on the report of the special committee of the Council who had conducted an investigation. But at present no remedial treatment seems to be altogether effectual. When the cable tramways now being laid down have been tried, perhaps the steam tramway routes will be curtailed. There is certainly a feeling in Birmingham in that direction. It is somewhat singular that the loss of life which seems almost inseparable from steam tram lines in England does not seem to occur so frequently in the United States.

The South Staffordshire and Birmingham District Tramways Company are asking for the issue of extra debentures to the extent of £32,000 or £33,000, for the purposes first of paying the contractors for the making of the line, and secondly for the development of the new system of goods carriage which was described in THE ENGINEER last week. The shareholders have held a special meeting, and have agreed to the issue.

The reorganisation of the ironworkers of South Staffordshire is proceeding smoothly. Meetings have been held during the week, at which the necessity of combination has been insisted upon. The men have passed resolutions affirming the necessity of forming branches of the Associated Iron and Steel Workers at all the works, and at the same time of supporting the Board of Conciliation and Arbitration, which is languishing for want of funds, as was pointed out a week ago.

The merchant firm of John Shaw and Sons, of Wolverhampton and Calcutta, have just availed themselves of the benefits of the Joint Stock Companies Acts, by converting their business into a private and limited liability company, with a capital of £120,000 in £10 shares. No shares are offered to the public.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—In the iron market prices generally keep very steady—in fact, pig iron makers in some instances are holding for figures slightly above those they have been willing to take recently, but the actual trade doing is still very slow. There is an absence of buyers of any weight in the market, and the immediate future holds out no prospect of any materially increased volume of trade coming forward. For the present, in common pig iron local and district makers are pretty well sold, and this causes them to be indifferent about pressing sales, whilst in hematites the continued activity in the large steel-making centres enables makers to be practically independent of this comparatively limited market. Finished iron makers, so far as hoops and sheets are concerned, are in a rather better position than they were, but any real advance upon late prices is scarcely obtainable, whilst bars continued only in poor demand, and, if anything, are weak.

The Manchester iron market on Tuesday was only moderately attended, and business was again very quiet. For pig iron there was only a very small inquiry, but prices generally were firm, and for delivery equal to Manchester Lancashire makers held to 38s. 6d. to 39s. 6d., with Lincolnshire brands not quoted under 36s. 6d. to 37s. 6d., less 2½, for forge and foundry qualities, which is 6d. above what one or two Lincolnshire houses were willing to take last week. At these figures, however, there is very little buying going on, and at the prices which local makers are asking their sales are practically confined to occasional very small parcels, which they are able to place with regular customers whose works lie in the immediate neighbourhood of the furnaces. For outside brands offering in this market quotations remain steady at the rates ruling last week. For good named foundry brands of Middlesbrough, delivered equal to Manchester, the average figure is about 43s. 4d. net cash, and in most cases the leading makers are not disposed to entertain offers at anything under this figure. There are, however, sellers who, in special cases, would take 3d. to 6d. per ton less, and in Scotch iron there is some underselling against makers' quoted prices. Hematites still meet with only a very limited demand in this market, but quotations remain firm on the basis of 52s. 6d. to 53s., less 2½, for good No. 3 foundry qualities delivered into the Manchester district.

In the finished iron trade makers of hoops and sheets are pretty full of orders, and there is a fair business still coming forward, with prices generally firm at £5 5s. for hoops and £6 5s. to £6 10s. for sheets delivered into the Manchester district; but bar iron still meets with only a slow sale, and at £4 17s. 6d. as the quoted basis for ordinary qualities delivered into the Manchester district, prices can scarcely be said to be firm in all cases.

I continue to hear reports of a fair amount of inquiry stirring amongst engineers, and in most cases works are moderately well employed. There is, however, still that general keenness of competition for any new work coming out, which is only too sure an indication that engineering concerns, taking them all through, are anything but full of work, and excessively low cut prices continue the general complaint.

The dispute in the Bolton engineering trade continues to be stubbornly contested on both sides. Strenuous efforts are, however, being made in independent quarters to provide some means by which an amicable settlement may be arrived at, and this protracted and disastrous struggle brought to an end. Whether these efforts will prove successful remains to be seen. The Employers' Association has already sent in a sealed reply to the proposals which have been put forward, but the men are holding back their decision until after a great mass meeting of trades unionists, which is to be held at Bolton on Saturday. So far the strike committee has been so liberally supplied with funds, their balance in hand having gone on increasing week after week, that they are naturally encouraged to hold out, and seem to be indifferent about entering into arbitration except on their own terms.

With the increasing use of extremely long wire cables, not only for tram and other cars, but for general hauling and winding purposes, it has become an essential that such cables should be manufactured throughout their entire length without splicing, and that a much larger number of strands should be introduced than was thought necessary in the old-fashioned cables. To meet these requirements various improvements in cable manufacturing machines have been introduced, and I have had an opportunity of inspecting one of the latest developments of inventive ingenuity in this direction. This is a Canadian invention, and is termed a patent compound wire-cable making machine, and the first machine constructed, and which is to be shipped to Canada, has been exhibited in action during the past week at the works of Messrs. Thos. Barrowclough and Co., Manchester, by whom it has been made. This machine carries forty-two bobbins of wire 11¼ b.w. gauge, and makes in one operation a seven-strand cable, 3in. circumference, and without any splice, whatever the length or weight that may be required. The construction of this machine may be briefly described as follows:—The driving is communicated from a headstock by means of spur gearing to a hollow central steel tube, 17ft. 6in. long and 6in. external diameter, with a hole through 2in. in diameter. This steel shaft runs the entire length of the machine to the lay plate, nnd carries the whole of the stranding mechanism, and it is made hollow to allow of the central core for the cable passing along the inside. By means of a sun-and-planet motion, the centre wheel of which is fixed to the steel tube, motion is conveyed to six bobbins, which carry the six central wires for the six strands, and these bobbins are carried by themselves on a separate ring. Then follow three other rings, also placed on the central tube. Between the first and second rings revolve three stranding apparatus, and between the second and third rings three other stranding apparatus, all these six stranding apparatus being driven by means of spur gearing fixed to the central steel tube, and motions are introduced for lengthening or shortening the lay of the wires in the strands. Each stranding apparatus is furnished with special guide rollers for the wire, which can be set at any angle so as to adapt themselves to any size of wire that is being spun. The six strands pass through dies, so as to ensure perfect rotundity, thence over guide rollers and through the head of the machine. This head carries the front end of the steel tube and revolves on anti-friction rollers. One of the rings of the machine also revolves on anti-friction rollers under the machine, which serve to carry a large proportion of the weight of the body of the machine, and thus relieve the two ends of the large steel tube. After passing through the lay plate, the six strands enter a set of dies, up the centre of which passes the core, and are thus formed into a cable. These dies are of special construction; the pressure on them is made elastic by means of springs, and the die can be set nearer to or farther from the lay plate according to the diameter of the cable that is being made. The finished cable passes five or six times round a draw drum, 5ft. diameter, which is driven by gearing, the motion being given by a long horizontal shaft running underneath the machine. After leaving the draw drum the cable passes between two compressing rollers, called in the trade jockey rollers, which serve to keep the cable tight during its passage round the draw drum. An ingenious arrangement is attached to the delivery end of the machine which, working by friction on the edge of the cable as it is being delivered, automatically records the exact length as it is being made. After passing through the jockey rollers, the cable is wound into coils by means of a reeling or winding-on apparatus. driven by the machine and worked by means of compound gearing, so as to allow very large coils to be made. The machine is constructed in such a manner that it can be reversed in all its motions, and also that it can make not only the ordinary cable, but, if required, Lang's patent rope, the special feature of which is that the lay of the strands and the lay of the cable are in the same direction. The operation of the machine will be sufficiently well understood from the above description, and it will be seen that a special feature is that the machine has two distinct and simultaneous motions—the six-stranding apparatus revolving with the central tube, while each of the six stranding apparatus has an independent revolving motion of its own in order to form its own strand. I may add that the machine is capable of making ropes in which the strands are composed of any number of wires not exceeding nineteen.

Except that there is a little more inquiry here and there with the view of getting in winter stocks at the present low rates, and which may be taken as an indication that the worst period of the summer season has been got through, there is really no change to report in the condition of the coal trade of this district. Three and a-half to four days a week remains the average working time at the collieries, with all descriptions of round coal bad to sell, and stocks accumulating. The present small production of engine fuel moves off fairly well. To effect clearance sales, prices are cut very low, but the current market rates are unchanged, and at the pit mouth average 8s. to 8s. 6d. for best coals, 6s. 6d. to 7s. seconds, 5s. to 5s. 6d. common coals, 4s. 6d. up to 5s. burgy, 3s. 6d. up to 4s. best slack, and 2s. 6d. to 3s. per ton common sorts. Some of the collieries are doing a very fair shipping trade, but the activity is not at all general, and prices are cut very low, ranging from 6s. 3d. to 7s. per ton for steam coal delivered at the high-level, Liverpool, or the Garston Docks.

Barrow.—The trade doing in hematite pig iron is still very brisk, although the sales are not so numerous or so heavy as the demand would seem to justify. The position of makers is that they are well sold forward and have not at the moment much iron to sell. The position is somewhat aggravated by the fact that in some parts of the district makers are being compelled to stop occasionally owing to the scarcity of water. In some cases the furnaces are damped down for the week end. This is having the effect of reducing the output of pig iron very materially, and as stocks generally have been reduced all round, it is impossible for makers to keep up to their delivery engagements, where such have been made as to require prompt attention. Prices are steady and firm at 45s. 6d. per ton net f.o.b. for Bessemer qualities of iron in mixed numbers, and 44s. 6d. for No. 3 forge and foundry iron net, with 43s. 6d. for No. 3 forge and foundry iron. The delivery of pig iron to America is not nearly so large as it was a season or two ago, and in all probability no improvement will be established so long as the protective tariffs are maintained; but America is a very good customer for steel in its various forms, and rails are especially a brisk business; that is to say, there is a very full demand for all qualities of rails for America, continental, colonial, general foreign, and home users. Makers are more heavily sold forward than they have been for years, and it is expected they will find employment on the work already in hand for fully twelve months to come. There is a fair business in other descriptions of steel, and the mills are very regularly employed. Plates, bars, angles, billets, and general merchant steel, is in fair demand, and it is anticipated that orders will soon be placed which will bring about considerable activity at the mills which have been recently put down for the production of shipbuilding material. The shipbuilding trade is still quiet, though the signs of better times are every week more hopeful. There are a few good inquiries pending, and it is anticipated confidently they will be placed in this district. No change can be noted in the finished iron trade. Orders are very slow in coming to hand—indeed, it is anticipated that the changes effected in the development of the steel trade for many purposes for which finished iron was previously used is likely at an early date to almost put an end to the finished iron industry in this district. The iron ore trade is steady, and a large tonnage has recently changed hands for forward delivery. The value of iron ore is steady at from 8s. 6d. to 11s. 6d. per ton net at mines. The coal and coke trades are steady, and there is a heavy consumption for manufacturing purposes.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

SHEFFIELD was not so seriously affected by the railway strike as other centres; but there was no little inconvenience caused by the rupture. Out of a staff of 152 men 146 ceased work. Assistance was given by the North-Eastern Railway Company, who sent fully-manned engines from York. Saturday was a bad day for the company. For passenger traffic August is the heaviest month of the year, and Saturday is the heaviest day of the month. The energy of the officials was taxed to the uttermost, and it must be admitted that in the crisis the company were admirably served by their staff. Despite every exertion, however, delays were inevitable. On Sunday the accumulated goods trains were dealt with, the yard cleared, and distribution commenced in the town. On Monday the special excursion traffic was entirely managed by the Midland officials, with the exception of one train to Bridlington, which was undertaken by the North-Eastern, but the company state that they could have run it, as they had an engine in the yard. On Monday intimation was given that the places of the former men had been filled up, and that if they desired to re-enter the company's service, they would have to break up their homes and leave Sheffield for some other part of the system. The men kept remarkably firm, in spite of other places breaking down. Not one of the firemen employed at the Sheffield depôt remained at work. Public feeling was considerably divided. It was freely stated that the men were entitled to be paid full time if they were at the company's call and restricted from engaging in any other occupation. This point was freely admitted. On the other hand, no sympathy whatever was felt for those engine drivers and firemen who had damped down the fires and left their engines on sidings far away from home. These men are not likely to be taken on again. The general public agree with the officials that these men ought to have completed their journeys and returned the engines into the sheds. That the company would win in any struggle with the men was a foregone conclusion, and the strike was not three days old before there was news of capitulations. It will be interesting to note, when the official return is issued, how far the public have been affected by fear of inexperienced drivers, and have taken other lines than the Midland when they possibly could. The meeting of the Midland shareholders on Friday will be waited with much interest.

There is a little more comfort in the Board of Trade returns for July. The iron and steel exports for the month amounted to £2,176,168, against £1,894,384 and £1,880,691 for the corresponding months of 1886 and 1885. For the seven completed months the values were—1887, £14,153,421; 1886, £12,812,989; 1885, £12,750,200. In iron the increasing markets are Germany, Holland, Belgium, and Italy; the markets showing a decrease being Russia, France, the United States, and British North America. Steel rails have been exported during the month to the value of £386,835, against £318,842 for July of 1886. The United States have taken £123,086, against £24,503. This is the largest increase, and the largest decrease is shown by British North America, the demand from that market having fallen from £103,578 to £55,245. Steel—unwrought—again shows an immense advance—£180,865 against £99,561; for the seven months, £1,303,300 against £703,859 for the first seven months of 1886. The United States is the chief improving market. Hardware and cutlery have slightly declined —£233,283 last month, against £236,537 for July, 1886.

Rain still keeps off, though sorely needed. I have been travelling over some 200 miles of country in the Midlands during the last week, and never, in a quarter of a century's experience, has the severity of the drought been more marked. The neighbouring county of Derby seems to be suffering as generally as any part. In the rural districts the water has to be carted distances of five and six miles. In some localities the water is turned off

three days a week; elsewhere the reservoirs are dry, and water is now a commodity which is being hawked about in barrels, and sold at so much a pitcherful from door to door, The sanitary inspectors and surveyors of the High Peak state that the scarcity of water has not as yet seriously affected the health of the people.

The Water Bill of the Sheffield Corporation has now received the Royal assent and become an Act. An account of the negotiations between the water committee of the Corporation and the Water Company was submitted to the Town Council on the 10th inst. It appears that the price originally suggested by the committee to be offered was £1,500,000; the price now agreed to is nearer £2,200,000. The figure is regarded as high, but the Corporation were determined to purchase, and when a thing is wanted "very badly" the seller usually gets a stiff price. The Sheffield water supply is of excellent quality and very abundant; during these severe droughts the great reserve of many million gallons has been untapped, and constant supply given night and day.

The new Master Cutler (Mr. James Dixon, of Tylecote, Ranmoor) is the grandson of the founder of Cornish-place (Messrs. James Dixon and Sons, silversmiths and electro-platers). Mr. James Dixon, of Page Hall, had a happy thought, which led to the great industrial establishment which is now known the world over. In Hunter's "Hallamshire" it is stated that, when connected in business with Messrs. Younge, he one day said to Mr. Younge, Jun.,—"Mr. John, I have a thought in my mind that will make my fortune." This was the manufacture in Britannia metal of the same articles which had as yet been produced only in silver and silver plate. Articles hitherto made of brittle crockery were soon generally superseded by a metal article more enduring, and therefore less costly in the end. Afterwards nickel or German silver was extensively used at these works. Mr. James Dixon began in Silver-street first, from which he removed to Cornish-place, where he took into partnership with him his three sons—Mr. Frederick Dixon, Mr. James Willis Dixon, and Mr. H. I. Dixon—and the late Mr. Fawcett. Of the three sons there remains now only Mr. H. I. Dixon, the father of the now Master Cutler. Britannia metal was largely superseded by electro-plate. Then the firm engaged upon the production of silver and plated goods, powder flasks, and shot pouches; and on breech-loaders coming in, they promptly undertook the making of cartridge cases and other specialities connected with breech-loading. There is no more honourable firm anywhere than Messrs. James Dixon and Sons, and the election of Mr. Dixon to the head of this great and ancient corporation is an event which is locally regarded with interest and pleasure.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

The statistics of the Ironmasters' Association for the month of July, which were issued on the 3rd inst., had a depressing effect on the Cleveland iron trade. In view of small shipments, and diminished consumption at the local works, a decrease in stocks could scarcely have been expected; but no one anticipated so large an increase. At the market held at Middlesbrough on Tuesday last, the feeling improved to some extent, on the circulation of a report from Glasgow that some good orders had been received from America. The amount of business transacted was small, but prices were firmer, most merchants asking 34s. 4½d. per ton for prompt delivery of No. 3 g.m.b. Foundry iron continues scarce, but it is just the reverse with respect to forge iron. The increase in the stocks being mainly of that quality, the price thereof is weak, and sales are reported at as low a price as 32s. 3d. per ton.

Stevenson, Jaques, and Co.'s current quotations:—"Acklam hematite," (mixed nos.), 45s. per ton; "Acklam Yorkshire," (Cleveland) No. 3, 35s. per ton; "Acklam basic," 36s. per ton; refined iron, 48s. to 63s. per ton, net cash at furnaces.

Holders of warrants are quoting 34s. 4d. per ton, but buyers are not at present willing to give more than 34s. 2d., and no business is proceeding.

It is a satisfactory sign that the stock in Messrs. Connal and Co.'s Middlesbrough store is steadily decreasing. On Monday last the quantity held was 334,486 tons, being a reduction of 220 tons for the week. The decrease during July was 1846 tons.

Shipments of pig iron are falling below what was expected for the month of August, only 18,216 tons having been so far exported, as against 20,400 tons in the corresponding portion of July, and even that figure was below the average.

The finished iron trade continues exceedingly dull. Makers offer ship plates and common bars at £4 10s. per ton and angles at £4 5s., all free on trucks at their works; but they are not indisposed to make concessions on these prices whenever they see an opportunity to secure a good order.

The statistics for July, already referred to, show that ninety-four furnaces were at work during the month. The production of pig iron of all kinds—including hematite, spiegel, and basic—was 211,272 tons, which represent an increase of 219 tons in comparison with June. The stocks of pig iron in the whole district amounted on the 31st ult. to 624,513 tons, being 9576 tons in excess of what they were a month previously.

An epidemic of incendiarism seems to have spread over Middlesbrough and the neighbourhood. Within a month no less than nine fires have occurred of which the origin has not yet, in any case, been clearly traced. A firm belief prevails that they are due to criminal action, and that the motive has been vindictiveness in some form or other. The damage done is enormous, most of the fires having been in timber yards, joiners' workshops, and oil stores. A curious circumstance, and one which may afford a clue to the discovery of the perpetrators, is that in almost every case the conflagrations have occurred upon property belonging to the owners of the Middlesbrough estate. The first few fires being at timber yards, it was then thought that they might be the result of the long continued dry weather upon the timber, occurring either spontaneously or by accidental ignition by tramps who might have sought shelter among the stacks of planks. This notion, however, is no longer entertained; the police are of opinion that the fires may be due to resentment or the desire to make a sensation for political purposes on the part of the numerous Irishmen in the town. The following are some of the principal firms affected:—Messrs. Calder and Co., timber yard; the lessees of Cargo Fleet, timber yard; Thomas Hallam and Co., timber yard and sawmills; Chapman Brothers, contractors and joiners; Wright, Petchell and Co., oil and machinery stores; a quantity of timber goods lying at Connal and Co.'s wharf was also burnt. The fires have mostly occurred at the week ends, that is, between Saturday night and Monday morning. On the night when Messrs. Knight, Petchell, and Co.'s warehouse was burnt down, the door of the house where the steam fire-engine is kept was found to have been somewhat damaged by some person or persons unknown, whose object, it is generally believed, was to cripple the fire-engine. On another occasion two men were seen throwing some liquid on the door of a warehouse belonging to a well-known firm of plumbers in the town. An alarm was given, and the men ran away. Some of the liquid was collected and analysed, and found to be turpentine and resin. The police are taking extra precautions, but as yet nothing has been discovered likely to lead to the detection of the incendiaries.

The ironworkers seem to have adopted the Irish term, "Plan of campaign," and applied it to some intended operations of their own. A conference has just taken place at Sheffield, under the presidency of a Mr. S. Waddington, of that town. The object was to remodel their trades union so as to include steel as well as ironworkers, and to consider and adopt a new set of rules. They hope to induce all connected with their trade to unite, whether they be miners, blast furnace men, or those engaged in subsequent processes. Mr. E. Trow was unanimously chosen general secretary, and it will be his duty to organise and put into operation the "plan of campaign."

NOTES FROM SCOTLAND.

(From our own Correspondent.)

A stronger tone has characterised the Glasgow pig iron market this week. The quantity of iron being sent into store, which of late had considerably increased, has this week become materially reduced, and this circumstance, together with the knowledge that larger quantities of pig iron are being sent to the ports for shipment, has exercised a favourable influence on the market. The pig iron shipments of the past week were 6473 tons, as compared with 9212 tons in the corresponding week of 1886. Our best customers at present are the United States, Canada, and Italy, fair quantities of iron also going to Australia, but comparatively little to the Continent. The number of furnaces blowing in Scotland is eighty-two, against eighty-five at the same date last year.

Some ironmasters report that they have of late being doing well, and that the orders coming to hand remind them of the prosperous times in the trade, except that the prices now being realised are comparatively low. There has been little change in values in the past week. Gartsherrie, f.o.b. at Glasgow, No. 1, is quoted at 48s. 6d.; No. 3, 44s.; Coltness, 54s. and 44s. 6d.; Langloan, 50s. and 45s. 6d.; Summerlee, 52s. 6d. and 43s.; Calder, 49s. and 42s. 6d.; Carnbroe, 44s. and 40s.; Clyde, 46s. 6d. and 41s. 6d.; Monkland, 43s. 3d. and 39s. 3d.; Govan at Broomielaw, 43s. 3d. and 39s. 3d.; Shotts at Leith, 49s. and 45s 6d.; Carron at Grangemouth, 52s. and 44s. 6d.; Glengarnock at Ardrossan, 49s. and 41s.; Eglinton, 43s. and 39s.; Dalmellington, 44s. and 40s. 6d.

The week's arrivals of Middlesbrough pigs at Grangemouth were 4929 against 5730 in the corresponding week of 1886.

There is more activity in certain departments of the steel industry, especially those which contribute to shipbuilding, the Clyde yards having received a good accession of fresh work in the course of the last two or three weeks.

The largest gas fitting contract ever arranged in Scotland, viz., that for the new Municipal Buildings of Glasgow, has just been secured by Messrs. W. Ramsay, jun., and Co., of Glasgow. The work is to be commenced at once.

During the past week there was shipped from Glasgow machinery to the value of £9550, including a sugar mill for Cuba, worth £6382; sewing machines, £1251; steel goods, £1415; and general iron manufactures, £17,620.

In the coal trade, the inquiry is on all hands reported better, and the shipping department is especially active. There is a marked improvement at Glasgow, but the shipping trade at Burntisland is in rather a backward condition. Steam coal is in good request, and there is also a steadier trade with home manufacturing consumers. There is no material change in prices.

The colliers are being strongly urged everywhere by their leaders to restrict the output, and prevent the storing of coals at the pits.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The declaration of the Bute Dock dividend, 4 per cent., and the Taff Vale, with its bonus of 14 per cent., are encouraging facts that somewhat modify the present falling-off in the coal trade. Last week was a poor one, generally, Cardiff especially showing a great contrast in foreign coal exports. Taking the late averages, which have shown a lessened trade, Cardiff sent away last week 25,000 tons less even than this, and this naturally caused such a diminished activity as to be very perceptible at docks and railway. This week there is a slightly better tonnage. Coalowners are firmer than was expected in resisting offers at lower prices. If they can continue for a few weeks the tone of trade will improve. If otherwise, and prices are forced down, the coal trade will again enter upon the old course of things, and it will be bad for coalowners and colliers.

I note improving signs in the coal development at Brynmaur—where Mr. Basil Jayne is forming a company—Tredegar, and near the Hafod, Rhondda Valley. House coal is still sluggish everywhere, and may be expected to remain so for another month. Swansea shipped only 21,000 tons of coal last week. Monmouthshire coals are somewhat in favour, quotations being low, 7s. 9d. to 8s.; while Cardiff quotes for dry good coal 8s. to 8s. 3d.; and for best steam, 9s. to 9s. 6d. That some of the leading coalowners get these figures is certain, in a few cases, but a good deal of business is being done at lower rates, and at such as, I fear, will not conduce to the declaration of an advance in wages.

Colliers fortunately are not so badly off, considering the low price of provisions, and that the prudent manage well is shown by the holiday trips that are being taken to the Wells, and the seaside.

In coke the demand is slight, consequent upon the slackness at the steel works. Crawshay Brothers, with their new Evance Coppée ovens, and Rhondda collieries, will soon be independent of outside supplies, this coal, mixed with their own small steam, answering well. The ovens are getting on capitally, and the building is worthy of the Cardiff firm in every respect.

Cyfarthfa is at present in full drive, and is using a good deal of Dowlais pig as well as its own. As regards water supply, it is better off than most works, and though the drain of the week tells even upon the fishponds, the partial stoppage of Saturday and Sunday is a help in adding to the supply. Cyfarthfa Castle fishpond, well planned by a London engineer of eminence, is doing good service in helping the steel works.

I am afraid that some of the Welsh works in this new steel era have not been supplied with sufficient water supply. What with the hydraulics and the greater force and make of the furnaces, a larger volume of water than ever is needed, and this long and dry season will certainly prompt to important changes for the future to yield this greater quantity.

This week it was decided at Llanelly to cut off the water supply to the works. This means a stoppage and destitution to the work-people. Other works will be obliged to follow suit unless rain sets in.

I am glad to see that the Dowlais management is doing its best to retain the ironworkers by employing them at all kinds of labour until the drought ends.

Cyfarthfa is reaping the benefit of the inability of others to supply tin bar and rails, and is very busy; the steel made is excellent.

There is a better tone in the steel trade, though prices are low. Rates to America for blooms and billets continue at 10s. 6d., and this allows of a little business being done. The prices quoted at the Swansea Exchange this week were—Bessemer steel blooms, £4 5s.; bars, £4 15s.; Siemens bars, £5 2s. 6d. cash, 2½ per cent. Scotch pig iron was quoted at 42s. 4d. closing price; hematite, 44s. 1d.; Middlesbrough, 34s. 6d. for No. 3. The prevalent opinion "on 'Change" was that the tin-plate trade was in a highly satisfactory condition, even though buyers continue to hold off. At present the works cannot turn out anything like the ordinary make, on account of short supplies of steel bars and deficiency of water. The make now is scarcely up to "hand-to-mouth use," and stocks are low. In addition, several works are expected to stop for water. Present quotations are—Coke tins, 13s. to 13s. 3d.; Bessemer, 13s. 3d. to 13s. 6d.; Siemens steel with coke coating, 13s. 9d. to 14s. 6d.; best charcoal, from 15s. 6d. Tin was reported as advancing.

The first train of coals from the Albion Colliery came into Pontypridd this week, and attracted a good deal of notice; quality excellent.

The 24th of this month has been fixed upon for the opening of the New Roath Dock. This important movement, which will give a third more dock capacity to Cardiff, should be signalised well.

Iron ore continues a drug, and very little chartering is going on, either from Bilbao or Carthagena. Ironmasters hold large stocks, and are not likely to increase until the drought is ended, though some few cargoes are coming to hand—portions of old contracts.

Swansea Harbour accounts are in a high degree satisfactory, as the report, now compiling, will prove. Mr. Capper is to be congratulated on the vigorous administration shown.

It is in contemplation to erect a new station on the Roath, Taff Vale line. The new Cardiff station will probably be opened on September 1st.

The projected line connecting Radnorshire with Neath is likely to have fresh life infused. It is badly wanted for the opening up of the country, taking away the minerals, in particular, and bringing in coal and lime.

A Cardiff company was formed some time ago for working mines n the Eppynt, but abandoned.

NOTES FROM GERMANY.

(From our own Correspondent.)

The tone of all the iron markets has improved perceptibly, and as all the finished ironworks are satisfactorily employed, the consequence has been a better demand for pig iron. Even in Silesia, where till lately nearly 20 per cent. of the output went to Russia, which has had to find purchasers elsewhere, and which has fortunately been the case in the country itself, as the rolling mills are better employed than for years past and at higher prices as well. Again, "it is an ill wind that blows nobody any good," and this is being illustrated by the wholesale disaster at the Friedenhütte, which till the sad accident, produced and worked up 50,000 tons of pig iron yearly, the make of which is now suspended till the works can be re-established, so this has also helped a little to improve the demand for forge pig in that district. Added to this, the machine shops, foundries, and steel works, are busily engaged, which naturally assists the consumption, so it looks as if the Russian tariff difficulty would be this time pretty easily tided over. America is again in the market here with inquiries for large parcels, and this creates a buoyant tendency, although it has not at present led to business.

In the Siegerland, steel ores have risen a further penny or two, and in Luxemburg from 2d. to 6d. p.t., according to the sort of ore. Pig iron is slowly but steadily rising, the demand for forge and Bessemer sorts are very active, and the prices of these have gone up more rapidly than for other sorts, also the lower qualities of spiegel are more called for, and a good many contracts have been made for it of late, whilst so much of the better sorts up to 20 p.c. Mn. has been sold that demand has outrun the stocks, so prices will probably soon be enhanced. In export, however, not much is doing. The fear now is that as usual production will be forced and put an end to this better state of things, indeed the seeds are already sown, for this June 45,000 t. more of pig iron, mostly forge, was made than last June. Foundry iron has been a little better in request. The present prices are—low quality spiegel, from 8 up to that with 20 p.c. Mn., M. 46 to 67; forge, 40 to 45, 50; foundry, 49 to 55; basic, 42 to 43; Bessemer, 50 to 51; Luxemburg, 27 to 33 p.t. The wrought iron branch is just now the best situated of all, for the demand has still further improved, and all the works, as already mentioned, are busily employed, and prices all round firm at the new base of M. 115 p.t. Boiler plates are a little more in request, and the works moderately employed. Sheets are momentarily in very brisk demand, with rising prices, as there are nowhere any stocks, so the ground price has been raised to M. 135 p.t., with extras as fixed at the beginning of the year. The American inquiries for wire rods are causing a cheerful feeling in the trade, and statistics show that more was exported to that country the first half of this as compared to the corresponding half of last year, otherwise there is nothing new to note. The steel works are moving along quietly, and the same may be said of the wagon works, though, if anything, the latter are less brisk than the former. There is no change to notice in the condition of the machine and constructive shops, which are quietly but contentedly employed, and though in isolated cases it is not the case, yet the foundries are generally better off than for some time past. The wrought iron and steel prices are—for bars, M. 115; hoops, 110 to 116; Bessemer billets, 110 to 124; boiler plates, 5 mm. and above, 150; sheets, 135; iron wire rods, 110; steel ditto, 108 to 110; drawn wire in iron or steel, 125 to 128; and light rails, 110 p.t.

The Altoona Chamber of Commerce, after it has said in its yearly report that the chief buyers of German hardware—including steel slabs, flat bars and billets for implement and tool making, wire rods, wire, &c.—are America and Russia, laments that it is almost shut out from the one and quite from the other country, and asks, "What is to become of our future so needful export industry, if the field for the sale of our articles is every year more and more crippled; if the cost of production is immoderately increased by the carrying out of our social-political-economy—meaning, probably, the State Sick-club, which costs industry millions of marks yearly—if the surplus from our railways is to be taken to cover Budget deficits, instead of being applied to the reduction of freight tariffs; if the Customs duties, which were intended to protect industry, are to be considered a necessary for the State finances; if reciprocity duties are not to be enforced for reasons of finance; and, lastly, what is to be said when the works sell their products at the lowest, sometimes, indeed, under cost price abroad, while through their conventions they increase the price of the raw materials to the inland export manufacturers of hardware?"

The ore market at Bilbao is very firm, indeed, more so than usual at this season; despite this, however, no great contracts have been entered into. The shipments for the week have been good, but there is a deficiency of loaders—88,192t. were despatched. The prices are 6s. 8d. to 7s. 2d. for Campanil and first qualities of red ore. England and America are the largest buyers. Up to July 30th, 2,574,479t. have been this year shipped against 1,945,922t. last year.

The iron market of France is as depressed and demoralised as ever, and prices cannot be induced to rise either by natural or artificial means, and with respect to the last, the best writers on political economy in the country complain that the works cannot be brought to form syndicates for special branches of industry, as in Belgium and Germany, which have raised prices, because they have no confidence in each other's reciprocal loyalty in keeping to the regulations agreed upon. The throwing out of the Bill for a net of railways round Paris has also acted depressingly on the trade. In Paris the prices for girders are 125f.; merchant iron, 135; angles, 145 up to 155 for heavy sections; but these are prices quoted by dealers who have great accumulated stocks they wish to dispose of, as it absorbs too much dead capital. In the Nord trade is a trifle more active. The coal trade remains unchanged.

The Belgian iron trade, on the other hand, keeps exceptionally firm; the demand is extremely active, and the prices of almost all articles are rising. This may be to some extent the result of the convention in the wrought iron branch, the production being this year 15 per cent. above that of last, whilst prices have risen, but so far as pig iron is concerned the enhanced prices are caused simply by a legitimately increased consumption. The production of steel also keeps pace with that of wrought iron, and both the Cockerill and Schlesin Companies have begun to roll girders out of steel in competition with those of England. The Angleur Works are treating for the Wallrand-Delattre patent for a small steel converter system with side tuyeres. Athus forge pig costs 42f., and Charleroi brands 40 to 46, girders 110 f.o.b. Antwerp, plates 135, and thin sheets 165 p.t. The coal trade is firm. Lumps cost 18 to 20f., furnace coal 5·75 to 7·50, cokes 11·25 p.t.

The result of the late Waanser accident has been that no more of the American pattern coaches are to be built for the State railways, and that the gas reservoir is to be contrived above, instead of below the carriages. A short time ago the President of the New York Central expressed the opinion with respect to European rolling stock and railways in general, that they were fifty years behind American. What would he now say to the retrograde step taken by Germany? Everybody here will rejoice, because the North Germans, like English people, never looked favourably on these omnibus carriages.

AMERICAN NOTES.

(From our own Correspondent.)

New York, July 28th.

Unusual interest has been developed in silver, gold, and lead-mining properties in the North-west. A large amount of American and foreign capital is being invested in promising developments, and in the South-west new syndicates are being formed to develope some of the richest mineral fields yet discovered—at least, according to the reports of experts representing investors. The industrial interests of the States have not been in better condition for years. The two great stimulating factors are railroad building and house, mill, and shop construction. The highest architectural authorities in the country state that 25 per cent. more money will be placed in building enterprises this year than last. The distributors of lumber corroborate this statement, and are making extensive purchases of manufactured lumber to meet the market requirements.

The iron trade has gained a point or two, on account of the booking of heavy orders for all kinds of material. The managers of some of our largest establishments, whose offices are in this city, report an improving feeling all round, and they are holding products at full prices. Large foundry sales have taken place this week at 21·50 dols. Furnace companies are booking forge iron contracts at 17·50 dols. Bessemer iron has been selling in large blocks at 20 dols. Steel blooms are wanted; quotations nominally 29 dols. to 29·50 dols. American critics are complaining over the heavy importations of foreign material. Our importations will probably increase. Steel and iron wire rods are selling very freely. Arrangements are being made for increased importations of iron ore. The manufacturers of machinery have booked some of the heaviest orders of the season within ten days, including several engines of 500-H.P.

The money markets are easy, and legitimate enterprises can readily borrow sums at a low rate of interest. The Baltimore and Ohio Railroad Company is preparing to construct its terminal facilities on Staten Island, 19 miles below New York city, with which it will connect with iron steamers.

The volume of railway traffic is increasing, and the earnings on 65,000 miles of mileage are reported by a very late authority at 15 per cent. in excess of last year. There is a general demand for all kinds of manufactured products, from textile goods to iron, and an increase of productive capacity will continue until facilities overtake demand. The wages question is occasioning very little trouble. The manufacturers have gained several important victories over the workmen. The strongest labour organisations have been losing membership rapidly, on account of these discouragements. All indications point to a very heavy Autumn trade. It is probable that a few orders for steel rails will be sent abroad for New Orleans and Galveston, and San Francisco delivery.

NEW COMPANIES.

The following companies have just been registered:—

Anthracite Iron and Steel Company, Limited.

This company was registered on the 28th ult., with a capital of £50,000, divided into 10,000 shares of £1 each, and 4000 shares of £10 each, to acquire the property, assets, and effects of Bull's Iron and Steel (South Wales) Company Limited. The subscribers are:—

	£10 Shares.
*E. Webb, 26, Great Tower-street, wharf proprietor	1
P. Copland, Buckhurst Hill, Essex, merchant	1
*H. Minchin Simons, 39, Lime-street, East India merchant	1
W. Paterson, 39, Lime-street, East India merchant	1
*T. D. Rock, 46, Leadenhall-street, merchant	1
*W. J. Thompson, 38, Mincing-lane, merchant	1
C. H. Rock, 46, Leadenhall-street, merchant	1

The number of directors is not to be less than three, nor more than five; the first are the subscribers denoted by an asterisk; the company at general meeting will determine remuneration.

General Apparatus Company, Limited.

This company was registered on the 28th ult., with a capital of £5000, in £1 shares, to take over a business carried on by Louis Charles Neyroud, trading as General Apparatus Company. The subscribers are:—

	Shares.
L. C. Neyroud, Churchfields, Woodford, Essex, merchant	1
J. B. Neyroud, 4, Mornington-terrace, Leytonstone, advertising agent	1
H. W. Clarke, Bedford Villa, Balham, agent	1
C. Sandell, 181, Queen Victoria-street, accountant	1
F. D. Sandell, 181, Queen Victoria-street, accountant	1
F. C. Sydney, 66, Basinghall-street, solicitor	4
S. Turner, 4, Mornington-terrace, Leytonstone, salesman	1

Registered without special articles.

Indian Planters' Steam Navigation and Flotilla Company, Limited.

This company proposes to acquire steam, sailing, and other vessels, and to trade as shipowners, shipbuilders, merchants, warehousemen, &c. The company was registered on the 29th ult., with a capital of £300,000, in £10 shares, with the following as first subscribers:—

	Shares.
G. W. Medley, 7, Copthall-court, dealer in stocks	1
W. Barton Wright, C.E., 148, Cromwell-road	1
J. Berry White, Monkham's Hall, Essex	1
B. Piercy, C.E., 8, Drapers'-gardens	1
A. M. Hay, 25, Fenchurch-street, steamship owner	1
R. Gordon Shaw, 88, Bishopsgate-street Within, tea planter	1
R. J. Price, 104, Sloane-street, barrister	1

The number of directors is not to be less than three, nor more than seven; the subscribers are to appoint the first, and are to act *ad interim*; remuneration, £1000 per annum, and also £5 per cent. upon the divisible profits after payment of 10 per cent. per annum dividend. The board may vest the right of nomination of two directors in the Assam Railways and Trading Company, Limited.

London Nitrate Company, Limited.

This company was registered on the 3rd inst., with a capital of £160,000, in £10 shares, to acquire the nitrate works and grounds of Puntunchará, San Antonia de Luza, and Transito, situate in the province of Tarapaca, Chili. The subscribers are:—

	Preference Shares.
*H. B. James, 16, Ashburn-place, S.W., merchant	1
E. J. T. H. Sandifon, Edward's Hotel, Hanover-square, and of Chili	1
*E. Hainsworth, Mersey-chambers, Liverpool	1
*G. Pietre, 1, Debere-gardens, shipowner	1
*J. E. Vanner, 1, Coleman-street, merchant	1
H. M. Read, 144, Leadenhall-street, bank manager	1
*W. MacAndrew, Westwood House, near Colchester	1

The number of directors is not to be less than three, nor more than five; qualification, 50 shares or £500 of stock; the first are the subscribers denoted by an asterisk; remuneration, £1500 per annum.

Mitcham Linoleum and Floor Cloth Company, Limited.

This company was registered on the 29th ult., with a capital of £100,000, in £10 shares, to manufacture linoleum, noiseless cork carpet, corticine floor-cloth, and other similar substances. The subscribers are:—

	Shares.
E. W. Clayton, Southfields, S.W., clerk	1
W. M. Duncan, 7, Brook-street, Grosvenor-square, clerk	1
S. H. Gladstone, 7, Great Winchester-street, merchant	1
W. John Taylor, Grove Park, Kent	1
Cyril Taylor, Grove Park, Kent, warehouseman	1
S. Trotter, Wormley, Herts, manager of Soho Bazaar	1
J. Trotter, Brickenden Grange, Herts, merchant	1

The number of directors is not to be less than three, nor more than eight; qualification, shares upon which £500 has been paid, or £500 registered stock.

Robert Dempster and Sons, Limited.

This is the conversion to a company of the business of gas, chemical, and hydraulic engineers, carried on by the above-named firm at Rose Mount Works, Elland, York. It was registered on the 2nd ult., with a capital of £100,000, in £10 shares. The subscribers are:—

	Shares.
*Robert Dempster, Elland, engineer	1
*J. Collier, Halifax, boiler maker	1
*F. Coates, Elland, manager of works	1
*A. Dempster, Elland, engineer	1
P. A. Boulton, 39a, King William-street, chartered accountant	1
W. Sharp, 9, Walbrook, solicitor	1
C. R. Lee, 141, Stock well Park-road, mechanical engineer	1

The number of directors is not to be less than three, nor more than seven; qualification, £1000 in shares or stock; the first are Messrs. H. Weld Blundell, J. Sharp, and the first four subscribers; remuneration, £200 per annum to the chairman, and £50 per annum and travelling expenses to each other director.

Scotch and Irish Oxygen Company, Limited.

This company proposes to enter into an agreement with Robert Raynsford Jackson for the purchase of licenses to use certain patent rights, particulars of which are not given in the registered documents. It was registered on the 30th ult., with a capital of £200,000, in £5 shares. The subscribers are:—

	Shares.
R. R. Jackson, Ashworth, Sydenham	1
W. B. Campbell, Sutton, secretary to a company	1
P. Holmes, 33, Denman-road, Peckham, bookkeeper	1
C. G. Llewellyn, 39, Cobbold-road, Forest Gate	1
H. F. Jackson, Ashurst, West Hill, Sydenham	1
W. H. Adams, 168, Friern-road, East Dulwich, accountant	1
E. S. Harper, Goodrich-road, East Dulwich, clerk	1

The number of directors is not to be less than three, nor more than seven, one of whom may be nominated by Brin's Oxygen Company, Limited; qualification, £1000 in shares; the subscribers are to nominate the first; remuneration, £1000 per annum and one-tenth of the net profits remaining after payment of 8 per cent. dividend on preference shares.

Turnstile Weighing Machine Company, Limited.

On the 2nd inst. this company was registered with a capital of £30,000, in £1 shares, to acquire patent rights relating to weighing machines, gates, doors, turnstiles, and the like, and to any automatic appliances or apparatus. The subscribers are:—

	Shares.
G. A. J. Macdonald, 12, Lydenburg-street, New Charlton, clerk	1
J. Croman, 348, Minton-road, S.E., clerk	1
T. Babb, 38, Aschurch-grove, W., traveller	1
F. W. Milbourne, 95, Boyson-road, S.E, secretary to a company	1
J. Yates, 4, Surrey-square, accountant	1
T. F. Ward, 28, Shellington-street, S.W., clerk	1
J. Day, 14, Moreland-street, Finsbury Park, N., secretary to a company	1

The number of directors is not to be less than two, nor more than five; the subscribers are to appoint the first, and act *ad interim*; qualification, 200 shares; remuneration, £60 per annum each, with £40 additional for the chairman.

Spanish Mines Exploration Syndicate, Limited.

Upon terms of an agreement of the 26th ult., this company proposes to purchase from Mr. George Simpson, of the Craven Hotel, Charing-cross, a concession from the Spanish Government for developing and working a tin mine in the province of Corunna, and to exploit the same. It was registered on the 28th ult., with a capital of £10,000, in £10 shares. The purchase consideration is £1800 in cash and 540 fully-paid shares. The subscribers are:—

	Shares.
W. Thorburn, M.P., Kerfield, Peebles, N.B.	1
*J. C. Bolton, M.P., Carbrook, Larbert	2
Mark J. Stewart, M.P., Ardwell, Wigton, N.B.	2
*J. Brunton, Stourport, Worcester	2
J. Harvey, 5, De Vere-gardens, merchant	1
T. Craven, 14, Crossfield-road, Belsize Park, merchant	1
W. Brown, Hamilton, Lanark, solicitor	1

The subscribers denoted by an asterisk, and Thomas Sutherland, Esq., M.P., of 167, Cromwell-road, are the first directors.

United Telephone Company of Rosario, Limited.

This company was registered on the 27th ult., with a capital of £20,000, in £10 shares, to purchase the undertaking of the Compania Telefonos Unidos del Rosario (now established in the Argentine Republic) upon terms of an agreement to be entered into with the River Plate Trust Loan and Agency Company. The subscribers are:—

	Shares.
F. H. C. Boutell, Adam-lodge, Loughton, accountant	1
P. H. Lyne, 48, Colby-road, Upper Norwood, clerk	1
C. F. Neve, 108, Lyndhurst-grove, Peckham, clerk	1
H. Dixon, jun., Aldenham-street Board School, St. Pancras, clerk	1
H. C. Hudson, 64, Moray-road, Finsbury Park, clerk	1
E. T. Botwright, 23, Sutton-place, Hackney, accountant	1
H. P. Gilbert, 6, Old Jewry, solicitor	1

The number of directors is not to be less than three, nor more than seven; qualification, £200 of share capital; the subscribers are to nominate the first; the company in general meeting will determine remuneration. Power is taken to issue £20,000 mortgage debentures.

Wynne's Electric Closed-Tube Tramways Company, Limited.

On the 28th ult. this company was registered, with a capital of £6000, in £100 shares, to acquire the letters patent of Frank Wynne, C.E., of 5, Westminster-chambers, for inventions relating to the application of electricity to the propulsion or otherwise of vehicles on tramways, railways, and roads. The subscribers are:—

	Shares.
Albert A. Wynne, C.E., 5, Westminster-chambers	2
H. E. H. Jerningham, M.P., 107, Pall Mall	1
Arthur Lucas, C.E., 15, George-street, Hanover-square	1
Sir Douglas Galton, K.C.B., 12, Chester-street, S.W.	1
T. H. Falkiner, C.E., 2, Westminster-chambers	1
D. Urquhart, C.E., 4, The Sanctuary, Westminster	1
A. A. May, 13, Bury-street, St. James	1

Most of the regulations of Table A apply.

Eccles and Patricroft No. 1 Manchester Ship Canal Share Company, Limited.

This is a local company for the purpose of facilitating the acquisition by members of shares in the Manchester Ship Canal Company. It was registered on the 3rd inst., as a company limited by guarantee to 5s. each member, with a capital of £10,000, in £10 shares. The subscribers are:—

	Shares.
R. Spary, Eccles, spindle and flyer manufacturer	10
W. Ward, Eccles, commission agent	5
W. Whitehead, Eccles, tea dealer	4
F. J. Morndain, Patricroft, book-keeper	2
J. Wilson, Eccles, warehouseman	5
J. R. Plews, Eccles, bootmaker	17
C. Wadsworth, Eccles, water rate collector	2
W. Knight, Eccles, builder	3
J. Leather, Eccles, glue merchant	20
J. Vickers, Eccles, tea merchant	4
W. E. Taylor, Eccles, butcher	5
W. Butler, Patricroft, water rate collector	5

The subscribers are the first directors.

Welsbach and Williams, Limited.

This company proposes to take over and purchase the manufacturing process connected with an invention of Dr. Carl Aver von Welsbach, for incandescent lights, and the business in connection therewith, carried on at 25, Theresianum Gasse, Vienna, and 6, Jeffrey's-square, E.C. It was registered on the 3rd inst., with a capital of £40,000, in £1 shares. The company will also carry on business as manufacturing chemists and metallurgists, and the business of an electric light and power company in all branches. The subscribers are:—

	Shares.
*F. de Lafontaine Williams, 6, Jeffrey's-square, merchant	1
*J. Mactear, 2, Victoria-mansions, chemical expert and engineer	1
*C. H. Feiling, 14, Throgmorton-street, stockbroker	1
A. Lechtenstadt, 33, Throgmorton-street, stockbroker	1
E. C. R. Roose, 45, Hill-street, W., physician	1
Fanny C. E. Feiling, Queen's Wood, Eltham	1
C. T. D. Crews, 33, Throgmorton-street, stockbroker	1

The number of directors is not to be less than three, nor more than six, the three first subscribers and Carl von Welsbach being the first; qualification, 500 fully-paid shares. Mr. F. de L. Williams is appointed managing director for five years at a salary of £500 per annum, and also 10 per cent. upon the realised net annual profits, subject to 20 per cent. of such profits being first paid to Carl Aver von Welsbach. The other directors will be entitled to £400 per annum.

Rigg's Technical Education Appliances, Limited.

This company was registered on the 5th inst., with a capital of £10,000, in £5 shares, to purchase the educational portion of the engineering business of Mr. James Rigg, 11, Queen Victoria-street. The subscribers are:—

	Shares.
W. H. Le Fevre, C.E., 26, Budge-row	1
J. E. Lowe, 2, Laurence Pountney-hill, engineer	1
D. Y. Bruton, Heathfield, Sussex, printer	1
R. Soutter, 150, Sewardstone-road, E., engineer	1
R. Lindsey, 60, Queen Victoria-street, chartered accountant	1
H. C. Paterson, 10, Lancaster-road, W., engineer	1
W. H. Chappell, Sugar Loaf-court, Garlick-hill, stationer	1

Registered without special articles.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Application for Letters Patent.

*** When patents have been "communicated" the name and address of the communicating party are printed in italics.

27th July, 1887.

10,452. Venetian Blinds, H. S. Cowan, Hampton Wick.
10,453. Measuring or Gauging Liquids, &c., J. Hawley, London.
10,454. Electrical Signalling Apparatus, J. T. Gent and H. G. Ellery, London.
10,455. Locks for Doors operated by a Coin, P. Everitt, London.
10,456. Treatment of Corn, F. Wegmann, London.
10,457. Compound, J. T. Griffin.—(*R. J. Henderson, United States.*)
10,458. Spongy Material, J. T. Griffin.—(*R. J. Henderson, United States.*)
10,459. Disc Stop, &c., J. W. Donovan and J. Wigham, London.
10,460. Gas Motor Engines, S. Griffin, London.
10,461. Water Waste Preventer, T. W. Bray, London.
10,462. Ventilating Railway Carriages, J. A. Yatman, London.

2nd August, 1887.

10,607. Steam Engines, G. G. Rhodes and J. S. Critchley, Bradford.
10,608. Wood Veneers, F. T. Hemming, London.
10,609. Cigar Holders, W. Riley, Leeds.
10,610. White Lead, T. O. Nesbit and T. Forster Newcastle-on-Tyne.
10,611. Electrical Batteries, R. P. Milburn, Newcastle-on-Tyne.
10,612. Handles, J. B. Moorhouse and A. M. Midgley, Keighley.
10,613. Street Pavement Trunks, A. Wilks, Oldbury.
10,614. Indicating the Presence of Mineral Ores, L. Mellett, London.
10,615. Twisting Yarns, J. Robertshaw and W. H. and F. Shaw, Halifax.
10,616. Tires, A. B. Pickard, Bradford.
10,617. Stop-valves, J. G. W. Fairbairn, Birmingham.
10,618. Artificial Arms, E. J. Beaumont, Erleigh.
10,619. Tubular Axles, A. Paterson, London.
10,620. Diffusing Heat, T. Pickup, London.
10,621. Fire-arms, J. Dickson, Edinburgh.
10,622. Sleeves, J. Gill, London.
10,623. Closing Packing-boxes, H. M. Ashley, Ferrybridge.
10,624. Guiding Tricycles, W. Oliver and R. Harrison, Sunderland.
10,625. Stop-motion for Twisting Machines, H. Tee, Tipperary.
10,626. Attaching Skates to Boots, E. Duckenfield, Birmingham.
10,627. Pencil Cases, M. Myers and E. Hunt, Birmingham.
10,628. Radiators, A. D. Mackenzie and G. G. Moncur, Glasgow.
10,629. Syringes, H. H. Lake.—(*H. C. Burton, United States.*)
10,630. Braces, H. H. Lake.—(*T. O. Potter, United States.*)
10,631. Wrapping Packages, W. S. Jarboe, London.
10,632. Conveying Cash, H. H. Lake.—(*G. B. Kelly and W. A. Webber, United States.*)
10,633. Buffers, A. Slater, London.
10,634. Conveying Cash, H. H. Lake.—(*G. B. Kelly and W. A. Webber, United States.*)
10,635. Steam Pumping-engines, L. D'Auria and H. M. Robert, London.
10,636. Draught Regulators, T. Baker, Birmingham.
10,637. Projectiles, M. Gledhill, London.
10,638. Metal Stays, H. H. Lake.—(*C. W. Hobbs, United States.*)
10,639. Folding Chair, E. Smith, London.
10,640. Portable Steam-engines, G. R. Mather, London.
10,641. Refrigerator Cars, W. L. Cook, London.
10,642. Preventing Leaking of Pipes, G. F. Redfern.—(*C. Petit-Didier-Lamidé, France.*)
10,643. Velocipedes, G. E. Osmond, London.
10,644. Sifting Meal, C. Haggenmacher, London.
10,645. Sifting, &c., Middlings, &c., C. Haggenmacher, London.
10,646. Chamber Cartridge for Military Rifles, F. L Stephenson, Woolwich.
10,647. Curing Fish, Flesh, &c., with Tar, J. Lyle, London.
10,648. Pressing and Binding Straw, H. J. Haddan.—(*N. B. Wood, United States.*)
10,649. Connecting Cuffs to Sleeves of Garments, H. Lewes-Gibbs, London.
10,650. Oiling and Fatting Wool, P. Cohnreich, London.
10,651. Artificial Teeth, G. H. Jones, Holborn.
10,652. Forming Collars or Flanges upon Forged or Rolled Shafts, J. Thompson, London.
10,653. Copying Press, J. Lewy, London
10,654. Life Preservers and Rafts, W. E. Gedge.—(*The Luduc Tule Improvement Company, United States.*)
10,655. Explosives, E. Turpin, London.
10,656. Paste for Polishing and Protecting Metal Alloys from Rust, A. J. Boult.—(*S. Rosenfeld, J. Zeleny, and A. Weiss, Austria.*)
10,657. Ratchet and Pawl Devices, W. P. Thompson.—(*W. A. Loud, United States.*)
10,658. Rolling Metal Articles, A. J. Boult.—(*C. F. Tebbets, United States.*)
10,659. Converters, W. P. Thompson.—(*G. L. Cobert, France.*)
10,660. Steam Cylinders, F. Wiske, London.
10,661. Brushes, W. P. Thompson.—(*W. England, United States.*)
10,662. Transmission of Cash, &c., W. P. Thompson.—(*S. W. Barr and W. Harrison, Albach, United States.*)
10,663. Type-writers, A. J. Boult.—(*J. F. McLaughlin, United States.*)
10,664. Securing Globes of Lamps, E. L. Harper, London.
10,665. Seed Drills, Baron X. de R. d'Alkemade, London.
10,666. Gearing, J. Ljung, London.
10,667. Explosives, E. Turpin, London.
10,668. Hydraulic Engines, B. Tydeman, London.
10,669. Stripping the Quills of Birds, C. Wolff, London.

3rd August, 1887.

10,670. Steam and other Engines, S. Robinson, London.
10,671. Screwing Stocks and Dies, T. Wood, Manchester.
10,672. Woven Belting, &c., H. B. Barlow, Manchester.
10,673. Weaving Velvets, &c., R. Collinge, Manchester.
10,674. Tubes, Bobbins, &c., T., G., and T. K. Wildman, Manchester.
10,675. Compass and Tool, J. Rickerby, Sheffield.
10,676. Tops and Stoppers of Bottles, J. Meesom, Sheffield.
10,677. Steering Apparatus, G. Perkins and G. T. Dunn, Newport, Isle of Wight.
10,678. Mixing and Weighing Apparatus, E. Redman, Leeds.
10,679. Treatment of Dyes, C. F. Young, Manchester.
10,680. Hydrocarbon Illuminating Oil, T. H. Gray, London.
10,681. Kettle, R. Hill, Aberdeen.
10,682. Valves, H. Ainley and J. C. Calvert, London.

10,683. Folios for Artificial Flies, W. Radcliffe, London.
10,684. Treating Ammoniacal Liquors, E. Grahn, Liverpool.
10,685. Cotton Warps, T. Halliday, London.
10,686. Suction Apparatus, F. Trier.—(*H. Oelert, Germany.*)
10,687. Steam Engine Governors, G. W. Garrett, London.
10,688. Automatic Revolving Bottle Washer, T. Swainson and P. Musgrave, Windermere.
10,689. Portable Chimney for Producing Immediate Warmth and Abating Smoke, H. J. Newcome, London.
10,690. Cleansing the Skin of Man and Animals, G. Rydill, Sheffield.
10,691. Separating Liquids from Steam in Motion, A. S. Savill, London.
10,692. Ordnance, J. Nicholas and H. H. Fanshawe, London.
10,693. Ball Bearings for the Necks, &c., of Bicycles, W. Hillman, London.
10,694. Boxes, Cases, &c., from Paper, &c., W. H. Allen, London.
10,695. Harvesting and Preserving Grass, A. Kempson, London.
10,696. Cleaning Knives, J. Lewthwaite, London.
10,697. Pocket Stay and Holder or Safety Pin, B. E. Tilden, United States.
10,698. Car and Engine Replacing Frogs, B. E. Tilden, United States.
10,699. Muffs, J. A. Spitzer, London.
10,700. Holders for Pens, &c., R. Elsdon, London.
10,701. Urns, H. C. Willmott, London.
10,702. Halter Attachments for Horses, M. M. Shelley, London.
10,703. Game of Skill and Geological Instruction, H. Reason, Preston Park.
10,704. Combined Door Fastener and Indicator, C. E. Alger, London.
10,705. Stopcock, W. Woodland, London.
10,706. Combined Stationery and Letter Case, A. Cotgreave, London.

4th August, 1887.

10,707. Apparatus for Testing Physical Strength, J. M. O'Kelly, London.
10,708. Fasteners for Loose Ends of Boots, H. C. Heard, Cardiff.
10,709 Automatic Measurement of Ink, &c , J. Corbridge, Halifax.
10,710. Carriage Springs, R. Grindle, Birmingham.
10,711. Diophanic Colour Printing in Register, W. T. J. Parkes, Dublin.
10,712. Preventer Bolt and Collar for Drawing and other Instruments, H. G. Mileson, London.
10,713. Pistol Knives, P. H. Unwin, Glasgow.
10,714. Ships' Davits, W. Mills, Sunderland.
10,715. Cradles for Ships' Boats, W. Mills, Sunderland.
10,716. Electric Coverings for Indicating Abnormal Conditions, T. M. Knight, London.
10,717. Syphon Bottles, T. H. Williams, London.
10,718. Spanners or Wrenches, R. E. Phillips.—(*H. Green, Australia.*)
10,719. Stanchions, &c., W. Duncan, West Hartlepool.
10,720. Health Teapot, H. S. Master, Cambridge.
10,721. Flower Pots, &c., G. B. McNicol, Glasgow.
10,722. Dobbies for Weaving, J. and J. Dawson and J. Clegg, London.
10,723. Calcining, &c., Materials, R. Cunliffe and J. Lund, London.
10,724. Organ Pedals, A. J. Boult.—(*J. S. Foley and J. Ruse, United States.*)
10,725. Dental Engines, W. P. Thompson.—(*W. A. Knowles, United States.*)
10,726. Privies and Privy Seats, A. J. Boult.—(*C. Kelley, Canada.*)
10,727. Bullets or other Projectiles, J. B. Clark, Liverpool.
10,728. Paste-board, &c., Boxes, W. P. Thompson.—(*M. Heinemann, Germany.*)
10,729. Match Magazine and Lighter, A. J. Boult.—(*J. S. Foley, United States*)
10,730. Ropes, &c., W. P. Thompson.—(*L. F. Lexius and S. Schachne, Germany.*)
10,731. Sharpening Attachment for Tools, A. J. Boult.—(*J. S. Foley and J. Ruse, United States.*)
10,732. Exhibiting Advertisements, T. J. Dewick, London.
10,733. Bottle Soaking and Washing Machines, T. Hill, London.
10,734. Safety Doors for Hoists, J. A. Walker, Glasgow.
10,735. Connecting Pipes, &c., to Vessels of Earthenware, H. A. Snow, London.
10,736. Pins for Millinery, A. Coles, London.
10,737. Stern Frames and Rudders of Ships, E. F. Wailes, London.
10,738. Rock Drills, A. and Z. W. Daw, London.
10,739. Printing on Envelopes, &c., B. Wolf, London.
10,740. Regulators for Electric Lamps, S. Mathias, London.
10,741. Printing Machines, F. Ullmer and G. Pescod, London.
10,742. Winding up Clocks, &c., H. Duboulet, London.
10,743. Carburetting, &c., Gas, J. H. W. Stringfellow and W. Brown, London.
10,744. Parallel Rules, Eyre and Spottiswoode, London.
10,745. Safety Attachments for Vehicles, J. Hirschfeld, London.
10,746. Sheet Metal Signs, A. Winkler, London.
10,747. Disinfecting, A. Boake and F. G. A. Roberts, London.
10,748. Portable Batteries for Producing Electric Light, A. Schanschieff, Gipsy Hill.
10,749. Membrane Diaphragms for Telephones, R. A. Lee, London.
10,750. Torpedoes, J. O'Kelly and B. A. Collins, London.

5th August, 1887.

10,751. Saving Life from Fire, J. C. Bloomfield, Blen-na-Lung.
10,752. Tobacco Pipes, A. Whowell and E. Chadwick, London.
10,753. Administering Nitrous Oxide Gas, S. Mitchell and T. Robertshaw, Halifax.
10,754. Excavators, J. H. Simpson and S. Porter, Liverpool.
10,755. Chamber Cartridge, F. L. Stephenson, Woolwich.
10,756. Circulation Valves, J. S. Lyon, Cambridge.
10,757. Cap for use in Riding in Toboggans, D. D. Austin.—(*J. McPherson, United States.*)
10,758. Amalgamator, N. Clayden.—(*D. Francis, South Africa.*)
10,759. Carbonic Acid Gas, H. W. Deacon.—(*C. Arnois, United States.*)
10,760. Advertising, R. Wotherspoon, Manchester.
10,761. Automatically Effecting the Sale, &c., of Goods, T. R. H. Fisken, London.
10,762. Fire-clay, &c., Fireplaces, W. Lewis, Halifax.
10,763. Strainer Bottles, H. Lagee, London.
10,764. Drying Cement Slurry, F. W. S. Stokes, London.
10,765. Advertising and Distributing Apparatus, J. Castle, London.
10,766. Sanitary Utensils, E. A. Sharp, London.
10,767. Instruments for Measuring Electric Currents, W. Lowrie, C. J. Hall, and H. W. Kolle, London.
10,768. Eyes or Holders for Stair-rods, G. Johnson, London.
10,769. Locks, T. Andrews, London.
10,770. Fluid Pressure Engines, &c., J. Gamgee and H. Fabian, London.
10,771. Magazine Fire-arms, A. J. Boult.—(*E. S. Field and S. K. Hindley, United States.*)
10,772. Lubricator, J. G. Fisher, Manchester.
10,773. Silencing Noise on Telephone, &c., Wires, W. Jamieson, London.
10,774. Wrapper or Envelope, W. P. Thompson.—(*T. Perls, Bavaria.*)
10,775. Mirror Screens, A. J. Boult.—(*J. W. Cheesworth and J. Ruse, Canada.*)
10,776. Counters or Recording Devices, A. Berrenberg, London.
10,777. Hand Drilling Machines, B. F. Smith, London.
10,778. Bolt Action of Breech-loading Fire-arms, J. Aston, London
10,779. Imitating Marble, E. de Pass —(*J. M. Danielli, France.*)
10,780. Breech-loading Fire-arms, E. R. Butler, London.
10,781. Fly Papers, S. Wilson, London.
10,782. Wire Fencing, H. H. Lake.—(*C. Swinscoe, United States.*)
10,783. Compound Preparation of Cotton-seed Oil, J. Sears, London.
10,784. Lasts for Boots and Shoes, H. H. Lake.—(*C. A. Shaw, United States.*)
10,785. Self-winding Clocks, J. G Lorrain, London.
10,786. Sewing Machines, F. Davis and E. G. Benford, London.
10,787. Rockets, A. Brock and G. J. Mayer, London.
10,788. Conical Paper Tubes, G. F. Redfern.—(*C. Frérot, France.*)

6th August, 1887.

10,789. Projectiles and their Sabots, A. F. Margary, London.
10,790. Boats, J. Roots, London.
10,791. Engine Tap, F. C. Cotton, Cheltenham.
10,792. Self-winding Clocks, J. G. Lorrain, London.
10,793. Safety Bicycle, D. L. Reaney, Bradford.
10,794. Photographic Roller Slides, J. E. Thornton, Moss Side.
10,795. Dobbies for Power Looms, J. Knowles and J. Mercer, Blackburn.
10,796. Metallic Tubes, E. Cope and A. Hollings, Liverpool.
10,797. Cutting Tubes into Lengths, E. Cope and A. Hollings, Liverpool.
10,798. Automatic Smoke-burner, R. A. Ray, Great Grimsby.
10,799. Shaded Photographic Stereotype Plates, F. Bosshardt.—(*J. Cassan, France.*)
10,800. Paper Lanterns, F. Bosshardt.—(*C. Beaurain-Vautherin, France.*)
10,801. Testing Butter, W. Devoll, Erdington.
10,802. Air and Water Cushions, H. C. Birley, Manchester.
10,803. Pneumatic Carrying Apparatus, W. H. Blakeney, Dundee.
10,804. Singeing Machines, C. H. Hopps and W. G. Bywater, Leeds.
10,805. Combination Tool for Weavers, J. Turner, Keighley.
10,806. Attaching Castors to the Legs of Bedsteads, J. Parry and F. J. Wythes, Birmingham.
10,807. Carding Engines, J. Heginbottom, Manchester.
10,808. Lifting or Raising Water, &c., J. Hurst, Ashton-under-Lyne.
10,809. Seed-planting Machinery, E. Buckle, Prestwich, near Manchester.
10,810. Desiccating Cocoanuts, &c., H. R. Romney, London.
10,811. Apparatus for the Receipt of Payments for the Delivery of Newspapers, H. H. Lake.—(*C. Galland, France.*)
10,812. Cutting and Ornamenting Glass, J. Earle, G. and T. Bourne, London.
10,813. Fittings of the Jaws of a Gaff, R. Aldous, Brightlingsea.
10,814. Paper, &c., for the Production of Drawings, &c., H. J. Shawcross, London.
10,815. Procuring Aluminium, W. P. Thompson.—(*M. G. Farmer, United States.*)
10,816. Chimney Tops, &c., J. Gowland, London.
10,817. Tempering Armour-plates, &c., J. Y. Johnson.—(*La Compagnie Anonyme des Forges de Châtillon et Commentry, France.*)
10,818. Alkali Waste for the Manufacture of Sulphuric Acid, J. Hanson, London.
10,819. Musical Instruments, A. L. Mora, London.
10,820. Tinned Wire, T. Mallinson, London.
10,821. Gunpowder, A. Brock and G. J. Mayer, London.
10,822. Quick-match, &c., A. Brock and G. J. Mayer, London.
10,823. Fastening for Boots, &c., W. G. Stoneham, London.
10,824. Brushes, A. E. Blake, London.
10,825. Imitation Bamboo, A. Model, London.
10,826. Neck-ties, T. H. Sangster, London.
10,827. Lock-stitch Sewing Machines, J. B. Robertson, London.
10,828. Telescopic Hydraulic Lifts, D. (C.) Thomas, London
10,829. Saddles or Seats of Bicycles, &c., J. Clay, jun , London.
10,830. Hot or Cold Water Waste and Overflow Lead Fittings for Baths, J. T. Docton, Merthyr Tydvil.
10,831. Making Copies of Drawings, &c., J. W. Marks and W. Hudson, London.
10,832. Solitaires, &c., F. Schroeder, London.
10,833. Electric Lamps, F. R. Boardman, London.
10,834. Galvanic Batteries, A. R. Upward and C. W. Pridham, London.
10,835. Bobbins, C. B. Robinson, London.
10,836. Electrical Firing Mechanism, C. A. McEvoy, London.
10,837. Bulkhead Doors for Ships, W. S. Winans, London.
10,838. Electrical Switches, F. L. Rawson and W. White, London.

8th August, 1887.

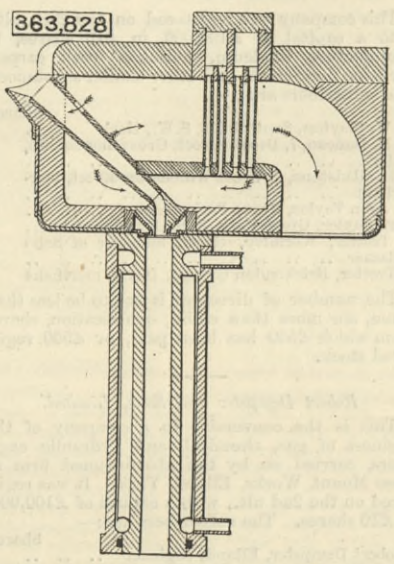
10,839. Beam Engines, G. G. Rhodes, J. S. Critchley, and N. Wood, Bradford.
10,840. Hydraulic Punching Machine, H. Berry, Hunslet.
10,841. Clamp, J. L. Berry, Aberdare.
10,842. Sugar, L. E. A. Prangey, London.
10,843. Hammerless Breech-loading Small-arms, T. Montrieux.—(*A. Lebeau, Belgium.*)
10,844. Photographic Camera Clip, J. Kennerell, Wisbech.
10,845. Beverage, T. Needham, Halifax.
10,846. Giving a Smokeless Flame, W. Garner, Sheffield.
10,847. Sanitary Pans, F. and D. Arkinstall, Deritend.
10,848. Seesaws, J. Gilman, Leeds.
10,849. Furniture Castor, R. A. Moon, Ardmore.
10,850. Switch or Contact-maker for Electric Lighting Circuits, A. J. Shirley, London.
10,851. Separating Cream from Milk, W. G. Cloke, London.
10,852. Playing a Game of Skill, G. W. Herbert, Birmingham.
10,853. Governors for Regulating Pressure of Steam, &c., F. B. Parkinson, Bury.
10,854. Preservation of Lawn Tennis Racquets, W. Wethered, Liverpool.
10,855. Last for Drying Damp Boots, E. W. Stead, London.
10,856. Extinguishing Oil, &c., Lamps, E. Phillips, London.
10,857. Valve Apparatus for Discharging Contents of Water-closet Cisterns, W. L. Holland, London.
10,858. Pottery, &c., J. Gill, London.
10,859. Advertising, M. Mackay, London.
10,860. Teaching Children Spelling, A. F. Liddell, Exeter.
10,861. Consuming Smoke, R. H. Michell, Prussia.
10,862. Cocks and Valves, W. H. Symons, London.
10,863. Supporting Persons in Water, F. G. C. Weir, London.
10,864. Automatic Sale of Perfumes, E. Appleby, London.
10,865. Lubricators, J. Cashmore.—(*M. Cashmore, South Africa.*)
10,866. Motor. C. A. de A. Basto, London.
10,867. Lawn Tennis Bats, F. H. Ayres and A. Foster, London.
10,868. Furnaces for Refining Metals, J. Toussaint, London.
10,869. Sight-feed Lubricators, J. H. Schofield and A. V. G. Worth, Lancashire.
10,870. Photographic Dry Plates, W. J. Wilson, Ealing.
10,871. Steam Boilers, C. J. Galloway, London.
10,872. Battery Connections, J. Imray.—(*C. Clamond, France.*)
10,873. Securing Rails, T. English, London.
10,874. Glass Furnaces, A. J. Boult.—(*P. Sievert, Germany.*)
10,875. Spinners' Bobbins, F. R Donisthorpe, London.
10,876. Tool, R. Brough, London.
10,877. Stoppers for Bottles, A. J. Boult.—(*A. Reiche, Germany.*)
10,878. Punching Machines, H. J. Haddan.—(*A. Salle, France.*)
10,879. Paper Barrels, J. R. Thame, London.
10,880. Automatic Fastener for Doors, W. H. Horn London.

SELECTED AMERICAN PATENTS.

(From the United States' Patent Office Official Gazette.)

363,828. Heated Funnel for Ingot Moulds, *W. R. Hinsdale, Brooklyn, N.Y.—Filed December 29th*, 1886.

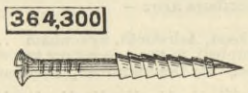
Claim.—The combination, with the top of an ingot



mould, of a heater lined with refractory material and provided with air and gas supply pipes and an escape flue, an aperture in the bottom of the heater, and a funnel of refractory material extending from the aperture in the bottom of the heater to the outside of the heater, as and for the purpose set forth. The combination, with the top of an ingot mould, of a heater lined with refractory material, an aperture through the bottom of the heater to the mould, a funnel of refractory material extended from the aperture in the bottom of the heater to or through the side of the same, a mouth to direct the fluid metal into the funnel, and an aperture for leading the neutral gases from within the heater to the said mouth, as and for the purpose set forth.

364,300. Drive Screw, *C. D. Rogers, Providence, R.I. —Filed August 6th*, 1886.

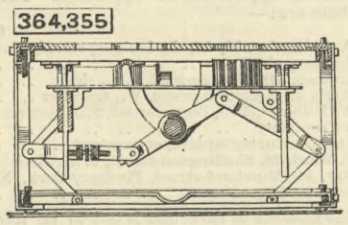
Claim.—(1) As an improved article of manufacture, a drive screw having a head adapted to receive a screwdriver or other analogous tool for turning the screw axially, a roughened shank adjacent to said head, a sharpened point, and a screw thread extending rearwardly from said point in a tapering or divergent direction and terminating in a larger diameter than that of the normal size of the wire, substantially as



described, and for the purpose set forth. (2) The nail hereinbefore described, consisting of a head, a roughened shank portion adjacent to said head, a sharpened point, and a series of barbs or corrugations extending rearwardly from said point in a tapering or divergent direction and terminating in a larger diameter than that of the normal size of the wire forming the nail, substantially as shown and described, and for the purpose set forth.

364,355. Sand-moulding Machine, *J. and J. H. Latshaw, Indianapolis, Ind.—Filed January 10th*, 1887.

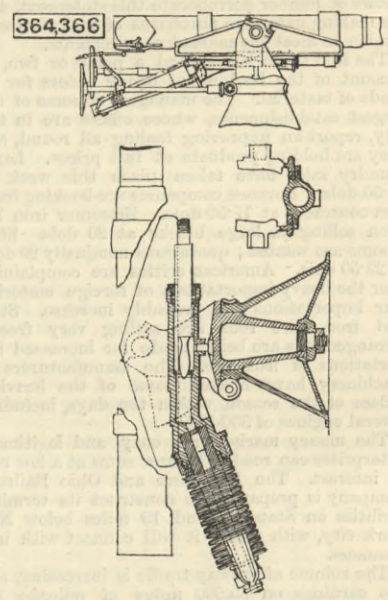
Claim.—(1) In a sand-moulding machine, a pattern-plate connected below to a pair of toggle levers at each end, and links of unequal length connecting such levers to the opposite arms of a shaft supported in bearings in the frame, whose partial revolution lifts the pattern through openings in a parting-plate, also supported in the frame, all combined substantially as described. (2) In a sand-mouldiug machine, a pattern-plate connected beneath and at each end to a pair of toggle levers, and links of unequal length connecting such levers to the opposite arms—which are also of



unequal length—of a shaft supported in bearings in a framework, whose revolution in one direction lifts and in another direction lowers the pattern through openings in a parting plate supported on top of such frame, all combined substantially as described. (3) In a sand-moulding machine, a pattern-plate connected beneath and at each end to a pair of toggle levers, and links of unequal length—one of which is adjustable lengthwise—connecting such levers to opposite arms of unequal length—one of which is provided with mechanism for adjusting its length—of a shaft supported in bearings connected with the frame, whose partial revolution in one direction lifts and in the other lowers the pattern through openings in a parting-plate supported upon such frame, all combined substantially as described.

364,366. Carriage for Machine Guns, *T. Nordenfelt, Westminster, England.—Filed September 14th*, 1886.

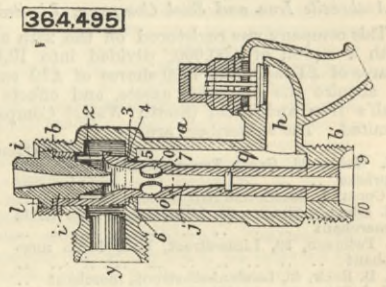
Claim.—(1) A gun carriage comprising a cradle mounted on trunnions, in which cradle the gun is able to move longitudinally, and two hydraulic cylinders upon the cradle, communicating with each other and of different diameters, the cylinder of smaller diameter receiving a ram connected with the gun and that of larger diameter being furnished with a ram operating against a spring to check the recoil, and moved by the reaction of the spring to return the gun to the firing position. (2) A gun carriage comprising a cradle mounted on trunnions, and a hydraulic cylinder mounted on the cradle controlling the recoil of the gun, and another hydraulic cylinder communicating with the first and having a ram exerting a pressure against the support on which the cradle is carried, and thereby preventing the movement of the cradle during the recoil, but leaving it free to be moved to alter the elevation of the gun when the force of the recoil is expended. (3) A gun carriage comprising a cradle mounted on trunnions, in which cradle the gun is able to move longitudinally, and a hydraulic cylinder on the cradle receiving a ram con-



nected with the gun, such ram having a tail or prolongation of varying cross-section entering a passage through which liquid is driven by the movement of the gun. (4) The combination of the pedestal, the turning support mounted in the pedestal, the worm teeth around the pedestal, the worm engaging the worm teeth, the transverse horizontal axis of the worm carried by the turning support, the hand wheel L, the sliding hand wheel axis gearing with the worm axis, the sleeve on the worm axis for supporting the hand wheel axis, the bearing Cx for the hand wheel axis and the gun cradle carried by the turning support and with which said bearing has jointed connection, substantially as and for the purpose set forth.

364,495. Injector, *W. E. Dodge, Everett.—Filed April 1st*, 1887.

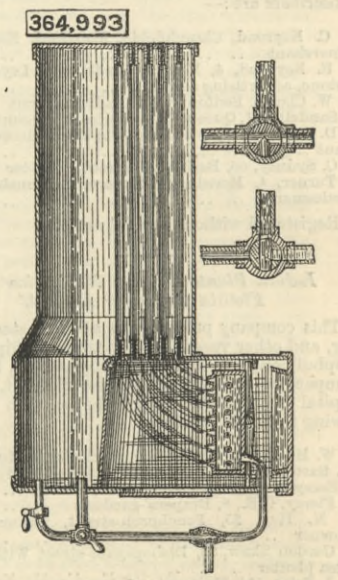
Claim.—The combination of the casing *a*, having the internal flange 6, and the internal socket 10, the former being provided with the seat 4 and orifice 5, the combining cone *j*, formed in one piece and provided with the shoulder 3, fitting the seat 4, and the enlargement 9, fitting the socket 10, all parts of said cone *j* below the shoulder 3 being smaller than the orifice 5, and thus adapted to pass freely therethrough,



and the steam cone *i*, having a threaded shoulder *i'*, adapted to engage an internal thread in the cone *j*, and a larger threaded shoulder *i''*, adapted to engage an internal thread in the casing *a*, the thread on one shoulder being of opposite pitch from that on the other, all arranged and combined substantially as shown.

364,993. Hydrocarbon-Burner for Steam Boilers, *J. B. Deeds, Terre Haute, Ind.—Filed November 10th*, 1886.

Claim.—In a boiler furnace, the combination, with a steam boiler and fire-box, of a numerously-perforated gas vapouriser or retort located in the fire-box, the oil-



supply pipe communicating with this gas vapouriser, a pipe provided with a cock, forming a communication between the steam-space of the boiler and the oil pipe, a branch pipe having a cock, forming a communication between the water-space of the boiler and the steam-pipe, the said steam and oil supply pipes forming an injector, substantially as shown and described.