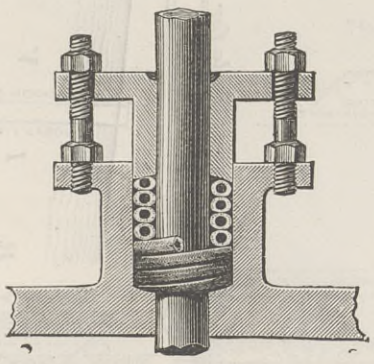
up against masonry instead of penetrating it when fired from these large high-velocity guns.

The shrapnel shell is shown at Fig. 5. Like the common shell, it is made of steel, and is of the general form of the pattern of General Boxer, with wooden head, central tube, and bursting charge in the base. It contains 2300 four-ounce sand shots and an 8 lb. bursting charge. It weighs 1800 lb. The fuse is time and percussion; it is shown in Figs. 6 and 6A. It closely resembles the original Armstrong time and percussion pattern. The action is as follows:—The ignition pellet A, which is ordinarily held by a safety pin, is, after the withdrawal of the latter, only held by a fine suspending wire, which is sheared by the inertia of the pellet on discharge, a needle lighting a percussion patch of composition and the composition ring B B, which burns round at a given rate until it reaches the communication passage C, when it flashes through the percussion pellet E and ignites the magazine D, and so ignites the primer shown in Fig. 6, flashes down the central tube of the shell, and explodes the bursting charge in the base—Fig. 5. The length of time during which the fuse burns depends on how far the composition ring is turned round, and what length it consequently has to burn before it reaches the communication passage C. If the fuse should be set too long, or from any other cause the shell strikes before the fuse fires the charge, the percussion action fires the shell on graze by the following arrangement:—The heavy metal piece containing the magazine D constitutes a striker, which is held in place by a plain ball G near the axis of the fuse and by a safety pellet H. On first movement in the gun, this latter by inertia shears a suspending wire and leaves the ball free to escape above it, which it does by centrifugal force, leaving the magazine striker D free to fire itself by momentum on the needle shown above it on impact. There is a second safety arrangement, not shown in the figure, consisting of a cross pin, held by a weak spiral spring, which is compressed by centrifugal force during flight, leaving the magazine pellet free to act, as above described, on impact.

The armour-piercing projectile is shown in Fig. 7. It is to be made of forged steel, and supplied by Elswick. In appearance it very closely resembles those fired from the 100-ton gun at Spezia, but if it is made on the Firmini system it will differ from it in the composition of its metal, inasmuch as it will contain a large proportion of chromium probably from 1 to 2 per cent., whereas an analysis of Krupp's shell gives none; in fact, as Krupp's agent at Spezia predicted, the analysis is less instructive than we could wish.

REINHOLD'S CORK CORE PACKING.

IT is well known that it is not a hard or tightly pressed packing that is most efficient in preventing steam or water escape, and that an elastic packing, carefully employed, best secures this result. In order to secure the necessary elasticity without the use of perishable materials, Mr. H. Reinhold, of Berlin, has made a new cork-cored packing of various forms and kinds of exterior, and various sizes of core. The cork is ground



nto a coarse powder and pressed into the tubular covering of hemp, cotton, and other materials impregnated with grease or soapstone, or other lubricant. The great advantage claimed for the cork-cored packing is its durability in consequence of the immunity of the cork from any action by oil, grease or steam, as solvents. It is light, elastic and flexible, and, judging by samples sent us, is well made. It has been introduced into this country by Messrs. Werner and Kœing, of 7, Falcon-avenue, E.C.

JOHN WIGNALL LEATHER.

THE death was announced last week, at De Grey-terrace, Leeds, of Mr. John Wignall Leather, in his seventy-seventh year. He had long ceased to follow his profession, in which, earlier in life, he occupied an eminent position. He was a man of more than ordinary capacity, and in his day there were few if any civil engineers in the North of England of greater experience and ability. His services as umpire in arbitration cases were in great request, and he designed and carried out many important engineering works in the county. He originated the Washburn scheme for the supply of water to Leeds, including the compensation reservoir at Lindley Wood, and as engineer to the old Waterworks Company he carried out the original Eccup reservoir, the existing Blackmoor tunnel for the conveyance of the water thence, the reservoir at Westwood, afterwards converted into filter beds, and the open reservoir on Woodhouse Moor, subsequently arched and covered in by Mr. E. Filliter. Mr. Leather was also the engineer of the Victoria and Crown Point bridges in Leeds, and he carried out the arterial drainage of the town, and some other important public works. In other parts of Yorkshire he was intrusted with great undertakings, including the Bradford Waterworks at Grimwith. He was elected a member of the Institute of Civil Engineers in 1849, but never contributed to its proceedings.

A correspondent of the *Leeds Mercury* sends the following list of works executed by the late Mr. John W. Leather, in conjunction with his father, and also, since his father's retirement, by himself:—The Aire and Calder Navigation, complete from Goole to Leeds, including the celebrated aqueduct which carries the canal over the river Calder at Stanley, near Wakefield, and which gained him two Exhibition prizes (1851 and 1867); the Docks at Goole; the Don Navigation; the Pocklington and other canals; several large drainages in the fen districts in Lincolnshire at Blankney, Nocton, Billinghay, &c., and the erection of engines and scoop-wheels there; the original Bradford Waterworks, belonging to the old company; the designing and carrying out of the extension of these works by the Bradford Corporation, including the conduiting, tunnels, and piping from Burnsall, in Wharfedale, to Bradford; also the Bradford High-level scheme from Thornton Moor, together with seven reservoirs connected with both schemes; the Chesterfield Waterworks; the designing and carrying out of the main trunk sewers of Leeds; the original Eccup scheme to Leeds—as mentioned in notice; the designing a scheme from the Washburn Valley in 1851, and the preparing and depositing the Parliamentary plans for same in that year for the old water company; four bridges in Leeds—Victoria, Crown Point, and the two Suspension Bridges at Hunslet and the celebrated Monk Bridge; the Stockton and Hartlepool Railway; and the Clarence Railway.

TENDERS.

BRISTOL DOCKS.

LIST of *bonâ fide* tenders received for the erection of a granary; Mr. John Ward Girdlestone, engineer:—

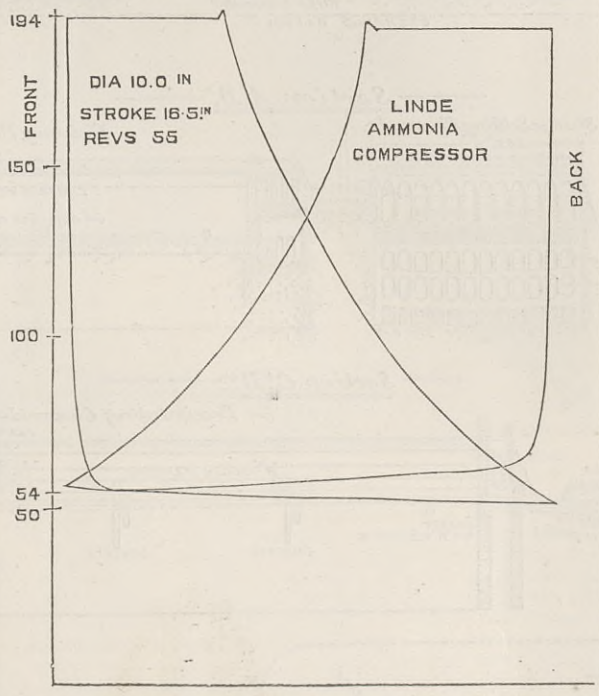
	£	s.	d.
1. Messrs. W. Storrs and Co., Stalybridge (accepted)	29,197	18	7
2. Messrs. Nelson and Co., Cardiff	30,195	12	11
3. Mr. S. Warburton, Manchester	31,200	0	0
4. Messrs. E. C. Howell and Son, Bristol	31,700	0	0
5. Mr. C. A. Hayes, Bristol	31,791	0	0
6. The Executors of W. Gradwell, Barrow-in-Furness	32,277	11	2
7. Messrs. P. Horsman and Co., Wolverhampton	32,407	15	5
8. Mr. A. J. Beaven, Bristol	32,700	0	0
9. Messrs. J. and W. Beanland, Bradford, Yorkshire	33,000	0	0
10. Mr. C. Burton, Cardiff	33,964	9	9
11. Mr. H. A. Forse, Bristol	34,102	0	9
12. Messrs. J. Jones and Sons, Wolverhampton	34,160	0	0
13. Mr. S. Robertson, Bristol	34,568	0	0
14. Mr. E. Gabbutt, Liverpool	34,830	0	0
15. Mr. J. E. Davies, Bristol	34,876	0	0
16. Messrs. H. F. Snow and Co., London	35,210	0	0
17. Messrs. R. Wilkins and Sons, Bristol	35,699	0	0
18. Mr. W. Church, Bristol	36,669	0	0
19. Mr. J. Wilkins, Bristol	39,700	0	0
20. Mr. A. Krauss, Bristol	41,930	0	0

LETTERS TO THE EDITOR.

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

REFRIGERATING MACHINERY.

SIR,—Referring to the interesting particulars of refrigerating machinery in THE ENGINEER of last week, I beg, with your permission, to state the following facts, qualifying somewhat the claims set forth in the description given. From that description it would appear as if Messrs. Wood and Shipley, of New York, had introduced a valuable and novel method of keeping cool the cylinders of the ammonia compression pumps by injecting liquefied ammonia into the suction side, and so obtaining a mixture of ammoniacal vapour and liquefied ammonia, the latter being partly or entirely converted into vapour, and thus absorbing the heat generated during compression. The ammonia compression machines constructed on the Linde system for cold-producing purposes have invariably been made so that a certain quantity of liquefied ammonia shall be present in the pumps so as to prevent any superheating of the vapours by the heat developed during compression; but instead of the special apparatus used by Messrs. Wood and Shipley—upon which they dwell with peculiar satisfaction—the Linde system needs no injection arrangement, or any other apparatus whatever for the purpose. The desired result is so completely obtained that an inspection of any of the 420 Linde compressors now at work—about 53 of which are in the United States—will show the exterior of the pump cylinders either partially coated with ice, or covered by the moisture condensed upon their cold surface from the surrounding atmosphere.



The Wood and Shipley machine has vertical single-acting pumps with the stuffing-boxes bathed in oil, and in these respects appears to be like the De la Vergre machines also made in America. This arrangement of two single-acting vapour pumps in a vertical position is supposed to be specially effective for preventing the escape of ammonia along the piston-rod, but there is no particular reason why, for a compressor of best material and workmanship a double-acting pump should not be adopted. There is no trace of escaping ammonia observable about the Linde machines, and all these possess a piston-rod working through a gland exposed to the full pressure of the ammonia, the pump being horizontal and double-acting. How completely the loss of the chemical is avolded is evidenced by the fact that for a plant producing twenty-five tons of ice per day the annual cost of ammonia averages less than £8, the machine being used continuously night and day.

I append copies of two diagrams taken from one of our ammonia-compressors, 10in. diameter, and 16½in. stroke, working at fifty-five revolutions per minute, and under what are usually termed somewhat trying circumstances, *i.e.*, compressing from 54 lb. to 194 lb. absolute pressure per square inch. The diagrams were taken during an official test, the machine eliminating simultaneously 352,000 heat units per hour whilst refrigerating water from 52·2 deg. to 36·3 deg. Fah., equivalent to the melting of 26·4 tons of ice per twenty-four hours, and the steam engine indicating 30·6-horse power. It would appear from your article of last week that one of the Wood and Shipley single-acting compressors equivalent to a refrigerating duty of 12 tons of ice per twenty-four hours requires 21-horse power when compressing from 25 lb. to 118 lb. per square inch, if we interpret the statement correctly, and consequently the Linde compressor would show a greatly superior efficiency.

As the subject of artificial refrigeration and ice making is rapidly growing in public importance, it may be of some interest to state that in the years 1885 and 1886 some 200 additional installations of Linde plant were set to work, equal to an aggregate of about 4200 tons of ice melting per day, and that we are now erecting in London a factory making 125 tons of ice per twenty-four hours, beside refrigerating large cold storage rooms for the preservation of fish and meat.

R. BANFIELD, Manager,
Linde British Refrigeration Company, Limited,
32, Walbrook, London, E.C., February 9th.

TESTING COLUMNS AND STRUTS.

SIR,—I was very pleased to find in your impression of the 28th ult. a letter from Professor Robt. H. Smith fully approving of my method of testing columns and struts by deflection. He suggests, however, as an improvement, that the castings be placed and tested vertically instead of horizontally, and that the load be also applied vertically at a certain distance from the centre line of the section.

No doubt the test might be carried out in that way, but with all deference to Professor Smith's authority, I submit that it would not be nearly so convenient nor so fully to be relied on, than when the column is freely supported in a horizontal position upon its end flanges and the load imposed in the centre of its length. For the vertical test, careful measurements must be taken from each column in order to accurately locate the centre of cross section, otherwise the result may be considerably affected. It would also be necessary to erect a high and solid frame or building for securely placing the column and applying the pressure. If the excentricity chosen for the leverage of the test weight be small, the weight itself must be great, approaching the full compressive stress and requiring stress apparatus for its apparatus. If the leverage be great, other difficulties arise which must be guarded against. With the horizontal test, on the other hand, no special arrangements or adjustments are involved, and the only measurement taken and recorded is that of the deflection caused by the superadded load.

Professor Smith's idea of the vertical test is probably due to a desire of avoiding the initial deflection of the column caused by its own weight when placed horizontally. But that deflection does not interfere with the result, as it is taken into account when determining the test-weight, and it is only necessary to measure the differential deflection due to the latter. Under these circumstances, whilst thanking Professor Smith for his suggestion, I do not at present see that anything would be gained by adopting it in preference to the horizontal test. Thanking you in advance for inserting the above.

JOS. BERNAYS.
96, Newgate-street, London, E.C.,
February 7th.

THE NORTHERN ENGINEERING COMPANY.

SIR,—We beg to call your attention to the 101st page of the current number of THE ENGINEER. Under the head of "The Northern Engineering Company, Limited," you state that one of the above company's objects is to purchase from Walter Schischkar and Francis Fleming certain patent rights. Mr. Francis Fleming, of the firm of Thos. Fleming, Sons, and Co., the well-known belting manufacturers of this town, is one of the directors of the above company; but in no way has he, beyond this, anything to do with the patent rights. This ought to be read "Walter Schischkar and George Harrison."

SCHISCHKAR AND HARRISON.
Hopwood Ironworks, Halifax, February 7th.

THE LOCAL GOVERNMENT BOARD.

SIR,—Your correspondent "J. A." is quite right in saying that the action of the Local Government Board is sometimes beneficial. In the conclusion of his letter he confirms my point by admitting that the nuisance was removed after some months of correspondence with the Board "*Hanc illæ lacrymæ.*"

C.
Westminster, S.W., February 7th.

CONDENSATION IN STEAM CYLINDERS.

SIR,—*Apropos* of a letter from Mr. D. K. Clark on the above subject in your issue of the 14th ult., will you allow me to say that in March, 1882, I wrote to you pointing out that cylinder condensation and re-evaporation was clearly explained, with its attendant loss of heat, in an article by Mr. Joseph Gill, published in Weale's "Quarterly Papers on Engineering," so long ago as 1843?

Palermo, February 4th. ROBERT GILL.

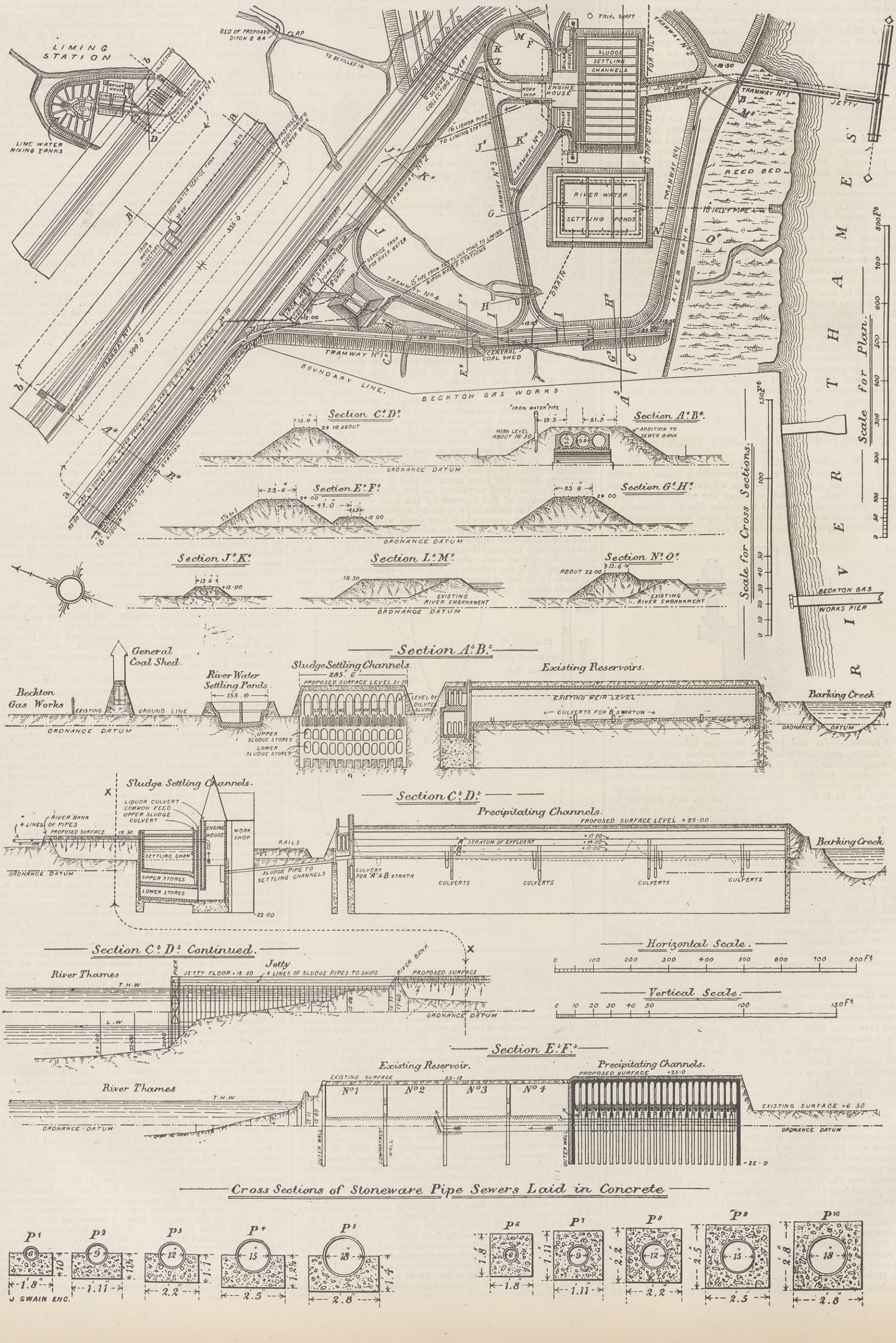
(*For continuation of Letters see page* 117.)

THE SALE OF THE ENGINES, MACHINERY, AND ELECTRICAL PLANT AT SOUTH KENSINGTON.—Large numbers of workmen are at present engaged in dismantling the Exhibition grounds at South Kensington, following upon the two sales of the buildings and materials, and the engineering machinery and electrical plant, extending over a period of six days. Messrs. Wheatley Kirk, Price, and Co., who conducted the sale of the engines, boilers, and electrical plant, had issued a descriptive illustrated catalogue of upwards of thirty pages, in which lengthened notices of some of the engines submitted, which had some time ago appeared in THE ENGINEER, were reprinted. The catalogue contained 375 lots, and stated that the sale was by the direction of the Royal Commissioners, Messrs. Davey, Paxman, and Co., of Colchester, and other engineering firms, whose engines had been employed at the several Exhibitions. The sale, which occupied two days, drew together a large company, which included, amongst others, the Marquis of Salisbury, the Marquis of Bute, Lord Edward Churchill, and Lord St. Oswald, all of whom were purchasers. The machinery submitted included eleven engines of an aggregate 1700-horse power, and eleven boilers, besides machinery sheds, shafting, &c. The engine which realised the highest price was a compound electric light engine by Messrs. Galloway and Sons, of Manchester. It was described as specially constructed for driving electric lighting machinery, and of 200-hors power. It was sold for £680. A "Paxman" horizontal high-pressur engine, by Messrs. Davey, Paxman, and Co., of Colchester, which, it was stated, had been working up to 300-horse power, realised £490. Another engine of the same character, also by Messrs. Davey and Paxman, which, it was stated, had been working up to 330-horse power, was sold for £455; whilst a pair of compound "twin" horizontal non-condensing engines, by Messrs. Galloway and Sons, of 140-horse power, realised £450. A self-contained improved horizontal fixed compound engine of 200-horse power, by Messrs. Davey, Paxman, and Co., was sold for £390; a "Windsor" quick-speed vertical compound engine of 70-horse power, by the same makers, realised £320; and two other engines, also by Messrs. Davey, Paxman, and Co.—one of 55-horse power, and the other described as having been used for driving one of Paxman's patent safety machines for extracting diamonds and other precious stones from the soil—were sold for £280 and £250 respectively. The boilers were also sold for £180 each. An "Elwell-Parker" dynamo, capacity 250 ampères current, was sold for £240; whilst a smaller one of the same character realised £85. The electric light cable, of which there were between thirty and forty miles, and some of which, it was stated, had been used since the commencement of the series of Exhibitions, was offered in sixty lots, and realised from £50 to £100 per ton. There were fifty incandescent lamps, all of which realised prices ranging from 1s. 8d. to 2s. 6d. each. The entire proceeds of the sale amounted to £10,000. It may be added that the total proceeds of the previous four days' sale by Messrs. Horne, Son, and Everstield of the materials of the Exhibition buildings, decorative works, furniture, and fittings amounted to £7000, that portion of the property which commanded the most attention, and for which there was a close and keen competition, consisting of the carved Indian screens in wood, stone, and marble. There were about twenty-five in number, and several gentlemen were present as purchasers representing museums in different parts of the country. The prices realised for these screens ranged from £25 to £100, the total proceeds of the whole of the screens being £1600. The aggregate sum realised by the two sales was £17 000.

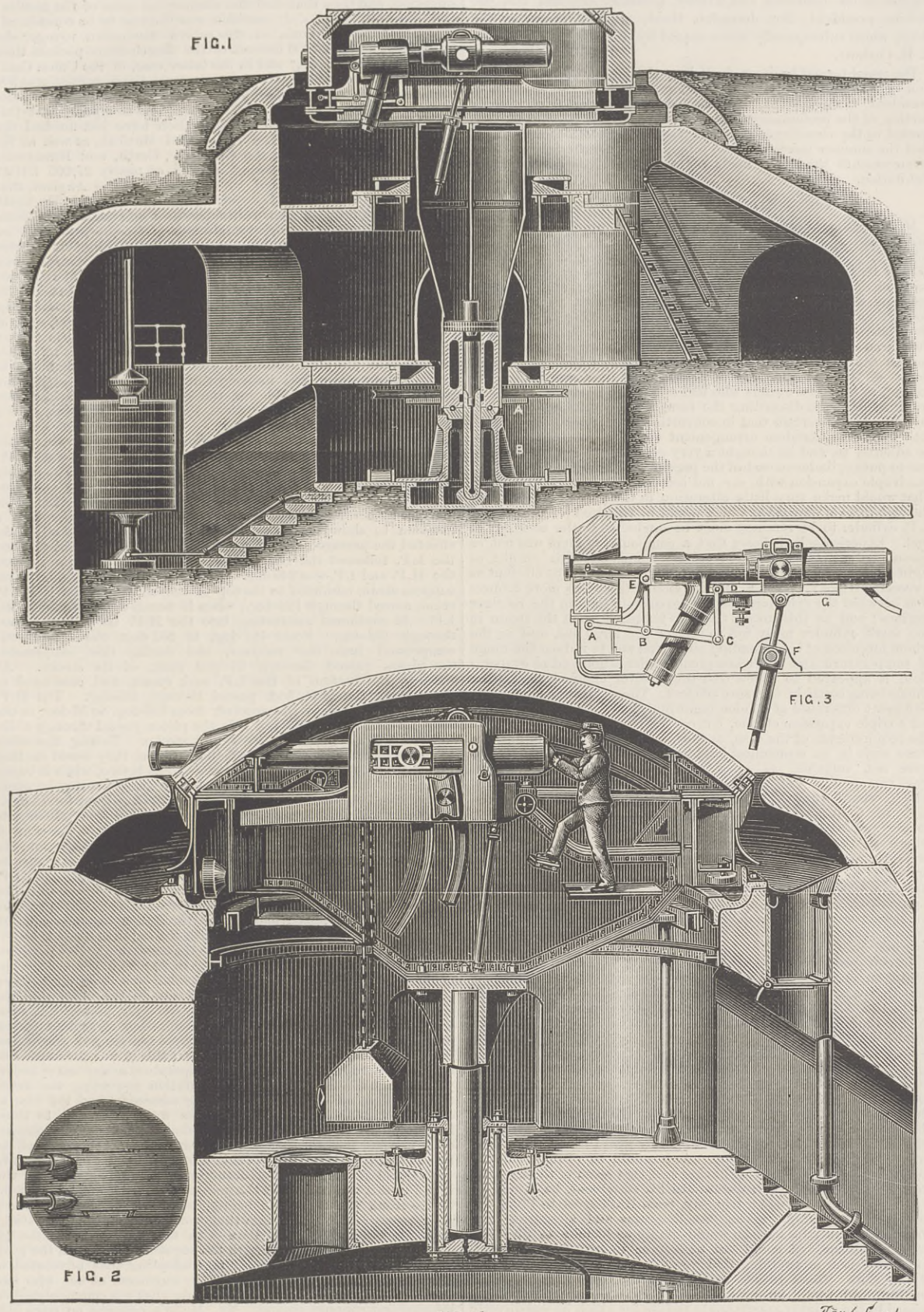
LONDON SEWERAGE.—NEW PRECIPITATION WORKS AT BARKING.

SIR JOSEPH W. BAZALGETTE, C.B., M. INST. C.E., ENGINEER.

(*For description see page* 109.)



THE MOUGIN DISAPPEARING TURRET.



DISAPPEARING TURRETS.

Le Genie Civil, of January 15th, describes a new disappearing turret to be tried shortly at Chalons. The writer (Claude Manceau) observes that certain inconveniences are inseparable from the dome which Major Schumann employs. It is suggested that the joints of the Schumann dome offer weak places, that the bolts are liable, both from shock of discharge and of impact, to fly and cause much injury to the detachment, and that it is impossible to predict what dislocation might be caused by the blow of even a single 21 c.m.—8·27in.—projectile falling vertically on the cupola dome, seeing that at Bucharest the vertical fire failed to strike either cupola. It is considered that Major Mougin, in the mushroom-shaped dome which he has now adopted, has remedied some of the faults of the Schumann construction. Dislocation is rendered less liable to occur because the dome is jointed in two parallel lines, shown in Fig. 2, which is thought much better than the radial form of division, which, it is urged, leaves each shield overhanging and depending for its stability on the support of the contiguous sections. The Mougin cupola will then, it is remarked, resemble that of Schumann in general appearance, but it will differ from it in its principles of construction, seeing that the guns of the latter are attached to their cupola, causing inaccuracy in fire as well as other evils. It is further observed that at Spezia, in 1886, the Gruson turret shield threw off the Krupp forged steel projectiles of proved excellent quality, breaking them up in small fragments. This, it is considered, is in a great measure to be attributed to the profile of the shield, against which the projectiles must strike at an angle more oblique than 45 deg.; but the extreme hardness of the metal is also noticed. The effect of projectiles with flat, or rather slightly concave cupped points is discussed. These projectiles, advocated by Whitworth and Krupp, have cut like a chipping tool into armour at oblique angles, the case in view being probably that at Buckau, when Ternitz projectiles bit into the surface of a Gruson cupola. It is suggested that an attack with cupped-out projectiles would prepare the way for sharp-pointed projectiles to enter. At angles over 25 deg., it was generally found at Gâvre—as in England at angles over the glancing angle—that a given vertical height received the same protection from a given weight of metal, whether the wall was at an inclination or placed vertically.

The main disadvantage of the cylindrical form then lies in the vulnerability of its sharp top edge, and in the distinctness with which so defined a form can be seen. At Cotroceni the latter evil was increased by the fact that the French turret stood on higher ground than the German one—a fact, we may observe by the way, which gave it a great advantage when its glacis plate—*avant cuirasse*, was attacked. The French turret also was painted black, and the German one grey.

M. Manceau concludes that the Bucharest experiments showed that no turret could resist constant artillery fire for a very long period, consequently, that it is most desirable to put it under cover, if possible, whenever it is not actually firing. This is what has been done in the design shown in Fig. 1. The cylindrical form has been adopted; the roof is made in one piece. There is little to fear from vertical fire, and the edge of the plate is fitted to the vertical wall in the manner shown in Fig. 1, which, it is thought, favours the throwing off of the projectiles and dispenses with vertical armour bolts.

As to metal, it is thought that the experiments of Cotroceni did not conclusively establish the relative resisting powers of steel-faced and wrought iron shields. On the whole, however, it has been decided to adopt steel-faced plates in the design before us—the machinery for effecting the union of the face and foundation plates being of such power that a high degree of perfection in the weld may be expected.

The interior diameter of the turret will be 4·6 metres (15ft.). The vertical wall is 1·2 metres high (3ft. 11¼in.), consisting of three plates of 50 centimetres (19·69in.), which are fitted together by tongues and grooves.

The roof plates resting on the wall, as above described, are 20 centimetres (7·87in.) thick. The whole armoured structure rests on a wrought iron structure and trunk, 5 metres in height, comprising two cylindrical portions of 1 and 2 metres, and a conical portion (see Fig. 1). The cylindrical parts slide, during the vertical movement of the turret, in two guiding rings—these keep the turret in the vertical position.

The base is supported on the piston of a hydraulic press, 45 centimetres (17·72in.) in diameter, which constitutes the pivot of the turret which moves on it. The centre of gravity falls well over the pivot, and rollers can be dispensed with. The piston is 1·5 metres (4ft. 11in.) long, the movement being 1 metre only—half a metre is always left in bearing. It is pierced from end to end for the passage of the liquid used in the press.

The total weight is 150 tonnes (147·63 tons). The diameter of the plunger being 45 centimetres (17·72in.) in diameter, a pressure of 100 atmosphere (0·66 tons) will support the whole structure.

The original element in the new design which enables so large a mass to disappear quickly, consists in the counterweight of an accumulator, of which the cylinder is in communication with the turret pivot press. The plunger of the accumulator is double the size of that of the pivot, consequently 7·5 tonnes (7·38 tons) is sufficient for the counterweight.

To destroy the equilibrium, water is admitted in the annular cavity round the piston. The differential effect thus produced provides for the vertical movement of the turret, which can be effected as quickly as the rotation, seeing that in each case it is a question only of overcoming inertia. Rotation is effected by means of the horizontal wheel at the base of the turret (see A, Fig. 1), by chain gear, or, better still, by hydraulic gear.

The two subterranean chambers facilitate the working of the gun by keeping the chamber from becoming crowded. The ammunition is brought up to the level of the breech of the gun by a lift from beneath. The carriage is entirely separate from the shield. The port is reduced to a minimum size by a jointed frame forming the system of parallel bars shown in Fig. 3. The gun and moving parts of the carriage are supported on an oscillating hydraulic press (see Fig. 3). The recoil is met at the trunnions (as in some of Rendel's designs), so that there is no disturbing couple generated by the shock of discharge.

The muzzle of the gun projects so little that disappearance is not interfered with and can be effected in all positions. When elevated for a long period the turret receives additional support brought under the base by hydraulic power B, Fig. 1. It then rotates on a ring of balls.

We are glad to be able to add to this description a cut, Fig. 4, which shows the new cupola adopted by Major Mougin. Little description is necessary, because the interior fittings are practically the same as those employed by him in his cylindrical turret at Bucharest. He has adopted the German mushroom form of dome, but, undoubtedly, as above noticed, the fact that his gun is separate from the shield constitutes a fundamental difference. We believe that in this Major Mougin has a much more valuable system; but we do not know why Schumann might not employ very much the same thing—Krupp has had recoil arrangements closely resembling this one. Altogether, we should be inclined to think very highly of this modified Mougin turret.

The disappearing turret must be commended for ingenuity and neatness, but there are one or two points we think weak or doubtful. The turret is in its weakest position when in action, and we question whether it is not a little top-heavy and delicate. Any contorting force would act with a powerful leverage on the piston. Another objection appears to us to be the curtailment of the length of the piece. Further, it must be borne in mind that the protection due to disappearance becomes less than might at first be supposed when the turret is in action. In a siege the firing is very systematic, and a besieger's guns would be pointed and waiting for the appearance of the turret. The latter could not move up and down sufficiently quickly to make feints and escape any fire. Generally speaking, the turret guns and its adversary's would be loading during the same periods, and unless the rates of loading differed much, the fire of the attack might be interrupted only to a very limited extent. We do not wish, however, to judge before a trial takes place. Disappearing guns in pits are admirable, but in a siege there may occur spots too hot for an open pit to be tenable by a detachment, when a disappearing turret, or a plate covered pit with a gun coming up through an opening might be very valuable. As to vertical fire on the roof of either turret, we think that the effect would be *nil*. Our ships with 3in. decks are in a very different position as to protection. A solid 7in. plate is about five times as strong as a 3in. one, the resistance being proportional to the squares of the thicknesses.

Incidentally, the adoption of steel-faced armour for the new turret is worthy of remark. We have lately been maintaining that this class of armour could not be said to have been beaten by steel, and that if through fracture is to be avoided, steel-faced iron armour or plates compounded of hard and soft steel will, in the long run, be found the best. Here is a case in point: the plates of a turret of this kind constitute the structure itself, and through fracture would be ruinous. It appears that under these conditions the French authorities, who surely have the greatest experience with steel, do not employ even the softest steel, nor do they, as we might suppose, continue to use wrought iron—although the Schumann turret iron armour really behaved very well at Bucharest; but they go out of their way to adopt steel-faced plates. This, of course, is only experimental, but still the selection for trial shows their present opinion. We do not argue that the French are disappointed in their steel. It has performed great things. No wrought iron—we are not speaking of compound plates—could have behaved as well as the steel plate at Spezia in 1884. But we maintain that any adoption of steel must be accompanied by the acceptance of through fracture and reliance on numerous bolts to hold the shield together. Our Sheffield makers ought to be encouraged by the preference of steel-faced armour for the new turret. We should like to see solid steel tried in this country; but unless our Admiralty change their standard and allow through fracture, we do not expect to see it beat compound armour of steel, or steel and iron.

PRECIPITATION WORKS AT THE BARKING SEWAGE OUTFALL.

In our present number we give a third page of engravings, illustrative of the precipitation works now being commenced at the northern outfall of the Metropolitan main drainage. At the top of the page is an enlarged plan of that portion of the works lying between the outfall sewer and the Thames. Following to the left we have separated portions, showing in plan the connection between the main body of the works and the liming station, with the intervening iron water service tank. At the extremity we have a plan of the liming station. Pipes connected with the river water settling ponds and with the iron water and liming stations will be readily traced by means of the engraved notes in the drawing. The sections at the top of the first page of drawings given last week will explain these particulars still further. The course of the several tramways is shown on the plan, as also the commencement of the sludge-collecting culvert contiguous to the precipitation tanks. The first continuous section below the plan is drawn on a line parallel to the Thames, proceeding across the river-water

settling ponds and the sludge-settling tanks, and leading on to the existing reservoir, given in the plan last week. As before, we remark on the difference between the vertical and horizontal scale in these sections, by which the vertical dimensions are greatly augmented in comparison with the horizontal. Proceeding down the page, we have a section at right angles to the former, so as to run nearly north and south, taking the line of the sludge-settling channels. The section shows the pipe which passes under the outfall sewer and takes the sludge from the precipitating channels. The culverts are also shown, by which the effluent will be drawn off at three different levels, leaving the sludge to pass away to the left, through the settling-channels into the sludge store beneath them, whence it will be pumped into pipes along the jetty to the pier built out in the Thames. The next section is on a line passing up northward from the river through the existing reservoir and its four compartments to the precipitating-channels.

Concerning the precipitating channels, it will be interesting to add something to our remarks of last week. The tanks, which include these channels, were shown on a full-page plan, together with part of the existing reservoir. The three culverts forming the outfall sewer present a strongly-marked curve, having on the side opposite to the tanks the new sludge-collecting culvert, The collective capacity of the tanks will be equal to 3,120,000 cubic feet; but they will not all be filled at once. The process will be so managed that the first of the series will have run off its effluent by the time the last is filled. The breadth of each of the thirteen tanks, as already mentioned, is 31ft. 6in., but this is halved by means of a range of brick arches carried longitudinally along the entire length of each tank, averaging about 1000ft. The dividing line, as well as the piers supporting these arches, is shown in the plan. It is this arrangement which gives to the tanks the title of double channels. The arches which cover in the tanks spring from the side walls and the dividing line. Their span is thus reduced by one-half. These covering arches are shown in the shaded portion of the plan, and these will be further covered over with concrete. The position of the piers supporting the arches is shown on the open part of the plan. Farther on, in the direction of Barking Creek, the foundations for the brick piers are indicated. These foundations consist of square pits carried down to the gravel beds, and filled in with concrete, as shown in section near the foot of the drawing on page 108. The sections of the borings given last week may be studied in relation to this part of the subject.

Precipitation being carried on in the double channels, the effluent will flow into the existing reservoir, except when the level of the tide will permit of a more ready discharge into the river. The sludge will pass in a different direction, entering into a collecting culvert designed for the purpose. The subsequent treatment of the sludge was described last week, and other particulars were then given. The magnitude of the works, and the unparalleled nature of the enterprise, cannot fail to invest the undertaking with a large amount of interest for the engineering profession, and for all who are in any way concerned in the drainage of towns. A prolonged discussion has been recently going forward at the weekly meetings of the Institution of Civil Engineers in reference to the chemical process for which these works are designed, and there is no doubt that much more will be said on the subject in time to come. It is proposed to construct works similar to those we have now described for the disposal of the southern sewage at Crossness, but they will be on a somewhat smaller scale.

LAUNCHES AND TRIAL TRIPS.

ON the 8th inst. Messrs. Doxford and Son, Pallion, launched the vessel known while on the stocks as the Nulli Secunda, the largest vessel yet built on the river Wear. She is of 5600 tons register, and has been designed for long ocean voyages. She is designed for carrying large dead weight of cargo at great speed, and is intended to carry 6500 tons at from 11½ to 12 knots per hour. She will be fitted with triple-expansion engines of 4000 indicated horse-power, with the boilers burning 52 tons per day, or not more than 1½ lb. of coal an hour per indicated horse-power. For quick removal of cargo there are eleven hydraulic derrick cranes and winches. The vessel is almost entirely constructed of Siemen's steel, bunkers, deck-houses, and similar fittings only being built of iron. The whole of the pumping engines and hydraulic gear were constructed by Messrs. Brown, Brothers, and Co., of Edinburgh. The engines working the pumping machinery are 100-horse power, working with a steam pressure of 150 lb. to the square inch. The main engines of the vessel are designed to indicate 4000-horse power, and are the largest ever constructed on the Wear. They are of the triple-expansion type.

A handsome little screw steamer, called the Gloria, was on Tuesday launched from the shipbuilding and engineering works of Messrs. J. F. Waddington and Co., at Seacombe, for Messrs. Bickersteth, Baker, and Co., of Liverpool. This vessel has been specially constructed for touring and general trade on the river Amazon, and has a wood-awning deck, fore and aft above the main deck. She was launched with engine and boiler on board, and the work has given entire satisfaction to the owners, and their superintending engineer, Mr. Irwin, of Liverpool. She will go on a formal trial trip to-day (Thursday), and leave for Brazils in a few days. Mrs. Waddington gracefully performed the ceremony of naming the vessel as she left the ways. We are glad to learn that Messrs. Waddington (who opened the Seacombe yard last July, after its having been unoccupied for a number of years) have several large steel steam launches, a steel screw tug with compound machinery, and some steel barges in hand, and they are besides building two wood launches and one high speed steel launch on stock, while they also manufactured the engines and boilers for them, thus giving employment to nearly 200 hands.

THE JUNIOR ENGINEERING SOCIETY.—The programme for the 1887 session of this Society, of which Professor Alex. W. B. Kennedy is president, includes papers on the fallacies of perpetual motion, torpedo boat machinery, steam jacketting, early training of mechanical engineers, illumination of lighthouses, and visits to works. On Friday evening, 14th ult., the second annual dinner of the Society took place at the Holborn Restaurant. The chair was occupied by Professor Alexander B. W. Kennedy, who, in proposing the toast of the evening, among other matters, remarked upon the value of such societies, and pointed out that increase in membership alone was not always indicative of advancement, a better criterion being the manner in which the meetings were attended and the discussions sustained. On the following Friday evening the meetings of the sixth session were inaugurated by Professor H. E. Armstrong, vice-president, with an introductory address on "The Relation of Chemistry to Engineering." The address throughout contained very much of interest to the engineer, and proved conclusively how close was the affinity between the two sciences, and showed the essential importance of a due regard for chemistry in making the study of engineering complete. At the close a cordial vote of thanks was passed to Professor Armstrong for his kindness in delivering his interesting address, which it is the intention of the committee to put into print.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE fortieth annual general meeting of the Institution of Mechanical Engineers was held at the Institution of Civil Engineers on Thursday and Friday, February 3rd and 4th, the retiring president, Mr. Jeremiah Head, at first occupying the chair, which subsequently was occupied by the new president, Mr. E. H. Carbutt.

The usual formal business, including the presentation and adoption of the annual report, the announcement of the election of president, vice-president, and members of the Council, occupied a portion of the preliminary sitting, after which the Institution proceeded to the consideration of the papers. It was also announced that the summer meeting would take place at Edinburgh, and that arrangements would be made for a day at Newcastle for the Exhibition.

TRIPLE EXPANSION MARINE ENGINES.

Mr. Morison, replying upon the debate on Mr. Robert Wyllie's paper, read at the last meeting—as reported in THE ENGINEER, vol. lxii., p. 363—said it was now generally recognised by shipowners that the triple expansion engine on three cranks was very economical from a wear-and-tear point of view; and although tandems were still advocated by many engineers, there was no doubt that the three-crank was preferable. Looking at the question generally, there was naturally a decided inclination towards the three cranks, as it might reasonably be expected that the motion was more uniform and the wear and tear less. The experience of the last three years proved that that assumption was correct, as they saw owners who had two-crank tandems and three-crank triples were discarding the former and continuing the latter design. It was certain that in converting the present compounds into triples the tandem arrangement would in some cases have to be adhered to, and he thought a very good solution of the problem was to put a cylinder on each of the present existing cylinders, and use quadruple expansion with, say, not less than 170 lb. steam pressure. That would make very little alteration in the present engines, and the high ratio of expansion which would be required for the present L.P. cylinder to be retained must be conducive to the economy of fuel. Experience had shown that a compound tandem was not so economical as two-cylinder receiver compound with cranks at right angles. Then why should a tandem triple be as efficient as a receiver triple? With a tandem engine there was more connection between the cylinders during expansion than in the receiver engines; and as this meant that the temperature of the steam in the small cylinder must fall to that of the large one, and as the whole intention of compounding an engine was to reduce the range of temperature and the consequent condensation and re-evaporation, it appeared to follow that the receiver engine would, other things being equal, be the more efficient. There certainly did seem to be a great difference of opinion regarding the best ratio of cylinders for a triple expansion engine, but considerable latitude was due to the requirements of the case, as they should not expect to find the same ratio in an economical land engine, where weight and space were not valuable, as in a man-of-war, where the reverse was the case. For instance, in an economical land engine, which would probably aim at an absolute terminal pressure, say, of 6 lb., which would give a ratio of high pressure to low pressure of 1 to 8·5 or 9; whereas in a man-of-war, where the range of power required to be large, the terminal pressure would be about 12 absolute, and the ratio of high pressure to low pressure would be between 5 and 6. He had constructed a diagram to show the effect of twisting moments by taking into account the weight of moving parts and the pressure required for their acceleration. It would be seen that those engines being comparatively low speed engines the pressure required to accelerate the moving parts was not great, and the difference produced by it upon the diagram of twisting moments might be neglected for purposes of comparison. He might say that that was why the weight of moving parts had been neglected in the calculations and curves given with the paper. The late Mr. Wyllie thoroughly appreciated the valuable data which would be obtained if the weight of steam used could be ascertained—in fact, it was so stated in the paper; but all marine engineers would agree that it was sufficiently difficult to get the usual diagrams of coal consumption on board a steamer, and although those results were only approximately correct, they served to indicate the efficiency of the machinery generally. Everyone would agree that correct data would be valuable, and he was sure that the firm with which he was connected would gladly give Professor Kennedy every assistance to obtain some. As it would be obviously unfair for Professor Kennedy, after having said that some of those results were impossible, not to substantiate his statement, he hoped he would be able to arrange a trip, say, from Hartlepool to Plymouth in one of their ships, taking the diagrams and measuring coal throughout the trip, and he would gladly undertake to give him every assistance, but could not undertake to introduce any feed-water measurer or anything that would interfere with the working of the ship. Those results could be made known at the next meeting, and would be both interesting and instructive. With regard to the roughly approximate results for which he was directly responsible, when those results of the Para were taken it was entirely for the information of the late Mr. Wyllie and the firm he represented, and with no idea of publication, so that they might rest assured they were not what engineers termed "cooked" in any way. He used three special indicators, and with the assistance of the chief engineer took diagrams at what was practically the same instant at regular intervals throughout the seventy-two hours. He kept the steam steady, weighed the coal and ash, and in fact did his very best to get a good idea of what a triple engine was going to burn. Of course there were not many triple engines afloat then. The whole of the diagrams were correctly worked out, the boat burnt the same amount, and travelled the same speed now as then, and had done so ever since. Taking the Para's cards by Professor Kennedy's methods, they found the H.P. showed 13·25 lb. of steam used per I.H.P. per hour, the I.P. 11·5, and the L.P. 8·9. Now, if they took Professor Kennedy's figures they had 13·25 + 2·35 = 15·60 lb. of steam in the H.P. when there was only 8·9 shown on the L.P., thus leaving 43 per cent. to be condensed. This he should term rather an uneconomical engine, and he had no doubt that if Professor Kennedy calculated by the same method the water consumed per I.H.P. with any published diagrams from triple engines, he would get more results, which he would declare impossible. Professor Kennedy said the water shown in the indicator diagrams was 85 per cent. of the total water, and to find the total water added 15 per cent. of what he at present has. He did not get the water by this method. Let x = water shown by cards, then by Professor Kennedy

$$x + \frac{15}{100}x = \frac{100}{85}x$$

$$\frac{115}{100}x = \frac{100\,x}{85}$$

$$97{\cdot}75\,x = 100{\cdot}00$$

If they took the Para in Professor Kennedy's table on page 506 of the "Proceedings," the ratio should be

$$85 : 100 : : 16{\cdot}1 : x$$

$$x = 18{\cdot}9 \text{ and not } 18{\cdot}5.$$

He would like very much to know the way in which Professor Kennedy arrived at his figures. He differed from Professor Kennedy with reference to the table published in the "Proceedings," because he thought instead of adding the portion of the clearance space he had not taken into consideration the difference of pressure, and he should bring down the pressure due to the end of the compression curve, and consequently he would have to take a certain amount from the volume V, and not add it to V. He, Mr. Morison, was not at all in favour of taking the lbs. of coal per indicated horse-power as the one entire basis for estimating the general efficiency of the machinery, as the available latitude in dealing with diagrams admitted of so many inaccuracies. Steamers of a certain class, and of approximately similar dimensions, should also be compared, that is, the dead weight carried a certain speed on a certain consumption, and they then had the commercial value of the results; and, after all, the £ s. d. question was the one to be considered. Regarding the Lusitania, on the return Australian voyage, she evaporated about £1000 less out of the shareholders' pockets than on any previous voyage, and in the latter case, of the Union Company's s.s. Spartan, the saving on a return Cape voyage was 500 tons, representing a monetary value of £750, and taking four voyages a year, that is, of course, £3000 a year; and as a proof that this had been appreciated, Messrs. Richardson have just finished the Athenian, are busy with the Trojan and Mexican, as well as Sir Donald Currie's steamers, the Grantully, Garth, and Drummond Castles, the whole representing a total of nearly 27,000 I.H.P. Professor Kennedy remarked, with reference to the Anglian, that the advantage given by triple expansion was in a perfectly legitimate way, by using higher boiler pressure and taking additional work out of the steam by expanding it. Of course, that was so. Then further, he said, it did not prove that three cylinders were better than two; what it did prove was that it was better to use 150 lb. than only 50 lb. It appeared to him that what it proved was that a three-cylinder triple expansion engine was an economical engine for using steam at a pressure of 150 lb. Of course, the work was in the steam, and not in the three cylinders, and, of course, theoretically one cylinder was as good as three. Still, a steam engine should not be considered in its purely theoretical aspect, since the chief source of loss in all engines, that due to initial condensation, was the very thing overlooked in such theoretical considerations. It was the reduction of this loss, due to the minimum of cooling from the cylinder surfaces, which made a three-stage expansion engine superior to even a simple condensing engine. The sequence advised in the paper was H.P., L.P., I.P., and that advised by Mr. Mudd was H.P., I.P., L.P. Now the question was, which was right? The former sequence gave an approximating horizontal exhaust line, and thus minimised the range of temperature and initial loads; the latter increased the range and also the load. He had prepared a diagram to show the manner in which the sequence of cranks affected the passage of steam between the cylinders. This showed the L.P. followed the H.P.—that was to say, the angle between the H.P. and I.P. was 240 deg. Looking at that diagram, let them suppose steam admitted to the top of the H.P. cylinder, the H.P. crank moved through 122 deg., when it began to exhaust into the I.P. It continued exhausting into the H.P. till it had passed through 162 deg. From 162 deg. to 232 deg. the steam was compressed into the receiver, and during this compression the piston passed through 23 per cent. of its stroke. At 232 deg. the bottom of the I.P. took steam, and continued to do so until the H.P. had passed through 335 deg. The H.P. then compressed into the receiver from 335 deg. to 50 deg. in the next revolution, and during this the piston passed through a distance equal to 16 per cent. of its stroke. Taking the other sequence of cranks and looking at the diagram, they would see that the H.P. crank passed through 122 deg., as before, when it began to exhaust into the I.P. top, which had been previously open. It continued exhausting into I.P. top till the crank got to 215 deg.; the steam was then compressed into the receiver from 215 deg. to 290 deg., during which the piston passed through 56 per cent. of its stroke. At 295 deg. the H.P. top began to exhaust into the I.P. bottom, and shortly after the H.P. bottom began also to exhaust into the I.P. bottom. This continued till the H.P. crank had got to 42 deg. in the next revolution. Steam was then compressed into the receiver from 42 to 110 deg., during which period the H. P. piston had passed through a distance equal to 57 per cent. of its stroke. Thus, with the crank arranged, H. P., L. P., I. P., the mean compression into the receiver was 19·5 per cent. of the stroke; with H.P., I.P., L.P., it was 56·5 per cent. The compression in the first case was just what was required to keep the receiver pressure practically uniform, in the other case the compression caused a variation in the receiver pressure, in some cases of 22½ lb. Mr. Mudd, in his classification of sources of loss on page 511, said that one of the principal sources was the excess of condensation over re-evaporation, and this it was attempted to minimise by reducing the range of temperature in any one cylinder; yet on page 515 he said that consideration respecting the detrimental effect of condensation during admission had led him to conclude that oblique lined diagrams were preferable to those having horizontal lines, although he acknowledged that the oblique diagrams had the greater range of temperature. It appeared to him to be evident that the reduction of the range of temperature was essential to maximum economy. Again, considering the initial load it was clear that the greater the load the greater should be the crank pin and main bearing surfaces; consequently for a given pressure per square inch they would require larger bearings with the oblique diagram than with the horizontal. Although many engineers commenced with the sequence H.I.L., all the leading firms in the kingdom were now adopting that advocated in the paper, and it was acknowledged by engineers at sea who had experienced both plans that H.L.I. made what was commonly called the sweetest running engine. Mr. Mudd's remarks on page 518, as to the necessity for care in designing the steam passages throughout the engine, in order to obtain equality in the powers, temperatures, and stresses, were the same in effect as if he had said that the object of a ferry boat was to reach the middle of the stream, and so it was; but still it was naturally achieved in crossing to the other side. So the equality in power, &c., was obtained by designing the steam passages so that the steam was got "freely on to the piston and freely off again at the proper times." He was sorry Mr. Mudd had given them a rule-of-thumb for ratios of cylinders, which he said had the merit of being easy to remember, as in his—Mr. Morrison's—opinion rules-of-thumb and scientific progress were not in harmony. The ratio 3, 5, 8, was the approximately accepted one for the ordinary class of cargo steamers, viz.:—

$$\frac{\text{H. P.}}{\text{I.P.}} \quad \frac{1}{2{\cdot}66}$$

$$\frac{\text{H.P.}}{\text{L.P.}} \quad \frac{1}{7{\cdot}11}$$

He desired to thank Mr. Adamson for reminding them that the present paper was comparative rather than absolutely theoretical, as that had been lost sight of frequently in the discussion. Professor Smith was perfectly right in saying that if the range of temperature in each cylinder was fixed, that fixed the range of pressure, and if the cylinder ratios were so fixed with this pressure as to give equality in the powers concurrently with those two other conditions, what was meant by the statement in the paper was that an approximate equality should exist between those three conditions, and the nearer to absolute equality the better. It was, however, incorrect to say that if the conditions of equality of mean pressure had been substituted, the two first conditions would have included the third. Equality in mean pressure was not equivalent to equality of horse-power, as in two cylinders of different areas to give the same power, at the same piston speed the mean pressure must be in inverse proportion to their area, not equal.

In reply to Mr. Cochrane as to the lineal velocity per second on which he based his calculations for those outlets and inlets from the cylinder according to their different diameters or pressures, Mr. Morison said to get the steam velocity, he took the area of the cylinder, multiplied it by the piston speed in feet per second, and divided it by the area of the port opening. In the various engines illustrated in the paper, the initial speeds of steam were about H.P. 100, I.P. 200, L.P. 250; and the exhaust H.P. 90, I.P. 120, L.P. 140; in some cases they had gone as high as 160 in the L.P. cylinder exhaust, and found no appreciable detrimental effect.

Mr. Morison having thus replied, as representing the late Mr.

Wyllie, to the discussion on the paper when read at Leeds, the Chairman called upon Mr. W. W. Beaumont, who, referring to some remarks made at Leeds tending to discredit the indicator diagram and coal consumption figures obtained at sea with triple compound engines, ventured to say he thought they ought not too lightly to throw away the information obtained at sea by engineers and by shipowners, and that the constructors of engines ought to be guided as much by the requirements of the shipowners themselves as by the information obtained from indicator diagrams. He hoped no one would think that he wished to under-estimate the value of the information to be obtained from indicator diagrams and as to the quantity of steam used; but, at the same time, he thought that the information obtained during numerous voyages or by observations taken over large numbers of hours was really valuable, and gave important comparative information by which they might judge of the relative economy of different kinds of engines. In the remarks made by Professor Kennedy he said, amongst other things with reference to compound and triple-cylinder engines, that there was no reason theoretically why the high pressure in the case mentioned should not have been as well utilised in the two-cylinder compound engine. Now it was a question very much of what was taken into consideration as theory. He thought that that was theory which took into consideration practical conditions, as well as those which, in the case of a diagram, would relate to a consideration of the behaviour of steam, very much as though a gas. There was no doubt whatever that the triple expansion engine was more economical than the ordinary compound engine, but of course, if they chose to take special cases, they might show that a compound engine had given results as good as any triple cylinder had yet, but they had to take engines generally, of the same class, and doing the same work. For instance, they might bring forward cases in which a single cylinder engine had, under special conditions, produced results as economical as, he believed, any compound engine of to-day had produced, but no one would care, he thought, to argue that theory indicated now that they could do as well in one cylinder as they could in two, and if theory indicated anything at all, when the practical conditions under which steam had to be used were taken into consideration, and steam looked upon as a thing that had to be used in a conducting cylinder, it showed that the ranges of temperature in any one cylinder must be reduced as much as was consistent with a moderate number of cylinders. He therefore repeated that the information obtained by shipowners which showed them what it costs to take a certain quantity of cargo from here, say, to Australia, was, after all, the information that was most important, and was that which must be used by engineers in selecting their type of engine.

Mr. Mudd said there were many points that he should have liked to have spoken upon, but he should not be able to do so in consequence of what the President had said as to necessary limitation of time. At the last meeting he had shown a combined diagram of the indicator diagrams of the s.s. Abeona; that diagram had been replaced to-night by another, because the one shown at Leeds was not constructed on the same plan as the combined diagrams in the paper. A copy of the diagram was now to be found in the "Proceedings" that had already been published. His principal object in sending that diagram was to prove what he believed to be the fact, that high-pressure crank leading gave better results than low-pressure crank leading on account of there being less space lost between the diagrams. He thought the diagram also proved one other point, that piston valves do not necessarily cause contracted steam passages as would seem to be implied by the paper. All three valves in the engine of the Abeona were piston valves, and there was apparently not much loss due to contracted passages. Referring to the diagram, it seemed to have struck some that it could not be accurate, because the diagrams overlapped each other, and that it therefore appeared that the steam during admission in the second cylinder, for instance, was higher than the back pressure in the cylinder before it, which seemed to be an impossibility. It must be remembered the diagrams were not combined in their relative sequence in working. To show that that did not at all follow, he had made another diagram below it, which was what they called a continuous diagram, in which they would find that the lines did not at any point overlap each other, though in one place they met. He held an opinion which seemed to be at variance with that held by the writer of the paper and by Professor Kennedy with regard to the proper method of showing indicator diagrams on a theoretical diagram, and he did not reconstruct the diagrams of the Abeona on the plan adopted in the paper, because he considered that the right method, but simply to permit of accurate comparison between engines with high-pressure crank leading and low-pressure crank leading. There were two points on which he differed from what Professor Kennedy said, and at the risk of correction he would venture to explain his views. They would not accuse him of wishing to depreciate the efficiency of Mr. Wyllie's engines when he told them that if the diagrams exhibited had been combined on his plan, the efficiency would have appeared much greater than as shown, and much of the discrepancy between one set and another would have disappeared.

The first point to which he particularly wished to call attention was that in any engine in which there was compression he considered the theoretical diagram used as a standard of reference for the actual diagrams should not include the whole of the clearance, but only so much of it as had to be filled with new steam at admission after compression had taken place. The other point had reference to the placing of the second and third diagrams. At the Leeds meeting Professor Kennedy stated that if all the clearances were shown from the vertical line, as was done in the combined diagrams shown in the paper, all the diagrams would naturally fall into their proper places in relation to the expansion

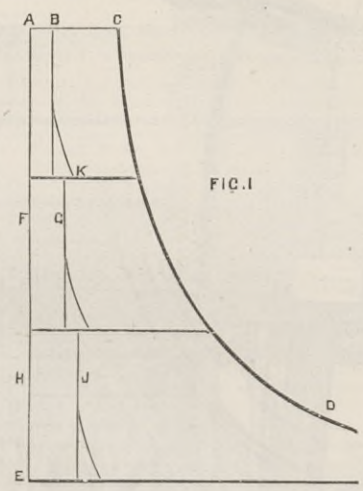
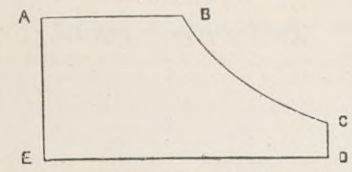


FIG. 1

curve; and he understood him to agree with the plan adopted in the paper of making the expansion curve of the theoretic diagram, such as was due to the whole steam in the cylinder including clearance. He thought he could make his objections to these methods clear by sketches on the blackboard—which we reproduce. In the method adopted in the paper, and agreed to by Professor Kennedy, having drawn $a\ c$ Fig. 1, $a\ b$ is set off to represent clearance in H.P. cylinder, and $b\ c$ the space passed through by the piston to point of cut off. Then $c\ d$ is drawn representing the expansion of a quantity of steam $a\ c$, including all the clearance. The area of reference in such a theoretic diagram is therefore the area $e\ a\ c\ d$, which he considered was too large, both in the clearance side and on the expansion side. The method adopted by the same authorities for placing the other diagrams within this theoretical area was to set off $f\ g$ equal to clearance in M.P. cylinder, and $h\ j$ equal to clearance in L.P. cylinder, the positions g and j indicating where the diagrams should commence. This, he believed, would only be correct for one condition of clearance and compression, and that not a very likely one to occur. Supposing Fig. 2 represented the diagram for an engine having no clearance whatever, and no com-

FIG. 2



pression; $a\ b$ is the steam taken from the boiler, $b\ c$ is the curve of expansion of that quantity of steam, and $a\ b\ c\ d\ e$ is the correct theoretic diagram for that engine. Moreover, this diagram represents all the work we can possibly get out of the quantity of steam $a\ b$, of pressure $e\ a$.

In Fig. 3 $a\ b\ c\ d\ e$ represent exactly the same as Fig. 2. Let us now suppose that a large clearance is added to the engine, but still no compression. The clearance $a\ f$ being added will enlarge the

FIG. 3

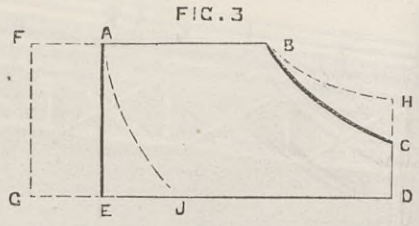


diagram by the area $a\ f\ g\ e$; and since at cut-off the cylinder contains a quantity of steam $f\ b$, the expansion curve due to that steam will be $b\ h$; and the area $g\ f\ b\ h\ d$ will be the correct theoretic diagram for this engine, which has no compression.

Let us now suppose that compression is added, so that the steam in the clearance space is just up to boiler pressure at the time of admission, the compression curve being $j\ a$. The case is now quite different. The engine gets no steam from the boiler in the space $a\ f$, and we cannot expect any work for nothing, therefore the space $a\ f\ g\ e$ requires eliminating from the theoretic diagram of this engine. All the steam the engine gets fresh from the boiler is $a\ b$, as in the engine represented by Fig. 2; but as the expansion curve is correctly $b\ h$, due to the steam $f\ b$ in the cylinder at cut-off, it appears at first sight that we have got the area $b\ h\ c$ for nothing. We shall find, however, that we have had to give the area $a\ e\ j$ for it. This compression area is the work done on the clearance steam to enable us to get the addition to the expansion curve above $b\ c$. The theoretic diagram for this engine with compression should therefore *not* include both $a\ e\ j$ and $b\ h\ c$, and as the latter will in an actual engine never be equal to the former, it seems clear that the proper area of reference for efficiency of steam is in this engine the area $a\ b\ c\ d\ e$, which is the same as Fig. 2, and which represents the expansion of that quantity of steam received from the boiler after compression has taken place. It is, however, also interesting to show on a theoretical diagram the lines $b\ h$, as the card should theoretically come up to that line. In making a theoretic diagram for a triple engine on these principles it will be found that $a\ b$, Fig. 1, should be only so much of the clearance as is not filled by compression, and the point a may be found by continuing the compression curve of the H.P. cylinder upwards to initial pressure. The curve $c\ d$ should be that due to the fresh steam supplied at each stroke, and in placing the successive diagrams it seemed to him the important point to be noted was the point k, Fig. 1, namely, the point where compression began in the previous cylinder. At this point the steam was practically cut in two parts, the part to the left of k being retained for compression, and that to the right of k being passed on to the next cylinder. If from k a vertical line be dropped, and to the right of that be set off just so much of the clearance in the second cylinder as requires to be filled after compression, that point will give the position of the second diagram, and so on with the third also. In

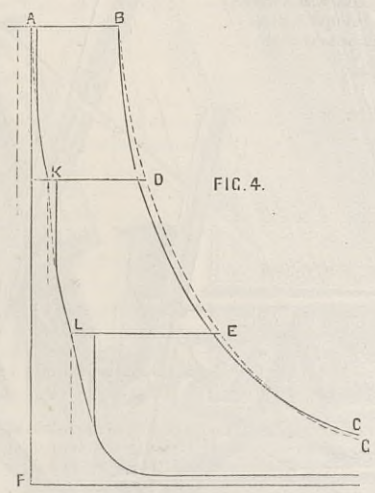


FIG. 4.

Fig. 4 this method is illustrated; $a\ b$ is the fresh steam taken from boiler at each stroke; $b\ c$ is the expansion curve due to $a\ b$; $f\ a\ b\ c$ is the theoretic diagram representing an area of reference for determining efficiency of steam; $b\ d$ is the curve due to all the steam in H.P. cylinder cut-off, including clearance; $d\ e$ is not continuous with $b\ d$, but is a curve due to steam $k\ d$, and is the curve to which the diagram should approach; $e\ g$ is again a new curve due to steam $d\ e$. This he thought a much more accurate method of comparing actual diagrams with theoretic, and put all engines on a fair basis, making due allowances for their clearances and compressions.

(To be continued.)

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Nathaniel E. Green, engineer, to the Swinger, additional, and when recommissioned; William J. Mabb, engineer, to the Dart; William J. Brown, engineer, to the Penelope; Caleb J. North, chief engineer, to the Immortalité; Thomas F. Brown, chief engineer, to the Orion; John R. D. Johnson, engineer, to the Falcon; Hugh Hawkins, engineer, to the Impérieuse; Thomas Rule, engineer, to the Garnet; Henry A. Evans, engineer, to the Anson; D. D. Murray, engineer, to the Hercules; Charles E. Shorey, assistant engineer, to the Tartar; George H. A. Mitchell, staff engineer, to the Renown; Charles W. Nibbs, staff engineer, to the Shah; George W. Hudson, engineer, to the Cordelia; William S. Stribling, engineer, to the Racoon; William J. J. Sivyer, engineer, to the Devastation; and Edwin W. Cudlip, assistant engineer, to the Rupert.

AMERICAN ENGINEERING NEWS.

THE following information concerning engineering works, and on industries relative to engineering trades, is from a New York correspondent:—

The Milford Haven Mail Route.—Mr. Austin Corbin, President of the Long Island, Railroad, and the Indiana, Bloomington, and Western Railroad, has written to Congressman Perry Belmont, stating that pressure of other matters had prevented him from giving much attention lately to his long projected scheme for an ocean steamship line from Fort Pond Bay, Long Island, to Milford Haven, England; but stating that he now desires to make a start and push the matter forward actively. He wants the Government to build a breakwater at Fort Pond Harbour at a cost of 250,000 dols; the Long Island Railroad Company to bear a portion of the expense. The harbour is one of the finest on the Atlantic coast, and Mr. Belmont will apply for an appropriation for its protection in the new river and harbour Bill. Mr. Corbin will not wait for the passage of the Free Ship Bill, giving Americans the right to purchase and operate foreign built vessels under the American flag. The necessary capital for building the ships and starting the line has been subscribed.

Locomotives.—In 1885 the demand was so small that several firms had to shut down. In 1886 seven firms turned out 1221 new engines, as against 800 in 1885. In the United States there are fifteen, and in Canada one, locomotive building firms. The total number for 1886 is estimated at about 1800, 275 of which were built by railroad companies' shops. The Baldwin locomotive works will build a large number of locomotives for Peru; they will be specially designed for steep grades and sharp curves; cars will also be sent from this country; these are for the great Transandine Railroad, which is to be completed and extended by the Grace Syndicate. The Atchison, Topeka, and Santa Fé Railroad Company has given contracts for a large number of engines, and other railroad companies are placing orders.

Ramie.—The American Jute and Fibre Company, of this city, has established a nursery at Brunswick, Ga., for the propagation of the ramie plant from seed. It is intended to grow enough plants to plant out 500 acres next spring and continue planting until 1000 acres are under cultivation. The soil and climate being favourable the crop will yield three cuttings a year, and will require no cultivation after three years. The yield is estimated at 500 lb. per acre at each cutting. It is reported that this will be a permanent and successful industry in the South and will have an advantage over cotton, flax, and hemp, in point of less expense of cultivation and higher selling price.

Railroad mileage.—The following represents the present mileage of each State and Territory: Alabama, 2286; Arizona, 988; Arkansas, 2208; California, 3292; Colorado, 2913; Connecticut, 976; Dakota, 3555; Delaware, 316; Florida, 1939; Georgia, 3274; Idaho, 811; Illinois, 9579 (highest); Indian Territory, 422; Indiana, 5700; Iowa, 7907; Kansas, 6059; Kentucky, 2069; Louisiana, 1393; Maine, 1147; Maryland and District of Columbia, 1252; Massachusetts, 2018; Michigan, 5468; Minnesota, 4918; Mississippi, 2069; Missouri, 5054; Montana, 1062; Nebraska, 3703; Nevada, 954; New Hampshire, 1044; New Jersey, 1955; New Mexico, 1219; New York, 7466; North Carolina, 2187; Ohio, 7403; Oregon, 1225; Pennsylvania, 7817; Rhode Island, 210 (lowest); South Carolina, 1802; Tennessee, 2184; Texas, 7234; Utah, 1139; Vermont, 944; Virginia, 2727; Washington Territory, 923; West Virginia, 1143; Wisconsin, 4796; Wyoming, 750. Total, 137,500 miles.

The American Society of Civil Engineers held its annual meeting at its house in this city on the 19th and 20th ult. The first day was devoted to business. The Norman medal was awarded to Mr. Edward Bates Dorsey for his paper on "American and English Railroads Compared," and the Rowland prize to Mr. C. C. Schneider for his paper on "The Niagara Cantilever Bridge." On the second day the usual excursion was made. The party visited the large drawbridge over the Harlem river on the line of the Suburban Rapid Transit Railroad, and then made a trip over this line, which is a suburban extension of the Second Avenue Elevated Railroad. From Harlem the party went by boat to the Continental Ironworks at Gunpoint. Here were exhibited tracings from the original drawings of the celebrated Monitor, the first turret ship, constructed from the designs of Captain John Ericcson at a crisis of the civil war, and sent into service without any trial trip. Her end was successfully accomplished. Many other drawings were shown, including those of the new "Strong" locomotive. Lunch was served in the drawing-office, and an inspection was then made of the works, which contain numerous points of interest, including the plant for welding and corrugating large steel tubes; two newly-finished, handsome exhausting engines, without governors or cut-off, were in operation. Thence the party proceeded by steamer down the East River and to Bedloe's Island, in the Upper New York Bay, to visit the Statue of Liberty. Lack of time and the uncomfortable means of ascent prevented a large number of visitors from reaching the torch. The party then proceeded to the Battery and separated. In the evening the annual reception and supper was held. The rooms were crowded to packing, and a large number of the leading members of the profession, as well as several distinguished visitors, were present. Mr. William E. Worthen, of this city, is the newly-elected president.

Limed coal for gas manufacture.—At the meeting last year of the American Gas Light Association, at Philadelphia, Pa., Mr. Walton Clark, of New Orleans, La., read a paper on experiments made by him on coal mixed with lime, at the Jefferson City, La., Gasworks. The experiment lasted for a period of twenty-five days. The lime was slaked with its own weight of water and allowed to cool, just before mixing with coal 100 per cent. more water was added, and the lime thrown over the coal, which was then turned once and loaded into barrows; fine stone lime from Alabama or Tennessee was used. With unlimed coal the total yield of ammonia per 2240 lb. was 5·3 lb., equal to 20·5 lb. of chemically pure sulphate, or 21·9 lb. commercial—24 per cent.—salt. With limed coal the yield was 7·4 lb. of ammonia, equal to 28·8 lb. of chemically pure sulphate, an increase of 8·3 lb. Owing to the increase of clinker the firemen were very glad when the use of lime ceased. He was unable to discover any change in heats, yield, illuminating power, or amount of fuel used that could be charged to the lime.

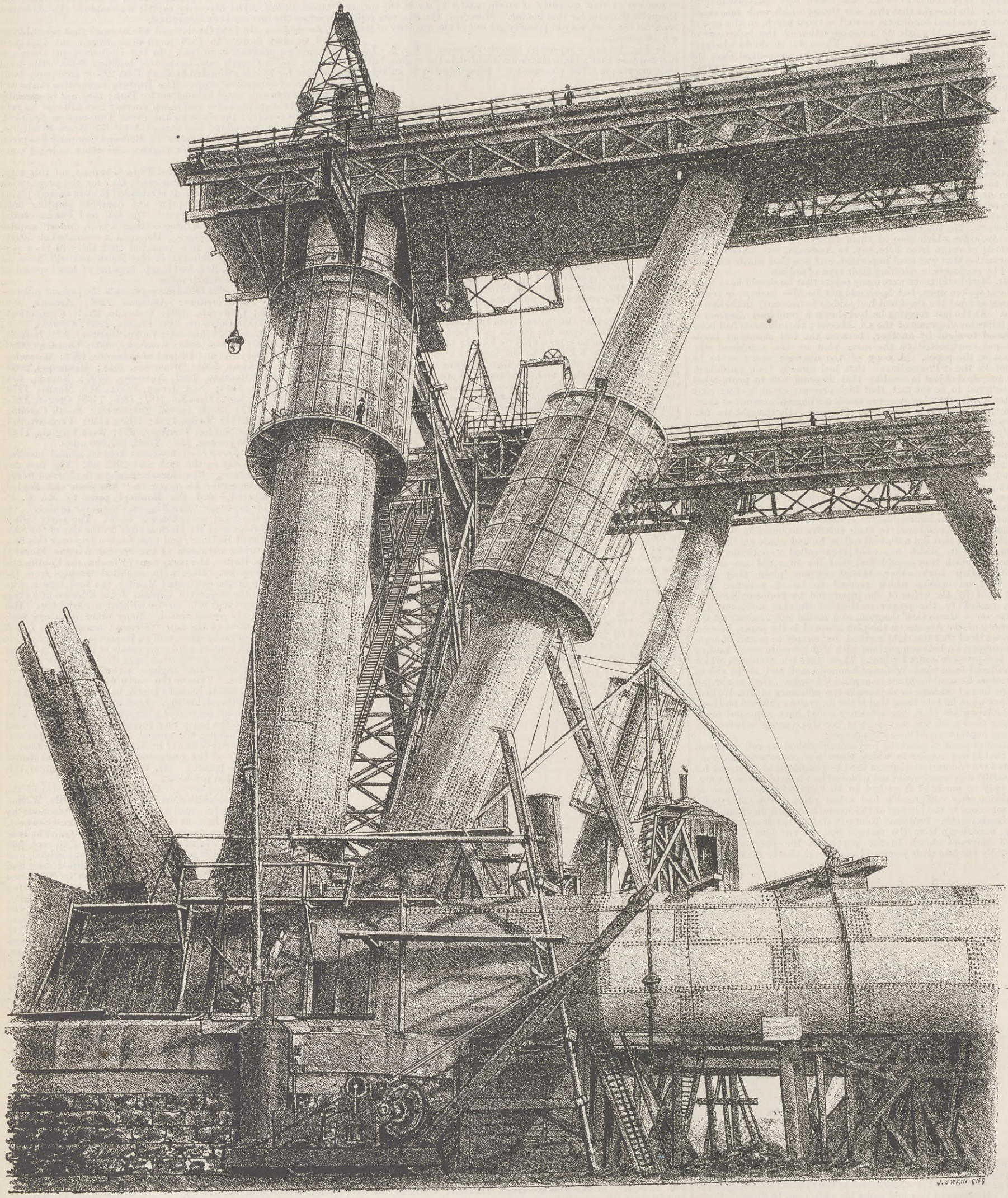
A new locomotive.—The Lehigh Valley Railroad Company has recently turned out of its shops at Wilkes Barre, Pa., a large and heavy "Strong" locomotive; the "Strong" design being a radical departure from ordinary locomotive construction. It is intended for work on grades of from 68ft. to 96ft. per mile, and will burn a low grade of anthracite coal. There are two fire chambers placed side by side, these unite in a single combustion chamber, at the far end of which is the tube sheet. The three chambers are of steel, corrugated, and welded tubes, 42in. in diameter. The cylinders are 20in. by 24in., and have four gridiron valves each, two steam and two exhaust; their motion being independent, permits of an early cut-off and a long exhaust. They are operated by a single excentric to each cylinder. There are six 62in. driving wheels, the forward pair having blind tires; under the cylinders is a four-wheeled truck, and under the fire chambers a two-wheeled truck with 42in. wheels; this truck is equalised with the drivers. The wheels are of Krupp steel; the total wheel base is 32ft.

The new bridge over the Mississippi River at St. Louis, Mo.—After hearing a large amount of evidence in favour of a high-level or a low-level bridge, the Board of United States Engineers, appointed by the Government to investigate the matter, has reported in favour of a high-level for overwhelming reasons. The report states that the main spans should not be less than 500ft., with a height of 50ft. above the river, and adds that in view of the progress of engineering science and the more extended adoption of the cantilever principle it may reasonably be supposed that even longer spans will be found practicable and economical. This will give a clean passage, and will offer no hindrance to the control of the large and heavy tows in the rapid current.

THE FORTH BRIDGE.—ELEVATION OF NORTH QUEENSFERRY PIER.

SIR JOHN FOWLER AND B. BAKER, MM. INST. C.E., ENGINEERS.

(*For description see page* 115.)



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NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31 *Beekman-street.*

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TO CORRESPONDENTS.

Registered Telegraphic Address "ENGINEER NEWSPAPER, LONDON."

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

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

*** *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* 1*d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

J. D. (Eccles).—*The proposal is not new, and cranks have been mended in that way.*

CHIEF ENGINEER.—*The feed from the hot well will do no harm if you keep it clear of tallow. If it were wrong to feed from a condenser, how would marine boilers get on?*

PUMP (Bristol).—*Injectors have not been used at sea because they are liable to be choked up with salt. We have no doubt that if injector makers overcame this difficulty they would be largely used instead of donkey pumps.*

J. B. J.—*So far as we are aware, an Englishman will not improve his prospects by going to the iron-making districts of the United States unless he has some good introductions and a little interest. An Englishman would not have as good a chance as an American.*

BLOODHOUND.—*Parents and guardians have only themselves to thank. If they made proper inquiries in the first instance they would not be taken in. The fees which they pay for pupils are often ridiculously small; and they cannot complain if the result is also small. It is very difficult to induce civil engineers of standing to take pupils at all, and parents and guardians should keep this fact, with its consequences, before them.*

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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.

THE INSTITUTION OF CIVIL ENGINEERS, 25, Great George-street, Westminster, S.W.—Session 1886-87. Tuesday, February 15th, at 8 p.m.: Ordinary meeting. Papers to be further discussed:—"Sewage Sludge and its Disposal," by William Joseph Dibdin, F.C.S., F.I.C.; "Filter Presses for the Treatment of Sewage Sludge," by William Santo Crimp, Assoc. M. Inst. C.E., F.G.S. Paper to be read, with a view to discussion:—"Irrigation in Lower Egypt," by Wm. Willcocks, Assoc. M. Inst. C.E. Friday, February 18th, at 7.30 p.m.: Students' meeting. Paper to be read:—"Diving; the Apparatus used, and the Work carried out under Water," by Geo. A. Becks, Stud. Inst. C.E.

SOCIETY OF ARTS, John-street, Adelphi, London, W.C. — Monday, February 14th, at 8 p.m.: Cantor Lectures. "Building Materials," by W. Y. Dent, F.C.S., F.I.C. Lecture I.—The nature of the influences to which stone is liable to be exposed as affecting its durability—The rusting of iron, and the means adopted for preventing it—Description of the various kinds of granite and sandstones employed for constructive purposes. Tuesday, February 15th, at 8 p.m.: Foreign and Colonial Section. "Some of our Colonial Woods," by Allan Ransome. W. T. Thiselton Dyer, M.A., F.R.S., C.M.G., Director of the Royal Gardens, Kew, will preside. Wednesday, February 16th, at 8 p.m.: Ordinary meeting. "Uses, Objects, and Methods of Techical Education in Elementary Schools," by Henry H. Cunynghame. Herbert C. Saunders, Q.C., will preside.

CHEMICAL SOCIETY.—Thursday, February 17th, at 8 p.m.: Ordinary meeting.

METEOROLOGICAL SOCIETY.—Wednesday, 16th instant, at 7 p.m., at 25, Great George-street, Westminster. Discussion on the Hon. R. Abercromby's paper, "On the Identity of Cloud Forms all over the World, and on the General Principles by which their Indications must be Read;" after which the following papers will be read:—"Remarks concerning the Nomenclature of Clouds for Ordinary Use," by Dr. H. H. Hildebrandsson, Hon. Mem. R. Met. Soc.; "Suggestions for an International Nomenclature of Clouds," by the Hon. Ralph Abercromby, F.R. Met. Soc.; "The Influence of Weather on the Proportion of Carbonic Acid in the Air of Plains and Mountains," by W. Marcet, M.D., F.R.S., F.R. Met. Soc., and A. Landriset.

PARKES MUSEUM OF HYGIENE.—Thursday, February 17th, at 5 p.m. Lecture on "Food Adulteration and Analysis," by Charles E. Cassal, F.I.C., F.C.S.

THE ENGINEER.

FEBRUARY 11, 1887.

A COLLEGE FOR COLONISTS.

IT has often been urged with much force that education as practised in this country lacks an essential qualification in that it is not useful. The meaning of the proposition must not be strained. It is not intended to convey the idea that all education is useless, but rather that too much time is expended by the pupil in acquiring information which he will never subsequently find himself in a position to utilise. That this is true to a certain extent, we do not care to dispute. A very prominent example of the defects of modern systems of education is found in the training which lads and young men intended to emigrate usually receive. The education which will fit a man for the learned professions, or the Civil Service, or a clerkship, is not that which will best enable a colonist to make a livelihood. The conditions under which he will live—his environment, in fact—are totally different in a hundred ways from those of home life in a highly civilised country. The intending colonist requires a special training, and this hitherto there has been no means of obtaining. It is true that there are agricultural colleges in which a young man can learn a great deal about farming; but they do not go quite far enough in some respects, and they go too far in others. It is with some pleasure, therefore, that we are able to state that a Colonial College has been established and is already training pupils at Hollesley Bay, Suffolk. Among the patrons of this College are the Agents-General for South Australia, New South Wales, the Cape, Victoria, Queensland, British Columbia, and Tasmania; the head masters of all the great English public schools; and a very influential body of noblemen and gentlemen, all interested more or less in our colonies. The Principal is the Rev. Gould Ross, M.A., formerly Head Master of St. Andrew's College, Grahams Town, South Africa.

The purpose for which the College is intended is to fit young men for colonial life. Hollesley is situated on the Great Eastern Railway, about two and a-half hours from London. The farm consists of 1330 acres of land of a very varied character, including pasture, arable, heath, and woods. In this respect nothing could be better. There is a frontage of a mile to the river Alde, so that there is every possible opportunity for the pupil to acquire experience in boating, swimming, fishing, &c., both in the sea and river. We gather from the information that has been supplied to us, that the course of training has been devised with no small care, and no doubt by men of considerable experience in colonial life. It goes without saying that the pupils will be taught how to farm, but they will not be taught in the way too often practised. They will not look on while others do the work. In the colonies the settler has to work with his own hands, and he begins at Hollesley; and we are pleased to see that he will be trained to use not English implements only, but those specially intended for colonial use, and found there. Not only will the pupil learn farming, but gardening—that is to say, so much as will enable him to cultivate vegetables and fruits with some chance of success when he gets abroad. Forest work is not neglected. The neighbourhood offers some good examples of woods and plantations, and a certain quantity of planting will be done every year on the College estate, which is already well timbered. As there is a great variety of soil and aspect, the planting may also be very varied, and valuable experience thus acquired. Felling, measuring, and converting timber will be regularly practised. In some new countries a knowledge of the value of timber, as well as how to plant and manage young plantations, is most valuable. Over vast regions of Canada and Australia, for example, shelter is needed if the land is to be properly developed. On the other hand, a knowledge of the value of timber would prevent the reckless destruction of trees in many places. Regular instruction will be given in the veterinary art; and an ambulance corps will be established, and the pupils taught what to do when accidents occur, or in various emergencies which may arise, endangering life. We need not dwell on the value of such instruction as this in districts far removed perhaps from medical aid of any kind. The physical training of the pupil will be by no means neglected. He will be taught to shoot, fish, and ride; to break in young horses and take charge of cattle. He will have to camp out, and, in a word, his life will be as far as possible assimilated to that which he must perforce lead when he has left the mother country. He will be taught, too, to shoe a horse, weld a bar of iron, put up a wooden house, build a brick wall, and even make the bricks. There will be classes for field work, drainage, mensuration, levelling, &c., and such instruction will be given in mineralogy and geology as will enable the colonist to form an idea of the value of ores he may find, or the chances of finding water by digging a well.

It will be seen that such a programme as we have sketched out covers a wide field, and it may naturally be asked how long is the course to last, and what are the fees. Concerning the latter point, we believe that nothing very definite has yet been settled, but they will probably amount, all told, to from £80 to £120 per annum. As to the time to be spent at the College, that will be either one or two years, according to the aptitude of the pupil. It will be said that even the major limit includes a term far too short for the acquisition of all that it proposes to teach. But this is really not the case. The College is not intended to turn out finished veterinary surgeons, or mineralogists, or engineers; but to give young men that amount of elementary knowledge which will prove of great value, and render its possessors infinitely superior as a colonist to the man who does not possess it. Take, for example, the colonist who can weld a bar of iron. A bolt is broken in his wagon, he can repair the mischief; the man who cannot make a weld is helpless. A colonist wants a pump; he has nothing but some boards and a few carpenter's tools. How to use these he cannot tell. The man who has been taught, soon produces a square barrelled pump, which perfectly answers his purpose; and so we might go on extending the list were it necessary. The only risk which will be incurred is that an attempt will be made to teach things too thoroughly. The man who can knock up a hut with the aid of a hatchet and a saw and an auger, will be far more useful to himself and to others than the man who can plane a board quite true, edges and sides, but cannot produce satisfactory results with comparatively rude appliances. It is not necessary to the measuring of a piece of ground or the taking of a set of levels that the colonist must be a good mathematician, with a competent knowledge of trigonometry. But the man who can with a drainage level ascertain whether a stream can or cannot be made to supply a given field with water, will have an enormous advantage over the man who cannot.

Year after year hosts of young men leave this country for our colonies, and, losing their money, fall from bad to worse, until they become drudges in the towns, or return, wasters, to the parental home. The idea that a young lad fresh from school or college, used probably to a town life, and absolutely ignorant of any conceivable kind of constructive art, can get on in the colonies better than he will at home is altogether absurd. The difference between the colonies and Great Britain is not that special training is not wanted, but that a training which would be valueless in this country is essential to success abroad. The power of being able to weld a bar of iron would be useless to a civil service clerk. To his son in New Zealand it may be worth a good deal. The man without money, or something—be it brain-work or hand-work—to give in exchange for money must starve or live on charity here. Why should he be better off in Australia or Canada? If, to put the matter in its very simplest and most elementary form, he is to live by hunting, and can neither set traps nor shoot straight, he must die of hunger. A young man is sent to a stock farm who never got on a horse in his life, or one goes to a sheep farm who never saw a sheep sheared. Is it wonderful that our colonists assert that we send them all that is worthless? Is it remarkable that young men return to this country bitterly disappointed? There can be but one answer to such questions. We wish the Hollesley Bay College every success, and no one will have more reason to rejoice over it than our colonies. In conclusion, to save ourselves the trouble of answering inquiries, we may say that these should be directed to the Colonial College, Hollesley Bay, Woodbridge, Suffolk.

FIRES IN LONDON.

CAPTAIN SHAW'S Annual Report on London Fires, although somewhat curt and statistical, always contains features of interest. However bare the statistics may be, they possess a significance which commands attention, and each yearly addition may be said to render them more valuable. The returns for the last two years show in each instance a decline in the number of fires. The annual list still comprehends more than 2000, a point that was reached in 1883; but, compared with that year, there was only a minute advance in 1886, the numbers being respectively 2144 and 2149. To establish a fair test we must take into account the increase in the population. If we do this we find the ratio of fires to have been less last year than in any year since 1882. But no farther back than 1884 we find the absolute number of fires to be greater than in any preceding year, and the ratio to the population to be higher than in any year except in 1870. That fires exhibit a tendency to increase more rapidly than the population is a fact to which we drew attention several years ago, and suggests some rather curious considerations with regard to the causes that are at work to produce such a result. The extent to which London is protected against these outbreaks is indicated by the proportion of fires designated "serious." We say "indicated" rather than "proved," for the reason that big fires are often brought about by circumstances over which the Fire Brigade can have no control. Taking the figures as we find them, it is satisfactory to observe that the serious fires during each of the last two years have only been 7 per cent. of the total. During the first six years of the period in which the Fire Brigade came under the control of the Metropolitan Board—namely, from 1866 to 1871, both inclusive—the serious fires averaged as much as 16 per cent. of the total. In the next sextennial period they averaged 10 per cent., in the next 9 per cent., and in the last three years under 8 per cent. One striking fact in reference to the past year is the comparatively small quantity of water used in extinguishing the fires. The total is stated to be little more than 10,000,000 gallons, which is only about half the consumption of the previous year, and less than in any year since 1869. The consumption in 1884 was more than four times that of last year. Three years ago it took, on an

average, more than 18,000 gallons of water to put out a fire, whereas now the quantity falls much below 5000 gallons. It would be interesting to know how far this reduction is due to the more extended use of hydrants. Perhaps we shall learn something further on this subject when the Metropolitan Board issues its general annual report. Captain Shaw has lately stated that out of thirty-eight fires occurring in the City in the course of one month, only two required the presence of engines. By this we understand that the high-pressure hydrants, so extensively provided by the Corporation, were found sufficient of themselves in almost every case. The two exceptions were probably large fires, but the economy and utility of the hydrant system can scarcely be questioned.

Looking back on the history of this subject, it is evident that the change which in 1866 placed the London Fire Brigade in the hands of the Metropolitan Board was very salutary. Palpable improvement did not come at once, but it was the beginning of better days. For several years there had been an undue predominance of fires of the most destructive character; and in the first year under the Metropolitan Board the serious fires were one-fourth the total. On the very day on which the transfer took place there was an immense fire at St. Katherine's Docks. Within the previous five years there was the fearful conflagration at Cotton's Wharf, where Mr. Braidwood lost his life, and property to the amount of £2,000,000 was destroyed. Davis's Wharf followed, and there was a great fire in Paternoster-row. In the following year Price's oil mills at Blackfriars were consumed, and a group of warehouses in the neighbourhood of Wood-street. In 1864 there was an immense loss of property at Meriton's Wharf, Dockhead, followed in a few months by other riverside premises in the same locality, and a vast warehouse fire in the City. In 1865 Saville House was burned, and there was a conflagration at Beale's Wharf, with other outbursts of magnitude. The list might be enlarged, but these are samples. When we contrast this state of things with the strength of the Brigade as it then existed, the danger which threatened London becomes very apparent. It is rightly contended that the Brigade, as it now exists, is not strong enough. But it looks wonderfully strong compared with the force which existed when the Metropolitan Board took charge of the business. In 1865 the population of London was about three-fourths what it is now. The firemen numbered 219, including the men in charge of fire-escapes, and the land engines were 36. The firemen are now 589, and the land engines 159. The large land steam fire-engines were 3, and the small ones 6. The land steam fire-engines of all sizes are now 45. The total quantity of hose was under 3 miles in length, whereas now it is 28 miles. The stations were 17, while now there are 55, in addition to 26 hose-cart stations. But appliances like these are rendered still more valuable by the introduction of others. The telegraph lines used by the old Brigade amounted only to 16. There are now 28 telegraphs and 39 telephones between fire-stations; 3 telegraphs and 18 telephones to police-stations; 14 telegraphs, 20 telephones, and 15 direct fire-alarms to public and other buildings; and 54 alarm-circuits round fire-stations, with 347 call points. By this network of electric communication the whole system is endued with extra vigour, so that the machinery for extinguishing fire may be set into motion with the least possible delay. Captain Shaw attaches special importance to the substitution of telephones for telegraphs, and states that this is proceeding more rapidly now than formerly, so that he hopes the change will be complete throughout the whole of the system of communication before the end of the present year.

One thing not mentioned by Captain Shaw has a most important bearing on the protection of the metropolis from fire. We allude to the presence of hydrants on mains charged at high pressure. The hydrant is the rival of the fire engine, besides being its assistant. This was clearly recognised in days gone by, and gave rise to some curious scenes. Mr. Edwin Chadwick was informed that when hydrants were first put down at Liverpool, a fire was put out by the hose and jet alone when the appliance was first used; but when the men of the Brigade force arrived on the spot with their engine, they were so enraged with the man who had put out the fire that they attacked and beat him for interfering with what they conceived to be their privilege. The same authority states that previous to 1862, in one of the sub-districts of London, an officer in charge got the idea that by the insertion of a hose into a plug, or attaching it to a standpipe, he could frequently extinguish a fire before the engines reached the spot. Mr. Chadwick says the man not only thought it out, but "he did it." Unhappily in putting out the fire in this fashion, he also extinguished the rewards which the vestries were in the habit of giving to the men whose engine arrived first, second, or third at the scene of the fire. The emoluments for working the engines were also lost. So much obloquy was incurred in consequence, that this man in advance of the age had to abandon the project, both he and the men who acted with him being stigmatised as low fellows —"stand-pipe men." Prior to 1866, the Metropolitan police had a certain vested interest in fires, each policeman receiving a pecuniary reward for keeping a place that was on fire shut up until the arrival of the Brigade, regardless of the distance whence the Brigade would have to be fetched. In our recollection this unlucky rule had the effect, to all appearance, of sometimes preventing the escape of the imperilled inmates. The designed effect might be good, but the actual result was often questionable, and the whole affair was very much like "keeping the place warm" for the operations of the Brigade.

The idea of a vested interest in the extinction of fires seems to have actuated the Metropolitan Fire Brigade some time ago in their treatment of the Royal Arsenal Fire Brigade at Woolwich. This latter Brigade was a police force, and had the use of hydrants charged at high pressure. Captain Harris, one of the Assistant Commissioners of Metropolitan Police, appeared as a witness in 1876 before a Select Committee of the House of Commons charged to inquire into the working of the London Fire Brigade. The evidence given by Captain Harris showed that on several occasions, when the Arsenal force was making use of its hydrants to extinguish fires outside the Government premises, the men were rudely and even violently compelled to cease their operations directly the Metropolitan Brigade arrived on the spot. The opposition in this case was not merely to the hydrants, but to the Arsenal Brigade; yet, as the latter was showing how effectively the hydrants could be made to do the work of the engines, it is possible that the antagonism was all the greater on that account. Once it happened that the Metropolitan men could get no water from the street mains; but the hydrants were worked by the Arsenal police and the fire extinguished. The hydrant system has now so thoroughly established its reputation that the Metropolitan Board has materially altered its policy on that point. The history of the relations between the water companies and the Board on this subject is one which it is rather painful to refer to. Those who choose to know the facts may find them in the evidence given before the Select Committee of 1876-77. According to present appearances, the hydrant system, so successful in the City, is destined to make rapid progress in the metropolitan area outside the City boundaries. An expenditure of £15,000 per annum is now being incurred by the Board in putting down hydrants, and the idea is entertained that in the course of time it will be possible, by the use of electric communication in conjunction with the hydrants, to cover London so effectually that every fire shall have water playing upon it within five minutes of its outbreak. If ever this is accomplished, there will inevitably be a further reduction in the number of "serious" fires. In the meantime, this is the ideal at which to aim. How far the hydrants exist we cannot tell; but this we know, that in the month of November, according to the last report made by Sir Francis Bolton before his death, there were more than 1100 miles of streets in London, containing mains constantly charged upon which hydrants for fire purposes could be fixed. There is also on record the recommendation of the Select Committee of 1876-77, declaring that "hydrants should, without delay, be affixed to mains and service pipes wherever there is a constant supply, and should follow the extension of such supply." Captain Shaw is careful to report that the "water arrangements were unsatisfactory" in twenty-nine instances during the past year. That is to say, sometimes the supply was short, sometimes the turncock was late, and sometimes he did not come at all. But we are not told in how many cases the arrangements were defective because the Metropolitan Board had not seen fit to put down the hydrants for which the water companies had made provision.

Never was London so much in need of the best possible defence against fire as now. In its structure and its wealth it calls for the utmost measure of protection. Mr. Braidwood, in his day, was in dread of a fire breaking out in some tall City warehouse during a hurricane of wind. He felt assured that under such circumstance no engine-power that he possessed or that was then known could prevent the occurrence of another "Great Fire of London." The peril created by tall warehouses is far greater now than it was thirty years ago. The means of combating with a large fire are vastly improved, but the necessity has probably increased in a yet greater degree. Some time back we pointed out the danger created, not only by the excessive altitude of City warehouses, but by their mode of construction and the materials of which they are composed. Our remarks have since been confirmed by more than one calamity. Hence the need for developing to the utmost the means employed for the extinction of fires. In 1877 Captain Shaw estimated that the Brigade ought to have a force of 931 men. It then had 406. Allowing for the increase of population, which must be taken as the measure of property as well as of life demanding protection, the Brigade ought now to comprise more than 1000 men, whereas it has barely 600. London cannot afford a second edition of that which happened in 1666, but something vastly worse might happen now if once a fire broke loose in the metropolis. The question comes before Parliament this year in connection with one of the Bills of the Metropolitan Board, and it is to be hoped that the absurd system by which the revenues of the Metropolitan Fire Brigade are so cramped as to create a perpetually recurring debt on the current account will be brought to an end.

THE VALETTA DISPUTE.

The differences which have arisen between the municipal authorities of Valetta, in the island of Malta, and the military government of that colony, raise an important question as to the relations which should exist between the civil and military power in fortified places. Malta generally—and its capital Valetta especially—are emphatically fortifications. The island is held by us solely and simply as a *point d'appui* whereby to safeguard our route to India, and to that end every other consideration must subordinate itself; and yet in that island—as in almost every other place of the kind under the sway of the British empire—the large trade which has sprung up in the supply of necessaries to vessels calling has attracted a very considerable and annually increasing population, which has chiefly located itself around the fine and commodious harbour of the island capital. The sanitary interests of this population are entrusted to a municipality, and this body creditably exerts itself to improve the condition of the city, which has long been in many respects defective.

Those who know Valetta well will realise that, owing to its peculiar site, and the exceeding narrowness of its streets, anything like effective sanitation and drainage are exceedingly difficult to secure. To such a natural difficulty must be added the obstacle of the inborn disposition of the Maltese to adhere to old Italian customs in household matters, rather than to adopt those of more advanced sanitary principle. But as if these stumbling blocks to improvement were not sufficiently discouraging, there has for some time been waged a war between the rivals under whose respective charges the city is divided. The measures which the municipality desire to carry out to improve the drainage of Valetta clash with the opinions of the military who are in charge of the fortifications which line the shores of the harbour, and the dispute therefore turns upon the point as to which of the two interests—the civil or the military—should be made subservient in this matter to the other. Recurring to the postulate with which we started, that Malta is, and must be as long as Britain holds it, a "place of arms," we do not see that there can be any hesitation as to the decision to be given. Everything must perforce give way to considerations of military defence, and the civil authorities must, *nolens volens*, find some alternative to any proposition they may make which is opposed to those considerations. Valetta may be said to possess two populations—there is that which is fixed and permanent and residing on the land; there is another which is transient and migratory and having its home upon the waters of the harbour. In time of war, if not during that of peace, the latter would probably outnumber the former, and we must hold therefore—always keeping in view the primary object in our retention of Malta—that the sanitary interests of our soldiers and sailors demand that their home—the harbour—should not be befouled in order to secure to the residents of the city the ready disposition of its sewage matters. The disposal of these so as to be inoccuous to everybody is, after all, but a question of pounds, shillings, and pence. The inhabitants of Valetta settle there mainly with the object of deriving profit from the large trade to which our naval and military occupation gives rise. Not alone therefore are they bound to yield precedence to Imperial necessity, but even their own interests should induce them to submit to any reasonable expenditure which may contribute to sustain the source whence their profits are derived. The harbour of Valetta is a comparatively narrow but deep embayment. Its entrance has no great width, and the very limited tide of the Mediterranean offers but little chance of effective scouring of offensive matter deposited in the harhour being made by any natural agency. We can therefore readily understand how opposed the military and naval authorities must be to any proposal of the civil powers which seems likely to further increase the evils which already to some extent exist. We can also realise that, apart from the insanitary effects of sewage discharge into the harbour, the mere construction of drains and sewers through the lines of fortifications of sufficient capacity to carry off the drainage of a large population may afford elements of danger in a military sense. It may thereupon be concluded that a sanitary system which might legitimately receive adoption under ordinary circumstances must be prohibitory when it is desired to apply it to what is, in the strictest sense of the term, a fortress. That the natural configuration of the site upon which the modern capital of Malta is built opposes very great difficulties to the disposal of its sewage save into the harbour must be admitted, but it is idle to assert that they are insuperable. As we have said, it is a finance question simply. We possess many methods by which sewage can be raised and discharged by natural gravitation at points whence no evil can arise. If it be urged and demonstrated that the cost of effecting this is beyond the capacity of the island revenue to bear, it may then perhaps be rightly insisted upon that any amount shown to be in excess of that power should legitimately be borne as an Imperial charge, for it is Imperial necessity which compels its incurrence.

We see that the public revenue of Malta is almost exactly balanced by the expenditure, and there is no reason to suppose that the authorities can either improve that position, or could be justified without doing so in incurring public indebtedness the charges of which their revenue would be unable to sustain. We must, we think, leave out of the question the undesirability of any town drainage being discharged into an almost land-locked harbour. That consideration, so far as it must affect the health of the city situated upon it, can hardly rank *pari passu* with those, more important, that we have pointed out; and it must be held therefore, we should say, that if our service demands impose upon the island revenue an expenditure which it is unable to bear, a case has justifiably been made out for aid from Imperial resources.

ATLANTIC TELEGRAPH WORKING.

Now that there is a keen telegraph war between the various companies engaged in the Transatlantic service, it is very interesting to look to the results of the working. We have much information as to that working in the report of the largest and the oldest company—the Anglo-American. In the last half-year the cheap tariff of sixpence per word has been in operation the whole of the time, and the volume of traffic has been growing. Since May, 1886, the increase over the corresponding period of the previous year has been not less than 122 per cent. In the last three months of the year it was 129 per cent., 141 per cent., and 151 per cent. more than in the same period of the previous year, when the rate was 1s. 8d. per word. But it is at once evident that there will be needed a much larger increase of revenue even to yield the same results as a year ago. In the last six months of 1886 the traffic of the company named gave receipts of over £85,000, or, with some other small items of revenue, there was an income for the half-year for the company of £89,808. This was £54,683 less than in the corresponding period of the previous year. The balance of revenue, after deducting the expenses of working, is £35,347, but this has been added to the renewal or reserve fund, so that the shareholders receive no return for their capital for the half-year. The satisfactory feature is that there has been so large an increase in the traffic, and it is probable that that increase will continue, for the low rate of working is very greatly stimulating the traffic, and with a cheap word rate there is

not the same tendency to the excessive use of the codes, which materially lessen the receipts of the companies. The competition in Atlantic telegraphy has very considerably increased of late, and seems likely still to increase. The larger number of cables now in operation will probably prevent any serious increase in the charges, but it is evident that when the companies cannot pay dividend at these charges, there must be either an advance in the rates or a much greater enlargement of the traffic. The increase which has taken place is in a considerable degree due to the large extension of trade with the United States, and though from period to period that will grow, yet there are usually retrogressions between the times of growth. It may be, then, that the very low cost of telegraphing now known may be only temporary; but the ten cables now operative have a large carrying capacity, and thus there is the need for the cultivation of further traffic, if that capacity is to be utilised, and if the owners are to receive dividends. It is probable then that the rate for telegraphy may in time be slightly raised, but it is to the enlargement of the traffic that the telegraph companies have to look for receipts sufficient to enable them to keep up their cables in number and a condition capable of work, and to furnish some remuneration to the adventurers who have connected the two worlds with the costly "girdles" that under the sea serve the ends of business and pleasure.

"ALL RIGHTS RESERVED."

THE notice recently circulated to the effect that the reprinting without authority of matter which has appeared in any Government publication is subject to the same penalties as those which would have been incurred were the copyright in private hands, and the circular soliciting advertisements for the *Board of Trade Journal* has been followed by printing the words "all rights reserved" on the title pages of the Diplomatic and Consular Reports on Trade and Finance. Who is responsible for this brilliant idea, or what benefit the Government expect to gain thereby, it is not easy to see. When, some months back, the manner of issuing consular and diplomatic reports was changed from that of "Parts" containing batches published at more or less irregular intervals, the sole reason for the alteration was that the often valuable information in these documents might be rendered more accessible to the public, and there was no idea that the Government would embark in the business of newspaper proprietors and endeavour to procure advertisements for their journal by prohibiting extracts from it, as well as vaunting the value and exclusiveness of the information contained therein. The estimate formed by the *Board of Trade Journal* is an exaggerated one. Much of its contents consist of extracts from foreign newspapers, consular and diplomatic reports, &c., to which the Government have no right, and for using which they are liable to be proceeded against for infringment of copyright. There is not much chance of this, as foreign Governments, unlike our own, do all they can to spread information rather than to suppress it. When to the above-named articles are added the information that used to appear in the *London Gazette*, the remaining contents of the *Board of Trade Journal* are not sufficiently valuable to influence advertisers. Connected with this subject are several interesting legal questions, such as whether there can be any copyright in such publications. Whether it is possible for the Government to acquire copyright in publications prepared for it by public servants paid by public money; and the effect of these publications not being registered, the general legal opinion being that without registration there can be no copyright. If this view of the law is correct, the recent action in prohibiting extracts and reserving all rights is but one more specimen of that blundering for which Government departments are so distinguished.

THE MALIGAKANDA RESERVOIR.

A FURTHER failure has occurred with this work, which has again delayed the supply of water to Colombo. This reservoir was designed to contain nine million gallons, with a depth of 40ft. When first filled, about a twelvemonth back, a defect appeared which caused considerable leakage, and the water had to be run out and additional strength given at the point where weakness had shown itself. Very recently this reservoir was again filled; but further leakage occurred, presumably from the shrinkage of the concrete flooring, and it had again to be run dry. We understand that the engineer in charge attributes this second failure to the rigidity of the concrete. He believes it to be too unyielding for a tropical climate, and that although the flooring is covered by a masonry roofing, the intense heat of the days and the cold of the nights, combined with the pressure of the great head of water, has produced the cracks which have appeared. He proposes to widen these and to fill them with asphalte, a material which will more readily accommodate itself to the great variations of temperature experienced. Engineers engaged in India have long ago found some such course requisite to render watertight the flat concrete roofs of that country. Their practice has been to open the cracks out and to insert canvas, which overlaps the cracks, and then to run in a mixture of tar and boiled tallow, which yields readily to the motion due to the shrinkage of the timber supporting the roofs. It is probable, we think, that some admixture of one or other of the materials above named with the great mass of the concrete would ensure to it a quality likely to obviate such mishaps as have arisen at the Maligakanda reservoir.

LITERATURE.

Hydraulic Power and Hydraulic Machinery, by Professor ROBINSON. London: Charles Griffin and Co. 1886. Pp. 184.

THIS is a disappointing book. With the exception of a few chapters on matters not strictly relevant to the subject, it consists chiefly of short and superficial descriptions of machines, many of which have been already illustrated and described to a much fuller extent in the proceedings of various engineering societies or in technical journals, while in some cases illustrations of important and special machines are given without any descriptive matter whatever.

Commencing with a long chapter on the flow of water under pressure, the author refers to the well-known experiments and formulæ of Eytelwein, Neville, and others, but devotes most of his attention to some recent experiments on flow through orifices, which, so far as we can see, have little or no bearing upon the subjects embraced by the title. Again, Osborne Reynolds' and Unwin's investigations are dealt with at some length, values to six and seven places of decimals being given. However, on page 11 we are told that, from experiments made with 4in., 3in., and 2in. pipes in the Great Western Railway Yard at Paddington, the pressure during the working of the machines in the usual way was found to be practically uniform at points from 1000 to 1600 yards apart, and that similar results were obtained at Swansea. We are therefore left to draw the conclusion, either that the elaborate formulæ previously given, many of which have for years served as guides in ordinary engineering practice, are of no earthly use, or that the Paddington and Swansea experiments are valueless. Surely the author might have avoided landing us in this difficulty. On the same page the word "force" is very loosely used. As regards the loss of energy in the passage of water through valves and cocks under usual conditions, we are told that difficulty will be realised in endeavouring to express this loss in any formula worth adoption. Exactly so; but why not give the results of experience, and let us know also something as to what areas of valve passages should be allowed, instead of merely giving such general and primitive information as that "the supply and exhaust-valves should be large and they should open quickly." We should also have liked to have been told how hydraulic engineers set about determining the sizes of their pipes. These are all matters which have to be dealt with in practice, and are dealt with according to established rules, which, it is to be presumed, the author must be acquainted with.

Under the head "General Observations" are given some particulars as to working pressures, effect of frost, &c. The illustrations in this section are very bad. Fig. 7 is intended to show "the usual high-pressure flange joint," by which we understand the joint as used by Sir William Armstrong, but it is incorrect both in proportions and design. Fig. 8 is so poorly executed that some of the important details cannot be discovered; while Fig. 9 shows a valve of such an utterly antiquated type, that it is difficult to imagine where the author could have obtained the drawing. Relief valves are not now used in the manner shown, and are not, as would be understood from the description, necessary in every valve controlling the working of a "quick-acting hydraulic machine." Water-wheels, turbines, and centrifugal pumps are then disposed of in seven pages, the remainder of the volume, with the exception of three or four chapters, consisting of descriptions, illustrated or otherwise, of various hydraulic machines and appliances. About these, so far as they go, but little need be said. The plates are, for the most part, good, even if the scales for the drawings are sometimes rather small; but the woodcuts, as a rule, are bad; indeed, many of them would be bad for a cheap illustrated journal, but are ten thousand times worse in a book written for the instruction and guidance of engineers. On page 35 the work stored up in a 12in. accumulator of 22ft. stroke is erroneously given as 678·582-horse power. This amount should have been divided by 12, the horse-power stored being really 56·5. We should like to ask the author what is the difference between a compound steam pumping engine and a compound hydraulic engine, for in the chapter headed "Hydraulic Pumping Engine" he uses the two expressions to describe practically the same machine. What he really means in both cases is a compound steam pumping engine, and the chapter should have been headed "Steam Pumping Engines." A hydraulic pumping engine is, we take it, a machine in which the motive power is hydraulic, such as is described under the head of water pressure pumps.

Plate 9, which, if our memory is correct, is copied from a paper read very many years ago by Sir William Armstrong, represents a form of double power crane cylinder, now but little if ever used. Of the later methods of obtaining double and treble power, by concentric rams or by three cylinders placed alongside each other, no mention is made, though much space is occupied with a description of Hastees' variable power hydraulic engine, which, however admirable, has an application extremely limited as compared with the methods of obtaining double and treble force just referred to.

Hydraulic pressure and lifts have thirty-two pages devoted to them, and yet we find neither description nor illustration of the most common lift of all, viz., that in which the cage is raised by a chain from a hydraulic cylinder and ram with multiplying power, or yet of the wagon lifts so largely used at Cardiff and other coal shipping ports. On the other hand, barge lifts, of which only some two or three have been made, are treated in considerable detail. The cuts illustrating this section are extremely poor. Thirty-two pages are also devoted to shop tools, the chapter dealing with them for some reason or other being headed "The Flow of Solids." Hydraulic rivetting is treated at some length, Professor Unwin's lecture on water motors, at the Institution of Civil Engineers, being drawn on to a considerable extent in reference to the action that takes place in a rivetted cylinder. Tweddell's machines are illustrated, but the examples are mostly of old and obsolete forms; none of the ingenious modern designs are shown. Cranes are summarily dismissed with only one page of descriptive matter and four plates. One of the latter shows a special construction of movable crane, but there is not a word of explanation in regard to it. It goes without saying that all that is to be written about hydraulic cranes cannot be conveniently compressed into one page, even by Professor Robinson. Hydraulic power applied to bridges is treated with greater respect, but surely it would have been better to have illustrated the machinery of the comparatively recent Tyne swing bridge, instead of that of the Ouse bridge, which, if our memory serves us, is some eighteen or nineteen years old.

Under the head of hydraulic coal-discharging machines is described a steam whipping apparatus, with water cataract, designed by Sir William Armstrong in 1851, no mention being made of anything more recent, with the single exception of the movable hydraulic crane erected a few years ago at Cardiff. It is, however, incorrect to state that this crane is a recent development of coal-discharging machinery, as its function is to ship coals direct from trucks into the vessel, and not discharge from the vessel. It is extraordinary that the most common of all coaling machinery, viz., the hydraulic lift with tipping arrangement for trucks, is not even alluded to. There must be some hundreds of these at work of one form or another.

With regard to hydraulic machinery on board ship, it is news to us, though it may be quite true, that the accumulator may be dispensed with. We are not now referring to the working of guns, which is discussed under a separate head, but to machinery such as cranes, jiggers, capstans, &c., on board ordinary vessels. In such cases we were under the impression that the accumulator or its equivalent air vessel was always adopted, as there seems no more reason for providing "enormous reserve of motive power in the engines themselves" on board ship than on land. The same economical considerations apply in one case as in the other. In the only example given, viz., the British India ss. Quetta, which was fitted up by Messrs. Brown Brothers, a steam accumulator is used. In the P. and O. ss. Massilia, Messrs. Sir W. G. Armstrong and Co. adopted an air accumulator.

Passing over the succeeding nine chapters, we come to one on the "Cost of Hydraulic Power," the data being taken from a paper read by the author in 1877. It is to be regretted that later information has not been given, as since the year 1877 several of the companies named have laid down compound steam pumping engines, a type which is indeed now much used in hydraulic work. The cost of pumping with these more economical engines should therefore have been given.

Though several chapters remain, we think we have said enough to show that Professor Robinson's book is incomplete in most essentials. It contains very little that is not easily accessible in much more extended form. Put into the hands of hydraulic engineers, it will be useless on account of containing nothing new and a great deal of what is absolutely obsolete, while in the hands of learners we are afraid it will also be useless on account of the entire absence of all teaching in regard to design and constructive detail, as well as on account of incompleteness in the treatment of the examples. No particular system has been observed in regard to arrangement, and it is difficult to understand what could have guided the author in making such an extraordinary selection of machinery. Added to all this, there is a looseness and vagueness of expression in many parts of the work which are quite unpardonable.

Illustrated Nautical Polyglot, by J. C. Coxe. Second edition. P. L. Breslauer, Bureau Veritas Agency, 155, Fenchurch-street.

THIS is a valuable book brought out in an original manner. The first edition had reference to sailing vessels only. This edition covers steam as well. It contains drawings of the various classes of vessels, their rigs, hulls, masts, yards, sails, rigging, &c., showing also engines and boilers, various views, with tackle and appliances. Each item is numbered, and its name is given in six different languages—English, French, German, Italian, Spanish, and Scandinavian. The book comprises also a list of the various port charges, of chandlery, and stores; engineers' tools, &c., treated in the same fashion. There is a copious index so arranged that most of the words and expressions contained in the book can immediately be found and translated into any one or more of the six languages named. The work is deserving of much praise, not alone for the ingenuity of its construction, but for the valuable information which it affords to the shipmaster, the yacht-owner, and, indeed, to all engaged in maritime affairs when finding themselves in foreign ports.

BOOKS RECEIVED.

Explosions in Coal Mines. By W. N. and J. B. Atkinson, H.M. Inspectors of Mines. London: Longmans, Green, and Co. Newcastle: Andrew Reid. 1886.

A Manual of Lithology. By E. H. Williams, Jr. E.M. London: Trübner and Co.

Die Galvanotegie. Von J. Schaschl. Wien: A. Hartleben.

Tabulated Weights of Iron and other Metals, for the Use of Engineers and Draughtsmen. Compiled and arranged by G. M. May. Brampton, near Chesterfield: G. M. May. 1886.

On Gas Engines; being a Reprint, with some Additions, of the Supplement to the Text-book on the Steam Engine. By T. M. Goodeve, M.A. London: Crosby Lockwood and Co. 1887.

THE FORTH BRIDGE.

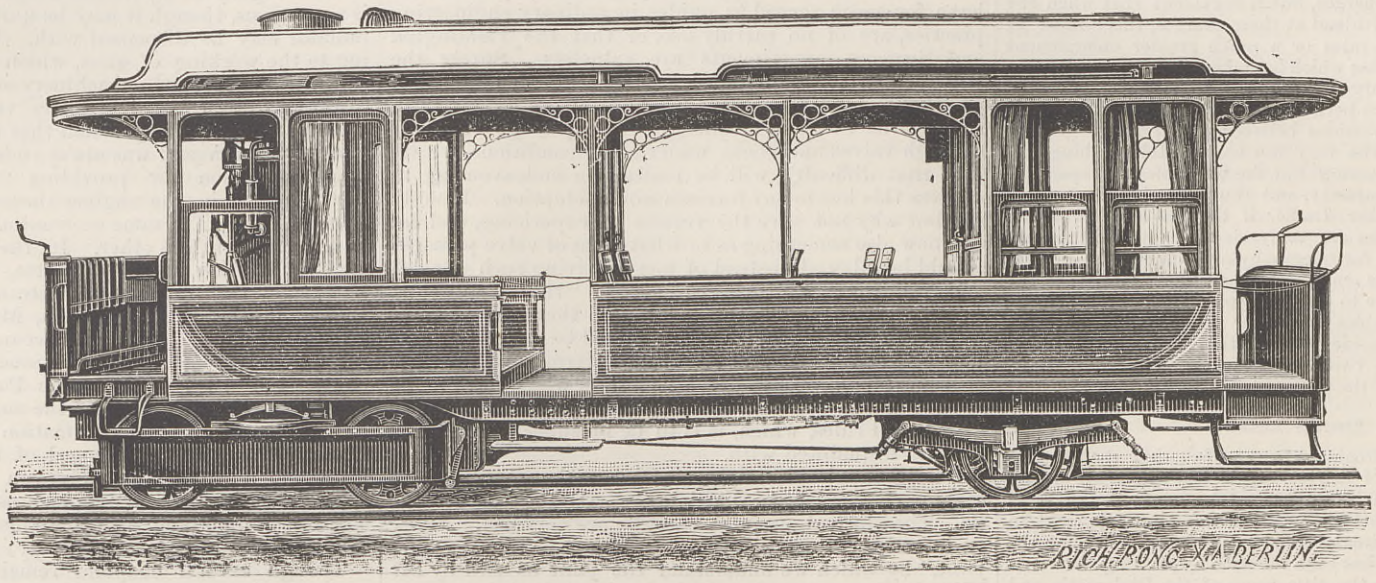
IN our last impression we published a two-page engraving, taken from a photograph by Mr. Philip Phillips, of the Forth Bridge Works, and showing the North Queensferry cantilever pier as at the early part of December last. We now publish on page 112 another view of part of this pier, showing it in side elevation, and in particular the connection of the vertical and horizontal tubes.

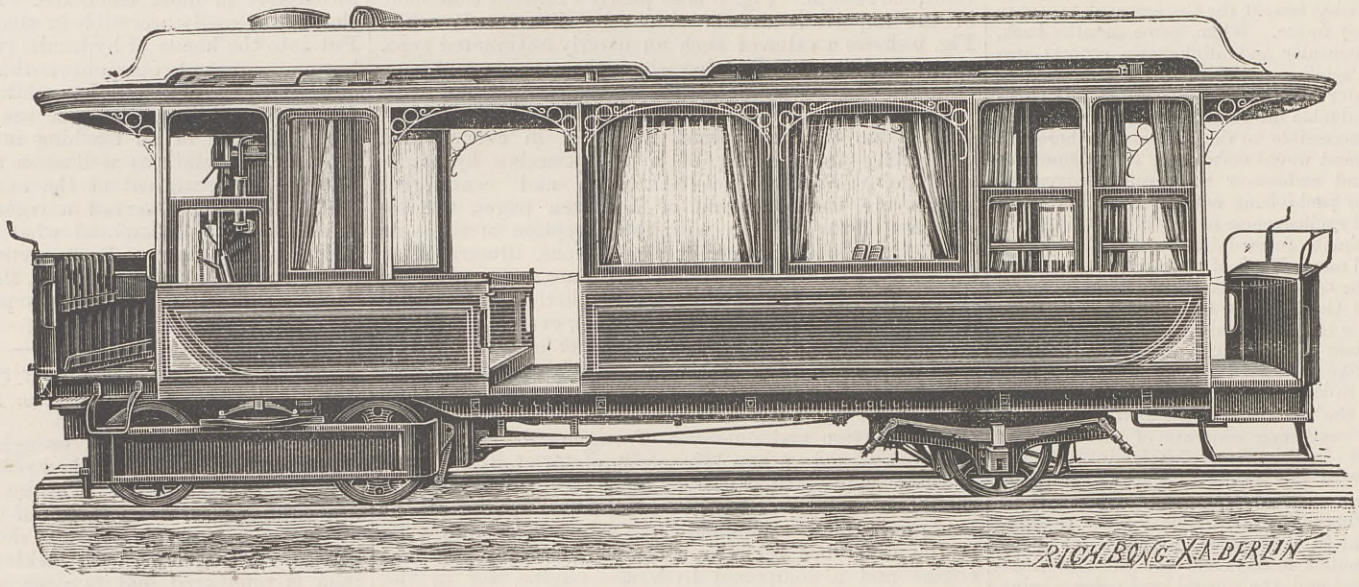
KING'S COLLEGE ENGINEERING SOCIETY.—At a general meeting held on Tuesday, February 1st, Mr. A. H. Preece read a paper on "Secondary Batteries." The author began his paper by defining a secondary battery as one in which, by the passage of an electric current through plates in a cell, certain conditions are set up by which electro-chemical energy is stored up. He then proceeded with a short history of secondary batteries, mentioning Planté as the originator of the present form.

OLD STUDENTS OF KING'S COLLEGE.—The annual dinner of the old students of King's College, many of whom are now engineers, was held on Friday, the 4th inst., at the Holborn Restaurant, and was attended by 180 of the old students and their guests. The chair was taken by Sir Edward Clarke, Q.C., M.P., the Solicitor-General; and amongst others present were the Rev. Prebendary Ware, D.D., who succeeded Dr. Barry—now Bishop of Sydney—as Principal of King's College; General Sir R. Wilbraham, K.C.B., Sir R. Rawlinson, C.B., C.E., Mr. J. G. Talbot, M.P., Mr. Shiress Will, Q.C., M.P., Sir C. D. Fox, C.E., W. H. Preece, Professors Shelley, Adams, and Castle, Mr. Henry Robinson, C.E., Professor Hughes, Messrs. Peter Brotherhood, C.E., R. H. Tweddell, C.E., A. E. Carey, John Hunter, E. K. Burital, F. S. Courtney, S. H. Terry, and W. E. Lines, the three last, with Professor Robinson, being members of the dinner committee, who have been successful in raising the attendance from eighty-two last year to 180 on the present occasion, and the committee hope that next year the attendance of the Applied Science Department, which numbered about forty on Friday last, will be still further increased.

STEAM CARS FOR STEEP GRADIENTS.

MR. W. R. ROWAN, ENGINEER, BERLIN.





ROWAN'S STEEP-GRADE TRAMWAY-CARS.

In The Engineer of the 26th March, 1886, we gave a description of the steam cars for tramways made from designs of Mr. W. R. Rowan, C.E., of Berlin, which was awarded the gold medal at the Antwerp competition of mechanical tramway motors in 1885. Since then these cars have been working very successfully in Berlin, where, however, the grades are not severe, 1 in 40 being the steepest. Several tramway companies in large continental towns have now had steam cars built under the supervision of Mr. Rowan for their lines with steep grades—Vienna, Stockholm, Pesth, and Naples—and we give above two illustrations of one of these cars which has been successfully tested on grades of 1 in 13. The first illustration shows the steam car as an open summer car, the second with the middle compartment closed for winter service. The alteration of the car from summer to winter car can be effected in ten minutes. In winter the closed compartment is heated with hot water from the surface condenser on the roof. The following are the principal details:—Length over platforms, 29ft. 4in.; extreme outside width, 7ft. 3in.; weight in working order, 9 tons; wheel pressure on rail with full load, 2 tons 2 cwt.; weight available for adhesion with full loads, 8 tons; number of passengers seated, 36; number of passengers standing, 14; total, 50; traction power of engine, $\frac{6\frac{3}{4}^2 \times 14 \times 180}{24} \times 0{\cdot}6 = 2800$ lb.; horse-power, 40 lb.; speed up to fourteen miles per hour; fuel consumption, coke, 4½ lb. to 5½ lb. per mile run; surface of air condenser, 1150 square feet. The steam car is constructed for curves 45ft. radius, and for grades of up to 1 in 15. It requires fresh water only two or three times during the day, and need only be fired once for every five miles' run. No stoker is ever required. Only one man is necessary on the engine. Although not shown, of course, one or more tram-cars may be attached to the steam car according to the work to be done and the grades.

DANGEROUS PAINTS AND COMPOSITIONS.

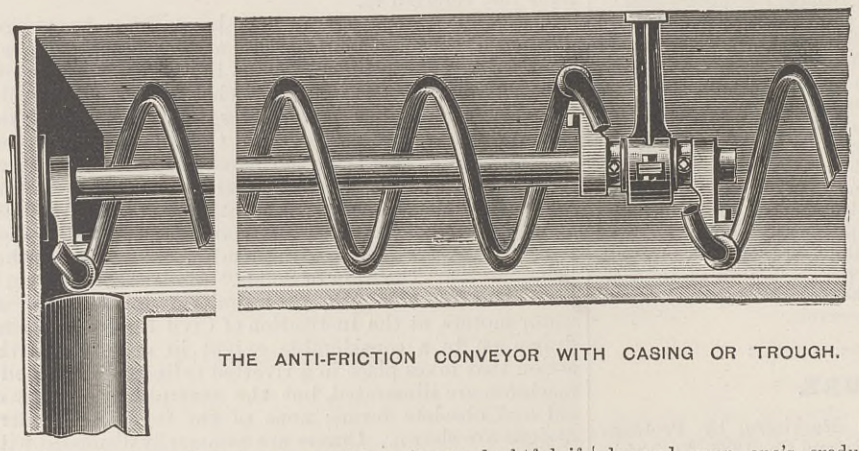
There is much in a name when it enables manufacturers to send by rail and by sea a dangerous compound identified by some title which appears to belong to a harmless composition. Judging, however, by the evidence taken during the official inquiry into a serious explosion on board the Thorndale, of Sunderland, by which one man was killed and two seriously injured on September 23rd, 1886, while on a voyage from Sunderland to the port of Galveston, this is a common practice. Mr. Danckwertz, in stating the case for the inquiry, said that before leaving, the Thorndale took on board three casks of "anti-corrosive paint," each containing about twelve gallons, and stowed under the forecastle. The casks bore no notice of any kind as to any special caution being necessary in dealing with the paint. When clear of the Channel the day watch was set to work to paint the interior of the vessel. While the men were engaged in pouring out the paint by the light of a candle, about 4ft. from the casks, a serious explosion occurred which knocked down the men standing around. The boatswain, who held the candle, had his clothes set on fire and was much burned, and two others similarly had their clothes set on fire, one being so much injured that he died the next day.

This anti-corrosive paint contained, among other things "coal tar naphtha," and Dr. Dupré proved that by analysis the volatile hydrocarbons constituted some 2 per cent. of the mixture. The result of the analysis seemed to be that one cubic inch of the paint was capable of rendering a cubic foot of air explosive. There was no doubt that this explosive property was the cause of the accident. The firm who supplied the paint said that the casks were labelled "anti-corrosive composition" which they said would indicate that there was spirit in the paint. Why this should follow is not clear. Dr. Dupré stated that at a temperature as low as 60 deg. Fah. to 65 deg. Fah. one cubic inch of it was sufficient to render one cubic foot of air explosive, and that under a higher temperature it would give off a much larger quantity. That under the circumstances under which this paint was being poured from one cask to another, the production of gas from it would be much increased, and that the quantity of paint poured out on the occasion in question was probably sufficient to render from 2000 cubic feet to 3000 cubic feet of air explosive. "Unless," said the Wreck Commissioner, "there was an order issued by the Privy Council that a notice should be placed on all similar compositions, it was doubtful if makers would do it, though with such dangerous compounds they would incur grave responsibility."

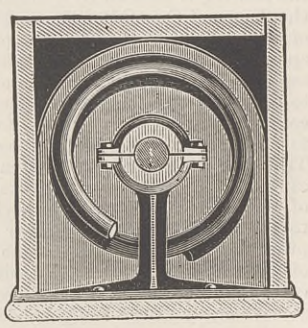
Numerous accidents and serious have occurred from similar causes, and the important issues at stake render legislative action urgently requisite, as, whether stored in railway sheds or trucks, in docks, in the store-rooms or holds of ships, so low an explosive temperature as 60 deg. renders this kind of material more dangerous than gunpowder or dynamite, and it is surely time that it should be placed under proper restrictions in its manufacture, storage, and carriage, so as to minimise as far as possible the great risks due to this new element of destruction to life and property alike. If makers were responsible for the results of these occurrences they would probably soon find a material for making these quick-drying compositions without volatile spirits. It is lamentable that men should be blown up and killed or seriously maimed and no responsibility be incurred by the person supplying or making the compound, without clearly stating its nature and explosive character. It appears that there are many makers of these paints and compositions for the insides and outsides of ships, and that all, or nearly all, contain a notable percentage of these very highly volatile hydrocarbons. It further appears that neither railway companies nor shipowners have knowledge of the possibly dangerous nature of these paints or compositions. If they had they would certainly carry them under special conditions and by special means, and shipowners would be careful of the way in which they stored materials which might give off a gas which, if fired in some parts of the ship, might send her to the bottom in the most innocent and unexplainable way.

THE ANTI-FRICTION CONVEYOR.

The accompanying engraving illustrates a remarkable invention. For ages screw conveyors for corn and meal have been employed, and in spite of the power consumed and the rubbing of the material conveyed, they have remained, with little exception, unimproved and without a rival. Now we have a new conveyor, which in its simplicity excels anything brought out for many years; and, until it is seen at work, makes a heavier demand upon one's credulity than is often made by new mechanical inventions. As will be seen from the engravings, the new conveyor consists simply of a spiral of round steel rod, mounted upon a quickly revolving spindle by means of suitable clamps and arms. The spiral as made for England is of §in. steel rod, because English people would not be inclined to try what is really sufficient in most cases, namely, a mere wire. The working of this spiral as a conveyor is simply magical. A 6in. spiral delivers 800 bushels per hour, at 100 revolutions per minute, and more in proportion at higher speeds. A little 4in. spiral delivers 200 bushels per hour at 100 revolutions per minute. It seems to act as a mere persuader; the spiral moves a small quantity, and sets the whole contents of the trough in motion. In fact, it embodies the great essentials of success, namely, simplicity, great capacity for work, and cheapness. It is the invention of Mr. J. Little, and is made by the Anti-friction Conveyor Company, of 59, Mark-lane, London.



THE ANTI-FRICTION CONVEYOR WITH CASING OR TROUGH.



END VIEW WITH HANGER.

Since the days of Archimedes, who is credited with being the inventor of the screw, there has not been any improvement in the principle of the worm conveyor. There have been several patents taken out for improved methods of manufacturing the old-fashioned continuous and paddle-blade worms, but Mr. Little's patent is the first for an entirely new kind of conveyor.

LETTERS TO THE EDITOR.

(*Continued from page* 107.)

THE VYRNWY WATERWORKS.

SIR,—Mr. Hawksley, in his letter published in your issue of the 4th inst., again makes statements which, without further observation, would be utterly misleading.

I have all the relevant documents in my possession, they have been printed by the Corporation of Liverpool, and published by the newspapers, and I propose, as in my former letter—every phrase of which is strictly correct—to confine myself to such further statements, based upon those documents, as are rendered necessary by Mr. Hawksley's last letter.

Mr. Hawksley's remark concerning the origin of the Vyrnwy scheme clearly means that Mr. Deacon has claimed more than his proper share of the credit; or that I, during Mr. Deacon's absence abroad, did so for him.

In his report of November, 1877, to the Corporation, Mr. Deacon wrote:—

"Before entering further into the subject, it should be stated that probably the first mention of the Vyrnwy as a source of supply was made by Mr. Bateman, who, in a pamphlet published n 1865, and in his evidence given in 1867 before the Royal Commission on Water Supply, enumerated this as one among several excellent sites for reservoirs in North Wales."

In his letter Mr. Hawksley arrogates to himself an act of generosity which the documents on the subject do not by any means affirm.

That the placing of Mr. Deacon's name with Mr. Hawksley's as engineer of the Vyrnwy scheme was an act of kindness on Mr. Hawksley's part, seems to me, in the light of the actual facts, strange. Here is the statement of the Chairman of the Liverpool Water Committee, Mr. Anthony Bower, concerning those facts. It is contained in a report made under a resolution of the Water Committee, and is dated the 12th October, 1885:—

"On the 1st day of September, 1879, the Water Committee, under the chairmanship of the late Mr. Wilson, passed a resolution requesting me to see Mr. Hawksley, and arrange with him about signing the plans, and I was also informally asked to come to a preliminary understanding with him as to the terms on which he would act as joint engineer with Mr. Deacon in assisting to carry the Bill through Parliament, and continue to act as joint engineer for the works if these were carried out."

"In accordance with these instructions I had an interview with Mr. Hawksley in Paris about the middle of September, 1879, and came to an understanding with him, subject to the approval of the Water Committee and the Council, that he and Mr. Deacon should be joint engineers; that both should sign the Parliamentary plans; that if the scheme got through Parliament Mr. Hawksley should continue as joint engineer; that in the event of failing in Parliament, and Liverpool not going on with the scheme, Mr. Hawksley should make reasonable professional charges, and that in the event of renewing, and finally carrying the scheme in Parliament, Mr. Hawksley was to be retained as joint engineer."

* * * * * *

"A memorandum to this effect was written by me in Mr. Hawksley's presence, and at his request I sent a copy of it to reach him on his arrival in London."

Memorandum referred to in Mr. Bower's letter of September 26*th*, 1879:—

"Mr. Hawksley and Mr. Deacon to be joint engineers. Both to sign Parliamentary plans."

"In the event of scheme going through Parliament, Mr. Hawksley to continue as joint engineer."

"In the event of failure in Parliament, and Liverpool not going on with the scheme, Mr. Hawksley to make reasonable professional charge for what he has done."

Then follow clauses as to remuneration, &c.

The receipt of this was acknowledged on the 29th September, 1879, by Mr. Hawksley's secretary.

". . . . All the engineering questions raised by the several opponents to the bill were discussed between their several engineers, and Mr. Hawksley, and Mr. Deacon; everything possible was done by both, in conjunction, to remove opposition."

The memorandum, as already stated, was dated September 26th, 1879—nearly two years after Mr. Deacon's first report, and more than one year after his second.

The Parliamentary plans were then in course of preparation by Mr. Deacon, and the statutory deposit was made in November of the same year.

In pursuance of the terms of this memorandum, the plans bore Mr. Hawksley's as well as Mr. Deacon's names bracketted together, as described more exactly in my former letter.

On the 23rd December, 1880, fifteen months later, Mr. Hawksley for the first time objected to the word "joint;" and on the 31st January, 1881, his solicitor stated, in a letter to the Town Clerk, that in the original memorandum "it was with Mr. Deacon, and not the engineer of the Corporation, that it was proposed Mr. Hawksley should act jointly."

Mr. Bower in his report shows, however, that at the time of drawing up the memorandum it was explained to Mr. Hawksley that Mr. Deacon would continue as a salaried officer of the Corporation. Mr. Deacon's agreement was drawn in accordance with the original memorandum, and no suggestion that he should take the office of resident engineer was made to him. Having regard to his part in the matter he would not have been likely to accept the office, and it was not, I believe, until about three years later that Mr. Hawksley for the first time made known to him his views, now expressed, of the relative positions of the two engineers.

Mr. Deacon naturally stood by his agreement and the practice up to that date; but in his letter to the Corporation, dated 19th May, 1885, which is throughout of a most conciliatory character, he very properly wrote as follows:—"This is my twenty-first year of practice in Liverpool as a civil engineer, and my fifteenth as water engineer to the Corporation. I have long felt a strong interest in the work and welfare of the city, and it is far from my desire that any personal considerations of my own should cause embarrassment or difficulty to the Corporation. A matter of infinitely more importance is the completion of the works with the least possible delay, and under the most favourable conditions. As I have already said, I court the fullest inquiry into the whole case. If, however, the council think it undesirable, on account of delay or otherwise, to adopt that course, or believe, contrary to my strong opinion—based on reasons which I feel sure would be acceptable to any committee of the council—that a concession on my part would conduce to the satisfactory completion of the works, I am prepared to accede to such a modification of my agreement with the Corporation, in respect of its alleged inconsistency with Mr. Hawksley's, as may be deemed by the Council to make it no longer inconsistent; but in that case I must ask the Council to define what assistance and advice they desire from me, and what responsibility they throw upon me as to future detail plans of the works." The Corporation, however, did not desire to make any change in Mr. Deacon's agreement, and no change was made; but the engineering works soon devolved entirely upon him.

The publication of the various documents, and the results of the engineering inquiry which took place, have justified, in every respect the course Mr. Deacon has taken. CIVIL ENGINEER.

Westminster, February 7th.

SIR,—From the correspondence which has appeared during the past three weeks in your paper on the subject of the engineering of the Liverpool Water Scheme, it would appear that the profession and the public will probably soon be in possession of the facts of the case, and it is certainly to be desired that they should. Any such difference of opinion between professional men is, or should be, a source of regret to all, but it is time that the relations which are to subsist between the eminent ones and those who, though members of the same profession, are unfortunately not within the charmed precincts of Westminster, should be clearly defined. Mr. Hawksley describes himself as a "professional engineer," Mr. Deacon as a "salaried officer." This is the gist of the whole matter, though as Mr. Deacon is a M.I.C.E., it is absurd to contend that he is not a professional engineer. With regard to the fact that Mr. Deacon did not contribute to the £15,000 expended, the only apparent deduction to be drawn is (1) that Mr. Hawksley is to draw all the percentage; (2) that an engineer is not to practice unless he is a capitalist. Suppose an engineer in the service of a company co-operates with the engineer whom the company employ in London to carry a Bill in Parliament, both of these gentlemen's names naturally appear on the Parliamentary plans, and both are engaged on the matter; would it be in character with the "reputation of a professional man" if, after the Bill became law, the eminent engineer totally ignored his brother engineer, and proceeded to execute the work, declining his co-operation? I commend this case to one who is respected by every man in the profession—the President of the Institution of Civil Engineers, of which I am

A MEMBER.

February 7th.

BUENOS AYRES PORT AND HARBOUR.

SIR,—Will you kindly allow me space for a few remarks relative to the article published in THE ENGINEER of the 5th ult.? In the first place, the two projects under discussion were those presented by Mr. Madero on behalf of Messrs. Hawkshaw, Son, and Hayter, and by Mr. Huergo, the engineer in charge of the Riachuelo Port works. Messrs. Church and Cleminson's project was not presented until after Mr. Madero's plan became law, and was never discussed even by the press. It is perfectly true, as stated in THE ENGINEER, that the Government engineers condemned Mr. Madero's plan, the adoption of which led to the resignation of the president of the department, as also of the engineer of the Riachuelo Port works. The opposition to Mr. Madero's plan was very energetic, to say the least, but whether it was very fairly carried on, or in good taste to condemn the most eminent engineers of harbour works, is a matter of opinion. It cannot, however, be denied that Mr. Madero very ably defended his project, and eventually triumphed.

But to return to Messrs. Church and Cleminson's project—which is by no means original—or rather, the most important part of it, viz., the breakwater. In the month of April, 1877, was published, in the *Buenos Ayres Standard*, a project by the undersigned to construct a breakwater precisely in the position shown in THE ENGINEER of the 5th November, 1886. As, however, this breakwater was proposed to be 24ft. in width, instead of 350ft., as proposed by Messrs. Church and Cleminson, it would only have occupied an area of 40,000 square yards, instead of 600,000 square yards, as shown in the latter project—in other words, the relative cost of the two plans would be as 1 to 15.

True, it was out-proposed in 1877 to construct "an island with a fine sea boulevard and promenade running its entire length flanked with powerful batteries mounted with heavy guns, or projecting piers for the shipping, with a line of storehouses for imports and exports, railway tracks in front and rear of the storehouses, a navy yard at the northern end of the breakwater, or a costly viaduct and double swing bridge to connect it with the shore;" all this, if not impracticable, would be a useless outlay.

A breakwater simply is required for the purpose of providing a safe harbour for Buenos Ayres, and that such could be constructed at a reasonable cost, anyone acquainted with the port can readily understand; moreover ample dock accommodation will be provided by Mr. Madero's plan, and the Riachuelo works, without unnecessarily increasing the cost of said breakwater by saddling it with useless if not impracticable structures.

As regards the construction of docks in front of the city, and in this warm climate, it is questionable if such be a wise policy in a sanitary point of view. We are unpleasantly reminded of this during the present visitation of cholera; the water in the Riachuelo has become so foul that all the shipping has been sent out of the port to the outer roads—*à fortiori*, will not the nuisance be much worse in enclosed docks immediately in front of this populous city? If the dock accommodation were simply to consist of piers projecting from the quay wall, as shown in THE ENGINEER, there would be no fear of stagnant water accumulating in front of the city, as the current of the river Plate would thoroughly cleanse the harbour and materially assist in sluicing the entrance channels.

Buenos Ayres, December 25th, 1886. JAMES HADDOCK.

GAS ENGINE PROGRESS.

SIR,—Within the last three or four years you have reviewed the various books and papers issued on the gas engine, and in your issue of 21st January remark "that by the time the gas engine advocates have got their 40 per cent. gas engine, the steam engine will perhaps have moved on from its present 12 per cent. efficiency." In this opinion many will agree with you, for when we look at the two motors it is surprising what slow progress the gas engine has made in heat efficiency compared with the steam engine within the last twenty or twenty-five years. By some misconception recent writers on the gas engine are completely in error respecting the gas consumed by the non-compressing gas engines. Macgregor, page 188, states that the Lenoir engine used 95ft. per indicated horse per hour. Bourne, on page 528, says 140 cubic feet. D. K. Clark, on page 123, gives 95ft. per horse indicated per hour, and many other writers state 90ft. to 100ft. of coal-gas to be the consumption per indicated horse per hour. This is totally erroneous. In a circular I have now before me of the Lenoir gas engine made in 1864 by the Reading Ironworks Company, they guarantee 1-horse power actual for 60ft. of ordinary London gas. I also have a circular of the Hugon gas engine, 1867, which gives 75ft. of gas per horse actual per hour. I think it is generally believed that the French Lenoir was the first gas engine in England, but I assisted at erecting a gas engine made by Robson of 1-horse power, which worked in a printing office for many years in Shields, and some years previously, about 1859; the same maker made a 3-horse gas engine. This engine was used as a supplemental engine to a steam engine in sawing and grooving wood in a builder's establishment in the same town, and did good 3-horse power. It consumed 70ft. of gas per actual horse per hour. Both these engines were non-compressing, a little over 50 per cent. was lost in engine friction; it gave over 6-horse indicated, and used nearly 35ft. of gas per indicated horse per hour. He also constructed several others on different principles. These, compared with Otto's arrangement of Rochas' compressing, is not so far behind in gas. The Otto averages 20ft. to 24ft. of gas per indicated horse per hour, so the reduction of 35ft. to 20ft. is nothing to be compared with the advance made in the marine steam engine in the same time, which is something like a reduction from 4 lb. to 1¼ lb. of coal per indicated horse. This completely justifies your remarks before alluded to. I may mention that the French, German, and other writers, Tresca, Armengaud, Wigand, &c., give 85ft. to 90ft. of gas actual horse in non-compressing gas engine.

Rochas' "Researches on Utilising Heat for Motive Force" published in 1862, caused long discussions at and since its publication, which cut at the foundation of the supposed irrevocable or theoretical amount of heat to be got from 1 lb. of coal, about 15 lb. of water evaporated per 1 lb. of coal, or 10 lb. to 11 lb. practically under a steam boiler. T. S. Prideaux, writing in Weale's Series in 1853, also foreshadowed the principle of using or burning the fuel under compression.

Now if this was properly done it would be found that the heating value of 1 lb. of combustible is not a fixed amount, as is universally accepted, but that the efficiency might be raised possibly to 20 lb. or more of water by burning the coal under a compression of, say, 3 or 4 atmospheres, as each 1 lb. weight of air under combustion would give about 3000 deg. Fah. at atmospheric pressure, whereas the 1 lb. of air under a pressure of 3 or 4 atmospheres would attain a temperature of from 4000 deg. Fah. to 5000 deg. Fah., giving a possible gain of 50 per cent. in its calorific value; the possible effects of dissociation at high temperatures could be avoided by a larger dilution with air. The energy absorbed in compressing the air into the furnace could be returned at the reverse end of the machine in the expansion of the air to the atmosphere, if the boiler lowered the temperature to 4000 deg. Fah. or 5000 deg. Fah., then in the expansion the temperature would fall to near that of the atmosphere.

Possibly many may think this entirely opposed to Carnot's and Joule's infallible law of the relation between heat and work, but it does not interfere with that law, it is simply a more elaborate and scientific method of burning fuel, and is worth the attention of men who can spare the means to carry out a set of experiments, for really to obtain an evaporative value of 20 lb. of water boiled off for 1 lb. of coal would be worth wasting a big candle over.

12, Dock-street, North Shields, TYNDSIDER.
February 1st.

PRESTON AND THE RIVER RIBBLE NAVIGATION.

SIR,—All who have read Mr. D. A. Stevenson's book on "Canal and River Engineering" must have been convinced that it not only emanated from the hands of a master, but was replete with carefully recorded facts, well worked out, on these somewhat special engineering works.

What Mr. G. H. Roberts, in his letter to THE ENGINEER of the 4th inst., means by "great high walls to be built across the sands" of the horse banks we cannot tell. He will find no such teaching in Mr. Stevenson's book, which, if he has not done so already, I advise him to purchase and study. In order to train a tidal river, I do not suppose any practical engineer would recommend "great high walls." Look at the river Dee.

What I have to say is this—that having been present at the time when large vessels have been stranded on the horse banks—vessels drawing 15ft. or more of water—that an entrance from the Irish Sea to the north channel should be provided and indicated by lighthouses or other means, so that vessels of any tonnage might enter the deep-water channel in all stages of the tide, or at half tide at least. That if, as Mr. Roberts states—and he has measured the depth of water himself—there is not more than 4ft. of water on the bar at low springs, then there is good reason to fear that the docks at Preston have been prematurely constructed.

The publication of a chart of the Ribble estuary in its present condition to any scale in THE ENGINEER would be a valuable illustration, and if the old channels could be "dotted on" so much the better.

As I stated in a former letter—an opinion I must still adhere to until shown to the contrary—the silting up of the channel is due to the river, and not to the action of the sea. I wish that some one acquainted with the behaviour of the Ribble for some years would give us the benefit of his observations. There are many who could.

I have been many times at low spring tide on the side of the Ribble opposite Lytham pier, and near that point, but have never seen the river in such a state that a person could cross it only knee deep. The thing has been attempted more than once at the cost of life for the temerity of the act.

Mr. Roberts gives great scope to his imagination when he states that the small fishing trade on the Southport sands is more valuable than that which would be done at Preston if the open channel connection with the dock works at that place could be successfully carried out. I cannot see, excepting "the great high walls," that the training of the river Ribble would interfere with the fishing operations on the "Southport sands" in the least. J. B.

Pontnewydd, Monmouthshire, February 5th.

SUGAR IN CEMENT.

SIR,—In further illustration of my observation that raw sugar and water mingled with Portland cement diminishes its resistance to tensile stresses, I venture to send you further results obtained from the same cement and sugar. The cement and sugar were kept in tightly-closed vessels in the interval of twenty days between the gauging of the two lots of twenty-four briquettes each. The first twenty-four were treated in the usual manner; they were immersed twenty-four hours after removal from moulds. The second twenty-four were never immersed, but kept in air until tested. Sugar appears injurious to cement under both conditions, but less in the latter than in the former case. The weight of material was the same in both lots of briquettes, and may be referred to in your issue of the 14th inst. In the annexed I repeat the figures you have already been good enough to publish alongside the fresh data, should you think the comparative results of sufficient interest for type. In the letter accompanying his table of my first results in a percentage form Mr. Middleton says he cannot agree with me that there is any necessity for cement tests to be inconsistent. I did not say that, so fail to see how we disagree. Mr. Middleton says that when cement tests are carefully made, they are not even often inconsistent; that when they are it is because one man can and another cannot gauge cement. The conclusion to be drawn from those remarks is that the manipulator of the briquettes of which you published the results was not fit for the job. If Mr. Middleton had watched the gauger as I have for six years, he might think otherwise. At any rate, the assumed incompetence is liberal to a degree. A. NELSON BARNES.

Llanwddyn, January 26th.

Results given by Briquettes of Neat Cement, Gauged with Water, and with Sugar and Water.

Setting time of pats of each gauging of immersed briquettes.	Sugar.	Age of briquettes before testing, and resistance to tensile stress in lbs.						Setting time of pats of each gauging of briquettes kept in air.
		Immersed.			Kept in air.			
		7 days.	14 days.	21 days.	7 days.	14 days.	21 days.	
	oz.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
3 hours.	0	620	800	700	632	600	750	90 min.
8 min.	½	200	120	Failure.	200	270	342	36 min.
31 min.	1	70	66	45	272	310	320	3 hours.
2½ hours	1½	113	215	148	196	186	380	50 min.
40 min.	2	158	100	135	118	108	155	45 min.
50 min.	2½	122	222	112	150	230	141	30 min.
30 min.	3	125	245	136	178	300	323	47 min.
80 min.	3½	Failure.	22	Failure.	180	300	312	2 hours.

A. N. B.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending 5th February, 1887:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m.: Museum, 8206; mercantile marine, Indian section, and other collections, 2971. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 4 p.m.: Museum, 698; mercantile marine, Indian section, and other collections, 110. Total, 11,985. Average of corresponding week in former years, 14,032. Total from the opening of the Museum, 25,398,289.

RAILWAY MATTERS.

There are now 10,409 miles of railway open in India, earning over 5 per cent. on capital outlay.

A Vienna correspondent writes that the last rails on the Vranja and Salonica line were laid on Thursday, the 3rd inst.

The Midland Railway Company have in constant employment no fewer than 3200 horses; and of these 1000 are located in London.

The Victoria Railway Commissioners have accepted the tender of Messrs. J. Falkingham and Sons for the construction of the Great Southern Railway line at a cost of £251,271.

The tender of Messrs. Millar Brothers to construct a railway line between Clackline and Newcastle, Western Australia, a distance of thirteen miles, has been accepted by the Government for £39,000.

Some interesting trials of the interchangeable automatic continuous brake were made on Wednesday on a piece of level and straight line, on the Hadleigh branch of the Great Eastern Railway, particulars of which we propose giving in another issue.

Last month all the companies carried larger quantities of coal to London. The North-Western report an increase of 2600 tons, the Great Northern 11,700 tons, the Great Western 5500 tons, the Midland 15,000 tons, and the Great Eastern 29 tons over last year's corresponding figures. The total tonnage was 665,325 tons, against 624,434 tons. The quantity brought by sea was 477,799 tons, or 49,470 tons increase.

The report of the directors of the Dublin Tramways Company shows that the recourse to penny fares, from which a temporary loss was suffered immediately after they were introduced, has turned out to be a great benefit, not only to the public, but to the shareholders, who have adopted the recommended dividend of 5½ per cent., free of income-tax. The directors are forwarding a tramcar of their own make to the Manchester Exhibition.

The interim report of the Southern Mahratta Railway Company states that it is expected that, during the course of the first half of 1887, the whole of the lines now under construction will be completed and opened to public traffic, with the exception of the Southern Mahratta Railway, Deuli to Portuguese frontier, seven miles, and Mysore Railway, Tungabudra Bridge to Gubbi, 157 miles. Public traffic on the open portion of the company's line is necessarily undeveloped but is improving, the net revenue receipts having increased from £3420 in the first half of 1885 to £22,317 in the same period of 1886.

The reports of the principal railway companies announce their half-yearly dividends. Profits on lines south of the Thames have generally risen, and on the heavy lines to the north have not fallen much. Usually they have held their ground, and occasionally they show an improvement. Passenger traffic is the mainstay of the southern companies; a large part of it is of a holiday character, and none is more speedily affected by a decrease of national prosperity, and none is more prompt to indicate a revival. The experience of the South-Eastern and Chatham Companies, and of the South-Western, though its business is of a more mixed kind, has been similar.

Recent returns show that the natives of India are by far the largest sufferers from railway accidents, though the number of accidents generally is happily on the decline. In the quarter ending June last there were 154 fewer accidents than on the corresponding quarter of the previous year. There was a considerable increase in the number of accidents on the Southern Mahratta, South Indian, and Oude and Rohilkund Railway, chiefly attributable to trains running over cattle on the line. But all the other lines showed a decrease. On the Eastern Bengal Railway three passengers were killed and five passengers and one ballast coolie injured by a collision at Habra between a down train and ballast train standing on the siding. The total number of persons including passengers, servants, and others, as well as suicides, who lost their lives, was 104, as compared with 96 in the corresponding quarter of the previous year, and of those injured 202 as against 230. No fewer than 95 passengers met their deaths in carriages and at stations from causes unconnected with the working of the trains. In England these casualties would represent a large sum in damages, but in India the only penalty they entail is a loss in rolling stock, in injury done to the line, and in the temporary interruption of traffic.

Agriculture appears to be carried on with advantage in Belgium, though it is languishing in England. Its railway system is more complete than ours. The flatness of a considerable portion of the country has facilitated the introduction of a system of horse and steam trams, the latter generally drawing goods as well as passenger cars, which acts as feeders to the railway lines, and open communication with localities which would not remunerate the heavier cost of a railway, but which are thus sufficiently and advantageously developed. Road railways would help considerably towards giving cheap means of frequent and rapid communication in districts, where such are now wanting, and where our expensive main lines could not be made to pay. These latter cost on an average £42,000 per mile, whereas, Messrs. Bolling and Lowe remark in their iron trade report, the road railway would not cost, including equipment, more than £5000, and under many circumstances much less, and would do the required work and no doubt prove remunerative, especially in those places where small holdings abound. By this mode of conveyance they arrange abroad, to a great extent, to gather up and despatch the enormous quantities of small farm produce which reach this country daily. We do not hear of fruit and fish rotting there because they cannot be brought to market. The road railways also enable many industries to be carried on away from the cities by giving cheap conveyance to the working population.

The report of the City of London and Southwark Subway Company, to be submitted to the shareholders at the fifth half-yearly ordinary meeting on the 15th inst., states that during the past half-year the works under the Thames have made considerable and satisfactory progress. The sinking of the shaft in the river was completed without any accident, and, after the openings for the tunnels had been put in on both sides of the shaft, the shield for driving the first tunnel was fixed in position and operations commenced on the 28th October last. The work has been carried on since without intermission and without any serious difficulty being met with, and up to the present time, 1st February, about 600ft. of one of the permanent tunnels have been completed out of a total distance of 667ft. from the shaft at Old Swan Wharf, on the Middlesex side, to the Hibernia Wharf wall, on the Surrey side of the river. In a few days the first tunnel will be completed the whole distance under the river. Thus a new "Thames Tunnel" will have been finished in about fifteen weeks from its commencement. The driving of the second tunnel has been commenced, and from the experience already gained there is no reason to doubt that it will be as safely and speedily finished as the first. The directors have felt that the short distance from the City to the Elephant and Castle was not sufficient to fully develope the carrying capacity of the line; and have therefore deposited a Bill in Parliament for an extension from the Elephant and Castle to the Swan, at Stockwell, running nearly the whole distance underneath the great thoroughfare known as the Kennington Park and Clapham-roads. The traffic along these roads is very great, and the extension, can be carried out at a moderate cost, and is of such a character that it can be worked economically and well. When this extention is completed the entire length of the line will be three miles.

NOTES AND MEMORANDA.

We import weekly about £1,000,000 worth of corn and flour.

Calcined soda, anhydrous alum, kieserite, or oxychloride of magnesium, mixed into a paste by the process of M. Tietjens, will swell as it hardens, and is used by him to inject, by a suitably arranged pipe, into rock fissures, to stop flow of water.

In a new process of gilding glass, the inventor cleans glass surfaces with chloride of tin—pours thereon the gilding solution, the glass being heated and inclined. The gilding solution is prepared from chloride gold, 3 parts; caustic soda, 1 part; glycerine diluted, and mannite. The film of gold is thickened and preserved by a backing of silver—deposited from the usual silvering solution.

Referring to a method of hardening small steel drills in different ways, Mr. S. P. Davis, writing to the *Scientific American*, says:—"I found a man recently, in the United States Mint here, who bored holes through the hardest steel and plate glass with drills. He told me that he drove the point of the drill, heated to cherry red, into a cold bar of lead, and the result was a much harder temper than the hydrochloric zinc-killed acid bath."

During last week 2665 births and 1485 deaths were registered in London. Allowing for increase of population, the births were 281, and the deaths 586, below the average numbers in the corresponding weeks of the last ten years. The annual death-rate per 1000 from all causes declined to 18·4. During the first five weeks of the current quarter the death-rate averaged 2·18 per 1000, and was 2·5 below the mean rate in the corresponding periods of the ten years 1877-86.

Writing to the *Scientific American* on drilling hard steel, Mr. J. S. Charles says:—"Having occasion to drill through a very hard piece of steel, I tried a saturated solution of camphor—alcohol and gum camphor—and the result was marvellous, the drill apparently 'biting' its way through the steel. Thinking your readers might be profited by a knowledge of this feature in drilling, I offer the same for trial, with the hope that those using it may be as well satisfied with the results as your subscriber has been."

At a recent meeting of the Royal Society of Edinburgh Mr. John Murray read a paper on the total rainfall of the globe, and its relation to the discharge of rivers. 2243 cubic miles of rain fall annually on areas with inland drainage. Such areas extend to 11,486,350 square miles. The land draining directly to the ocean has an area of 44,211,000 square miles. If from this quantity we subtract all areas having less than 10in. of annual rainfall, we get 38,829,750 square miles. The mean discharge from this area into the ocean is 6569 cubic miles annually. The total weight of substances carried by this means to the ocean is rather more than 5,000,000,000 tons each year.

The census taken last May, and published on the 6th ult., shows the population of France to be 38,218,000, whereas in December, 1881, it was 37,672,000. This gives an increase of 546,000, whereas in 1881 the increase in five complete years was 766,000. In Paris the increase is only 75,000—namely, from 2,269,000 to 2,344,000, whereas last time it was 280,000. Lyons has the much larger proportionate increase of 25,000—namely, from 376,000 to 401,000. Marseilles has increased from 360,000 to 376,000, Bordeaux from 221,000 to 240,000, Lille from 178,000 to 188,000, Nice from 66,000 to 77,000. Roubaix has increased by 8000, and Toulouse and Tours each by 7000. The other large towns, with the exception of St. Etienne, which has fallen from 123,000 to 117,000, show an increase n no case exceeding 6000. The 53 cities or towns having more than 30,000 inhabitants, Paris included, show a net increase of 309,000.

Professor W. F. Barrett has found that the hard manganese steel wire has the extraordinary tenacity of 110 tons per square inch, a number confirmed by independent tests which the chief engineer of the Irish Great Southern and Western Railway Works had kindly made for Professor Barrett. The tenacity of ordinary steel wire is from 80 to 100 kilogrammes per square millimetre, as against 173·5 of manganese steel, the best pianoforte steel wire alone showing a higher tenacity than the manganese steel wire. The soft manganese steel wire had a tenacity of only 48 tons per square inch, with an elongation of nearly 20 per cent. The modulus of elasticity was also determined by the author by direct stretching. It was found to be lower than wrought iron, the mean number for the hard manganese wire being 16,800 kilogrammes per square millimetre, the soft manganese wire having a still lower modulus. The modulus for ordinary steel wire is 18,810, and for iron wire 18,610 kilogrammes per square millimetre; so that, though hard manganese steel has an enormous tenacity, it "gives" more than steel under sudden stress, recovering itself, of course, if the limits of elasticity are not passed.

The number of new books published in the year just closed was 3984, and of new editions 1226—a total of 5210. This is a falling-off of more than 400 from the publications of the year 1885, which were 5640 in number. Messrs. Sampson Low, Marston, Searle, and Rivington, to whom we are indebted for these figures, publish, as is their custom, an analytical table of the books published during the year. The table is divided into fourteen classes, and the numbers of each are as follows:—Theology, including sermons, 752; educational, 572; juvenile works and tales, 445; novels, 969; law and kindred subjects, 33; political and social economy, trade and commerce, 246; art, science, and illustrated works, 178; voyages and travels, 221; history and biography, 350; poetry and the drama, 93; year books and serials, 294; medicine and surgery, 171; belles-lettres, essays, and monographs, 479; and miscellaneous, 407. From the table of publications issued every month, it appears that January was the weakest, producing only 205 books. The number rose, with considerable variations, to 445, or more than double, in June, fell continuously to 258 in September, rose to 602 and 642 in October and November, and finally reached 852 in December. Most of the fourteen heads show a decrease. Novels increased from 455 to 755.

In a recent lecture before the Liverpool Astronomical Society, Mr. J. E. Gore, F.R.A.S., said:—"When the parallax of a binary was known, and the elements of its orbit satisfactorily computed, it was easy to find some of the masses of the component stars in terms of the sun's mass, and the real dimensions of the orbit. The parallax of a few of them had been ascertained. First, there was the famous binary star α Centauri, which, as far as was known, was also the nearest star to the earth. From its orbit, computed by Dr. Hind in 1877, combined with a parallax of 0·928″, he found the mass of the system = 1·79 times the sun's mass, and the semi-axis major 23·49 times the earth's mean distance from the sun. Assuming the latest elements found by Dr. Elkin (a = 17·50″, and period = 77·42 years), and his parallax of 0·798, he found the sum of their masses = 1·759, and the semi-axis major = 21·13 times the sun's mean distance. Second, η Cassiopiæ. Dr. Duner found for this binary a period of 176·37 years with semi-axis major = 10·68″. Combining these elements with O Σ parallax of 0·154″, Mr. Gore found the mass of the system = 10·722 times the sun's mass, and the mean distance = 69·35. The magnitude of the components was about 4 to 7·6; so they had a star of the 4th mag. with a mass about six times as great as that of α Centauri. The calculations of the elements of the well-known companion to Sirius were still more interesting, and there was no doubt that it was in rapid orbital motion round its primary, probably with a period of about 49 years. He had found the mass of this system = 71·63 times the sun's mass. Assuming the attraction of the companion to be the cause of the observed irregularity in the proper motion of Sirius, Auwers found that its mass must be about one-half that of Sirius; thus, we have the mass of a 10th mag. star greater than that of the sun."

MISCELLANEA.

Oil lamps are used in the streets of Kilkenny, and shopkeepers and consumers generally are paying 6s. per 1000 cubic feet of gas.

Work at the projected railway exhibition at the Bois de Vincennes commenced on the 7th, and of course "in presence of a large assemblage."

A new patent slip has been opened at Tanjong Rhoo, which will afford additional facilities for the repairing and overhauling of small steamers visiting Singapore.

It is thought that the Tay Bridge will be ready for goods traffic some time during the month of May, and the formal ceremony of opening will take place on June 20th.

The Imperial German Post-office is making extensive experiments with telephones. All places in the Grand Duchy of Hesse have just been telephonically connected, and should the experiment succeed the arrangement will be extended to the whole of Germany.

The rage for high towers has now taken effect in Belgium, and a design for a wood tower of Flamboyant type, and 300 metres in height, has been made by MM. F. Hennebeque and E. Néve, and proposed for erection in connection with the Brussels Exhibition of next year.

Messrs. J. and J. Hayes, of Leigh, have been making a series of exhaustive trials of carding engines, frames and mules made by all the principal machine makers in Lancashire, and have ordered the machinery for their large new mill of Messrs. Dobson and Barlow, of Bolton.

It is proposed, in accordance with Royal and Ministerial decrees, to open on the 1st of May next, at Milan, an international competition of corn driers, and especially of driers of Indian corn. Foreigners as well as Italians may compete. Two prizes are established, each of the value of 2000 lire, with a diploma of honour, for the best driers of Indian corn and rice respectively. Applications for admission must be forwarded to the Executive Commission, at the Ministry of Agriculture, Rome, by March 31st.

The use of kerosene is connected with the growth of diphtheria by a Dr. Wilson, of Meriden, Conn., who says that the use of kerosene oil was in no slight manner accountable for the seemingly otherwise inexplicable spread of diphtheria and the greatest percentages of fatal cases of diphtheria occur in households whose inmates employ kerosene oil for artificial illumination; and, further, his figures also show that all those who used either gas or candles, even when attacked by the malady, eventually reached a convalescent state.

Bristol College is offering wealthy men a chance of distinguishing themselves, as Sir Andrew Walker and Mr. Thos. Harrison have done at the University College, Liverpool. It is stated that in consequence of the financial difficulties of the Bristol College, and lack of endowments, the salaries of all the professors will be reduced by the council, and some chairs are to be abolished. The course pursued by the council has given rise to much discussion, and it must be hoped that the council may be as successful in their asking for money as have those at Liverpool.

The Central News correspondent at Gibraltar writes:—"It has transpired, at an inspection of H.M.S. Monarch's boilers, that she had a very narrow escape from a serious accident on her passage from Gibraltar to Port Mahon. It seems that when steam was being got up for additional speed, it was found that instead of the proper amount of water being in the boiler it had run nearly dry. Cold water was on the point of being pumped into the boiler, but fortunately a leading stoker opened the valve, thus preventing the boiler from bursting. A court of inquiry will investigate the affair."

Mr. George Kynoch, M.P., ammunition manufacturer of Witton, Birmingham, addressing his workpeople last Friday, said there could be no doubt that it was the defective cartridges in the Soudan that caused Colonel Burnaby's death; and Mr. De Lisle, M.P., had told him that it was also the cause of the death of his brother. The War-office were still making the same old style of cartridges, notwithstanding the announcement in the House of Commons that they would be made better in future. Reluctantly he sent in a tender for 500,000 cartridges for Queensland. It reached the War-office on Wednesday morning, instead of Tuesday, and he was told it was too late. The order was then given to a German, who actually had not a manufactory, and would have to build one before he could fulfil the contract.

The port of Limerick is somewhat in bad odour in commercial circles, and the latest occurrenee will not tend to improve matters in this respect. On Sunday morning the inner wall of the north side of the floating dock subsided, the ruins falling into the basin, and causing such commotion as to give rise to a scene of the utmost confusion while it lasted. The shipping moored within had a very narrow escape from serious damage. The harbour engineer, Mr. Hall, had anticipated the occurrence, and by his foresight prevented serious consequences following the mishap. The floating docks were built in 1815, at a cost of £70,000, and the damage done to the works by the present occurrence is estimated at between £8000 and £10,000. The Limerick Harbour Board held a special meeting with regard to the matter, and decided on taking immediate steps to prevent further damage being done by the force of high winds and tides acting on the breach already made in the works.

In answer to a question in the House of Commons on Tuesday by Mr. W. Corbet, Mr. Jackson said "The south or main pier at Arklow has been completed, with the exception of some unimportant work which is expected to be finished early in April. As regards the north groyne, the concrete blocks have been made, and the contractor has given notice that he will be able to proceed with the work early in March; but before anything further is done the question of the incidence of the cost of this portion of the work will have to be determined, in accordance with the provisions of the Arklow Harbour Act. It is to be hoped that dredging will not be required at the harbour entrance. In continuation of the reply which I made to a question of the hon. member on the subject of Greystones Pier and Boatslip in September last, I have to say that a fresh contract for the execution of the works was entered into, but continued bad weather had prevented any considerable progress being made. If adequate progress is not made by the new contractor the contract will be determined and other steps taken for the completion of the works."

On the 7th inst., the American Senate continued the discussion of Mr. Eads' Tehuantepec Ship Railway Bill. Senator Morgan—Alabama—resumed his speech on European relations to the Panama Canal. He held that the action of the English Government relative to Tobago and other islands in Panama Bay in settling upon and preparing to fortify them amounted to notice of its purpose to place itself in a position to command the Panama end of the canal; while on this side of the Isthmus it had a similarly strong position in Jamaica. He hoped that the American people had reached a point of determination at which they would say to England, "Whatever it is essential for us to have in the way of transit across the Isthmus, for the passage of our armies, ships, merchandise, and coastwise trade, we are entitled to in natural justice, and that we will have." The duty of the Senate was, he said, to enable the American Corporations engaged in the Tehuantepec project and the Nicaragua Canal project to go as far as they could with propriety to secure a foothold, and establish themselves if possible.

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

(*From our own Correspondent.*)

THE improvement in trade is developing slowly. There is no rush upon the exchanges in this district such as there has been in some other centres. At the same time the recent slight reaction in Scotland and Cleveland is being escaped here, since there has been no attempt to force the market to carry more than it could well bear We are therefore, it may be hoped, proceeding steadily in the revival which we are confidently expecting will become more marked as the year advances. Manufactured iron greatly needs increased vigour, and it is a revival in this connection that we must wait for.

On 'Change yesterday in Wolverhampton and to-day in Birmingham sellers of Midland pigs again resisted the efforts of consumers to pull down prices. The supply is now so limited that they indeed found no great difficulty in their way. A decision which has been come to within the past few days by certain of the Northampton owners not to blow in additional furnaces at present strengthened sellers' hands. The decision is that the market is not sufficiently strong, and prices scarcely high enough to warrant the blowing in of furnaces which were put out last autumn.

Forty shillings is now practically the minimum for Northampton pigs, which were freely sold last summer at 35s., and less. Good brands of Derbyshire are about 2s. 6d. per ton extra, making them 42s. 6d., and Lincolnshires are also quoted 42s. 6d. A waiting policy is being adopted by buyers. They are generally well bought, and have abundant deliveries to come in under previous contracts. Numbers of them are covered up to the end of the year.

Staffordshire pigs keep in excellent consumption, and makers are busier than for a long while past. There is not just now much talk of further increasing production. To do so would only be to work against an improvement in prices. In this branch rates have not strengthened to the same extent which marks imported pigs. All-mine qualities remain at 52s. 6d. to 55s. for hot blast and 75s. to 80s. for cold blast. Part mines keep at 40s. to 42s. 6d. and common 30s. to 32s. 6d.

Hematites to-day retain their recent strong position. The brisk American demand and the good orders which are being received from the steelmakers have the effect of keeping prices very firm. Good forge sorts from Lancashire and the west coast are still quoted 60s., delivered here, and foundry numbers 1s. 6d. to 3s. per ton extra. The Barrow Company quote 62s. 6d. for forge. Earl Granville's North Staffordshire mine pigs are quoted 43s. for forge, 45s. for No. 2 foundry, and 48s. for No. 1.

Sheet makers continue to give better accounts of the state of trade than do any other ironmasters. Galvanisers and other buyers of this class of iron are still expressing their requirements with a good deal of freedom, and the mills are kept going full time. Prices are firm, but a further advance of 10s. is needed before they have reached the point at which it will pay to restart the works now standing. Singles keep at £6 for galvanising purposes; doubles, £6 10s.; and lattens, £7 10s. per ton. By some makers 2s. 6d. and 5s. per ton more than these terms are quoted.

Capital reports are possible of the activity amongst the galvanisers. For delivery in Liverpool £10 10s. is about the figure for 24 g., packed in bundles. Some firms will take rather less.

The demand for steel sheets is rapidly on the increase, to the displacement, in some degree, of iron. Prices in this department are better than for iron.

Mild steel rolled by Messrs. Hatton Sons, and Co., Bilston, is quoted at:—Blooms and billets, £5 15s. to £6; boiler plates, £7 to £8; heavy sheets, singles, £9 to £10; doubles, £10 10s. to £11 10s.; and lattens, £12 to £13. Superior steel sheets for deep stamping purposes and for tinning are £10 to £11, according to specification, for singles, the exact prices all depending upon the processes through which consumers desire the metal to go in the matter of annealing and the like. The above prices for doubles and lattens are calculated upon the full "extras" of 30s. per ton, but the market assumes that in some cases only 20s. "extras" would be demanded, and this is a custom which is now becoming common.

The demand for marked bars is increasing. Ironmasters engaged extensively in this branch reported more favourably to-day than for some time past. Last month the out-turn at some of the Staffordshire works was nearly 50 per cent. in excess of the out-turn in the first month of a year ago. The better sales are on account both of the export and also the home markets; and the New British Iron Company have secured a four years' contract for supplying certain of the Admiralty contracts. Prices keep at £7 for first quality of marked bars, £6 for second quality, and £5 10s. for merchant sorts.

"Mitre" iron rolled by Messrs. Philip Williams and Sons, of Wednesbury Oak Works, is a uniform 5s. per ton less than the make of other list houses. Bars of $\frac{5}{8}$in., round or square, or $\frac{1}{2}$in. to $\frac{15}{16}$in., round or square, and flats 1in. by $\frac{3}{8}$in. or $\frac{7}{8}$in., are £6 15s., as against £7 by other firms. Strips from 1$\frac{1}{2}$in. to 6in. broad, £7 5s., and angle and plating bars also £7 5s. Sheets of 20 w.g. are £7 15s.; 24 g., £8 10s.; and 26 g., £9 10s. Wednesbury Oak branded qualities are quoted at £1 less than "Mitre."

Unmarked bars are selling slowly at £5 upwards, while sectional iron for engineering purposes is going off in increased lots. Common hoops are £5 10s., and superior sorts £6 5s. The Gas Strip Association is firmly maintaining its quotation of £5 5s. Nail strip of 24 g. in size is also quoted five guineas, and hinge strip is quoted at £6.

A case of iron of singular excellence has been prepared at the Round Oak Works of the Earl of Dudley, by the manager, Mr. Smith Casson, for transmission to Australia, where it will be shown at the Adelaide Exhibition which opens in June. Several specimens of his lordship's celebrated "L. W. R. O" brand are included, which have undergone tests, showing the remarkable ductility and tenacity of the iron. There is a 2$\frac{1}{2}$in. round of treble best crystalline iron which, tested to destruction, broke at 26·5788 tons per square inch of original area, while the reduction of area of fracture was 32·76 per cent., and the elongation 21 per cent. The crystalline bars, when nicked and broken, show a grain as fine as that of mild steel, and when case-hardened, bear a remarkable polish. Another specimen is a treble best crystalline 1in. square bar, which has been punched both ways and beaten out on an anvil into the form of a hand and a hatchet, while a 1$\frac{1}{4}$in. crystalline round has been split into five parts, each part being subject to tests of ductility. The base of the case is formed of massive specimens of girder iron, from 7in. up to 12in., which have been bent cold without showing signs of fracture; while the whole is surrounded by a ponderous 2in. round tied in a knot.

Coal is not brisk. Quotations for best house coal vary from 9s. to 10s per ton, and second quality 8s. to 9s. Forge coal is 5s. to 6s. Rough slack, 4s. to 5s.; and engine slack, 2s. 6d. to 3s South and North Staffordshire cokes are 11s. 6d. to 12s., with an improved demand.

The Board of Trade returns for January are of peculiar interest to the manufacturers of this district, since the most gratifying features of the returns are the increased shipments of iron and steel, machinery and mill work, hardware and cutlery.

For the past month there was an increase of 57,234 tons, or 26 per cent., in the quantity of iron and steel exported, and of £104,015, or nearly 6$\frac{1}{2}$ per cent., in value. In pig and puddled iron there was an increase of £14,374, or over 10 per cent.; in railroad iron the augmentation is £45,847, or nearly 18 per cent.; in cast and wrought iron it is £25,844, or nearly 7 per cent.; in hoops and steels it is £7782, or over 2 per cent.; in old iron it is £52,138, or 340 per cent.; and in unwrought steel it is £63,201, or 86 per cent. On the other hand, there is a decrease of £29,677, or over 21 per cent., in bar and angle iron; of £10,407, or 18 per cent., in wire; and of £54,181, or 79 per cent., in telegraph wire. The increase in railroad iron is due to the shipments to the United States, which took none in January, 1886, but over 15,000 tons last month.

It is noteworthy that Egypt has also been a better customer for this class of iron, as well as Australia. Italy has taken more of pig and puddled, and the United States a greatly increased quantity of unwrought steel. It would appear that the activity in the iron and steel is mainly due to Transatlantic requirements. The figures are as follows:—

Iron.	Month of January. 1886. £	1887. £
Pig and puddled	135,003	149,377
Bar, angle, &c	133,216	103,539
Railroad	235,172	301,021
Wire	53,168	42,761
Telegraph ditto	68,623	14,442
Cast and wrought	338,458	364,302
Hoops, sheets, &c.	235,138	242,920
Old iron	15,530	67,668
Steel, unwrought	73,083	136,284

The leading engineers and machinists are busy, and constructive ironwork orders are offered through merchants for rather heavy quantities. Ironfounders are better situated with orders for large castings.

The South Staffordshire hardware manufacturers have no reason to complain about foreign business. Large inquiries are being received from Australia and India, but unfortunately merchants compel the acceptance of low prices; and trade with the West Indies and with South Africa is improving steadily. There is no diminution in the orders from South America, and in some special branches there is an expansion.

The Cradley Heath chainmakers completed on Saturday six months of their strike. They have been reduced to a deplorable condition, and a settlement seems as remote as ever.

The Sharpness and Birmingham Navigation Company is about to adopt a plan which is likely to considerably benefit Midland traders. At a special meeting the shareholders have agreed to adopt the Acts empowering canal companies to vary rates on different parts of their navigations, and to enable the company to become carriers of goods upon its canal. This has been done to enable the company to undertake the lighterage between Sharpness and Gloucester; and if the plan succeeds the company will consider the desirability of extending the system to Birmingham and the Midland counties.

The Severn Navigation Commission have unanimously determined to oppose the Liverpool Water and Improvement Bill, which they consider will seriously interfere with their own interests. The promoters of the Bill are seeking powers to supply from the Severn an extensive district, which the Severn Commissioners understood to be "any place or plans within twenty miles of their aqueduct," and the aqueduct is some sixty miles long.

Mr. Kynoch, M.P., has been again speaking upon the refusal of the Government to obtain war supplies from English works. The enormous strength which the Government had in private manufactories was not, he said, appreciated by them, and at his works alone they were prepared to manufacture twice as many cartridges in one week for the service of the English army as they could at that expensive establishment at Woolwich. He complained of the action of the War Department in giving orders for the manufacture of cartridges to a German firm, when they could have been equally, if not better and more cheaply, made in England.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There is again very little change to report in the iron trade of this district; the market remains in an unsettled condition, and there is only a very limited weight of actual business doing. This, of course, tends to a further weakening of the market, and although there is perhaps no really quotable change in the current list rates, so far as prices can be tested by the small amount of actual business offering, the tendency is in the favour of buyers. The threatening aspect of affairs on the Continent has necessarily a disturbing influence, there is also a cessation of American inquiries which have been the chief stimulus to the recent rise in prices, and there is still the most discouraging feature of all, that the iron-using branches of industry in this district show no improvement. Makers of pig iron are, it is true, so well sold that for the present they are in the position of not being anxious sellers, but there is a competition springing up of iron held in second hands, which is forcing them to give way a little, and hematites are not so firm as they were, whilst in manufactured iron prices are gradually receding from the advance which was put on at the January quarterly meetings.

There was about an average attendance on the Manchester Iron Exchange on Tuesday, but only a very slow market. For common pig iron there was little or no inquiry. Normally quoted prices for Lancashire iron were about 39s. 6d. to 40s. 6d., less 2$\frac{1}{2}$, delivered equal to Manchester, and about the same figures represent the average basis for Lincolnshire iron, but there were district brands to be bought at quite 6d. per ton under these figures. Outside brands offering in this market were also easier in price; good named brands of foundry Middlesbrough were quoted at 45s. 4d. net cash, delivered equal to Manchester, but ordinary g.m.b.'s could be got at 6d. to 9d. per ton under this figure, and Scotch iron was offering at 2s. 6d. per ton under the prices which makers have recently been asking.

Hematite makers in most cases are holding pretty firmly to late rates, but there are good No. 3 foundry qualities to be got at about 58s. 6d., less 2$\frac{1}{2}$, delivered into the Manchester district.

In manufactured iron there is only a slow business doing, and even where makers have a fair weight of orders on their books, they find it very difficult to get specifications to keep their works going, and with second-hand lots there is some very low cutting in the market. The average prices for delivery into the Manchester district are about £5 to £5 2s. 6d. for bars, £5 7s. 6d. for hoops, and £6 10s. to £7 per ton for sheets.

Ironfounders report business as very slack, and in this branch of trade the prices which have to be taken to secure orders are quite as low as ever, notwithstanding the advance which has taken place in raw material.

The condition of the engineering trades can only be described as very discouraging all through. The anticipations of improvement which were so prevalent with the commencement of the year have not been realised, and a depressed tone characterises nearly all branches of industry, complaints that trade is even getting worse being very common in some quarters. Locomotive builders are rather better off for work, and the same may be said of railway carriage and wagon builders, but they are still only indifferently employed; machinists are also rather better supplied with orders, but these are chiefly for export, and scarcely any of the local firms are what may be termed really busy. Toolmakers are kept fairly supplied with work without, however, any real improvement in this branch of industry, and taking the engineering trades all through this district, it is only in exceptional cases that there is any real activity.

Brassfounders report a falling-off in the weight of work given out by engineers, with a continued absence of demand for marine fittings, which is an indication that there is no improvement in the shipbuilding trade.

Boilermakers, engineers, and steam users in the Manchester district have been very much exercised during the past fortnight by the appearance of a draft Bill for the registration and inspection of steam boilers, both in regard to their construction and their management by the users thereof. This draft Bill, which has been drawn up under an order from the Government by the officers of the Board of Trade, is so loaded and hampered with restrictions as to present an altogether unworkable condition of things both to the makers and the users of steam boilers. It does not appear that any concerted action has yet been taken by those most directly interested in this matter as the Bill has not yet been presented to the Legislature; but taking the tendency of such remarks as are current amongst engineers and steam users, the opposition to the Bill when it is brought forward is likely to be of a most obstinate and determined character. The object of the Bill is to control the construction and management of all boilers, except locomotives, under rigid Government inspection, but still leaving all risks upon the hands of the makers and users.

Notwithstanding the very severe weather which has been experienced since the commencement of the year, the erection of the buildings for the Manchester Royal Exhibition is making very satisfactory progress. So far as the engineering section of the Exhibition is concerned, it promises to be one of the most important that has ever been held, and for the machinery in motion a larger space has been provided than at any previous Exhibition, whilst for stationary machinery and other engineering work a very large space has been set apart. Notwithstanding this, the applications for space have far exceeded any possible limits for which accommodation could be provided, and the committee have had the very delicate task of selecting what they considered the most suitable. This has necessitated the cutting down of the space applied for in a great many cases, whilst many applications, if not actually refused, have had to stand in abeyance until it is seen whether they can be possibly entertained. Naturally a feeling of deep disappointment has been created in many quarters, and intending exhibitors who have been putting forth special efforts to introduce novelties and improvements of one kind or another have found themselves crippled because they have not been able to secure the requisite space for their exhibits. The committee have, however, endeavoured to do their best, and there is one very great satisfaction, that all the available space will be so fully occupied with what may be termed legitimate exhibits that the mere shop and bazaar element will of necessity be almost entirely eliminated.

In the coal trade there is a fair business doing, but the demand is beginning to show a falling off; and here and there collieries are either putting into stock or having to resort to a restricted output. All descriptions of fuel are plentiful in the market, and although there is no quotable change in prices, they are easier. At the pit mouth best coal averages 9s. per ton; seconds, 7s. 6d.; common house coals, 6s.; steam and forge coals, 5s. to 5s. 6d.; burgy, 4s. 6d. to 5s.; best slack, 3s. 6d. to 4s.; and common, 2s. 6d. to 3s. per ton.

In the shipping trade there has been a fairly active business doing; the dispute with the Scotch miners has thrown a number of orders into this market, chiefly for Ireland, and rather better prices have been obtainable, 7s. 6d. per ton being readily got for good ordinary qualities of steam coal delivered at the high level, Liverpool, or the Garston Docks.

The miners in the south-west Lancashire district have sent in applications to the colliery owners for an advance in wages of 10 per cent., and at the same time they have given notice that after the 21st inst. they will only work five days a week and eight hours per day. As to the advance of wages, there is not the slightest chance of the application being entertained by the employers; and as to the restriction of the output, it is scarcely necessary for the men to send in a formal notice that they will only work five days a week, when it is very probable that before long they may not be required to work more than four days a week.

Barrow.—More cheerful prospects are opening out in the hematite pig iron trade than was shown by the attitude of the market during the past two weeks. The demand fell off somewhat, but this was mainly owing to the fact that buyers found it difficult to place orders, as makers are so fully sold forward. The business which has been done in Bessemer qualities especially has been exceedingly large, and makers are in such a position as to deliveries that in many cases they cannot entertain contracts for delivery before Midsummer. There is a large consumption of Bessemer pig iron for steel-making purposes, and this remark applies equally to home makers of steel as well as to foreign and colonial producers. The latter, however, are encouraging an increased business in blooms and billets, in preference to taking parcels of pig iron or manufactured rails. There is a very full inquiry for blooms and billets, especially for America, and the outlook in most of the departments of the steel trade is good. There is a fuller enquiry for steel shipbuilding material, and shipbuilders are more hopeful than they have been for some time that new orders will be placed in their hands in the course of the next few weeks. Competition, however, in the shipbuilding trades bring prices down to a very low point. The finished iron trade is fairly but not actively employed. Steel forgings and steel castings are in rather better request. Steel wire and hoops are in slow sale. Iron ore is in good demand for forward delivery, but sales are not largely made, as raisers are looking hopefully forward for better prices. Quotations are given this week as follows:—Mixed numbers of Bessemer iron net, f.o.b., 52s. per ton; No. 3 forge and foundry iron, 50s. to 51s.; steel rails, ordinary heavy sections, £4 5s. per ton; plates, £6 5s.; and angles, £5 2s. 6d. It is true that sales of pig iron have during the past few days been effected at 48s. 6d. to 49s. per ton; but those makers who are best situated for orders are asking the full rates quoted above, and as they are so fully sold forward it is easily understood that the market is firm. There is an appreciable increase in the output of pig iron by the relighting of furnaces. Engineers are indifferently well off for orders, and ironfounders and boiler makers are still doing a quiet business.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

SEVERAL representatives of leading Sheffield establishments in armour plates, steel, iron, and ordnance, and other heavy material, have had an interview this week with the Secretary of State for War and the Surveyor-General of the Ordnance. They were received in a very friendly manner, and it is to be hoped that the results will be favourable to the interests of Sheffield, where the opposition to the Government competition in military material is naturally very strong.

The improvement in the iron and steel trade already noted continues, and gets greater.

The proposed amendment of the Merchandise Marks Act, 1862, will have an important bearing on Sheffield manufacturers. For years the Cutlers' Company has been endeavouring to draw the cords of commerce rather tighter to prevent fraudulent trading. Its efforts appear at last to be bearing fruit. At Rome it succeeded in getting a resolution carried by the International Property Convention, which practically means the exclusive use for this town and district, comprised in the term "Hallamshire," of the word "Sheffield." Previously "Sheffield," or some close imitation of the word, had been struck on wares which never were within our walls. Even at present it is known that Sheffield names and trade-marks are fraudulently imitated on goods which are intended to be passed off as high-class Sheffield productions. At home the bill to be introduced by the President of the Board of Trade is expected to be a salutary and stringent measure. The Town Council has appointed a deputation to wait upon the President of the Board of Trade, who has fixed next Saturday afternoon for the purpose. The Cutlers' Company will be represented by the Master Cutler, and Mr. H. Hughes, from the office of the law clerk.

The accumulation of spiegeleisen and iron at the furnace bottoms has long been a difficulty at local works. Explosions sufficiently effective to separate and dislodge the masses have been attended by peril to person and damage to property, and rather than incur the risk many furnaces have been left idle through the metal embedded in them. I noticed some blasting operations at the Atlas Works—Messrs. John Brown and Co.—last week. Still more successful explosions took place on Monday.

About 40 tons were operated upon. Eight holes were bored from 12in. to 26in. deep in the metal. In these holes were inserted cartridges of German dynamite, the quantity varying from 12 oz. to 18 oz. in each hole. The bulk of the mass was most effectively dislodged, not a piece flying eight yards from the scene of the explosion, which was made within twenty yards of the highway and fifty of the railway, and closely adjoining other furnaces and buildings. The upward tendency of iron and steel is causing makers to bring their plant into operation, and the clearing of the furnace bottoms is certain to be extensively undertaken, if the American "boom" is maintained.

At the Leeds Assizes on Tuesday Allen Beresford, engineman at Houghton Main Colliery, Barnsley, was brought up on the charge of manslaughter. It was alleged that the cage disaster at that colliery on the 30th of December, by which ten men lost their lives while being drawn to the surface, was in consequence of the prisoner's neglect in over-winding. Beresford was found not guilty. This verdict is very popular in the Barnsley district, where the engineman has the entire confidence of his class.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

But little business has been done in Cleveland pig iron during the past fortnight. By the end of last week the price of No. 3 g.m.b. had fallen to 36s. per ton. At the market held at Middlesbrough on Tuesday last the tone was somewhat firmer, but the rumours of war and the continuance of the strike at the Eston steel works had a depressing effect upon the market, and neither buyers nor sellers would operate largely. A few sales of No. 3 g.m.b. were made by merchants for prompt delivery at 36s. 3d. per ton, which is the same figure as ruled a week previously. Makers will not do business at this price. They quote 38s. to 39s., and are not anxious to sell at that.

For delivery over the second quarter of the year merchants ask 37s. The price of forge iron is the same as it was a week ago, viz., 35s. per ton; but one or two small parcels have changed hands at 34s. 6d.

Messrs. Stevenson, Jacques, and Co.'s current quotations are:—"Acklam hematite," mixed numbers, 50s. per ton; "Acklam Yorkshire"—Cleveland—No. 3, 39s.; "Acklam Basic," 40s.; refined iron, 54s. to 64s. per ton.

Warrants are in poor request both at Middlesbrough and at Glasgow; the nominal price is 36s. 6d. per ton.

The stock of pig iron in Messrs. Connal and Co.'s Middlesbrough store was on the 7th inst. 310,065 tons, which represents an increase for the week of 383 tons.

Shipments of pig iron from the Tees have improved somewhat this month. The total quantity which had left up to Monday evening last was 13,092 tons, which compares favourably with the 7994 tons exported during the first seven days of January.

The position of the finished iron trade does not improve. Prices are as last quoted, viz.:—Ship plates and common bars, £4 15s. per ton; angles, £4 10s. f.o.t. at makers' works, payment cash 10th, less 2½ per cent. discount.

The Cleveland ironmasters' returns for January were issued on the 4th inst., and show that 89 furnaces were in blast throughout last month, of which 51 were producing Cleveland and the remainder hematite and other kinds of pig iron. The total output amounted to 192,990 tons, or 303 tons less than during December. The stocks at the end of January stood at 651,517 tons, that being a decrease of 928 tons in comparison with those of the previous month.

The Tees Conservancy Commissioners have just pensioned off their secretary, Mr. Settle—an old and valued servant. To succeed him they have been so fortunate as to secure the services of Mr. J. H. Amos, hitherto secretary to committees of the Newcastle-on-Tyne Corporation. The loss of this gentleman from the locality where he has lived long, and where he has been always greatly respected, will be much felt. Besides his official duties, he has frequently undertaken others of a public character, and for an undertaking such as those it will not be easy to find a successor. He had much to do with the detail arrangements connected with the Stephenson Centenary, and with the visit of the Prince of Wales to Newcastle, and up to the present time he has filled the office of hon. secretary to the Newcastle Jubilee Exhibition; but, of course, just in proportion as his removal will be felt as a loss in Tyneside so it will prove a gain to Tees-side.

The strike at the Eston Steel Works continues. An interview took place on Friday last between Mr. Winsor Richards, general manager, and Mr. F. Hilton, works manager, on the one hand, and a deputation from the workmen on the other hand. The situation was discussed, but no settlement was arrived at. On Monday the works were thrown open to those who chose to re-commence on the employers' terms. The boilers and the gas producers were fired up by the firemen, and all other arrangements necessary for a start were made. But only a few men made their appearance at the commencement of either day or night shift, and so the attempt failed. There is no doubt but that if the Eston men succeed in obtaining any advance, the men at all other steel works in the district will follow suit.

The strike at the Northumberland collieries still wears a determined, if not obstinate, aspect. During the last few days a ballot has been taken to ascertain how far the compromise suggested by Mr. John Morley, M.P., had the approval of the miners. The proposal was that a reduction of 10 per cent. should be agreed to, less 1s. per week allowance or rebate to every man not occupying a colliery house. At several collieries the men refused to take any part whatever in the ballot, but between 9000 and 10,000, or about one-half of all on the strike, did record their votes. The result was that 8238 votes were given in favour of continuing the strike, against 1850 in favour of settling it on the terms named. The two-thirds majority required by the rules of the union was therefore more than secured, and so the strike continues.

Up to the present time the exports of coal from the Tyne do not appear to have been adversely affected by the strike. Indeed, if all the staithes on either bank be included, the shipments during January have exceeded to a very considerable extent those for the corresponding month of last year. If Tyne Dock alone be taken into account, the same may be said as regards last week's shipments. Whenever the slackness begins really to make itself felt it will naturally be mostly at the staithes on the north side of the river, and especially at the Northumberland and Albert Edward Docks. But as far as consumers generally are concerned, it is scarcely likely they will feel any scarcity at all, for competing collieries in other districts are already augmenting their outputs to a degree which in the aggregate will make up for any deficiency.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*

The present position of the iron trade can scarcely be regarded as satisfactory. A great strike of colliers has disorganised the arrangements for obtaining fuel, and threatens, unless it is speedily terminated, to lead to the damping of a proportion of the furnaces. Some of the manufactured iron and steel works are already partially idle on this account. As regards the pig iron market, there has been a rather improved tone, and a recovery to a certain extent from the rates to which the market had fallen. Further inquiries are also reported from the United States, although it does not appear that these have as yet resulted in the placing of orders of any consequence. The past week's shipments were small, being 5667 tons, as compared with 5621 in the same week of 1886. The additions to stocks in the warrant stores have been inconsiderable.

Business was done in the warrant market on Monday, between 44s. 6d. and 44s. 4d. cash. Tuesday's market was fairly active, with a further advance to 44s. 9d., closing with buyers 1d. less. On Wednesday there was a quiet business at 44s. 8½d. to 44s. 2d. To-day—Thursday—business was limited between 44s. 1½d. and 44s. 3d., closing with buyers at 44s. 2½d. cash.

The current values of makers' pigs are not as yet materially influenced by the state of the warrant market, and are in most cases a shade lower than they were a week ago. Gartsherrie f.o.b. at Glasgow per ton, No. 1, 52s.; No. 3, 45s.; Coltness, 58s. and 46s. 6d.; Langloan, 54s. and 47s.; Summerlee, 56s. 6d. and 45s. 6d.; Calder, 52s. and 44s.; Carnbroe, 49s. and 44s.; Clyde, 49s. and 44s.; Monkland, 46s. 6d. and 42s. 6d.; Govan, at Broomielaw, 46s. 6d. and 42s. 6d.; Shotts, at Leith, 51s. and 46s.; Carron, at Grangemouth, 52s. 6d. and 44s. 6d.; Glengarnock, at Ardrossan, 51s. 6d. and 45s.; Eglinton, 46s. and 42s.; Dalmellington, 49s. and 44s.

A scarcity of coals at a number of the malleable ironworks, as a result of the miners' strike, keeps, as hinted above, a considerable proportion of the furnaces idle for a time.

Steel makers are for the most part busy, but they are likewise experiencing some difficulty in obtaining fuel. Business has not yet been reported at the full rates to which plates and angles were recently advanced.

Arrangements are in progress for starting several new works in the neighbourhood of Glasgow. At Renfrew a steel works is to be erected for the production of castings such as are used in shipbuilding and engineering; while Mr. Peter A. Somervail has begun to lay down at Dalmuir large workshops, where he intends to carry on the business of steel and iron bridge, roof, and girder building.

The coal trade has been greatly hampered by the colliers' strike. In the past week there was shipped at Glasgow 4332 tons; Greenock, 60; Ayr, 3342; Irvine, 1015; Troon, 393; Burntisland, 13,118: Leith, 1492; Grangemouth, 6116; and Bo'ness, 595; total, 30,468, or 15,697 tons less than in the corresponding week of 1886. The prices of coals have risen very considerably to the domestic consumer in the course of the week. Shippers are either obliged to keep their ships waiting at the ports or go to England for supplies, and the coals being supplied for inland use are for the most part of very inferior quality, such as has been lying about the pits for a long time.

The colliers in several districts have been seriously disturbing the peace. At Blantyre they sacked a number of shops, carrying away and using the contents, which included quantities of spirits, and the Riot Act had to be read more than once and the crowds dispersed by the police. A number of persons were hurt during the disturbances, which were not entirely suppressed until the assistance of the military was obtained.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

The coal trade is decidedly better, and the several ports indicate distinct increase. Cardiff alone sent 160,000 tons away last week to foreign destinations, and if this can be maintained for a few weeks, it will prove that it is not due to an alarmist spurt, but is the result of a general improvement in trade.

I am sorry, however, to see that the labour ruptures of the North and of Scotland are being imitated in Wales and in Monmouthshire, though, fortunately, not accompanied with any violence, except in a solitary instance—that at Abercarne. At that place the tin-plate men are out on strike, and are resisting a 10 per cent. reduction. Last week there was a strong inclination shown towards rioting. The attitude of the men is causing a good deal of distress. Pontypool—late a flourishing town—is suffering considerably. The reduction in that quarter alone in the make of tin-plate tells also on colliery production and on tin-plate bars, so that ironworkers have in some quarters lessened employment.

The revival in the rail trade is still one of the promised blessings. There is some fencing going on about prices, and makers are holding back, refusing orders in many cases. Quotations have been advanced consequent upon the advance in ore, pig iron, and coke. A cargo of steel rails and sleepers left Swansea for Port Nolloth this week, and 1000 tons old rails for America. On Saturday nearly 4000 tons of iron were sent from Newport for the States. Still there is nothing like a good make of rails going on either for the colonies or home railways, and but for a good demand for steel bar ironworks would not be half so active as they are. Cyfarthfa is doing a large tin bar business, and its make appears to be strongly approved of. Some little upset amongst the Cyfarthfa colliers took place this week, but an agreement has been brought about and work resumed. The Tredegar colliers have had a meeting, and have agreed to contribute towards the sliding scale. The Werndda colliery dispute still remains unsettled, and promises to, as long as other collieries contribute to the relief of the unemployed. Coal remains unchanged in price. An effort made to put up best steam to 8s. 9d. at port has only been moderately successful, 8s. 6d. being the ruling price, and many descriptions of coal can be had at very different figures; 7s. 3d. is a common figure for seconds.

As the output of large steam increases, and consequently small coal is more plentiful, its price has become weaker, and 4s. 3d. is about the best figure obtained. House coal in several of the Monmouthshire districts is in fair demand, but generally there is not much activity in the trade. In the Garw district there is only moderate business, and at Gilfach last week trade was very quiet. At Penrhiwfer little doing. Some few steam collieries brisk.

I have referred to the tin-plate trade in Monmouthshire as very disorganised. In the Glamorgan district work continues active, and at Swansea there is little or no cause for complaint. A large number of orders has been booked of late, and makers are consequently careless of new business, which buyers are determined to keep back as much as possible on account of existing quotations.

Makers can afford to wait. Last week they despatched 62,491 boxes, and sent into storage only 29,000, leaving in stock but 171,830 boxes, as compared with 191,491 of the previous week. Large quantities of tin-plates continue as usual to go to America. Quotations are:—Bessemers, 13s. 6d.; Siemens stiff at 14s. 6d., sales in some cases effected at 14s. 3d.; coke wasters, 12s. 6d. Large cargoes are getting ready for next week.

The Penarth Railway contracts have been let to Messrs. Logan and Co.

The contract for the thirty and odd miles of pipes from Cardiff to Cwmtaff is proceeding well, and the vacant spots at Plymouth and Cyfarthfa works have been secured for the pipes.

NOTES FROM GERMANY.

(*From our own Correspondent.*)

In general there is little alteration to note in the Rhenish-Westphalian iron market since last reported, but it has shown a steady tone all through the week. Orders have come to hand regularly, though the demand is not quite so brisk as it was, because the merchants and dealers in finished iron, having supplied their requirements whilst prices were lower, are now more disposed to march quietly and watch what turn they are likely to take in the immediate future. The works are full of confidence in the future, although on the Iron Exchange a somewhat sobered-down tone prevails, which is perhaps a wholesome sign, which will prevent producers from becoming too sanguine, which might otherwise check the well-begun improvement. It is principally the pig iron prices which have gone up perhaps too rapidly, and time should now be allowed to let finished iron follow step, which is, however not yet the case. In Silesia, also, there is great confidence in the situation, and in anticipation of the Common Office in Berlin, for the sale of all the iron made in that district, being established. Large sales of both crude and finished iron have taken place at advanced prices, namely, M. 48 for forge, 50 for foundry pig, and 107·50 for common bars. In Belgium as well the market is steady, but the same complaints are heard there, as here, that raw iron has gone up in price out of all proportion to what can be realised for the finished product. The prices are unchanged since last week. In France the base price is now 145f. for merchant sorts of wrought iron. The Lyons-Mediterranean Company has just ordered 45,000 iron sleepers for Algeria, and the War Department for 775,000f. worth of Melanit-shells, 50,000 of 125 mm., and 25,000 of 220 mm. calibre. As regards ores in the Rhenish-Westphalia district, there is no alteration from last week's notation either in demand or price. The market for pig iron was brisk, and as large sales have lately greatly reduced stocks, prices could be well maintained. The demand for spiegel iron still continues, but the prices remain unchanged.

Foundry pig has had what may be called a good sale in comparison to the slowness of the demand for it for a long time back, and the prices have an upward tendency, indeed they have overstepped the base price settled by the convention.

In Bessemer sorts the situation is now more favourable than it was, and pig costs M. 49·50 p.t. Wrought iron has maintained its price, as the rolling mills are still fully employed, section iron of all sorts being in great request, and prices have advanced a shade. In December the demand was double that of the same periods in the two last years. The dealers seem thus to have seized the opportunity of filling up their stocks before the greater rise took place. Hoops and small sizes were lately raised by circular M. 5 p.t. There is no change to note in boiler and thick plates, and with the exception of a few favoured works the rest are poorly employed on them, whilst thin sheets and plates are in great demand for home and foreign account, the prices being very firm, with a rising tendency. Still, in spite of the enhanced prices, they are too low in comparison to those paid for the forge pig; this may also be said of wire rods, which are still being sent away in large quantities, and at somewhat increased prices from last quotations. Many of the steel works are not so well off for orders as others, and the former, it is said, have taken foreign ones under prime cost in order to keep their people employed. Messrs. Naylor, Benson, and Co., of London, have placed the first instalment of an order for steel blooms—20,000 tons—with the four following firms:—Krupp, the Bochum Union, Dortmunder Union, and Phœnix Company. The price is reported to be very little under that of rails, but the Americans prefer the steel in this form on account of the reduced duty. A report, which will certainly require confirmation, is current to the effect that an agent of Krupp is now in London presumedly with the object of mooting a fresh International Rail Convention, but at the same time to look after an order for 50,000 tons of rails, which it is said China is about to give out. The nominal price of rails is as last noted. There are more encouraging symptoms as regards work for the machine and iron construction shops, but the great complaint is the too low price, the pipe founders appearing to feel the pinch the most acutely. The brass founders are, with few exceptions, fully occupied, but prices will not rise; buyers, indeed, trying to depress them lower than they are, namely, red brass castings, M. 1·65 to 1·70; bronze, 1·55 to 1·65; phosphor bronze, 1·65 to 1·75 per ko.

There is no alteration to note in the coal and coke trade. The latter is brisk, the former normal for the time of year. Strenuous efforts are being made to create an export trade in Westphalian coals from Rotterdam, now that the new tip has been established there, and as a first attempt an English steamer—the first—has been chartered with coal, instead of leaving in ballast to seek a cargo in English ports. This may ultimately lead to a rival trade if the quality prove to be such as is required. It is reported that coal has been discovered close to the gate of Posen.

A works in Luxemburg is making and introducing a substitute for the wooden poles used in the cultivation of the vines, made of Bessemer steel. Its section is that of a T, and it has notches all down the edges, 10 c.m. apart, to prevent the binders slipping down which are used to tie up the vines. Nine advantages are claimed for these bars or staffs over the old wooden poles, amongst which are greater cheapness and durability. A staff 1 m. long costs M. 0·12. Therefore one of the common lengths of 1·50 m. and 2·00 m. M. 0·18 and 0·24 pfg., and for ½ pfg. a piece extra. A distinguishing mark is put upon them to avoid neighbourly or other annexation; furthermore, with an order for 1000 a suitable mallet to drive them into the ground is delivered gratis. If these were made in England, they might become an article of export to some of the wine-growing colonies or other wine countries where wood is becoming scarce, or even find a sale for gardens at home, as their cheapness—the 6½ft. staff costing less than 3d.—would recommend them, and they might be galvanised with advantage.

It may be mentioned that a London house is said to have ordered, through a Berlin firm, the purchase of 4000 tons of old horseshoes for export to China. It seems rather odd to go to Berlin for them, for of all places in the world experience would say this was the worst, for, as a rule, a very poor and irregular quality of iron—much of it from Silesia—is used there for shoeing horses, whilst in England a special sort is made and employed for the purpose, which must evidently be the better article for what the Chinese are said to require it, namely, for the manufacture of sabre blades and knives, for which purpose it appears to possess—as the Chinese seem to have found out—peculiarly good qualities. It is explained that the continual and regular concussions accompanied by the constant warmth communicated through the hoof to the iron produces a certain toughness and hardness which give it the required steely properties. Be this as it may, it is well known that old horseshoes have long been employed in the manufacture of the celebrated Toledo rapiers—no doubt those very thin shoes peculiar to the country made out of hammered charcoal iron.

AMERICAN NOTES.

(*From our own Correspondent.*)

New York, Jan. 28th.

Advices to-day from western iron centres, between Pittsburg and Chicago, point to a general strengthening of prices for finished iron steel, nails, season's hardware, and for shop machinery for spring and summer. To-day's advices from Kentucky and Alabama, and other Southern States, show a strengthening demand for southern pig iron, and an increased activity in all the iron-making establishments in the South. To-day's quotations for forge iron are 19·00 dols. to 19·50 dols.; foundry iron, 19·00 dols. to 22·50 dols.; according to number and quality. Rail blooms are quoted by brokers at 30·50 dols. to 31·00 dols.; double heads, 25·50 dols. to 26·00 dols. English Bessemer, 21·00 dols. to 22·00 dols.; billets, 32·00 dols. to 34·00 dols.; according to size and quality. Steel rails 39·00 dols. for large lots, and 40·00 dols. for small lots. Inquiries for English steel rails are in the market, and large blocks will be contracted for in a few days, at prices not far from 41·00 dols. to 42·00 dols. at gulf ports. American buyers are very reticent as to their purpose for the future; it is evident that they will be obliged to make very heavy purchases either in steel material for rails, or rails themselves. The mills are overloaded, and are avoiding as far as possible the taking of new orders.

In the forthcoming American Exhibition, Indian corn is to be shown in all its phases, from grain on the stalk, to the last refinement of manufacture in table delicacies. Indian corn, or maize, is very little used in Europe, and the purpose of this exhibit is to illustrate the wide variety of food products obtained from it, and also to afford instruction as to the methods of preparing starch, corn, sugar, whiskey, or glucose, paper pulp, and other products, from the "hoe-cake" of the southern darky to the hasty pudding of New England.

NEW COMPANIES.

THE following companies have just been registered:—

City of Chieti Waterworks Company, Limited.

This company proposes to acquire a concession from the Municipality of Chieti, in Italy, for supplying the town and neighbourhood of Chieti with water. It was registered on the 27th ult., with a capital of £80,000, in £5 shares, with the following as first subscribers:—

	Shares.
A. W. Sharp, 49, Sulgrave-road, West Kensington, merchant	1
G. Lowthean, C.E., 35A, Great George-street, Westminster	1
C. W. Jones, 32, Great George-street, Westminster, surveyor	1
A. Vivanti, 63, Cornhill, merchant	1
H. J. Lucas, 130, Loughboro' Park, Brixton, clerk	1
A. W. Connell, C.E., 35A, Great George-street	1
G. W. Larkman, 24, Davies-street, Berkeley-square	1

The number of directors is not to be less than two, nor more than three; the subscribers are to appoint the first and act *ad interim;* qualification, 10 shares. The remuneration of the board is not to exceed £150 per annum, or such larger sum as the shareholders may agree upon.

Garnier and Co., Limited.

This company proposes to trade as enamellers on iron and other materials, and as manufacturers of dials, medallions, jewellery, and other articles, and as advertising agents. It was registered on the 27th ult., with a capital of £2000, in £1 shares, with the following as first subscribers:—

	Shares.
Miss E. C. M. Heriot, 44, Argyle-road, Kensington	1
Miss M. V. M. Heriot, 44, Argyle-road, Kensington	1
Mrs. M. M. Heriot, 44, Argyle-road, Kensington	1
*A. A. M. Heriot, Scottish Club, 39, Dover-street	197
*C. Garnier, 77, Rosomand-street, Clerkenwell, enameller	197
Mrs. Garnier, 77, Rosomand-street, Clerkenwell	197
Miss K. E. Clark, 23, Mildmay-road, N.	1
Miss M. E. Roberts, 46, King's-square	1

The subscribers denoted by an asterisk are appointed joint directors. No shares except those applied for in the memorandum of association will be allotted, and no shares are transferable without the consent of the directors.

Marine Investment Company, Limited.

This company was registered on the 27th ult., with a capital of £100,000, in £100 shares, to acquire shares in the following steamers and in companies owning steamers, viz.:—Ours, Bothal, Agnes Otto, Sir Garnet Wolseley, Birch, Connaught, Helen Otto, Berganio, Cliveden, Edinboro, Bessarabia, Arthur, Bewick, Commonwealth, Prince Llewellyn, Aunty, Titian, Highfield, Magnolia, Cornucopia, the Commercial Steamship Company, Limited, the Corinthian Steamship Company, Limited. The subscribers are:—

	Shares.
E. T. Agius, 101, Leadenhall-street, merchant	1
H. Trumpy, 10, Chalcot-gardens, Belsize Park, clerk	1
F. A. Tagliaferro, 29, St. Lawrence-road, North Kensington, merchant	1
T. R. Eames, Fordyce-road, Lewisham Park	1
W. H. Northage, Mornington-road, Leytonstone, accountant	1
Conrad Briming, 21, Parkhurst-road, Holloway, merchant	1
J. W. Butchant, 6, Banchory-road, Blackheath, clerk	1

Mr. E. T. Agius is appointed manager.

Matlock and District Gas Company, Limited.

This company proposes to acquire the gasworks and business of the trustees of the will of James Winson, deceased, situate at Matlock, Bath. It was registered on the 29th ult., with a capital of £17,000, in £10 shares. The subscribers are:—

	Shares.
*R. Wildgoose, The Poplars, Holloway	1
*C. Hill, Cromford, merino spinner	1
*S. Skidmore, Matlock, draper	1
*F. C. Arkwright, J.P., Cromford	1
*W. Harrison, J.P., Matlock	1
*T. C. Drabble, Matlock, stone merchant	1
*W. Wright, Matlock	1
*W. Moxon, Matlock, physician	1
*W. B. Hunter, M.D., Matlock	1
R. Hall, Matlock, accountant	1

The number of directors is not to be less than seven, nor more than nine; the first being the subscribers denoted by an asterisk. The company in general meeting will determine remuneration.

New Portable Electric Lamp and Power Syndicate Company, Limited.

This company proposes to acquire inventions in connection with the production and use of electricity, and, in particular, a certain patented invention referred to in an unregistered agreement of the 30th of December, entered into with Benjamin Nicholson. It was registered on the 2nd inst., with a capital of £9000, in 45 shares of £200 each. The subscribers are:—

	Shares.
George Marquis de Stackpoole, Mount Hazel, Galway	1
F. Holme Sumner, Ottershaw Cottage, Chertsey	1
B. Nicholson, 4, Coleman-street, accountant	1
D. Parrish, Bromley, Kent	1
N. Story Maskelyne, M.P., Swindon	1
H. Hoare, 5, Moorgate-street	1
J. F. Jackson, J.P., Bexley	1

The number of directors is not to be less than three, nor more than ten; qualification, one share; the subscribers are to appoint the first; remuneration, £100 per annum, and 15 per cent. of the net profits remaining after payment of a 10 per cent. dividend.

James, Hosking, and Miller, Limited.

This company was registered on the 27th ult., with a capital of £25,000, in £5 shares, to acquire the enamelled slate and marble manufactory, Moor-street, Aberystwyth, and the Gwaralltyfedre Stone Quarry, situate in the parish of Llandyssal, Cardigan, and the goodwill of the business carried on there by Messrs. James, Hosking, and Miller. The subscribers are:—

	Shares.
F. Spurling, 140, Southampton-row	5
Major-General C. F. Brown, Harlesden, N.W.	1
F. Bridger, 5, Salisbury-street, Strand, journalist	20
S. M. Hosking, Aberystwyth	1
S. Y. Crop, 3, Frederick-place, Old Jewry, clerk	1
Sir A. E. Campbell, Bart., 5, Mitre-court, E.C.	10
Cuthbert Vaux, Howard Lodge, Woodside, S.E.	20

Registered without special articles.

"Maryland" Steamship Company, Limited.

This company was registered on the 28th ult., with a capital of £35,000, in £20 shares, to acquire the s.s. Maryland, now building by William Gray and Company, of West Hartlepool. The subscribers are:—

	Shares.
*B. N. Baker, Baltimore, U.S.A., merchant	1
J. P. Hooper, 31, Lombard-street, steamship owner	1
*A. S. Williams, Lombard-street, steamship manager	1
S. Maclachlan, 21, Lime-street, merchant	1
A. H. Hillen, 230, Hill-street, Kennington Park, S.E., accountant	1
J. W. Bartlett, 111, Grosvenor Park, Camberwell, clerk	1
H. G. Webb, 22, Blythewood-road, Crouch Hill, accountant	1

The first directors are Messrs. Bernard Nadal Baker, G. B. Baker, and A. S. Williams; the company in general meeting will determine remuneration.

Ormerod, Grierson, and Company, Limited.

This is the conversion to a company of the business of engineer, millwright, and wheel and pulley manufacturer, carried on by Sir E. F. Piers, Bart., trading as Ormerod, Grierson, and Company, at St. George's Ironworks, Hulme, near Manchester. It was registered on the 31st ult., with a capital of £100,000 in £5 shares. An unregistered agreement of the 28th ult. regulates the purchase. The subscribers are:—

	Pref. Shares.
E. Wilmot Witham, 1, Mincing-lane, printer	1
J. N. Rowbotham, 4, Union-court, merchant	1
P. H. Stevens, 69, Rectory-road, E., accountant	1
Eustace F. Piers, 5, Westminster-chambers, engineer	1
T. Bouwens, 38 to 42, Bermondsey-street, chocolate manufacturer	1
R. C. Hanrott, 14, Bedford-row, solicitor	1
Lieutenant-Colonel W. G. N. Burney, 6, Vigo-street	1

The number of directors is not to be less than three, nor more than seven; the subscribers are to appoint the first and act *ad interim;* qualification, the sole ownership of a single share. The company in general meeting will determine the remuneration of the board.

THE PANAMA CANAL.—Writing to *Science* on this subject, Mr. Frank Goodwin, Framingham, Mass., makes some comments which are worthy of notice. "The article with the above title, from the pen of M. de Lesseps, copied by you in December 3rd issue from the *Scottish Geographical Magazine* for November, contains some errors both of fact and of inference. Commercially, the needs for and uses of the canal are misstated and overestimated. Trade must follow certain routes, governed by the earth's form and dimensions, and by the winds that blow or do not blow. For fear of the calm belt in Gulf of Mexico, the captain of a big ship, loaded with guano or nitrate of soda, would rather face the gales off Cape Horn. Because of the 'trades,' sailing ships from India to Australia would still go home *via* Cape of Good Hope. I have yet to meet a captain who would not elect Cape of Good Hope rather than Panama if loaded at a port even as far east as Philippines. A sailing ship bound from San Francisco to Liverpool would think twice before she paid anything to be put into the calms in land-locked water off Colon. Many captains have told me they would go on around the Cape Horn. Many cargoes are put on to sailing ships *because* they will be longer at sea than if sent per steam. It is no uncommon thing that a sailing ship gets the same, and even more, freight than a steamer, because of the exigences of the shipper or the condition of the market for merchandise. Hence the assumption that any of his '2' (p. 519), or that all of '1' or '3,' would seek Panama, is unfounded. A fair estimate, granting the correctness of his figures, would throw out '2,' and halve '1' and '3,' and leave, say, rising 2,000,000 tons per annum. In the table of distances, same page, London to Sydney, Havre to Sydney, he conveniently forgets that that traffic would use Suez rather than Panama. I fancy it is not generally known that the entire traffic of Suez is steam. There has never been an American merchantman through Suez, nor a sailing ship of any nationality. The few sailers that have passed through were towed, not only through Suez, but the entire distance to and from the port of departure, Bombay, and destination, Malta. Practically, the entire traffic on Suez is steam But M. de Lesseps does not refer to the most important factor in the problem. The evolution of the marine engine is still progressing. Steamers of moderate size and speed already approximate the expenses of sailers, not counting the further saving in interest on plant by reason of more frequent 'turns,' *i.e.*, though a steamer may cost more than a sailer, the former makes more voyages in a year, *i.e.*, earns more frieghts. Before the Panama Canal is finished, I doubt not such progress will have been made in compounding engines and in expansion of steam, that few new sailers will thereafter be built. The carrying trade of the world will be done by steamers, just as the passenger trade has passed into their hands. Soon, as nations reckon life, sail will be limited to cruising for pleasure, fish or whale, or scientific research: even these will have steam power to go and come to place of resort. This change might and probably would throw the traffic of west coast America with east coast America and Europe into Panama Canal; but Australia and India with Europe and America, never."

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.

31st January, 1887.

1517. METALLIC COVERED TUBES, F. Madeley, London.
1518. TAKING-UP CATCH MECHANISM employed in LOOMS for WEAVING, H. Ainsworth, W. Campy, and J. Anderton, London.
1519. EXPELLING and RENDERING INNOXIOUS SEWER GASES, H. H. Lake.—(*L. L. Benson and W. T. Stilwell, United States.*)
1520. SHELL and CARTRIDGE CASES, A. Greenwood, London.
1521. FOLDING PIPE STEM, G. H. Hill, London.

1st February, 1887.

1522. LAYING UNDERGROUND ELECTRIC CONDUCTORS, D. Brooks, London.
1523. AUTOMATICALLY REGISTERING the FLOW of LIQUIDS, C. A. Marriott, Handsworth, and W. Norris, Birmingham.
1524. THRASHING MACHINES, A. W. Mantle, London.
1525. ELIMINATING PERNICIOUS PARTICLES from ATMOSPHERIC AIR, H. W. Newton, Newcastle-on-Tyne.
1526. GRINDING, &c., CARDING ENGINE CYLINDERS and FLATS, J. Bullough, Accrington.
1527. AUTOGRAPHIC TELEGRAPH, H. J. Allison.—(*The Writing Telegraph Company, Incorporated, United States.*)
1528. SELF-ADJUSTING CONNECTING LINKS, J. H. Parker and T. Mason, Birmingham.
1529. COMBING MACHINES, T. Willis, Manchester.
1530. MARINER'S COMPASS and BINNACLE, D. McGregor, Glasgow.
1531. ELECTRIC LIGHTING APPARATUS for LOCOMOTIVE ENGINES, H. L. Pyle, London.
1532. FORMING FLOORS, T. A. Woolldridge and T. Jones, Birmingham.
1533. PHOTOGRAPHIC CAMERAS, &c., W. J. Lancaster, Birmingham.
1534. CORK-SCREWS or CORK-DRAWERS, F. R. Baker, Birmingham.
1535. CONTINUOUS PRODUCTION of METAL BARS and RODS direct from the MOLTEN METAL, C. M. Pielsticker, London.
1536. MACHINES for SCORING CARDS, &c., H. Stevenson and D. Nichols, Manchester.
1537. BISCUIT BOXES, J. and R. H. Meeson, Park Wood Springs.
1538. ASBESTOS to OIL LAMPS, &c., as a NON-CONDUCTOR of HEAT, E. Sherring, Manchester.
1539. OPERATING AUTOMATIC BRAKES for RAILWAY CARS, A. G. Brookes.—(*B. C. Rowell, United States.*)
1540. DABBING BRUSHES employed in MACHINERY for COMBING FIBRES, W. H. Cockcroft and S. Best, Bradford.
1541. PRESERVATION of SHIPS, A. Young, South Norwood.
1542. LETTER and ACCOUNT FILES, S. Reid, Newcastle-on-Tyne.
1543. HORSE-SHOE, W. Hanton, Glasgow.
1544. IRONING and PRESSING MACHINES, R. B. Sanson, London.
1545. PACKING MATERIAL, A. Umbeck, Barmen.
1546. RESTS or CHAIRS for RAILWAY POINTS, &c., J. Worthington, Blackpool.
1547. PACKING for STUFFING-BOXES, &c., T. Grimshaw, and H. Skelton, London.
1548. STREETS, &c., for the BETTER REGULATION of TRAFFIC, F. F. Abbey, Huddersfield.
1549. GIVING SHOCKS of ELECTRICITY by placing a COIN or COINS to work APPARATUS, F. E. Stuart, Twickenham.
1550. INK BOTTLE, F. Foster, London.
1551. ECONOMISING GAS for LIGHTING and HEATING PURPOSES, J. Torkington, J. A. Ewins, and C. Torkington, Birmingham.
1552. CASE to HOLD a PIPE, &c., W. J. Simmons, Taunton.
1553. NEEDLE-POINTED CARDS, W. Brierley, Halifax.
1554. AUTOMATIC FIRE-EXTINGUISHING APPARATUS, J. B. Hannay, Glasgow.
1555. DRY SLIDE, H. Hateley and J. Lea, Birmingham.
1556. NEW MATERIAL for the CONSTRUCTION of MATS, G. H. Seddon, Huddersfield.
1557. DOLLY WASHING MACHINES, W. H. Summerscales and J. Greenwood, Halifax.
1558. VELOCIPEDES, &c., C. H. Guest and L. Barrow, Birmingham.
1559. VELOCIPEDES, &c., C. H. Guest and L. Barrow, Birmingham.
1560. ALTERATION of GAUGE in ROLLING STOCK, W. J. Ewing, Letterkenny.
1561. SECURING STAIR RODS, W. W. Lunt, Wolverhampton.
1562. MAKING LEATHER WATERPROOF, E. Dunkley and A. Dunkley, Northampton.
1563. SCORING CARDBOARD for BOXES, J. G. Horsey, Catford
1564. BRACE, E. A. Herbert, Erith.
1565. IMPERMEABLE EARTHERNWARE COFFIN, M. Wyatt, London.
1566. METAL CORNER for CARDBOARD BOXES, J. G. Horsey, Catford.
1567. LADDERS, J. T. Guest, London.
1568. OIL LAMPS, H. Mills and W. Borick, Halifax.
1569. GAS CARBON, F. H. Snyder, London.
1570. CIRCUIT-CLOSING APPARATUS for ELECTRIC BRAKE, &c., E. E. Ries, London.
1571. OPERATING ELECTRIC BRAKES, E. E. Reis, London.
1572. DRAUGHT REDUCERS for VEHICLES, C. W. Pearsall, London.
1573. MANUFACTURE of SCREWS, J. H. Ladd.—(*H. A. Harvey, United States.*)
1574. GARMENT SUPPORTERS, R. S. Willard, London.
1575. SCREWS, J. H. Ladd.—(*H. A. Harvey, United States.*)
1576. CAR WHEELS, E. Peckham, London.
1577. SAFETY VALVE, J. Foord and W. W. Paddon, London.
1578. HOOKS for the SUSPENSION of ARTICLES of DRESS, J. B. Moorhouse, Skipton-in-Craven.
1579. METAL HANDLES for OPENING and CLOSING DOORS and DRAWERS, H. A. Done, Sutton Coldfield.
1580. HOLDERS for PENS, J. Y. Johnson.—(*H. Berolzheimer, United States.*)
1581. VELOCIMETERS, J. Boyer, London.
1582. BOILER CLEANING COMPOUNDS, A. J. Boult.—(*S. W. Merryman, United States.*)
1583. NUTS, J. H. Burdick, London.
1584. ELECTRIC SIGNALS for ENGINES, J. C. Ricketson, London.
1585. CORSETS, J. A. House, London.
1586. MACHINES for the DELIVERY of CIGARETTES, F. J. A. Goodacre and E. P. Phillips, London.
1587. SETTING DIAMONDS, E. Brockhuysen, London.
1588. PIT CAGES, T. Smith, Liverpool.
1589. SCRAPING and CUTTING SOAP, P. Gill and T. Osman, Liverpool.
1590. VEHICLES for the CONVEYANCE of DEAD MEAT, W. C. Mowbray, London.
1591. CLOCKS, E. E. Wigzell, London.
1592. TRICYCLES, L. P. Valiquet, London.
1593. LEAD and RULE HOLDERS for PRINTERS or COMPOSITORS, J. C. Mewburn.—(*A. A. Low, United States.*)
1594. WHISTLES, G. Meerch and C. Dold, London.
1595. ELECTRICAL BATTERIES, W. and A. Beissbarth and C. Fleischmann, London.
1596. STRETCHING TROUSERS, &c., S. D. Blogg, London.
1597. CLOD CRUSHERS or PULVERISERS, H. H. Lake.—(*D. Lubin, United States.*)
1598. PREVENTING DAMAGE by OVERFLOW or LEAKAGE of WATER, H. H. Lake.—(*L. Weil, United States.*)
1599. HARDENING and TREATING BONE, H. V. and J. E. Stacey, London.
1600. MEDICINAL COMPOUND for ANIMALS, J. Everitt.—(*J. A. Sewall and W. H. Stennett, United States.*)
1601. STORM-WATER and TIDAL VALVES, A. C. Trew, London.
1602. APPARATUS for RAISING, LOWERING, and HAULING, T. Bass, London.
1603. PYROTECHNIC DISPLAYS, C. H. Thayer, London.
1604. DETACHABLE CHAINS, A. Bagshawe, London.
1605. BRACKETS, &c., A. Barker and C. Groombridge, London.
1606. MATCH BOXES, D. Lindo, London.
1607. MATCH BOXES, &c., D. Lindo, London.
1608. CASKS, &c., P. A. Newton.—(*G. R. Nafis and W. C. Dunn, United States.*)
1609. ELECTRICALLY WOUND CLOCKS, W. J. Barnsdale, London.
1610. HOLDING SEWING BUITONS to FABRICS, J. F. Haskins.—(*H. H. Cummings, United States.*)
1611. METALLIC REELS, &c., G. Tucker and J. Wilday, London.
1612. INDICATING in CARRIAGES the NAMES of RAILWAY STATIONS, J. Moss and C. B. Hunt, London.
1613. SWING CORNICE POLES, &c., M. Jacob, London.
1614. ROVING FRAMES, J. Wallace, jun., London.
1615. BYE-WAY COCK, A. Edmeades, London.
1616. GAS STOVES, &c., J. Westwood, London.
1617. CRABBING FABRICS, E. Kemp, Leeds.
1618. PATTERN LINOLEUM PLATE, A. B. Herrfeldt, London.
1619. BOOTS and SHOES, C. E. Bird, London.
1620. RECEPTION of COIN, J. S. Wallace, London.
1621. RECEPTION of COIN, J. S. Wallace, London.
1622. SEWING BUTTONS, J. F. Haskins.—(*H. H. Cummings, United States.*)
1623. BOTTLES, P. England, London.
1624. LOADING and DISCHARGING COAL, G. Taylor, London.
1625. LACE MACHINES, A. M. Clark.—(*E. Darchicourt, France.*)
1626. ATTACHING WOVEN WIRE to BEDSTEAD FRAMES E. Peyton, London.
1627. MENU HOLDER, J. Baker, London.

2nd February, 1887.

1628. ELECTRIC MEASURING INSTRUMENTS, W. T. Goolden and S. Evershed, London.
1629. OILCLOTH COVERS, W. Higson, London.
1630. SEPARATING or SORTING PEAS, &c., T. R. Banks, London.
1631. SLIDE VALVE and PORTS for an ENGINE, A. H. Wallace, Basingstoke.
1632. SPRAY LAMPS or BURNERS, J. B. Hannay, Glasgow.
1633. EMBOSSING, A. N. Hopkins, Birmingham.
1634. LAMPS, F. R. Baker, Birmingham.
1635. KEGS, W. S. Bradley, Bilston.
1636. SASHES, M. Stansfield, Yorkshire.
1637. CAMERAS, G. W. Elliott, Sheffield.
1638. SPINDLES, J. Lyon.—(*R. Roscoe, India.*)
1639. LOCKS, J. Edwards, London.
1640. MACHINERY, J. S. Sutcliffe and J. S. Smith, Manchester.
1641. BOTTLES, A. Philburn and A. Moors, Ashton-under-Lyne.
1642. BOOT PROTECTORS, J. Blakey, Halifax.
1643. GAUGES, G. Fisher, Stroud.
1644. CORK, J. Smith, Staffordshire.
1645. HOLDER, H. Whitfield, Birmingham.
1646. SHAVING, H. Lyon, Manchester.
1647. BEARINGS, C. Holmes, I. Pearson, and N. Midgeley, Bradford.
1648. REMOVING BUR in WOOL, T. Speight, Bradford.
1649. PADS, R. E. Sissons, Stroud.
1650. BRAKE, J. Boon, Devonshire.
1651. CAR, J. H. Smith, jun., Bristol.
1652. PINS, I. Greenbury, Edinburgh.
1653. GOODS, R. G. Oliver, London.
1654. BELLS, W. Kingsland, London.
1655. BOOKBINDING, D. Forbes, Glasgow.
1656. FUMES of GAS, &c., M. Bailey and J. Warner, London.
1657. INK, C. J. Smith and J. S. Tanner, London.
1658. BELTS, M. Gandy, Liverpool.
1659. CABLES, E. de Pass.—(*La Société d'Exploitation des Cables Electriques, Système Berthoud, Borel, et Cie., Switzerland.*)
1660. SWITCH-POINT, W. J. Cowan and F. Mitchell, Newcastle-on-Tyne.
1661. CAMERA, G. P. Smith, Tunbridge Wells.
1662. TRUNCHEON, G. Pinder, Birmingham.
1663. PINS, G. and T. Claughon, London.
1664. SEAT, A. J. Box, London.
1665. UNICYCLE, J. A. Iliffe.—(*A. Hewitt, New South Wales.*)
1666. TOOTHED ROLLED WIRE, J. Schmidt, London.
1667. ELECTRIC ILLUMINATION, &c., M. McMullin, London.
1668. COLOURING PHOTOGRAPHS, P. Ward and S. W. Oliver, London.
1669. PAPIER-MACHE HOLLOW VESSELS, &c., P. Cook, Glasgow.
1670. BOBBIN WINDING MECHANISM, A. J. Boult.—(*A. Delavigne, France.*)
1671. SELF-ACTING MULES and TWINERS, R. L. Holt, London.
1672. MAKING FABRICS REPELLENT to WATER, A. T. Wedelin, London.
1673. MALTING and DRYING MALT, &c., J. M. Anderson, Glasgow.
1674. ENGINES or MOTORS, H. H. Lake.—(*C. Lallément, France.*)
1675. LIFTS, &c., E. T. Cleathero, London.
1676. SEWING MACHINES, S. Keats, London.
1677. WEIGHING MACHINES, H. E. Newton.—(*M. E. Bennett, United States.*)
1678. CARBURETTORS, D. Duvilers, London.
1679. MEASUREMENT of the FOOT, R. Haddan.—(*G. Laurent, France.*)
1680. COMPOSITION for COATING PULLEYS, &c., T. H. Wright, London.
1681. PHOTO-CHEMICAL PRINTING, W. Willis, London.
1682. EMBROIDERING APPARATUS, J. W. von Pittler, London.
1683. AIR ENGINES, &c., P. J. Lynam, London.
1684. ARTIFICIAL FUEL, W. H. Lindsay, London.
1685. SIGNAL LAMP, S. H. Gladstone.—(*G. W. Lyth, Sweden.*)
1686. COVERING WIRE with INSULATING MATERIAL, W. S. Smith, London.
1687. FUZES for EXPLODING SHELLS, W. Anderson and J. G. Buchanan, London.
1688. AUTOMATIC DRAUGHT PREVENTER, D. F. Sorfleet, London.
1689. NEW HOUSEMAID'S BOX, &c., T. Poole, London.
1690. PRESSURE REGULATOR for LAMPS, J. J. Gilks, London.
1691. INK BOTTLES, W. C. Church, London.
1692. INK BOTTLES, W. C. Church, London.
1693. DISC DYNAMO MACHINES, C. D. Abel.—(*La Compagnie Continentale Edison, France.*)

3rd February, 1887.

1694. ALKYLISED DIAMIDOBENZOPHENONE AMINE CHLORIDES, O. Imray. — (*The Farbwerke vormals Meister, Lucius, and Brüning, Germany.*)
1695. MACHINES OPERATED by a COIN, F. C. Lynde, Manchester.
1696. SKATES, J. Sieper, Manchester.
1697. STEAM TRAP, W. M. Porter, Belfast.
1698. WASHING APPARATUS, E. Goodison, Bradford.
1699. UTILISING SEWAGE SLUDGE, D. Craig, Bradford.
1700. ELIMINATING IMPURITIES from IRON, J. G. Wright, Wolverhampton.
1701. FORMING BISCUITS, J. and T. Vicars and J. Vicars, jun., Liverpool.
1702. FEEDING FUEL to FURNACES, J. and T. Vicars and J. Vicars, jun., Liverpool.
1703. WHEELS for VEHICLES, J. Adams, Ashburton.
1704. WEDGING DOWN COAL, &c., M. Coulson, Spennymoor.
1705. POTATO PLANTING MACHINERY, E. Buckle, Prestwich.
1706. PNEUMATIC HAMMERS, G. Glossop, Sheffield.
1707. WIRE, A. Lee, Sheffield.

1708. Syphon Flushing Cistern, H. Roberts and T. Osborne, Sheffield.
1709. Stop Cocks, A. F. Baird.—(*Messrs. Greiner and Friedrichs, Germany.*)
1710. Runners and Notches for Umbrellas, &c., W. H. Welshman, Birmingham.
1711. Grain-crushing Machines, E. Weiss and L. Fraenkel, Berlin.
1712. Wheeled Vehicles, J. Brown and J. Howard, Liverpool.
1713. Separating Machines, E. Weiss and L. Fraenkel, Berlin.
1714. Non-automatic Railway Coupling, A. Boots, Eastbourne.
1715. Snuffers for Oil Lamps, C. C. Cotton, Hampton Wick.
1716. Felt Hats, B. and L. Herzberg, London.
1717. Fire Lighter, T. G. Pim, London.
1718. Tobacco Pipes, H. F. J. Wright, London.
1719. Fixing Candles in Candlesticks, F. B. Hanbury, London.
1720. Steering Gear of Velocipedes, N. Davis, London.
1721. Stacking Derricks, A. Gallagher, J. S. Burk, S. Ragan, N. Gallagher, W. Lantz, and H. Gallagher, London.
1722. Billiard Cue and Tip, E. W. Cleversley, London.
1723. Bodies of Perambulators, &c., W. Wilson, London.
1724. Safty Lamps, J. Laidler, Durham.
1725. Ships' Berths, E. Lawson and H. Lea, London.
1726. Smoking Jackets, G. Lacey and C. Wheeler, London.
1727. Belts for Driving Machinery, M. Gandy, Liverpool.
1728. Side Reflecting Lamps, C. Gibbons, London.
1729. Preventing Accidents by Overwinding Cages, &c., C. Holcroft, London.
1730. Closing Space Underneath Doors, J. H. Gibson and W. Glazier, Liverpool.
1731. Magic-lanterns, J. H. Barry, Dalston.
1732. Chaff Cutters, R. Maynard, London.
1733. Substitute for Stained Glass, W. Reynolds, London.
1734. Solid Flame Atmospheric Gas Burners, D. Thompson and F. H. Davisworth, London.
1735. Ploughs, J. Huxtable, London.
1736. Removing the Tops of Eggs, E. Wright, Smallheath.
1737. Step Bearings for Spindles, S. Tweedale, Halifax.
1738. Dynamo-electric Machines, C. D. Abel.—(*The firm of Siemens and Halske, Germany.*)
1739. Breech-loading Guns, W. Lorenz, London.
1740. Water-tight Joints, J. Gets, London.
1741. Two-pole Type for Making and Breaking Electrical Circuits, S. Sudworth and C. K. Falkenstein, London.
1742. Making and Breaking Electrical Circuits, S. Sudworth and C. Falkenstein, London.
1743. Pincers, H. J. Haddan.—(*H. Haake, Germany.*)
1744. Accumulators of Electricity, O. Chauer and S. Rabay, London.
1745. Table Bells, Saving Boxes, &c., J. C. Heine, Germany.
1746. Engines, E. Casper.—(*A. E. Tavernier, France.*)
1747. Wheel Castors, H. Greene, London.
1748. Mounts for Artificial Teeth, J. Stewart, Glasgow.
1749. Recovery of Ammonia and Carbonic Acid, R. Hamilton, Glasgow.
1750. Electro Deposition of Aluminium, H. H. Lake.—(*Count R. de Montgelas, United States.*)
1751. Extracting Aluminium from its Chlorides, H. Lake.—(*Count R. de Montgelas, United States.*)
1752. Electric Batteries, H. H. Lake.—(*Count R. de Montgelas, United States.*)
1753. Soap Tablet, L. Hunter, London.
1754. Door Closer, F. Purdon and H. E. Walters, London.
1755. Skirt and Dress Forms, B. J. B. Mills.—(*R. R. Appleton, United States.*)
1756. Pipe Tongs or Wrenches, H. H Lake.—(*Patten Manufacturing Company, Incorporated, United States.*)
1757. Gas Lamps or Lighting Apparatus, H. H. Lake.—(*C. J. Cheuret, France.*)
1758. Sash Fastener, J. Harrington, London.

4th Jannary, 1887.

1759. Improvements in Tiles, C. J. Ford, London.
1760. Driving-belts, — Bockmühl and — Karthaus, Manchester.
1761. Sewing Machines, J. Holroyd, Manchester.
1762. Adjusting the Frames of Carding Engines, G. and E. Ashworth, Manchester.
1763. Preventing Wear of Brackets of Spinning-frames, D. McGregor and J. Balfour, Dundee.
1764. Water-jets for Propelling Ships, F. W. Richardson, West Hartlepool.
1765. Portable Table and Desk, C. W. Watson, Dublin.
1766. Pistons for Steam-engines, J. Lepper and J. Pollock, Belfast.
1767. Gas, J. H. R. Dinsmore, Liverpool.
1768. Rollers, A. Steel, Sheffield.
1769. Preventing Overwinding in Mines, P. Nicholls, Barrow-in-Furness.
1770. Indicating Temperature, J. Murrie, Glasgow.
1771. Refining Cotton Seed Oil, R. Hunt and E. S. Wilson, Liverpool.
1772. Milk, J. France, Halifax.
1773. Stoppers for Bottles, C. H. Boyne, Devonshire.
1774. Bottle Stopper, J. Smith, Staffordshire.
1775. Electro-plating, G. Freemantle, Manchester.
1776. Knitting, The Nottingham Manufacturing Company, J. Groves, and J. Whatnall, London.
1777. Pedals for Velocipedes, N. G. K. Husberg, Birmingham.
1778. Baking Pans, A. Smith, London.
1779. Watering Cans, G. Hyde, Birmingham.
1780. Tricycles, &c., G. Todd, Birmingham.
1781. Sucker for Horses, J. McKenny and W. F. Lennan, Dublin.
1782. Gutter Brackets, G. A. Harvey, Kent.
1783 Machines for Hauling Fishing Lines, W. Morrison and J. B. Morrison, Glasgow.
1784. Saw-sharpener, &c., J. Griffin, London.
1785. Receiving Tickets from Printing, J. Graham, London.
1786. Self-acting Mules, W. T. Watts, London.
1787. Anchors, G. Tyzack, London.
1788. Chain Wheels, H. Randhahn and F. W. Hering, London,
1789. Locks, J. M. Lockerbie, London.
1790. Sash Fasteners, J. B. and E. B. Podmore, Middlesex.
1791. Stools, R. Hartley, Bradford.
1792. Feed-rollers, J. D. Black, Bradford.
1793. Heating Recreation Grounds, J. and F. B. Pickles, Bradford.
1794. Latches, P. Hayman and W. Stobbs, London.
1795. Boots, J. Mayglothing and E. Chetwyn, London.
1796. Spring Wheels, R. Edwards, London.
1797. Wedge, H. Forman, London.
1798. Explosive Compounds, H. E. Newton.—(*A. Nobel, France.*)
1799. Oil Lamps, A. Gough, jun., London.
1800. Coupling, T. Hale, London.
1801. Bee Feeder, J. A. Abbott, London.
1802. Hold Comb Foundations in Beehives, S. W. Abbott, London.
1803. Cocks or Taps, W. Lea, London.
1804. Forging by Revolving Discs, C. Fairbairn and M. Wells, London.
1805. Clutches, J. Marshall, London.
1806. Mounting Heavy Guns, A. Noble, C.B., Newcastle-upon-Tyne.
1807. Ships' Cranes, W. Shapton, London.
1808. Paper Pulp, H. H. Lake.—(*F. J. Marshall, United States.*)
1809. Chains for Transmitting Motion, E. J. B. Augé, London.
1810. Applying Chenille to Tulle, &c., H. H. Lake.—(*H. Pervet, A. Gros, H. Million, France.*)
1811. Warming, &c., Buildings, W. P. Thompson.—(*J. D. Smead, United States.*)
1812. Draught Preventing Appliance, J. M. Martin, Liverpool.
1813. Backs or Covers for Books, A. J. Boult.—(*F. Hinckley, United States.*)
1814. Counter Check Books, &c., M. H. Spear, London.
1815. Anchors, A. J. Boult.—(*V. Pagan, France.*)
1816. Bleaching Vegetable Tissues, A. J. Boult.—(*F. Rubay, Belgium.*)

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1817. Taps, W. G. Hicks, Ramsgate.
1818. Rollers, &c., W. S. Sneade, Liverpool.
1819. Instrument for Recreative Games, J. Gillingham, Chard.
1820. Vent-peg, W. Elliss, Sheffield.
1821. Hoist, &c., A. J. Lester, Handsworth.
1822. Clips, &c., E. S. Perry, London.
1823. Utilising Marbles, C. Leversidge, Doncaster.
1824. Pen Wiper, F. C. Leonardt.—(*H. Mellin, Germany.*)
1825. Toys, J. G. Harrison, Birmingham.
1826. Shaping the Outer Crust of Pies, H. Draper and H. J. Miller, Birmingham.
1827. Automatic Advertising, H. R. and R. E. Yeo, Plymouth.
1828. Stop Bells, &c., C. E. Challis, London.
1829. Pen Fountains, F. R. Baker, Birmingham.
1830. Bearings, &c., W. E. Moss and J. Mitton, Nottingham.
1831. Brakes, J. Adams, Devonshire.
1832. Generating Carbonic Acid Gas, J. Mangnall, Harpurhey.
1833. Rollers, W. Birch, Manchester.
1834. Venetian Blinds, &c., F. A. Lehman, London.
1835. Steam-boilers, H. C. Parkinson, London.
1836. Door Handle, R. L. Cozens, Taunton.
1837. Adjustable Guides, G. F. Williamson and F. Litchfield, Wellingborough.
1838. Combined Sheet Ridge and Load Securer, W. Jardine, Dumfries.
1839. Ties, &c., E. Hale, Liverpool.
1840. Refining Cotton-seed Oil, W. H. Stead, Liverpool.
1841. Movable Poultry House and Run, W. Field, Hastings.
1842. Winches, M. Archer, Newcastle-on-Tyne.
1843. Distilled Water, &c., A. C. Kirk, Glasgow.
1844. Gas-motors, D. Clerk, Glasgow.
1845. Inclined Roadways, E. V. Bellew, London.
1846. Cover, C. Vale, Birmingham.
1847. Hand Organs, E. de Pass.—(*C. F. Pietschmann and Sohne, Germany.*)
1848. Cinder-sifter and Dust-bin, A. Schelff, London.
1849. Feeding Bottles and Fittings, F. Dymott, London.
1850. Ships' Bottom Scraper, T. Thorsen, Norway.
1851. Coupling or Joints for Pipes, J. Bogie, Manchester.
1852. Coupling Shafts, C. H. Reed, London.
1853. Suspending Books, &c., H. H. Lake.—(*I. Fine, United States.*)
1854. Liquid Measuring Pump, E. O. Eaton.—(*J. Lancaster, United States.*)
1855. Machines for Ploughing, &c., M. Wainz, London.
1856. Salts of Sodium and Potassium, T. Schmidt, London.
1857. Transmitting Motion to Coal-cutting Machines, T. and R. W. Bower, J. Blackburn, and F. Mori, London.
1858. Wearing Apparel, T. Fishburn and D. Glassford, London.
1859. Lamp Wicks, A. H. Hearington, London.
1860. Operating Goods Selling Apparatus, C. H. Russell, London.
1861. Stopper for Bottles, E. Lüderitz, London.
1862. Secondary Batteries, C. D. Abel.—(*A. Dun and F. Hasslacher, Germany.*)
1863. Tobacco Pipes, S. Reeve, C. E. Ratcliffe, and J. B. Davis, London.
1864. Moulds for Casting Chains, &c., W. Gibson, W. Penman, and L. T. Penman, London.
1865. Preservation of Flowers, &c., H. Van der Weyde, London.
1866. Isolating Gas, &c., J. Davies, London.
1867. Automatic Cleat, E. A. Goddin, London.
1868. Dredging Vessels, A. Brown, London.
1869. Self-emptying Spittoon, &c., R. J. Shepherd, London.
1870. Stopping and Starting Apparatus for Tramcars, &c., A. Weissenborn, London.
1871. Gloves, H. Dalgety, London.
1872. Trouser Stretchers, A. McCall, Glasgow.
1873. Roundabouts, F. Savage, London.
1874. Circular Looms, A. de Laski, United States.

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1875. Regulating the Duration of the Exposure of Sensitive Plates to Light in Photographic Cameras, J. Adams, Stone.
1876. Lids or Covers, W. T. Seymour, Stockton-on-Tees.
1877. Knife Sharpener and Fork Combined, M. Loder and T. F. Stidolph, Woodbridge.
1878. Metal Folding Machines, S. Stevens, London.
1879. Pulverising Machinery, J. W. and R. Pope, London.
1880. Malting, &c., Barley, Grain, &c., R. Wood, Cardiff.
1881. Water Stopper for Ships' Sides, E. G. Wright, Portsmouth.
1882. Milling and Fulling Machines, J. D. Asquith, Bradford.
1883. Attachments for Corsets, M. S. Winfield and M. E. Hutchinson, Glasgow.
1884. Correction of the Mariners' Compass, N. Harrison, Folkestone.
1885. Reduction of Cereals to Flour, T. Voss, Manchester.
1886. Ends of Beer Cocks or Taps, J. Morley, Birmingham.
1887. Supporting Music Books, &c., C. Platts, Leicester.
1888. Cutting off the Tops of Eggs, J. and R. H. Meeson, Sheffield.
1889. Bars for Doors, &c., R. Holmes and B. Sugden, Skipton-in-Craven.
1890. Manure and Seed Drill, J. Adams, near Ashburton.
1891. Ash-pan Cinder Sifter, H. D. Peckover, London.
1892. Distilling Sea-water, J. Darling, Glasgow.
1893. Lubricating Grease, W. Hicks, Middlesbrough.
1894. Flax Thread Conical Conductor, A. McCullough and W. Hanley, Belfast.
1895. Tools for Forming the Mouths of Jars, &c., J. Denison, Leeds.
1896. Reservoir Pen, J. B. Small, Glasgow.
1897. Fanning-out Envelopes, &c., W. C. Pellatt, Brockley.
1898. Match-boxes, E. R. S. Lloyd, London.
1899. Chimney Cowl or Wind Guard, E. Allwright, London.
1900. Braces, H. Aked, London.
1901. Fluting Picture Frame and other Mouldings, J. Goldberg, London.
1902. Lighting Pictures, &c., W. de W. Abney, London.
1903. Turn Buckles, W. Cunnington, London.
1904. Transformers, G. Kapp, W. H. Snell, and J. M. V. Kent, London.
1905. Handle for Boxes, A. Woolfert and O. Hetterich, London.
1906. Folding Chairs, G. A. Farini, London.
1907. Indicators, A. J. Boult.—(*W. Griffith, United States.*)
1908. Casement Fastenings, S. Kristensen and A. Jensen, London.
1909. Hand Printing Machine, J. Wright, Sheffield.
1910. Railway Chairs, J. Colby, London.
1911. Case for a Razor Strop, T. F. Turner, London.
1912. Horse Clipping, J. Arnold, London.
1913. Entrenching Tools, W. C. Underwood, Glasgow.
1914. Lubricators, R. McL. Young, London.
1915. Scutching Flax, &c., A. M. Clark.—(*A. Casse, France.*)
1916. Ink Mill, T. R. Johnston, Edinburgh.
1917. Sewing Machines, C. Stuart, London.
1918. Welding Compounds, A. H. Reed.—(*H. G. Hicks, United States.*)
1919. Road Pavements and Curbstones, P. Cornish, Stratford New Town.
1920. Lamps, W. Kilsby, London.
1921. Chills for Casting Iron, C. Dickinson, London.
1922. Refining Crude Petroleum, &c., P. Haddan.—(*G. L. Benton, United States.*)
1923. Boots and Shoes, W. Damer, London.
1924. Knitting Machines, W. H. Kelly, London.
1925. Colour Printing Machines, H. H. Lake.—(*P. F. Auguste-Godchaux, France.*)
1926. Compass, &c., H. H. Lake.—(*R. L. Spencer, United States.*)
1927. Decorating Detachable Wall, &c., R. Scott, London.
1928. Seat Convertible into a Table, L. Evans, London.
1929. Galvanic Batteries, C. D. Abel.—(*A. Dun and F. Hasslacher, Germany.*)
1930. Crumpling Paper, &c., C. D. Abel.—(*T. Grison, France.*)
1931. Extracting Saccharine from Sugar Cane, M. A. Perret, London.
1932. Converting Two Ordinary Bicycles, J. Howard, London.

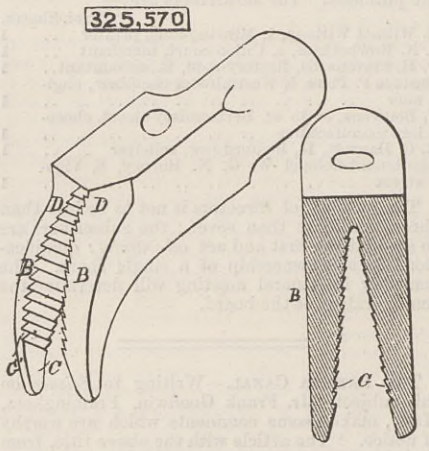
SELECTED AMERICAN PATENTS.

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

352,570. Hammer, *S. G. Pillsbury, Long Island, Kans.*—*Filed May 19th*, 1886.

Claim.—(1) A hammer-head having curved claws B B, the inner and outer sides of which are bevelled, as at C D, forming sharp edges E, said inner sides, C, being provided with teeth or corrugations extending from the upper to the lower edges of the said jaws, substantially as set forth. (2) A hammer-head having curved claws B B, bevelled so as to form sharp edges E, the inner bevelled sides of said jaws being provided with teeth, the sides of which, facing the points of the jaws, are provided with abrupt shoulders G, while

325,570

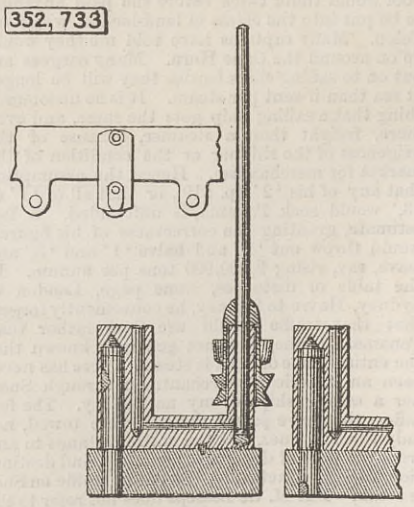


their inner sides are bevelled at G', substantially as and for the purpose set forth.

352,733. Spindle-support for Spinning Frames, *W. T. Carroll, Worcester.*—*Filed May 29th*, 1886.

Claim.—(1) A spindle, a bolster or step rail, and a pin or stud, one end of which enters a hole in the said rail, while its other end terminates above the said rail, combined with a spindle-support consisting of a block having not only an upright sleeve to receive the pintle of the spindle, but also a socket to surround the said pin or stud loosely, thereby permitting the block to move to a limited extent above the surface of the said rail with the pintle or lower end of the spindle, substantially as described. (2) A spindle and a bolster or step rail having an attached vertical pin or stud, combined with a spindle-support consisting of a block having an upright sleeve to receive the pintle of the spindle, and

352,733

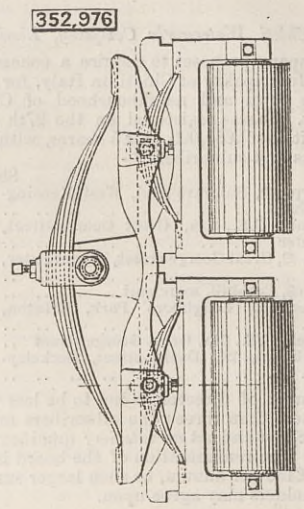


provided with a socket to surround the said pin or stud loosely, thereby permitting the block to move above the surface of the said rail with the pintle or lower end of the spindle, the said block having communicating passages for oil, substantially as described. (3) The combination, substantially as described, of the bolster or step rail, the spindle-support having at one end a sleeve or tube to receive the pintle of the spindle and a pin or stud directly but loosely connecting the said support and rail, and located out of line with or at one side of the centre of rotation of the spindle, the said pin or stud serving to hold the said spindle-support loosely on or with relation to the step-rail.

352,976. Planing Machines, *L. P. Hoyt, Aurora, Ill.*—*Filed July 16th*, 1885.

Claim.—(1) The combination, with the independent pressure rolls, of the two independent distributing springs, one on each roller, the balance bar supported upon both of the distributing springs, and the main spring held at the middle by a rocking box or bearing, and at its ends arranged to bear upon the balance bar substantially in the manner and for the purpose herein described. (2) The combination, with the independent pressure rolls, of the two tilting distributing springs held at the middle portions by vertically movable and rocking clips or bearings, and bearing one on each roller, and a main upper spring common

352,976



to both distributing springs substantially as and for the purpose described. (3) The combination, with the independent pressure rolls, of the balance bar, the distributing springs held at their middle portions by clips or boxes pivotted to the balance bar, with each distributing spring bearing on one pressure roll, and the main spring bearing upon the balance bar, substantially as described.

353,151. Dynamo-electric Machine, *R. H. Mather, Windsor, Conn.*—*Filed January 2nd*, 1886.

Claim.—(1) A dynamo-electric machine having a field magnet consisting of two segments whose ends, being turned toward each other in pairs, embrace two armatures, the latter being located upon a single shaft which is parallel to the longitudinal axes of said segments, and is provided with a sleeve or collar which is attached to one of said segments, substantially in the manner and for the purpose specified. (2) In a dynamo-electric machine, a metallic plate or apron which is rigidly attached to the middle part of a segment of the field magnet and supports the yokes to which the brushes of such machine are attached, substantially as set forth. (3) In a dynamo-electric machine a field magnet consisting of two like parallel segments provided with like pole pieces, which are turned toward each other in pairs and are bolted together upon intermediate blocks of brass or other insulating material, in combination with two separate armatures, both of which are mounted upon a single shaft parallel to the longitudinal axes of said segments, and each of

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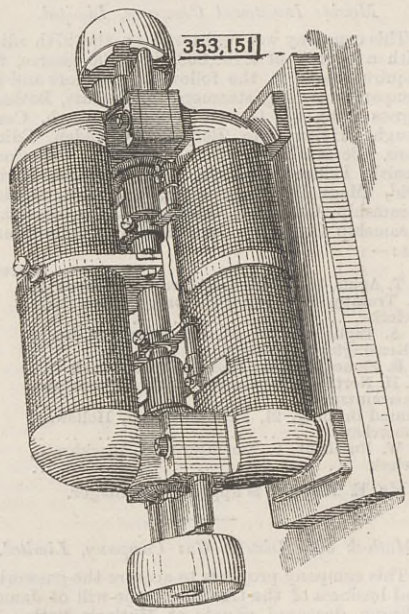

which is supported between a pair of said pole-pieces and also between a pair of said insulating blocks by means of suitable yokes which are firmly attached to said insulating blocks, substantially in the manner and for the purpose specified. (4) In a dynamo-electric machine, two armatures and two commutators upon a single shaft, in combination with an intermediate sleeve or collar which is fixed in an immovable position about said shaft, and serves as a support for two brush holding yokes, substantially in the manner and for the purpose specified. (5) In a dynamo-electric machine, an armature shaft carrying two armatures and commutators, in combination with two brush yokes which are mounted upon an immovable sleeve, surrounding said shaft between said commutators, sustantially in the manner and for the purpose specified. (6) In a dynamo-electric machine, a metallic plate or apron which is rigidly attached to the field-magnet and holds in an immovable position upon the armature shaft a sleeve or collar, to which the brush yokes of such machine are attached, substantially in the manner and for the purpose specified. (7) A sleeve or collar which is formed in two longitudinal segments and is fixed between two commutators in an immovable position upon the armature shaft of a dynamo-electric machine, substantially in the manner and for the purpose specified.

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Claim.—The combination, with the index and the shaft having means for connecting it with the part whose speed is to be measured, of an annular gyratory weight encir ling said shaft, arms projecting from said

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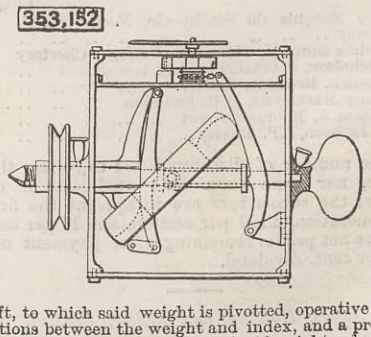

shaft, to which said weight is pivotted, operative connections between the weight and index, and a projection from said shaft in the path of said weight, whereby the latter is arrested substantially in the manner and at the instant set forth.