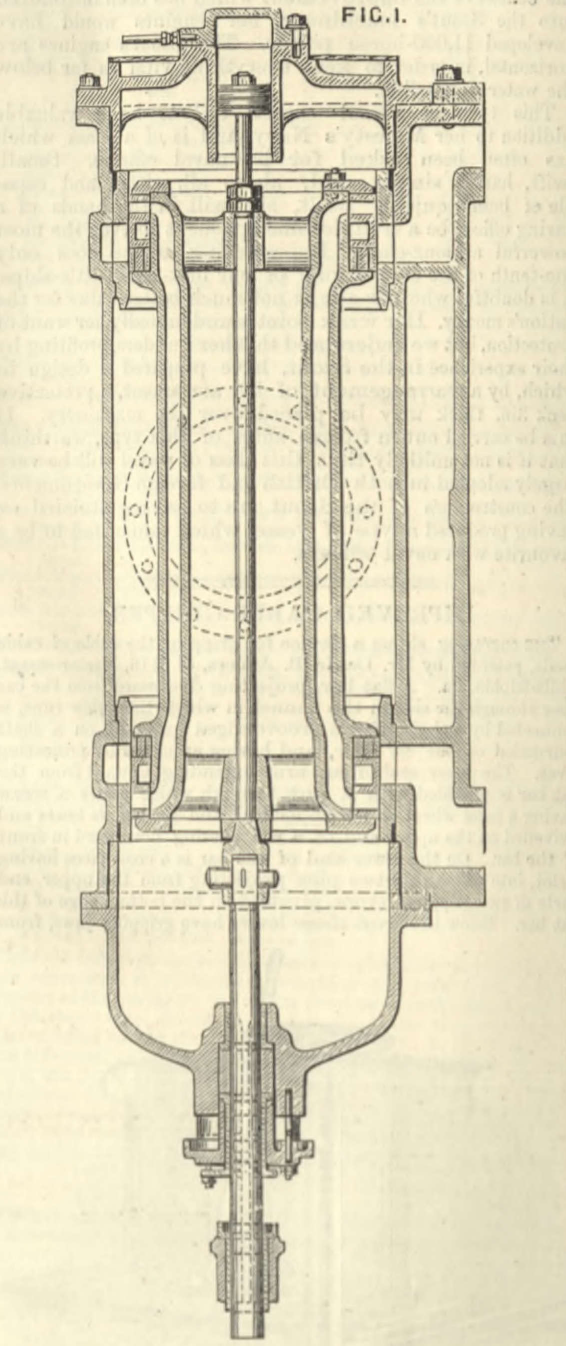
THE ANTWERP EXHIBITION.

No. IV.

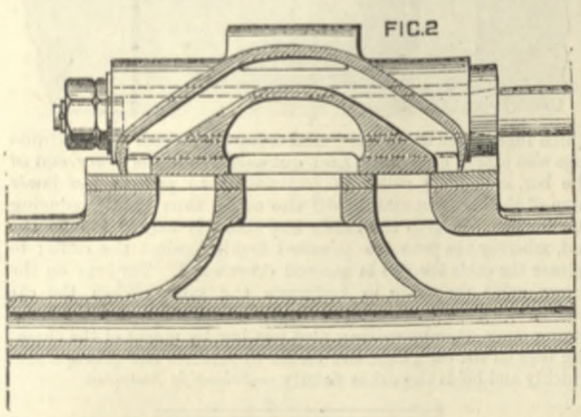
THE most important display of steam engines in the Antwerp Exhibition is that of the Société Cockerill, of Seraing. The space occupied is very large. Beginning at one end of the stand, we find a pair of winding engines, coupled, and driving a flat rope drum. The cylinders are each 35·4in. in diameter, with a piston stroke of 6ft. 6·74in. The depth of the pits for which these engines have been constructed is at present 765 yards. The final depth will be 1093 yards. The work of winding will be effected at a speed of 33ft. per second. The weight of coal raised at each lift will be 31 cwt., but of stone as much as two tons

FIG. 1.



can be taken. These engines are admirably designed, and the material and workmanship leave nothing to be desired. Next to them come the engines and boilers of a spar decked ship, at present building at Hoboken. The engines will indicate 800-horse power. After these we find a compound vertical direct-acting blowing engine for Russia. This is an enormous machine, towering up nearly to the

FIG. 2



roof of the building. The diameter of the high-pressure cylinder is 35·43in.; that of the low-pressure cylinder, 59in.; stroke, 4ft. 11in.; number of revolutions per minute, 30. The blowing cylinder is 85in. diameter; the diameter of the single-acting air pump is 29·5in.; the stroke of bucket, 2ft. 5·5in. The feed pump is single-acting, and has a diameter of 6in., and a stroke of 2ft. 5·5in. This engine will deliver 720 cubic yards, or nearly 2000 cubic feet of air per minute, under a pressure of 10½in. of mercury, or, say, in round numbers, 5 lb. per square inch; developing under these conditions 388 useful horse-power in the air. The steam is distributed by double beat valves worked by cams. The point of cut-off is variable by hand, and under normal conditions steam is expanded about five times in the small cylinder. This engine is supplied with steam, and the compressed air is employed to keep the winding engine in motion, and also the magnificent machine we are about to describe, namely, the port engine of the Russian ironclad Tchesma.

This vessel, now being constructed, will have a displacement of about 10,000 tons, and will be propelled by twin-screws, the engines combined indicating 11,000-horse power, or 5500-horse power each. At one period it was impossible to procure engines of the kind required out of England, and it is a suggestive fact that Belgium has been able to supply them. The engine shown is a very fine piece of work. It is of the three-cylinder overhead type, the high-pressure cylinder in the middle, and the large cylinders at each end. In certain respects it resembles the engines of the French war ship Mytho, exhibited in Paris in 1878 by the same firm, and subsequently illustrated in our pages. The framing is nearly all of wrought iron. The small cylinder is 67in. diameter, the large cylinders each 78in.; stroke, 3ft. 9in.; revolutions per minute, 90. The valves are of the piston type, on a system patented by the firm. Fig. 1 shows one of them in section. It is a circular Trick valve. The pumps are worked by back levers. There are two feed pumps 6·29in. diameter, two bilge pumps of the same dimensions, and two air pumps 32in. in diameter, the stroke of all being the same, namely, 22·5in. The circulating water is supplied by two independent centrifugal pumps, the discharge pipes of which are 14in. in diameter. The propellers are of gun-metal, four-bladed, and 19ft. 3in. in diameter, with a pitch of 18ft. 5in. Steam will be supplied by fourteen boilers with three furnaces in each. The total heating surface will be 31,500 square feet; the grate surface, 1100 square feet; working pressure, 95 lb. on the square inch. We have examined this engine very carefully, and we failed to find anything to which exception could be taken. The design is very good, and the strength of the parts so distributed that weight has been kept down. One length of screw shafting is shown in place, with the screw on the end; and this engine in motion, making about 11 revolutions per minute, constitutes a very impressive spectacle, the noise of the compressed air exhausting directly into the atmosphere quickly attracting a crowd after the engine has started. Concerning the locomotives exhibited we shall say nothing at present. We may return to their consideration.

We have said that between the blowing engine and the winding engine are shown the boilers and machinery of a cargo steamer. This exhibit deserves special attention. Hitherto it has been held that English and Scotch engineers had the trade in this class of machinery almost in their own hands; because although such engines were built abroad, they could not compete in economy with English machinery. Those who remember the annexe to the Paris Exhibition of 1878, close to the Seine, will also remember how much there was to be seen there which fully supported this view. But all this has been changed, and those who like to examine the marine engine shown by the Société Cockerill will find in it nothing to distinguish it from the best English practice. Everything is shown; even the chimney is in place, rising up to the very top of the roof. The engine is intended for a ship built to carry ore from Bilbao. On another page we illustrate, through the courtesy of Messrs. Cockerill, not this particular engine, but another similar to it. The diameter of the small cylinder is 33·5in.; that of the large cylinder, 55in.; stroke, 3ft. 3½in.; number of revolutions, 65. The air pump is 21·6in. diameter; the circulating pump, 11·4in.; the feed pump, 3·5in. diameter, the stroke of all being the same, namely, 21·6in. The screw is four-bladed, 14ft. diameter and 17ft. 10in. pitch. There are two boilers, with three furnaces in each. The total heating surface is 3128 square feet; the grate surface 108 square feet; the engines indicate 800-horse power.

The Société Cockerill has for some years made the production of economical engines a study. We give particulars of the trial of one of their vessels, the Concha, which is full of interest. We have for the convenience of our

Table of Observations made on the Working of the Engine and Boiler of the Steamship Concha, on a Voyage from Antwerp to London, the 5th and 6th of February, 1878.

Time.		Effective pressure in atmospheres.		Vacuum, in inches.	Number of revolutions per minute.	Degree of admission.	Mean pressure.		Indicated horse-power.		
Hour.	Minutes.	Boiler.	Engine.				Small cylinder.	Large cylinder.	Small cylinder.	Large cylinder.	Total.
3	50	3¼	—	—	—	—	—	—	—	—	—
							lb.	lb.			
4	30	3¾	3	26·7	62	5/10	25	9·5	151	153·4	304·4
4	45	3½	3	27·1	63	,,	—	—	—	—	—
5	0	3¾	3·6	26·7	67	,,	28	10·5	180·9	185·9	366·8
5	15	4	3·8	25·9	68	,,	—	—	—	—	—
5	30	4	3·9	25·9	70	,,	29·5	11	198·9	205·4	404·3
5	45	4	3·8	27·5	—	—	—	—	—	—	—
5	50	—	—	—	—	—	—	—	—	—	—
6	0	3⅞	3·7	26·3	67	5/10	28·5	10	184·4	178·7	363·1
6	30	4	3·8	26·3	67	,,	28·5	10	185·3	183·6	368·9
6	35	—	—	—	50	—	—	—	—	—	—
7	0	—	—	—	45	—	—	—	—	—	—
7	7	4	3·8	27·5	50	5/10	18	6·5	85·7	88·5	174·2
7	25	4	3·9	27·5	61	4/10	—	—	—	—	—
7	30	4	3·9	27·1	61	,,	23	9·5	141·5	158	299·5
8	0	3¾	3·7	27·5	61	,,	23	9	139·8	145·8	285·6
8	15	4¼	4·3	27·5	63	,,	—	—	—	—	—
8	25	4⅜	4·4	27·5	70	5/10	—	—	—	—	—
8	30	4¼	4·2	27·5	62½	4/10	26	10	157	168·1	325·1
9	0	4⅜	4·3	27·5	63	,,	26	10	157·8	172·6	330·4
9	30	4¼	4·2	27·5	62½	,,	25	9·5	147·1	162·2	309·3
9	50	4¼	4·2	27·5	47	—	—	—	—	—	—
9	55	—	—	—	—	—	—	—	—	—	—
9	58	—	—	—	—	—	—	—	—	—	—
10	0	—	—	—	—	—	—	—	—	—	—
10	3	—	—	—	—	—	—	—	—	—	—
10	6	—	—	—	38	—	—	—	—	—	—
10	10	—	—	—	—	—	—	—	—	—	—
10	14	—	—	—	38	5/10	—	—	—	—	—
10	18	3¾	3·7	27·5	62	,,	29	10·5	172·4	170	342·4
10	25	4	3·9	27·5	67	,,	—	—	—	—	—
10	30	4¼	4·2	27·5	63	4/10	28	10·5	164·7	170·9	335·6
11	0	4¼	4·2	27·5	63	,,	25	10	150	165	315
11	30	4⅓	4·3	27·5	65½	,,	24	10	149·6	167·2	316·8
12 mid	night	4¼	4·2	27·5	62	,,	25	10·25	145·5	168·2	313·7
12	28	—	—	—	—	,,	—	—	—	—	—
12	35	4⅜	—	—	—	,,	—	—	—	—	—
12	45	4¼	4·1	27·5	62	,,	24·5	10	144·1	159·9	304·0
1	30	4¼	4·1	27·1	62	,,	25	10	151	163·6	314·6
2	0	4¼	4·1	27·5	62	,,	25	10	151·4	161·6	313·0
2	30	4½	4·4	27·5	63	,,	25	10·25	151·7	170·4	322·1
3	0	4⅜	4·3	27·5	62	,,	26	10·25	152·9	165·4	318·3
3	30	4⅜	4·3	27·5	63	,,	24	9·5	143·9	163·2	307·1
4	0	4	4	27·1	62	,,	25	10·25	151	165·4	316·4
4	30	4	4	27·5	62	,,	23	9·5	134·6	158·7	293·3
5	0	4	4	27·1	63	,,	23	10·25	137·4	166·6	304·0
5	15	4¾	4·6	27·5	65	,,	—	—	—	—	—
5	30	4½	4·2	27·5	63	,,	25	11	147·4	184	331·4
6	0	4⅓	4·4	27·1	63	,,	26	10·5	157·4	174	331·4
6	30	4½	4·4	27·5	63	,,	25	10·5	153·4	176·4	329·8
6	45	4¾	4·7	27·5	65	,,	—	—	—	—	—
7	0	4½	4·45	27·5	64	,,	25	10·5	150·5	179·7	330·2
7	15	—	—	—	—	,,	—	—	—	—	—
7	30	4½	4·4	27·5	64	,,	25	10·5	153·6	178·5	332·1
8	0	4⅜	4·6	27·5	65½	,,	24	10	152·3	177·1	329·4
8	30	4¼	4	27·5	61	,,	24	10	142·3	165·5	307·8
9	0	4¼	4	27·5	62	,,	25	9·5	148	160·7	308·7
9	30	4½	4·3	27·5	63	,,	25·5	9·5	153·9	166·8	320·7
9	55	—	—	—	53	,,	—	—	—	—	—
10	0	3½	3·3	27·5	4[illegible]	3/10	15	6·5	67·7	85·9	153·6
10	9	—	—	—	—	—	—	—	—	—	—
10	10	—	—	—	—	—	—	—	—	—	—
10	15	—	—	—	50	4/10	—	—	—	—	—
10	17	3¾	3·6	28·3	56	,,	—	—	—	—	—
10	30	4	3·9	27·9	62	,,	25	9	146·7	150·5	297·2
11	0	4½	4·3	27·7	64	,,	27	10	165·5	172·7	338·2
11	30	4⅜	4·3	27·5	63	,,	25	10	155·6	168	323·6
12	0	4¼	4·1	27·9	62	,,	25	10	146·8	165·6	312·4
12	30	4¼	4	27·9	62	,,	25	9·5	145	161·8	306·8
1	0	4⅝	4·7	27·5	66	,,	27	10	172·6	188·2	360·8
1	30	4¼	4·3	27·5	64	,,	27	10	166·4	174·8	341·2
1	49	4⅜	4·4	27·5	56	3/10	—	—	—	—	—
1	55	—	—	28·3	42	—	—	—	—	—	—
1	58	—	—	—	—	—	—	—	—	—	—
2	0	—	—	—	—	—	—	—	—	—	—
2	2	—	—	—	—	—	—	—	—	—	—
2	5	4	3·8	27·9	65	5/10	28	10	175·3	174·6	349·9
2	30	3½	3·4	26·7	65	,,	26	9·5	170	172·8	342·8
3	0	4	4	26·3	70	4/10	32	11·5	219·6	213·9	433·5
3	30	4⅛	4	26·3	69	,,	31	11	209·5	206·9	416·4
3	35	—	—	—	—	—	—	—	—	—	—
3	40	—	—	—	—	—	—	—	—	—	—
3	42	—	—	—	—	—	—	—	—	—	—
3	45	—	—	—	—	—	—	—	—	—	—

readers reduced the French to English measures, or more properly, to the nearest equivalent possible without the use of small fractions. The Concha is a steamer intended for the Bilbao ore trade. She sailed from Antwerp on Tuesday, 5th of February, 1878, at 4.15 p.m. in the evening and reached London at 4.30 p.m. on the following evening. She is 217ft. long between perpendiculars, 27ft. 9in. beam, and 17ft. depth of hold; builders' measurement, 822 tons; draught of water, 13ft. 6in., with a cargo of 1000 tons. During the run from Antwerp to London she had a cargo of rails, bridge work, and bunker coal of, in all, 1350 tons. Her draught forward was 15ft. 3in.; aft, 16ft. 3in. The nominal horse-power of the engines is 90. The diameter of the high-pressure cylinder is 27in.; of the low-pressure, 45in.; stroke, 2ft. 9in. The four-bladed screw is 10ft. 9in. diameter, and 15ft. pitch. The boiler is 12ft. 2in. diameter, and 10ft. 9in. long, with three furnaces; the heating surface 1665 square feet; the working pressure 67·5 lb.

The experiment possesses a special interest, because the actual trials of the kind which have been made are exceedingly few. The investigation was carried out by MM. Henri Biquet and V. Neuman, engineers, from Seraing, and M. Devillers and Mulkay, the first and second engineers of the ship. The voyage was made nearly in a dead calm. The mean speed of the ship was 8½ knots per hour. The coal used was of good quality from the Marie Colliery, near Seraing. The coal was delivered to the firemen in baskets, each basket holding 46 kilogs., or 123¼ lb. The firing with weighed coal began at 4 h. 30 min. in the evening of Tuesday, and ceased at 3 h. 42 min.; the trial thus lasted 23 h. 12 min., a period long enough to eliminate causes of error likely to operate when shorter experiments are made. The total consumption was 5313 kilogs., or 5·21 tons. The table in previous page gives the principal details.

The run may be divided into three sections—(1) From Antwerp to Flushing; (2) from Flushing to Gravesend; (3) from Gravesend to London. The consumption of coal per horse per hour was during the first ·717 kilogs., or 1·577 lb.; during the second it was ·703, or 1·546 lb.; and during the third ·585, or 1·287 lb. The difference is easily explained when we remember that during the first part of the voyage the steam had a pressure of only 48 lb. on the square inch, and the fires were pushed, while during the latter part of the run the fires were allowed to burn down and the pressure to fall to what it was at starting. The general average for the run is ·694 kilogs., or 1·526 lb.—a very admirable result.

The engine which we illustrate on page 222 is fitted with modified Trick valves, of which we give a section, Fig. 2. In a succeeding impression we shall give another view of the engine, and the results of further experiments made by the firm.

H.M.S. SCOUT.

MESSRS. THOMSON launched from their yard at Clydebank, on Thursday, the 30th July, the pioneer of the Scout class. This vessel is in many respects an enlarged torpedo boat, but she is intended to keep the sea in all weathers, and to act as a guardian of our commercial marine against the depredations of all the Queen's enemies on the high seas. She will have speed enough to keep at any desirable distance from an ironclad, while she has in her torpedo armament of eleven separate torpedo ejectors a means of instilling caution into even the most formidable opponent. Her great speed of over seventeen knots, her great steering power, and her small size will enable her to turn very rapidly, and thus to evade a more powerful but larger opponent. So much is this class of ship appreciated by the Admiralty, that since the Scout has been ordered they have entrusted Messrs. Thomson, her builders, with orders for six others of a similar but improved class. A detailed description of the vessel may be interesting to our readers, and as we have had special opportunities for examining the ship and obtaining information, we give this description with every confidence in its accuracy.

The vessel is 220ft. long between perpendiculars, 34¼ft. extreme breadth, and 19ft. moulded depth. Her displacement is 1450 tons at the ordinary load draught. The vessel has two complete decks, an upper and a lower. On the former are worked all the torpedo tubes excepting one which is fitted through the stem under the water line. The ends of this deck are covered by a poop and forecastle, each about 55ft. long, and forming perfectly water-tight compartments. Three of the torpedo tubes are worked under the forecastle, one firing right forward, the other two firing on the broadside. Four tubes are worked in the open part of the upper deck, but as the bulwarks are carried solid to the height of the poop and forecastle, they are fairly well protected. Three tubes are carried under the poop, one firing right aft, the other two firing on the broadside. In addition to these there are eight Nordenfelt machine quick-firing guns fitted in the topsides. The whole of this armament is protected by 1in. steel plating. At each of the forward corners of the poop and the after corners of the forecastle is fitted a 5in. breech-loading central-pivotted gun, mounted on a sponson projecting beyond the ship's side. These guns have practically an uninterrupted range from right forward to right aft on their own side of the ship. The under-water torpedo tube through the stem is made suitable for a 14in. Whitehead. The bow is bossed out about 8ft. below the water-line, to allow the torpedo to pass out through it, and a shifting cap is fitted over the aperture. This cap can be turned clear of the tube by means of gearing inside the ship. In addition to this a large sluice valve is fitted inside the stem on the forward end of the tube, and a sluice door is fitted on the after end, where the torpedo is entered. On the forecastle is a conning tower, formed of 3in. plates, in which are all the telegraphs and voice pipes by which the ship can be controlled. It is oval in shape, with an opening in the after end, covered by a screen plate, about 2ft. abaft of it. If the officer stands outside in rear of the screen he may have as much as 8in. of iron between him and an enemy in front, or at the side he may have 6in. No unarmoured ship that we know of has such a strongly protected conning station. The lower deck right forward is fitted up for the stowage of the electrical stores, which have become such an important part of a war ship's equipment. In the next two compartments is part of the crew's accommodation, the remainder being under the forecastle on the upper deck. For the length of the machinery space—which is 100ft.—the lower deck at the side is occupied by coal bunkers, about 8ft. thick, and at the middle line by the machinery openings, engineers' and stokers' berths, and wash places. Abaft of this are the cabins and quarters for the officers. The stability of this ship in an action will depend very much upon the protecting and water-excluding qualities of the coal and stores over the machinery space, and arrangements are therefore made so that in war time the whole of this space may be filled with coal, the engineers and stokers being provided with the necessary accommodation elsewhere. Below the lower deck, commencing forward, are the torpedo store-rooms and torpedo magazines, the provision rooms, the powder magazines, the condenser room, and chain cable lockers—all before the machinery. Abaft are the steering engine room—the engine being by Forrester—the small-arms magazine, the bread room, spirit rooms, and other small-store rooms; and right aft the most important compartment in the ship, viz., that where the steering apparatus is placed. This compartment is practically full of machinery; and as the ship is exceedingly fine just here, considerable ingenuity has been exercised in order to fulfil the necessary requirements. On the rudder head is a short tiller 2ft. long, which is actuated by a long tiller 16ft. long, turning on a false rudder head about 6ft. forward of the true head. This is worked by a Rapson's slide; and though there is considerable multiplying power in the levers, it is stated that so great is the strain on the rudder in the hard-over position when the ship is going at full speed that a force of over 15 tons will be required to be passed through the steering chains in order to hold the rudder in this position. In addition to the steam steering gear, there are three distinct methods of steering by hand. One is by a pair of wheels, which can be worked by eight men, and which actuates the same shafting that the steam steering engine works upon. The second is by a lead off attached directly on to the tiller end and led away to the ship's capstan. The third is by attaching blocks to the two eyes in the upper corner of the rudder and steering from over the ship's side. We have described fully the steering gear of this ship, as the efficiency of a fighting war vessel depends so largely upon it. It is not difficult to build ships-of-war more cheaply than the British Admiralty do; but if the cheapness is gained at the expense of non-duplication and triplication of the vital qualities of a warship, it will only be advantageous until the ship is required to do actual service. In the Scout every consideration has been given by her builders to make her in every respect as a thoroughly efficient warship should be.

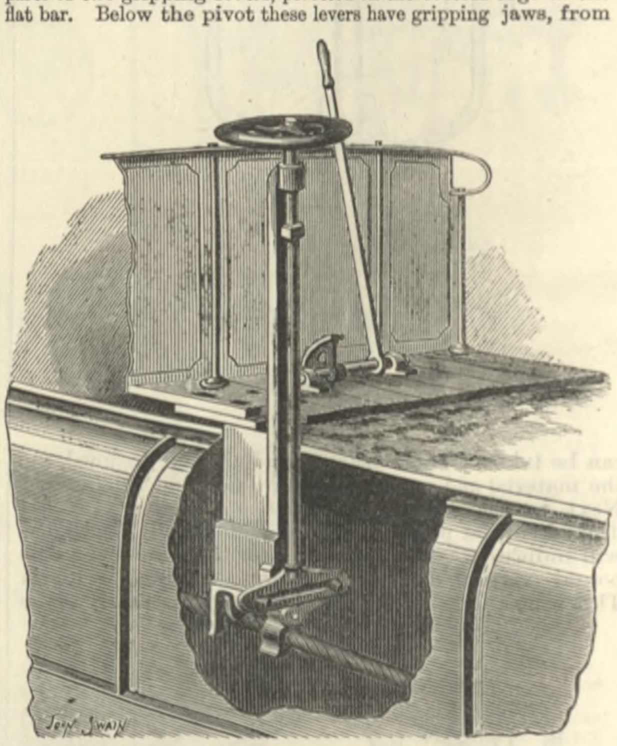
The hull is built of steel throughout on the ordinary floor system, but instead of having frames and reverse frames formed of separate angles, the framing is formed of a Z bar 6in. by 3½in. by 3in. The floor plates are all galvanised. The bulkheads necessary for the minute sub-division of the hull which is usual in war ships, have been taken advantage of by her constructors to form integral portions of the structure, and have in a large degree contributed to the great strength of the vessel. The floor-plates are $\frac{5}{16}$in. in thickness; the bulkheads vary from ¼in. to ⅛in. The outside bottom plating is a little less than $\frac{5}{16}$in. The upper-deck stringer is ⅜in.; the water-tight deck over the machinery is ⅜in. The frames are spaced 23in. apart. The upper deck is of 3½in. crown deals, while the lower deck is of 2½in. The watertight or protective deck has no planking on it, except in the passages, where 1¼in. teak is laid. The stern, sternpost, shaft brackets, steering tiller, and a large number of other things which are usually made of wrought iron have been made of cast steel by the Steel Company of Scotland, and not a single casting has had to be rejected by her builders. This speaks very favourably for the certainty with which steel castings can now be produced.

The preliminary trials of this vessel took place on the Clyde, at Skelmorlie, on the 20th August. The engines are horizontal compound, working at 120 lb. pressure; there are two independent sets, one for each screw, each having cylinders of 26in. and 46in. diameter by 30in. stroke. The crank, intermediate, and propeller shafting are all of Whitworth's fluid compressed steel. The connecting and piston rods are of Siemens steel. The framing is of cast steel made by the Steel Company of Scotland. The cylinder liners are of fluid compressed steel. The slide valves are all of the piston type. She is the first vessel in her Majesty's service in which all the valves are of this kind. The condensers are of brass and are circular in form, having 5200 square feet cooling surface. These engines throughout are exceedingly lightly constructed for the power which they develope; but as their maximum power will be but seldom used, there is not the same margin of strength necessary as in an ordinary merchant ship. The boilers are of the usual Navy type, with the tubes in the ends of the furnaces. There are four boilers, each 9ft. in diameter and 18ft. long, with three corrugated furnaces, having in all 200 square feet of grate. The safety valves are loaded to 120 lb. The stokeholes are closed air-tight and are put under air pressure by four fans, two in each stokehole. The whole of the machinery is under the protective deck, the boilers being in two separate compartments. On the trial, with an air pressure in the stokehole of 1½in., the maximum indicated horse-power was 3700, or 18½-horse power per square foot of grate. The engines were running at 156 revolutions, and the ship attained a mean speed of 17·3 knots per hour on the measured mile with a mean horse-power of 3200. The maximum power developed is capable of increasing the speed to above 18 knots. As the machinery of this vessel does not much exceed 300 tons the result cannot but be considered as highly satisfactory. The Scout is much smaller and less costly than the Iris and Mercury, but her armament is in many respects more formidable, while her speed will be very little less. For the price of the Iris four Scouts can be produced. This is a fair measure of the progress which has been made in war ships and engine design and construction in the last ten years, and both the Admiralty and Messrs. Thomson are to be congratulated upon the results. A large portion of this advance is due to the very much greater amount of horse-power which can be produced for one ton of weight than could be when the Iris was designed. Her machinery, which developed 7500 indicated horse-power and weighed 1100 tons, were thought to have been a marvel of lightness. In the contracts for the armour-clads which were recently placed by the Admiralty, 10,500 indicated horse-power has been guaranteed for less weight. Hence, if the Iris had had the benefit of the improvement which has been introduced into the Scout's machinery, her engines would have developed 11,000-horse power. The Scout's engines are horizontal, in order to keep everything vital as far below the water as possible.

This type of vessel cannot fail to be a valuable addition to her Majesty's Navy, and is of a class which has often been asked for by naval officers. Small, swift, handy, simple, and, above all, cheap and capable of being quickly built, she will in the hands of a daring officer be a troublesome opponent to even the most powerful armour-clad. Representing as she does only one-tenth of the cost of one of our first-class battle-ships, it is doubtful whether she is not much better value for the nation's money. Her weak point is undoubtedly her want of protection, but we understand that her builders, profiting by their experience in the Scout, have prepared a design in which, by a rearrangement of her armament, a protective deck 3in. thick may be placed over the machinery. If this be carried out in future ships of this type, we think that it is not unlikely that this class of vessel will be very largely adopted in both British and foreign Governments. The constructors of the Scout are to be congratulated on having produced a type of vessel which cannot fail to be a favourite with naval officers.

IMPROVED CABLE GRIPPER.

THE engraving shows a device for gripping the cable of cable roads, patented by Mr. David B. Anders, of 2116, Master-street, Philadelphia, Pa. A flat bar, projecting downward from the car floor through the slot in the tunnel in which the cable runs, is connected by a chain with a groove-edged quadrant on a shaft journalled on the car floor, and having an upwardly projecting lever. The upper end of an arm extending upward from the flat bar is provided with a nut, through which passes a screw having a hand wheel on its upper end, and having its lower end swivelled on the upper end of a rod passing downward in front of the bar. On the lower end of the bar is a cross piece having a slot, into which pass two pins projecting from the upper end parts of two gripping levers, pivotted on the bottom edge of the flat bar. Below the pivot these levers have gripping jaws, from



which lugs extend downward and away from each other. Guide lugs also extend downward and outward from the lower end of the bar, in which a roller is journalled to prevent the lower edge of the bar from sliding off the cable, thus greatly reducing the friction. To grip the cable the screw is turned to raise the rod, whereby the jaws are pressed firmly against the cable; to release the cable the rod is moved downward. The lugs on the levers guide the cable in between the jaws. When the car arrives at a cable crossing, the cable is released and the lever swung down, thereby raising the flat bar by means of the chain; the lugs on the bar guide the cable to place. This grip operates quickly and holds the cable firmly.—*Scientific American.*

THE GERMAN AND SPANISH NAVIES.—It may be of interest, in view of a possible conflict between Germany and Spain, to reproduce the following statistics with regard to the nominal strength of the navies of the two countries:—Germany has 13 first-class ironclads, with 147 guns and 5990 men; 14 ironclad gunboats, each armed with a revolving Krupp gun, and with a crew of 76 men; 8 cruising frigates, armed with 123 guns, and carrying 3200 men; 10 cruising corvettes, with 99 guns and 2700 men; 4 cruisers, with 22 guns and 484 men; 4 gunboats, with 12 guns, 350 men; 8 despatch boats, with 18 guns and 800 men; 9 training ships, with 78 guns and 1050 men; 2 transports, 11 coasters, 11 light-ships, and a great number of torpedo ships, of which no fewer than 30 are capable of taking the open sea. As against this fleet, Spain cannot oppose, even on paper, more than 5 first-class iron-clads, with 62 guns; 4 first-class wooden frigates, with 97 guns; 6 first-class cruisers, with 48 guns; 4 second-class wooden frigates, with 99 guns; 5 second-class cruisers, with 15 guns; 7 steam corvettes, with 26 guns; 3 despatch boats, with 9 guns; 2 third-class cruisers, with 6 guns; 18 steamers, with 53 guns; 1 transport, with 2 guns; 10 second-class gunboats, each with 1 gun; 42 third-class gunboats, of which 10 are armed with 2 and the rest with 1 gun; 11 sloops, each armed with 1 gun; 4 torpedo ships, 1 steam tug, with 2 guns; 4 sailing vessels, with 33 guns, and 5 pontoons.

THE EFFICIENCY OF AMERICAN STEAM BOILERS.

(*Continued from page* 206.)

HARRISON BOILER.

The test began at 11.25 a.m., October 9th, 1884, in the same manner as described for the Root test. At 12.57 p.m., October 10th, cleaned boiler by means of steam nozzle, and at 11.25 p.m., October 10th, fires were hauled and the test concluded.

Rating of boilers, manufacturers	100-h p.
Water heating surface	948·54 sq. ft.
Steam ,, ,,	348·96 sq. ft.
Total ,, ,,	1297·50 sq ft.
Steam room in boiler	29·8 cub. ft.
Grate surface	35·13 sq. ft.
Height of stack from ground	44ft. 6in.
Size of pipe	30 by 30
Water in boiler to steaming level	4878 lb.
Time of test	36 hours.
Total weight of water evaporated in boiler	92,606·75 lb.
Mean temperature of water	68·77 deg. F.
Total weight of wood used	348·5 lb.
,, ,, coal ,,	11,725·75 lb.
,, ,, ashes ,,	1475·75 lb.
Percentage of carbon in coal	75·21 lb.
,, ,, hydrogen in coal	1·82 lb.
Mean temperature of air during test	57·84 deg. F.
Mean barometer	30·253in.
Mean pressure in boiler	95·83 lb.
Mean temperature of steam	337·16 deg. F.
Mean temperature of smoke pipe	411·03 deg. F.
Mean draught in chimney	·24in. water.
Mean pounds of air per pound of carbon = 15·09	

Quality of steam.—The quality of the steam was determined both by the Barrus calorimeter and the apparatus shown in Fig. 3, with the following results:—

Barrus Calorimeter.

From 5.40 p.m. to 7.40 p.m., October 9th, steam contains 7·4 per cent. water.
From 7.40 p.m. to 9.40 p.m., October 9th, steam contains 7·0 per cent. water.
From 9.40 p.m. to 11.40 p.m., October 9th, steam superheated 63 deg.
From 1.25 a.m. to 4.20 a.m., October 10th, steam contains 3·4 per cent. water.
From 4.20 a.m. to 11.30 a.m., October 10th, steam contains 3·5 per cent. water.
From 11.30 a.m. to 1.25 p.m., October 10th, steam contains 2·1 per cent. water.
From 2.40 p.m. to 4.45 p.m., October 10th, steam contains 0·11 per cent. water.
From 4.50 p.m. to 6.45 p.m., October 10th, steam contains 2·8 per cent. water.
From 6.50 p.m. to 8.55 p.m., October 10th, steam contains 4·5 per cent. water.
From 9.45 p.m. to 11.20 p.m., October 10th, steam superheated 168 deg.

From the apparatus shown in Fig. 3 we have the following results:

1 p.m., October 9th	steam superheated 68 deg.
2 p.m., October 9th (*a*)	,, ,, beyond limits of tables.
4 p.m., October 9th	steam contains 13·1 per cent. water.
5 p.m., October 9th	,, ,, 5·3 ,, ,, ,,
6, 9, 10, 11, 12	same as (*a*)
7	steam contains 30·7 per cent. water.
1 a.m., October 10th	same as (*a*).
3 a.m., October 10th	steam superheated 57 deg.
5, 6 a.m., October 10th	same as (*a*).
7 a.m., October 10th	steam contains 7·7 per cent. water.
8 a.m., October 10th	,, surperheated 57 deg.
9, 10, 11, 12, October 10th	same as (*a*).
1 p.m., October 10th	same as (*a*).
3, 4, 5, 6, October 10th	same as (*a*).
7 p.m., October 10th	steam superheated 70 deg.
9, 10, and 11 p.m., Oct. 10th	same as (*a*).

While the results given from the Barrus calorimeter show a reasonable agreement, it is doubtful whether the results are a fair measure of the quality of the steam produced, as the thermometer in the steam space shows 337·16 deg. F., while the temperature corresponding to the steam pressure, 95·83 lb., is 334·93 deg. F. The difference, or 2·23 deg., shows that the average quality of the steam was dry or superheated 2·23 deg. F., and in the succeeding deductions this value will be taken in calculating the relative weight of water evaporated per pound of coal. As before, assuming that 1 lb. of wood = ·24 lb. of coal, the total equivalent weight of coal used is $348·5 \times ·24 + 11,725·75 = 11,809·39$ lb. The percentage of ash is $\frac{1475·75}{11,809·39} = 12·5$ per cent., while the analysis made shows 14·03 per cent. The heat-giving power of the fuel is determined as follows:—There being 75·21 per cent. of carbon and 1·82 per cent. of hydrogen, exclusive of water, the equivalent percentage of carbon is $75·21 + 1·82 \times 4·28 = 83·00$ per cent., and the equivalent amount of carbon in the 11,809·39 lb. of coal is $11,809·39 \times ·83 = 9801·79$ lb. To change 1 lb. of water at 68·77 deg. F. into steam at 337·16 deg. F. requires $1184·77 - 36·77 = 1148·00$ heat units. As it takes 966·07 heat units to change 1 lb. of water at 212 deg. into steam, at 212 deg., 1 lb. of water from 68·77 deg. to steam at 337·16 deg. requires the same amount of heat as 1·1883 lb. of water from and at 212 deg.

Pounds of water evaporated per hour under the conditions	= 2572·41
Pounds of water evaporated per hour from and at 212 deg.	= 3056·79
Pounds of coal used per hour	= 328·04
Equivalent pounds of carbon used per hour	= 272·27
Horse-power of boiler on the basis of 30 lb. of water from and at 212 deg. per horse-power	= 101·89
Pounds of water evaporated per pound of coal under the conditions	= 7·8417
Pounds of water evaporated per lb. of coal from and at 212 deg.	= 9·3183
Pounds of water evaporated per equivalent pound of carbon under the conditions	= 9·4480
Pounds of water evaporated per equivalent pound of carbon from and at 212 deg.	= 11·2270
Amount of air used in furnace per pound of coal $\frac{15·09}{·7521}$	= 20·06 lb.

DICKSON'S BOILER.

This boiler, Figs. 8 and 9, is manufactured by the Dickson Manufacturing Company, of Scranton, Pennsylvania. It is a horizontal tubular boiler having sixty-eight 3in. tubes, each 15ft. long. It has a spread fire-box wider at the top than at the bottom. The grate used was of the Howe pattern, 6ft. 6in. by 4ft. 10in. The shell is cylindrical, 50in. in diameter, and is 34½ft. long. The steam dome is 30in. by 30in. Rating of boiler, manufacturers = 76-horse power. Before beginning this test the boiler was thoroughly protected by means of a 1in. lay of felt over the entire boiler, excepting the front head. The test began at 6.31 p.m., October 13th, 1884, and ended at 6.31 a.m., October 15th. The boiler was designed to burn culm, but as none could be procured in time for the test, screenings from pea coal were used instead.

Water-heating surface	= 841· sq. ft.
Steam ,, ,,	= 2·5 sq. ft.
Total ,, ,,	= 843·5 sq. ft.
Grate surface	= 31·41 sq. ft.
Steam space in boiler	= 67 cub. ft.
Weight of water in boiler at ordinary standing level	= 10,200 lb.
Time of test	= 36 hours.
Total weight of water evaporated in boilers	= 137,152·75 lb.
Water used per hour to run jet	= 472·5 lb.
Mean temperature of water	= 67·17 deg. F.
Total weight of wood used	= 232·5 lb.
,, ,, coal ,,	= 20,026·50 lb.
,, ,, ashes (net)	= 5048·37 lb.
Percentage of carbon in the coal	= 72·87
,, hydrogen, exclusive of water	= 2·53
Mean temperature of air	= 50·26 deg. F.
Mean barometer	= 30·299in.
Mean pressure in boiler	= 83·54 lb.
Mean temperature of steam	= 326·19 deg. F.
Mean temperature of smoke stack	= 422·72 deg. F.
Mean draught in chimney	= ·15in.
Mean air per pound of carbon	= 13·66 lb.

Quality of steam.—The quality of the steam was determined both by the Barrus calorimeter and by the apparatus shown in Fig. 3, with the following results:—

Barrus Calorimeter.

From 7.20 p.m., October 13th, to 11.20 a.m., October 14th, steam contains 0·78 per cent. water.
From 1.20 a.m. to 3.20 a.m., October 14th, steam contains 2·7 per cent. water.
From 3.20 a.m. to 5.20 a.m., October 14th, steam contains 1·9 per cent. water.
From 5.20 a.m. to 12 noon, October 14th, steam contains 2·5 per cent. water.
From 12 noon to 2 p.m., October 14th, steam contains 7·6 per cent. water.
From 2 p.m. to 4 p.m., October 14th, steam superheated 22 deg.
From 4 p.m. to 6 p.m., October 14th, steam superheated 7 deg.
From 6 p.m. to 8 p.m., October 14th, steam contains 1·2 per cent. water.
From 8 p.m. to 10 p.m., October 14th, steam contains 3·8 per cent. water.
From 10 p.m. to 12 midnight, October 14th, steam contains 2·6 per cent. water.
From 10 midnight to 2 a.m., October 15th, steam contains 0·8 per cent. water.
From 2 a.m., October 15th, to 4 a.m., October 15th, steam contains 1·7 per cent. water.
From 4 a.m., October 15th, to 6 a.m., October 15th, steam contains 1·2 per cent. of water.

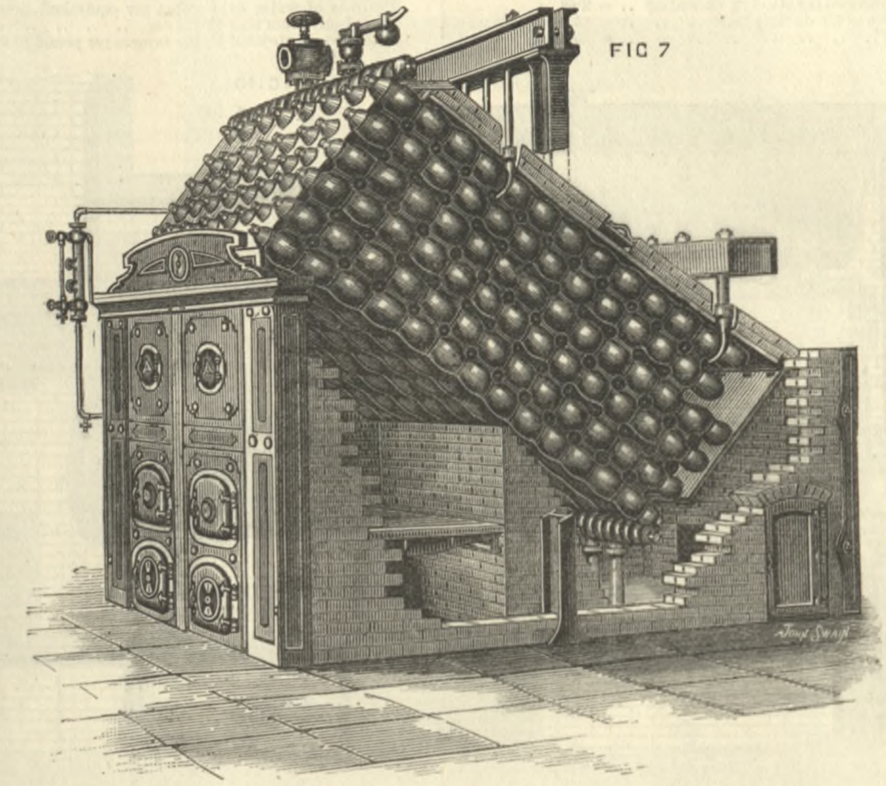


FIG 7

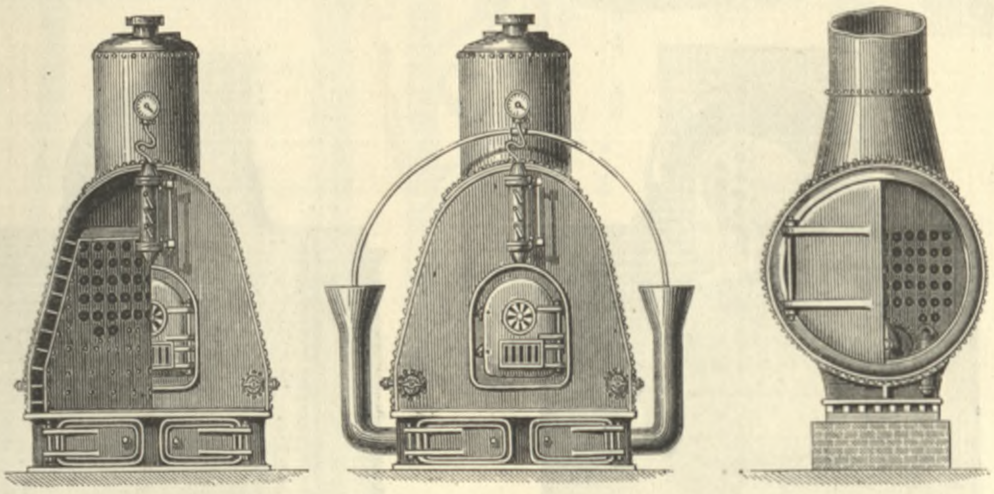
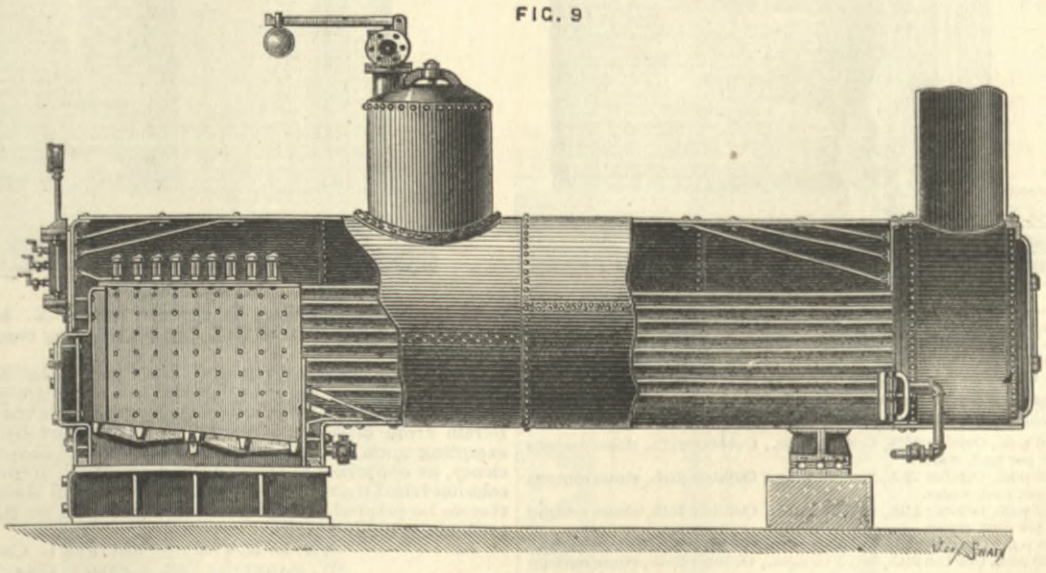


FIG. 8.

FIG. 9



The results from the apparatus shown in Fig. 3 were totally unreliable, giving in every case highly superheated steam of 400 deg. or over. As the temperature of the steam almost exactly corresponds with the temperature corresponding to the pressure, it is evident that the steam must have been either saturated or wet, and taking the results from the Barrus apparatus as correct, we have for a mean 1·55 per cent. of moisture in the steam, and this value will be taken in the succeeding deductions. As before, assuming that one pound of wood = ·24 lb. of coal, the total equivalent weight of coal used is $232·5 \times ·24 + 20,026·50 = 20,082·3$ lb. The percentage of ash is $\frac{5048·37}{20,082·3} = 25·1$ per cent., while the analysis of the coal made shows but 10·39 per cent. This discrepancy may be accounted for in the following way: the coal used was siftings from pea coal, much of which fell through the grate partly burnt, and as the ashes were continually wet from the steam jet, no attempt was made to burn the refuse a second time, as the loss from the wet ashes would probably be more than the gain from more perfect combustion. The equivalent weight of carbon used was determined as in the case of the preceding boilers. The percentage of carbon being 72·87 and of hydrogen—exclusive of water—2·53, the equivalent percentage of carbon is $72·87 + 4·28 \times 2·53 = 83·70$; and the equivalent amount of carbon in the 20,082·3 lb. of coal is 16,808·89 lb. To change one pound of water at 67·17 deg. into steam 83·54 lb. pressure and containing 1·55 per cent. of moisture requires $1167·78 - 35·17 = 1132·61$ heat units. As it takes 966·07 heat units to change one pound of water at 212 deg. into dry steam at 212 deg., one pound of water under the conditions of this test requires the same amount of heat as 1·1724 lb. of water from and at 212 deg. As the total weight of water evaporated is 137,152·75 lb., and as 472·5 lb. of water are used per hour to run the jet, the amount of water available for use outside the boiler, or the proper quantity of water which should be credited to the boiler is $137,152·75 - 36 \times 472·5 = 135,451·75$ lb.

Pounds of water evaporated per hour under the conditions	= 3762·55
Pounds of water evaporated per hour from and at 212 deg.	= 4411·21
Pounds of coal used per hour	= 557·84
Equivalent pounds of carbon used per hour	= 466·91
Horse-power of boiler (on basis of 30 lb. of water from and at 212 deg. per horse-power)	= 147·04
Pounds of water evaporated per pound of coal under the conditions	= 6·7449
Pounds of water evaporated per pound of coal from and at 212 deg.	= 7·9076
Pounds of water evaporated per equivalent pound of carbon under the conditions	= 8·0584
Pounds of water evaporated per equivalent pound of carbon from and at 212 deg.	= 9·4477
Amount of air used in furnace per pound of coal $= \frac{13·66}{·7287}$	= 18·74 lb.

BALDWIN BOILER.

An attempt to test this boiler was made on September 29th, 1884, and after continuing for twenty-four hours the fires became very low because of the coal having so much clinker, requiring that the fires should be constantly cleaned, and the test was stopped. At the request of the company exhibiting the boiler, a second test was made beginning at 1.19 p.m., October 24th, 1884, and ending at 1.19 p.m., October 25th, 1884, and the results of this test alone are given in this report. The boiler was made by the Baldwin Locomotive Works. It is a horizontal cylindrical flue boiler 16ft. long, of 54in. diameter, and having 4in. flues. The bottom of the boiler was set 34in. above the grate. Over the boiler is placed a steam drum 24in. in diameter and 8ft. long, connected to the boiler by means of one neck 12in. in diameter and 10in. long.

Rating of boiler	= 50-H.P.
Grate surface	= 21 sq. ft.
Heating surface, total	= 799·62 sq. ft.
Heating surface, wetted	= 663·31 sq. ft.
Heating surface, steam	= 136·31 sq. ft.
Grate	= 42in. by 72in.
Chimney	= 30in. by 30in.
Height of chimney	= 44ft. 6in.
Time of test	= 24 hours
Total weight of water evaporated in boiler ..	= 38,108·0 lb.
Mean temperature of water	= 59·91 deg. F.
Total weight of wood used	= 191·5 lb.
Total weight of coal used	= 6031·0 lb.
Total weight of ashes	= 654·25 lb.
Percentage of carbon in coal	= 80·22
Percentage of hydrogen (exclusive of water) ..	= 2·53
Mean temperature of air during test	= 45·25 deg. F.
Mean barometer	= 30·274in.

FIG. 10

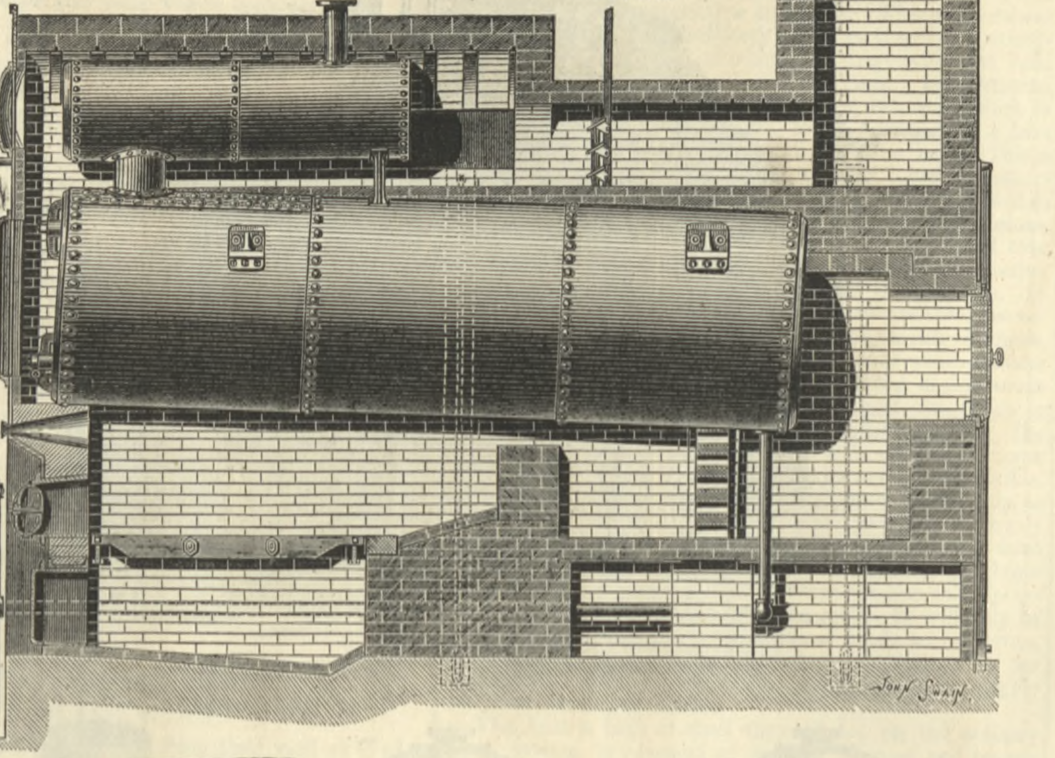
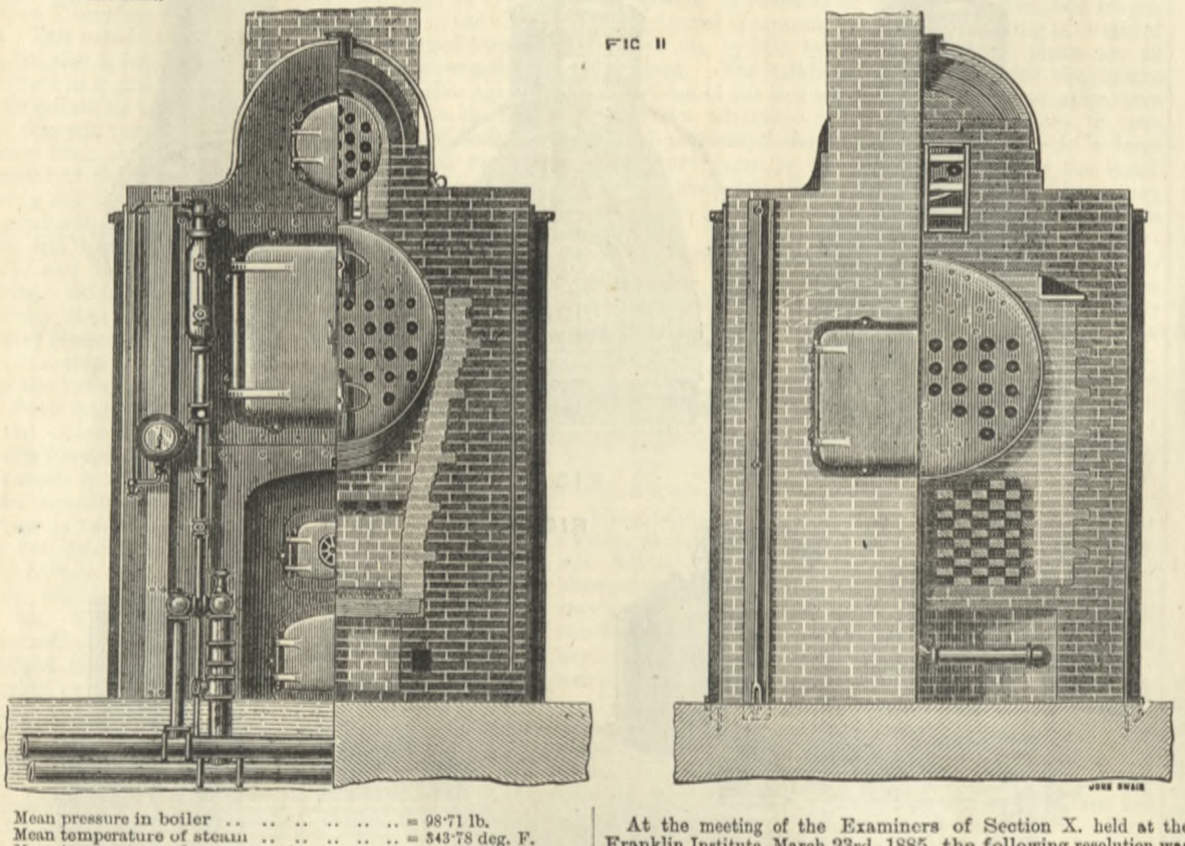


FIG. 11



Mean pressure in boiler	= 98·71 lb.
Mean temperature of steam	= 343·78 deg. F.
Mean temperature of smoke stack	= 346·85 deg. F.
Mean draught in chimney	= ·243in.
Mean air per pound of carbon	= 16·24 lb.

Quality of steam.—The quality of the steam was determined only by the Barrus calorimeter with the following results:—

From 2.50 p.m., October 24th, to 4.20 p.m., October 24th, steam contains 0·78 per cent. water.
From 4.20 p.m., October 24th, to 6.20 p.m., October 24th, steam contains 1·8 per cent. water.
From 6.20 p.m., October 24th, to 8.20 p.m., October 24th, steam contains 1·9 per cent. water.
From 8.20 p.m., October 24th, to 10.20 p.m., October 24th, steam is dry.
From 10.20 p.m., October 24th, to 12.20 a.m., October 25th, steam contains 2·8 per cent. water.
From 2.20 a.m., October 25th, to 4.20 a.m., October 25th, superheated 174 deg.
From 4.20 a.m., October 25th, to 6.20 a.m., October 25th, contains 3·9 per cent. water.
From 8.40 a.m., October 25th, to 12.20 p.m., October 25th, contains 23·5 per cent. water.

The mean of these results is 6·95 per cent. of moisture in the steam. The temperature of the steam by thermometer is 343·78 deg. F., and the temperature corresponding to the pressure 98·71 lb. per gauge is 336·83 deg. F., and the average quality of the steam from the temperature is 6·95 deg. superheated. Assuming that this latter value is more correct than the one given by the Barrus calorimeter, this value will be used in the following deductions. As before, assuming that 1 lb. of wood = ·24 lb. of coal, the total equivalent weight of coal used is $6031 + 191·5 \times ·24 =$ 6076·96 lb. The percentage of ash is $\frac{654·25}{6076·96} = 10·76$ per cent., while the analysis made shows 10·39 per cent. The equivalent weight of carbon used was determined as in the cases of the preceding boilers. The percentage of carbon being 80·22, and of hydrogen—exclusive of water—2·53 per cent., the equivalent percentage of carbon is $80·22 + 4·28 \times 2·53 = 91·05$ per cent., and the equivalent amount of carbon in 6076·96 lb. of coal is = 5533·07 lb. To change 1 lb. of water at 59·91 deg. into steam of 98·71 lb. pressure and 6·95 deg. superheated, requires $1186·791 - 27·91 =$ 1158·881 heat units. As it takes 966·07 heat units to change 1 lb. of water at 212 deg. into steam at 212 deg., 1 lb. of water under the conditions of this test requires the same amount of heat as 1·1996 lb. of water from and at 212 deg.

Pounds of water evaporated per hour, under the conditions	= 1587·83
Pounds of water evaporated per hour, from and at 212 deg.	= 1904·76
Pounds of coal used per hour	= 253·21
Equivalent pounds of carbon used per hour	= 230·54
Horse-power of the boiler (on the basis of 30 lb. of water from and at 212 deg. per hour horse-power) ..	= 63·49
Pounds of water evaporated per pound of coal, under the conditions	= 6·2708
Pounds of water evaporated per pound of coal from and at 212 deg.	= 7·5224
Pounds of water evaporated per equivalent pound of carbon, under the conditions	= 6·8874
Pounds of water evaporated per equivalent pound of carbon, from and at 212 deg.	= 8·2621
Amount of air used in the furnace per pound of coal ..	= 20·24 lb.

At the meeting of the Examiners of Section X. held at the Franklin Institute, March 23rd, 1885, the following resolution was adopted*:—

Resolved:—That the report of Mr. Spangler be adopted as rendered, and that the same be published in its entirety, with the addition of a tabulated *résumé* of the results. That the committee refrain from criticism of the boilers as prescribed by the Code, excepting upon the points of economy of fuel and evaporated efficiency, as contained in report adopted. That all accuracy of the calorimetrical measurements be disclaimed, but all data referring thereto be printed, as evidence of work performed in the attempt to obtain reliable results.

Wm. D. Marks,	Arthur L. Church,
W. Barnet le Van,	Fred'k. Graff,
C. Chabot,	Chas. E. Ronaldson,
A. B. Wyckoff,	Otto C. Wolf,
	Committee present.

Members of Section X.—Gould H. Bull, C. Chabot, R. E. Crawford, J. E. Denton, Charles H. Fisher, Carl Hering, Washington Jones, Gaetano Lanza, W. Barnet le Van, William Ludlow, William D. Marks, O. E. Michaelis, John Milliss, John W. Nystrom, T. W. Rae, Charles E. Ronaldson, H. W. Spangler, Otto C. Wolf, A. B. Wyckoff.

* This report has, according to the directions of the Board of Managers of the Franklin Institute, been edited and supervised by the committee appointed for that purpose. The language of this resolution must not be interpreted to imply that any exception was made to the mode of printing the reports.

Persifor Frazer,
Wm. H. Wahl,
Executive Committee of Editing Committee.

Résumé of Results obtained in Boiler Tests.

Name of boiler on trial.	Root.	Harrison.	Dickson.	Baldwin.
Date of trial.	Oct. 2, 1884.	Oct. 9.	Oct. 13.	Oct. 24.
Duration of trial in hours ..	36	36	36	24
Rated horse-power by makers	150	100	75	50
Developed horse-power in test assuming 30 lb. of water from and at 212 deg. per horse-power	148·27	101·89	147·04	63·49
Water heating surface in square feet	1,440	948·54	841	663·31
Steam heating surface in square feet	360	348·96	2·50	136·31
Total heating surface in square feet	1,800	1,297·5	843·50	799·62
Grate surface in square feet ..	50	35·13	31·41	21
Ratio of grate to heating surface	1 : 36	1 : 37	1 : 26·8	1 : 38
Height of chimney, in feet, from grate	44·5	44·5	28·6	44·5
Average steam pressure in pounds per square inch ..	91·41	95·83	83·54	98·71
Barometer in inches	30·323	30·253	30·299	30·274
TEMPERATURES, FAHRENHEIT.				
Average temperature of the air (Fah.)	57	57·84	50·26	45·25
Average temp. of the steam in boilers	341·32	337·16	326·19	343·78
Temperature corresponding to average boiler pressure..	331·95	334·93	326·36	336·83
Average temp. of the chimney	369·92	411·03	422·72	316·85
Average temp. of the feed-water	71·6	68·77	67·17	59·91
COAL AND ASHES.				
Pounds of wood used	291·5	348·5	232·5	191·5
Pounds of coal used	18,021·5	11,725·75	20,026·5	6,031
Pounds of coal and wood, including value of latter ..	18,091·5	11,809·39	20,082·3	6,076·96
Pounds of ashes	2,666·75	1,475·75	5,048·37	654·25
Pounds of carbon	15,350·64	9,801·79	16,808·8	5,533·07
Pounds of carbon per hour ..	426·41	272·27	466·9	230·54
Pounds of coal per hour ..	468·87	328·04	557·84	253·21
WATER.				
Pounds of water feed in the boiler at average temperature above given	134,937·3	92,606·75	137,152·75	38,108
Pounds of water evaporated per hour from and at 212 deg.	4,448	3,056·79	4,411·21	1,587·83
Pounds of water evaporated per pound of coal	7·99	7·84	6·75	6·27
Pounds of water evaporated per pound of carbon from and at 212 deg.	10·43	11·23	9·45	8·26
Quality of steam by thermometer, or amount of superheating	9·37	2·23	—	6·95
Percentage of moisture.. ..	—	—	1·55	—
RATE OF COMBUSTION.				
Pounds of coal burnt per square foot of grate per hour	10	9·3	18	12
Pounds of water per square foot of grate per hour ..	87	89	140	76
Pounds of water per square foot of heating surface per hour	2·3	2·5	5·2	2
DRAUGHT.	Blower.	Natural.	Steam jet.	Natural.
Mean draught in chimney in inches	0·7	·24	·15	·13
Steam room in boiler in cubic feet	7·65 ap.	29·8	67	—

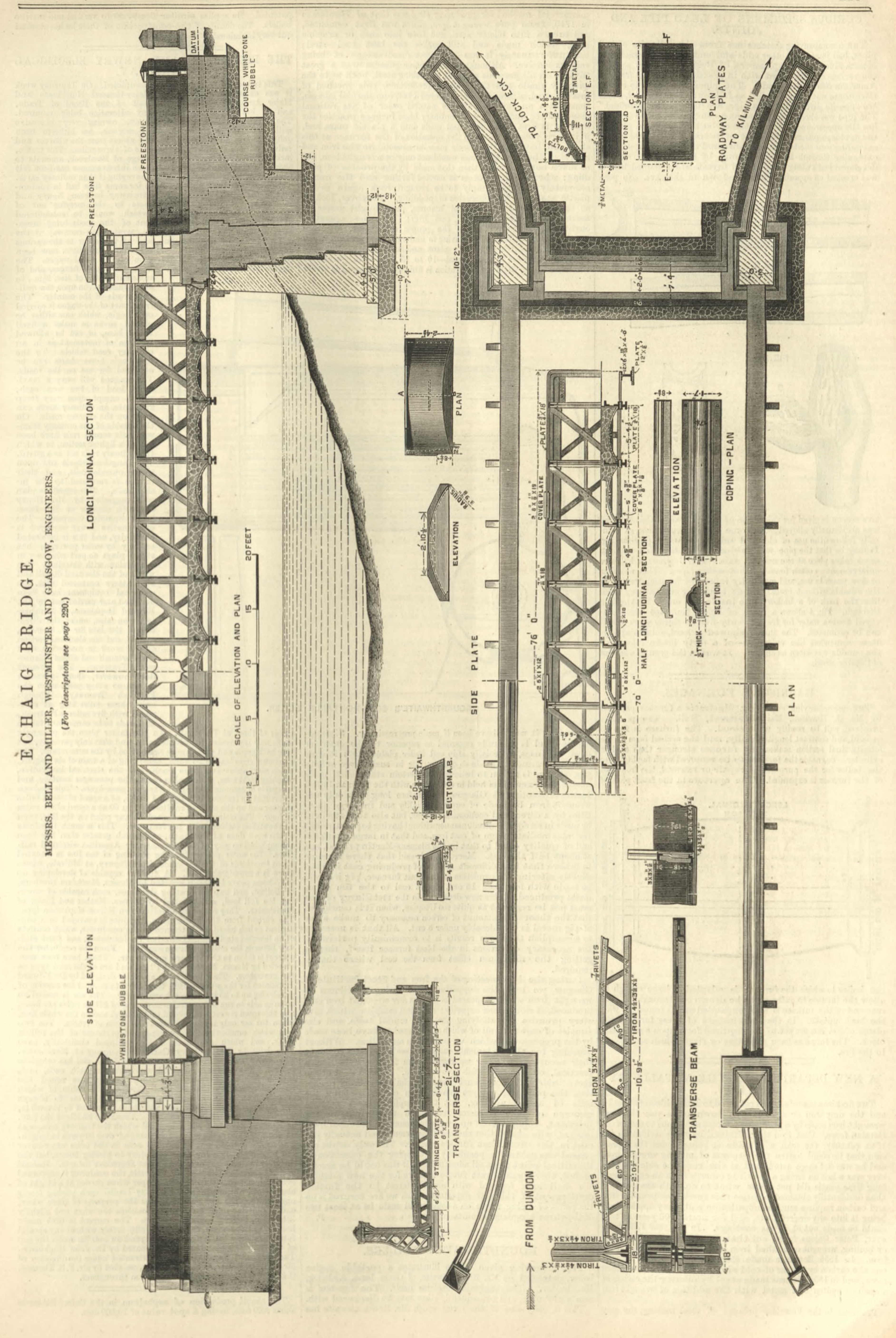
Steam Tramway Engine Manufacture.—A point of much interest to the manufacturers of steam tramway engines has just come before Mr. Justice Day, sitting at the Birmingham Assizes. It was an action which occupied the closing three days of the assizes, and was brought by Mr. Jno. Downes, of Birmingham, formerly the proprietor of large works at Liverpool and Stockport, to recover £20,000 damages from the Falcon Engine and Car Works, Loughborough, for alleged infringement of patent. The facts were unusually instructive. In 1870 Mr. Downes, observing the severe labour of the tram-car horses in Birmingham, conceived the notion of a noiseless and steamless engine to be used upon the road, and four years afterwards he entered into negotiations with Messrs. Hughes, of Loughborough, for the construction of such a locomotive. The engine was built at a cost of £600, and early in 1876 it was publicly tried in Birmingham. The trial turned out to be a complete success. Two or three months afterwards Messrs. Hughes conducted a public trial at Birmingham of a second engine which they had made, and which proved equally successful. Mr. Downes claimed that this second engine was a usurpation of his patent rights; but Messrs. Hughes ignored the claim, and floated a limited liability company, with a capital of over £71,000, to manufacture the locomotive. That company went into liquidation, and the concern was purchased by the Falcon Engine and Car Works, which has since carried on the production. The Falcon Company denied the infringement, and called Sir Frederick Bramwell. Sir Frederick gave it as his opinion that the plaintiff's notion for constructing a noiseless engine was entirely that of water condensation, while the defendants' was that of air condensation. There were many noiseless engines in use before plaintiff's patent was taken out. Mr. Justice Day concurred, and entered a verdict for the defendants. Mr. Downes has intimated that he will appeal.

Removing Microbes from Water.—Professor Frankland has recently made a series of experiments on the relative efficiency of filtration, agitation with solid particles, and precipitation as a means of removing micro-organisms from water. His method was to determine the number of organisms present in a given volume of the water, before and after filtration. The filtering materials were greensand, silver sand, powdered glass, brickdust, coke, animal charcoal and spongy iron. These materials were all used in the same state of division, being made to pass through a sieve of forty meshes to the inch. Columns 6in. in height were used. It was found that only greensand, coke, animal charcoal and spongy iron, wholly removed the micro-organisms from the water filtered through them, and that this power was lost in every case, after the filters had been in operation a month. With the exception of the animal charcoal, however, all these substances, even after being in operation for a month, continued to remove a very considerable proportion of the organisms present in the unfiltered water; and in this respect coke and spongy iron occupied the first place. Water containing micro-organisms was also agitated with various substances in the same state of division as above mentioned, and after subsidence of the suspended particles, the number of organisms remaining was determined. A gramme of substance was in general agitated with 50 c.c. of water for a period of about fifteen minutes. It was found that a great reduction in the number of organisms could be produced in this way; and the complete removal of all organisms by agitation with coke is especially to be remarked. Precipitation by "Clark's process" also showed that it affords a means of greatly reducing the number of these organisms in water. Dr. Frankland concludes from his experiments that although the production in large quantities of sterilised potable water is a matter of great difficulty, involving the continual renewal of filtering materials, there are numerous and simple methods of treatment which secure a large reduction in the number of organisms present in water.—*Journal of the Society of Arts.*

ECHAIG BRIDGE.

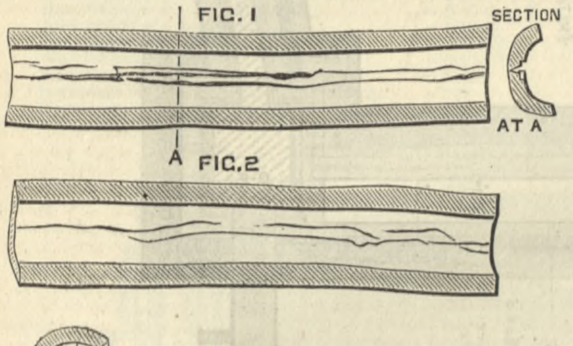
MESSRS. BELL AND MILLER, WESTMINSTER AND GLASGOW, ENGINEERS.

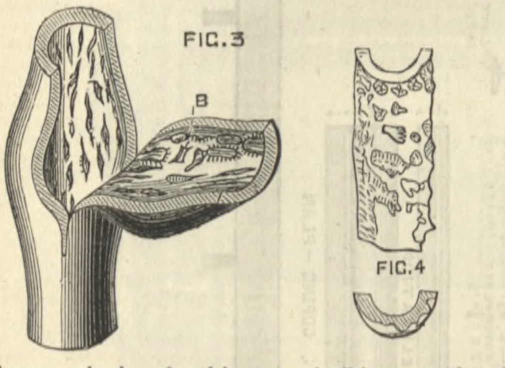
(For description see page 220.)



CURIOUS SPECIMENS OF LEAD PIPE AND JOINTS.

THE accompanying sketches are from the collection of lead pipes, bad joints, and other odds and ends in the possession of Messrs. Riley and Hill, plumbers, of Boston, and show some of the various conditions met with in practice. They are from the American *Sanitary Engineer*. The pipes were used to convey Cochituate water, and labelled as follows:—Figs. 1 and 2, which are opposite parts of the same pipe, are described as "poor lead." The pipe was three years in use as a conveyor of cold water, and has the appearance of being vitrified on the inside—or, perhaps, the appearance is more like that of petrified wood—the colour extending into the lead about $\frac{1}{16}$in., and the hardness apparently extending through it, judging only by the cracks. This pipe developed leaks along its side, and investigation showed that it was cracked on opposite sides, as shown in sketches. No posi-

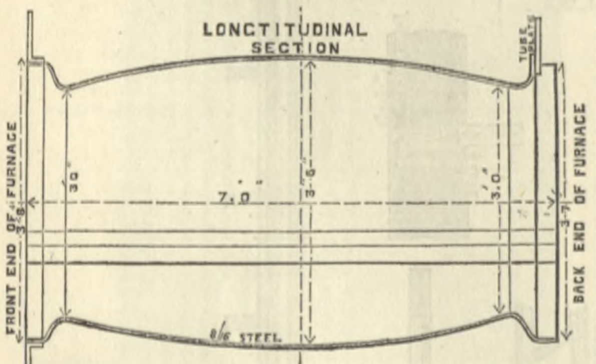




tive reason is given for this state of affairs, except that the lead was accidentally alloyed with some foreign substance, as naturally follows the use of old and mixed leads for pipe-making. It may be that the pipe was subject to bending, and that the crack takes place at the neutral axis. Fig. 3 shows a bulge or enlargement so often found on hot-water pipes. This was four or five years in use, and gradually increased in size, drawing on the outside without cracking, but becoming cracked very much like the bark of a hickory tree inside, the crack B extending through. Fig. 4 shows a piece of heavy $\frac{3}{4}$in. pipe which conveyed Boston water for from twenty-five to thirty years as well can be estimated. The inside showed a hard, smooth appearance—somewhat like vulcanite—of a dirty brown colour, and the outside was eaten as shown. It was in the ground where an old stable stood.

HARRISON'S FURNACES.

THE accompanying engraving illustrates a furnace patented by Mr. J. Harrison, Margaret-street, Hull. The principle involved will be readily understood. The furnace is free to expand and contract longitudinally, and the arched form of the longitudinal section makes the furnace stronger than a plain cylinder. To enable the furnace to be removed with facility from the boiler for the purposes of repair or removal, the front end of the furnace is expanded. The aperture in the front plate of



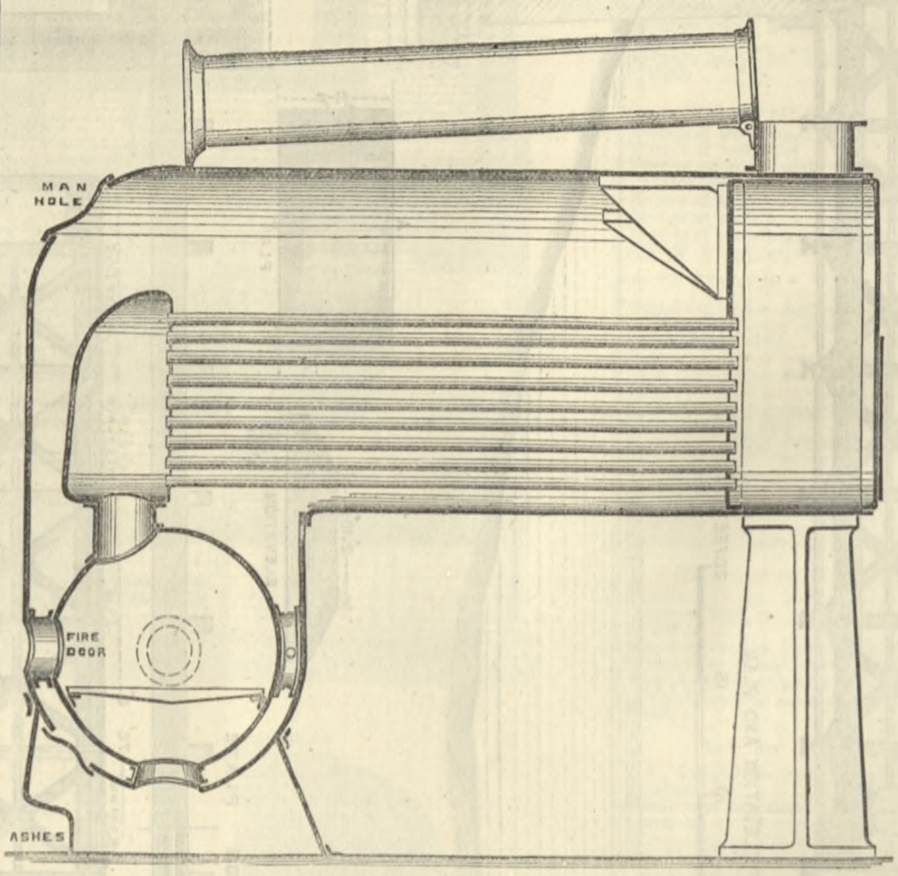
the boiler to which the furnace is adapted is large enough to allow the furnace to enter or to be drawn out through it. The rear end of the furnace is also expanded and is connected with the back uptake. In the manufacture of these furnaces, the plates whilst hot are set to the required form upon a cast metal block. The furnaces have no seams or rivets which are exposed to the fire.

A NEW DEPARTURE IN THE METALLURGY OF IRON.

THE first iron manufactured referred to in the oldest of all books, and the only iron or steel known down to the year 1600, was wrought iron made by a primitive process analogous to that of the Catalan forge. Cast iron was obtained by mere accident in the 15th century, the man who made it being under the impression that he could hasten the process of making wrought iron, and he was not more astonished at the result he obtained than ever was a hen on seeing a duckling emerge from an egg. For a long time people did not know what to do with the cast iron thus accidentally obtained, because this special compound of iron and carbon requires much manipulation and many appliances to bring it into any desired form, and for nearly 100 years all that could be made out of it was castings. In the year 1784, however, Peter Onions found out that, by the process of puddling or boiling, wrought or finished iron could be produced from pig iron. In 1855 Bessemer made steel out of cast iron, burning out the carbon by means of cold air forced through the molten mass, and in 1856 Siemens made steel by diluting the carbon of a bath of molten cast metal with the addition of wrought iron or iron ore.

Previous to the Bessemer process of steel making, the only commercial method for producing steel was that of Huntsman in 1740, from pure wrought iron, which was first cemented, and turned into blister steel, and then into cast or crucible steel, which made and still makes the best tool steel; but unfortunately it has the great disadvantage of being very expensive. Although the Bessemer process was a great advance on all previous methods of making steel, both as to the quantity made and the price of production, this method of making steel, although it has achieved a vast commercial success, constitutes an inversion of the natural order of its rational manufacture, inasmuch as in ordinary blast furnace practice the iron ore is first deoxidised and made into a plastic mass, and, if it were possible to stop the operation of the furnace at this stage and hammer the plastic mass to consolidate the iron and get rid of the slag, the mass would not only be wrought iron, but of much better quality than that made by the process of puddling; whereas the process is carried further and the iron is completely molten, simply to be brought back again to the plastic state by the operation of puddling. Moreover, looking at the matter in a rational manner, steel ought never to assume the condition of cast iron; but the operation ought to be stopped when the proper degree of carburisation is attained, instead of having to undergo an operation which not only requires expensive plant and machinery, but also involves a serious loss of metal—10 to 15 per cent.—while at the same time, after the operation is finished, the steel is never so good as it would have been if made progressively. Siemens-Martin steel is generally regarded as superior to Bessemer for most purposes, especially ship and boiler plates, but it costs more and cannot be made so quickly, nor in such large quantities. There is reason to believe from certain statements made during the excursions held in connection with the Iron and Steel Institute meeting at Glasgow, that before long not only will wrought iron be made of superior quality and in large quantities by a direct and economical process, but also that steel will be made in an equally direct manner without having to pass through the intermediate range of cast iron, and that in large quantities and of quality equal to that by the Siemens-Martin process, and at about half the cost. Moreover, it is said that there is reason to believe that by a different method of producing cast iron and slightly altering the condition of the blast furnace, pig iron will be made with less than 18 cwt. of soft coal to the ton of pig metal produced. This new departure in the metallurgy of iron must not be regarded as quite too Utopian, when it is considered that the theoretical amount of carbon necessary to make a ton of pig metal is considerably under 8 cwt. All that is necessary to accomplish the above results is to economically perform all the necessary operations in the blast furnace itself, thereby getting the maximum effect from the coal where that is required.

During the late meeting of the Iron and Steel Institute at Glasgow we had the opportunity of seeing specimens of wrought iron which appeared as good as any wrought iron ever produced, if not indeed superior; also steel samples which give every promise of satisfying the most crucial tests, and also samples of cast iron, all of which were stated to have been made by the processes of which we have given an outline. Without vouching for the statements made, we see no reason to doubt their accuracy, whether we regard them from a scientific, a practical, or a commercial point of view. A good deal of the above information we must certainly admit is merely prediction, the processes not yet having been carried out on the scale of actual working, but the simplicity and rational sequence of the processes recommend themselves to the judgment, being backed up by the testimony of practical ironmasters, who stated that the conditions mentioned actually did exist in the usual blast furnace practice. The only doubt expressed was as to the possibility of stopping the operation at the critical point; but all admitted that if this could be accomplished, there was a vast future in store for the new method. We shall look forward with much interest to the further development of this new departure, which we are assured is on the point of being made on a commercial scale in at least two of the three kingdoms simultaneously. P.



ROUNDTHWAITE'S SEMI-PORTABLE BOILER.

ROUNDTHWAITE'S BOILERS.

THE engraving given above illustrates a portable engine boiler, patented by Mr. Roundthwaite, of Green-lane, Ardwick, Manchester. The engraving explains itself. The fire-box is nearly globular, and consequently stays may be dispensed with.

This is only one of the forms which Mr. Roundthwaite has patented. He applies similar fire-boxes to vertical and marine boilers. The details of the construction of these he has worked out very ingeniously.

THE BESSBROOK AND NEWRY ELECTRICAL TRAMWAY.

THIS tramway has been at last completed. On Thursday week it was examined officially by Major-General Hutchinson and Major Armstrong, R.E., on behalf of the Board of Trade, and it has passed without any alteration being required. The Bessbrook Spinning Company, owning very extensive mills and granite quarries at Bessbrook, has hitherto been obliged to cart all coals, goods, and stores from the wharves and railway stations at Newry, a distance of three miles. This traffic, including that incident to the village of Bessbrook, amounts to about 28,000 tons annually, and much inconvenience has been felt from having no better method of conveying it than ordinary carts. The directors of the company have for some time had in contemplation the establishment of a tramway between Newry and Bessbrook, but the great obstacle to the carrying out of this has been the difficulty which would be encountered at both ends by the transhipment of the goods being necessary, as there were difficulties in carrying the tramway at the one end to the railway stations, and at the other to the various departments of the mills. These difficulties have now been entirely overcome by a modification of the usual wagon. The wagons are constructed with wheels having no flanges, and of sufficient width of tire, $2\frac{1}{2}$in., to allow them to run upon the ordinary roads of the country. The front part of the wagon is carried on a bogie, which can either be pinned so as to make a fixed wheel base, or can be allowed freedom of movement as in an ordinary road vehicle. To the fore bogie horse shafts can be attached for use on the roads. The wagons will carry a maximum load of two tons each, which, except upon very steep gradients, an ordinary horse can draw on the country roads. On the outside of the ordinary tramway rails second rails have been laid of a lighter section, to which the ordinary rails act as a guard. The flangeless wheels run upon these outside rails, and their motion is restricted by the inside rails. This ingenious plan was suggested by Mr. Henry Barcroft, director of the Bessbrook Spinning Company. The only motive power employed is electricity, and this is generated entirely by water power, so that steam plays no part whatever in connection with this line. The whole of the electrical details and all matters connected with the electrical equipment have been designed and carried out by Dr. Edward Hopkinson, of Manchester, who also, under the direction of the late Sir W. Siemens, carried out the electrical portion of the work in connection with the Portrush and Giant's Causeway Tramway. The present line, however, shows advances in almost every point upon the Portrush Tramway. Though only three miles long as compared with five miles at Portrush, the loads to be carried are far in excess of those at Portrush. In the latter place the passenger traffic only is provided for electrically, and that only partially, but here both goods and passengers are carried by the same means. The maximum gross load is 26 tons, consisting of a train of six wagons, which carry about two tons each, and the electrical locomotive, weighing eight tons, which also forms the passenger carriage, and is capable of accommodating thirty-four passengers. This load can be brought up inclines averaging 1 in 85, at a speed of seven miles an hour and up the stiffest incline of 1 in 50 at a speed of six miles an hour. The train can be started at any point on the line, even on the stiffest incline, with perfect ease. This is much in excess of the work done at Portrush, and much greater than has been accomplished on any of the German or American electrical railways. The water power for the working of the line is situated about two-thirds of the distance from Newry, at Millvale, where there is a considerable fall. A turbine capable of developing up to 65-horse power has been erected by Messrs. MacAdam Brothers, of Belfast, and two generating dynamos, each capable of working the full load, constructed by Messrs. Mather and Platt, of Manchester. They are of the well-known Edison-Hopkinson type. The current from the generating dynamos is conveyed to a convenient switch board, and thence to the conductor, which consists of an inverted steel channel carried on insulators, and fixed midway between the ordinary tramway rail. From the conductor the current is taken to the motors on the car. These have been constructed by Messrs. Mather and Platt, and are of the same type as the generators. They have been specially designed by Dr. Edward Hopkinson for the work which they have to do, and are capable of developing up to 25 indicated horse-power. The car is geared so as to be able to run at a maximum speed of fifteen miles per hour, and this speed is easily attained on the level and up the whole line, when the car only is run without the train of trucks. The two cars which constitute the passenger department of the rolling stock, and which are both fully equipped electrically, have been built by the Ashbury Carriage Company of Manchester. The driver stands in front on a platform, and has complete control. The cars are carried on bogies at both ends, and, though 35ft. long over all, they readily pass round the terminal curves at either end of the line, the radius of which is only 55ft. This arrangement enables the car to always run in the same direction, so that there is no need to reverse it, which can, however, be easily done. About the middle of the line, at Millvale, there is a country road which the tramway crosses at an angle, so as to make a level crossing of over 50 yards in length. The conductor could not be carried here in the same way as over the rest of the line for fear of injury to passing horses, but the difficulty has been got over in a most ingenious manner. Instead of being carried at the level of the rails, the conductor is supported overhead, and consists of two copper wires carried at a height of about 15ft., which will allow of any loaded carts passing freely underneath. The car passes under the supports of these wires, and a collector fixed on its top catches the wires and slightly lifts them, making a good contact. The current is thus never broken, and the wires can hang quite freely without any special form of collector being necessary beyond an iron bar across the top of the car. This plan has been patented by Dr. John Hopkinson. The permanent way has been constructed under the direction of Mr. J. L. D. Meares, C.E., of Newry, assisted by Mr. F. S. Thomas, C.E., and is of substantial construction throughout.

THE annual production of asphaltum in the United States is about 3000 tons, having a spot value of 10,500 dols.

LETTERS TO THE EDITOR.

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

THE STRENGTH OF BRIDGES.

SIR,—In your issue of July 5th there are several topics which specially interest me, and about which I would like to express an opinion. The first is an extract from the *Chicago Herald* concerning American railway bridges, which, it appears to me, you use in a manner disparaging to those structures. In the first place, the *Chicago Herald* is not a technical paper, and in the second, the quotation is merely the opinion of an engine-driver—a man utterly incompetent to pass an opinion of any value concerning such a complicated structure as a railway bridge. He says: "Did you ever ride on a locomotive? on the cow-catcher? Well, then, you must have noticed that whenever she strikes a bridge she seems to drop down a little. Its the bridge settling under the terrific pressure," &c. Of course the bridge will settle. For what other reason is the camber put in? Such a settlement is not injurious to a well-proportioned structure, for it immediately regains its original shape and position upon the removal of the load. English bridges must spring more than American, for with nearly the same intensities of working stresses the former have much shallower trusses than the latter. Experiments have lately been made in the United States on the actual vibration of bridges with rapidly passing loads, the results showing that the dynamic effect has been over-estimated.

I have lately been experimenting upon single members of iron railroad bridges, so as to ascertain the ratio between the effects of train loads statically and dynamically applied. The experiments were a failure, owing to the bad fitting of the apparatus, the play of the pins in the holes proving to be greater than the stretch in the bridge member, the length of which was necessarily restricted to 6ft. With a reduction in the multiplying power and larger pins I hope to obtain satisfactory results a few months hence.

As a general rule, English engineers may be said to have a very low opinion of American bridges. The reason is partly because they know very little about American structures. It is true that there are both bad and good bridges in the United States. The former are built by inferior bridge companies, and designed by men unworthy the name of engineers. In fact, many of them do not pretend to be engineers. This last remark applies to highway bridge designers. But there are at least half a dozen bridge companies in the United States engineered by men who stand in the foremost ranks of the profession, and these build bridges that for strength, stiffness, economy of material, and scientific proportioning excel those built in any other country. For instance, not one of these engineers would think for an instant of making such a fault as that pointed out in your same issue by Mr. W. C. Kernot. Such a mistake would be a disgrace to the most inferior of American highway bridge companies. With all the remarks in Mr. Kernot's letter I most cordially agree, and it is to be hoped that he will not confine his observations to this one case, but will show up the weak points in rivetted connections of web members to chords; the variation of the line of pressure from the centre of gravity of the chord section, even when the chord is straight between panel points; the triangular intersection at panel points of the web and chord stresses in trusses not pin-connected; the insufficiency of pony trusses without side bracing to resist wind pressure; the faulty attachment of floor beams to trusses, &c.

But to return to the opinion of the engine driver on the New York Central, his dread must be due to one of two causes—first, the vertical blows of the on-coming engines; and secondly, the horizontal thrusts of the same. If it be the first reason, I fail to see how he has bettered himself by changing to a single track road; for, although in bridges on the latter there can be only one "blow" to be resisted, the trusses have only half the strength of those on double track roads. If it be the horizontal thrust that he fears he may set his mind at rest; for the lower lateral systems of first-class American railroad bridges—and undoubtedly those on the New York Central must be such—are capable of withstanding far greater stresses than any that could be produced by the thrusts of two trains, even when the brakes on the locomotives are set as the trains reach the bridge.

Concerning this point I would refer those interested to chapter xxiii. of my treatise on "A System of Iron Railroad Bridges for Japan," copies of which may be found in the library of the Institution of Civil Engineers, and in the libraries of the principal English universities and technical colleges. In the same treatise will be found a detailed description of the best kind of lower lateral system, showing that lower lateral struts are required, and that the floor beams should not be used instead of these members.

It appears that a number of your readers have been worrying themselves concerning the "laws of motion," and have succeeded in getting themselves pretty thoroughly mixed as regards force, energy, momentum, work, effort, and all the other terms that one finds in treatises on dynamics. A similar discussion with a like result has lately been taking place in some of the American technical papers. In my opinion all this trouble is due to the fact that the various treatises on dynamics fail to show the exact relation between these quantities, and do not sufficiently explain fundamental and secondary units. If one starts out with the principle of the conservation of energy, and the fact that bodies at rest or in uniform motion are acted upon by a system of balanced forces, the difficulties will eventually vanish. The term force should be made to depend upon that of work or energy, and not be treated as something tangible. Force is merely rate of change of energy. This definition will apply to forces that act on a body at rest; for, if the balancing force were removed, motion would occur, and the rate of change of energy could be measured. Here comes in the necessity for a perfect comprehension of the fundamental and secondary units.

But—some of your correspondents may suggest—if the subject be not such a difficult one, why do I not clear it up? The reason is that it is several years since I left the domain of "rational" and entered that of "technical" mechanics. Besides, there is a friend of mine who is now preparing a treatise upon "Dynamics" that I think will cover the ground in a satisfactory manner.

Tokyo, Japan, August 2nd. J. A. L. WADDELL.

ENGLISH AND FOREIGN STEAM ENGINES.

SIR,—Your outspoken language in the leading article of to-day's issue is just what is required; it may not be welcome to the trade, but it is very wholesome, and to such as read and profit by it there cannot fail to be advantage. Probably few men know so little about their business or profession as engine builders; they seem void of all notions of proportion. Of course there are exceptions; but the number who know how, or care, to build an engine on correct lines is very limited. America has one or two marked exceptions—good finish, correct balance of parts, and fair notions of governing. Belgium contains one or two firms who are equal to the best American. When you come to think over the many of our own British makers, no one can name six firms who can make an engine in due or proper proportions.

Probably 80 per cent. of the beam engines are badly out of balance; many that I have seen would do with one ton of metal patched on to one end of the beam to make them equal. Can this be called engineering?

Horizontal engines are nearly as bad. I have seen, not ten miles from here, an engine working—made by a firm of excellent name—with a connecting rod four or five times too heavy, and throwing the engine out of balance, ruining the gearing and making bad work inside the mill. Then there are fly-wheels too light, and fly-wheels not balanced; bearings short, and shafts unduly weak. No wonder we have breakdowns. Engines in many cases are not built, but seem to be thrown together. Then, in addition to want of balance and proportion of parts, there is the vital question of governing. With the exception of some half a dozen makers—whom I will not hint at, much less name—there probably is not any builder who can run an undeviating and straight course under a varying load or under changing steam pressure. I am within the mark when I say that 99 per cent. of builders cannot accomplish this vitally necessary and yet simple feat. I will prove it to any one who may feel disposed to question my assertion. I have heard of gold medals being given for engines when running at a supposed speed of sixty revolutions per minute; the actual speed is constantly ranging from 54 to 66. Is this engineering?

Expensive plants are laid down for electric lighting, and when every known improvement is added for good results, the whole thing is marred by an engine that cannot govern within 10 to 20 per cent. Is there a single engine now working at the Inventions Exhibition whose maker will say he can govern them within 5 per cent.? I think I can prove that the first one I am led to will vary over 10 per cent.*

If your leader and my remarks will lead our engineers to look these points up, and set them to think how they can make more perfect engines, and if the users of steam power will only inquire into the real merits of various makers and buy only the best, the whole lump will soon be leavened, and in a few years many of the present monstrosities will have been thrown into the scrap heap, and their place occupied by engines built by careful and scientific men. OBSERVER.

Manchester, September 12th.

SIR,—Your article in this week's ENGINEER concerning the above and the Antwerp Exhibition has greatly interested me, and I sincerely trust it may receive the attention it so truly deserves by my fellow-engineers throughout the country. It cannot be too publicly reproduced by the local press amongst the iron industry, and by such means become distributed broadcast. I have taken the opportunity of visiting the Exhibition at Antwerp on some few occasions, and from inquiries I have made, and general observation, I can but conclude, first, that we are run close in the production of first-class machinery; secondly, that such machinery is value for the money, or in other words, that the prices asked there allow a very fair profit as considered with respect to prime cost if produced in this country. I may say that some special tools are shown there, and these are excellently designed, and constructed with a due regard to long life. They are what one might call almost high-priced, but then they are just such as one might require and have faith in as being good, serviceable tools.

Now, to get at one root of an all-absorbing topic—"dulness of trade" in England—and as engineering is one of our chief trades, I have one or two facts that strike me very forcibly, as they continually appear before me in my branch of the business. I observe a great demand for "cheap stuff," and as I cannot supply it, some nine-tenths of my inquiries result in "no order." By cheap stuff I mean the "cheap-and-nasty," and I know my brother manufacturers will understand to what this refers without further explanation. The reason why I can't supply it is the best of all reasons, and that is, I won't; and yet, Sir, my business has increased some five-fold during the last fifteen years. Granted the profits are not so great; but the good article I endeavour to turn out commands a fair profit.

Now those demanding the cheap stuff are not the *bonâ fide* users, but the middle-man or dealer—merchant if you like; the one who buys to sell again, and to reap a profit out of my wares and brains. He gets an indent, frequently for the articles made by me, and illustrated in my trade book, which I issue at great cost in all countries. This individual tells me he can get a similar article cheaper. He does so, with the result that the colonial or continental customer finds himself taken in with an inferior article, and, as far as I know, is not heard of as a customer in this country again.

I have not the least fear of foreign competition when quality is a *sine quâ non*, and until the makers of inferior articles are run to earth, and those who are so ready to palm them off as the genuine thing, or equal to it, I opine that England's engineering industry must materially suffer for a time. AN ENGINEER.

September 14th.

SIR,—I read your article under the above heading with some considerable interest, but I think you have overlooked the fact that there is just now a very great mania for the lowest price in almost everything, and consequently good makers find themselves at a very great disadvantage, as they are unable to compete against the low prices of inferior makers—more particularly in our foreign trade. I believe that our best manufacturers are still superior to the foreigners, if buyers will only take the trouble to find them, as so many firms are now making cheaper and inferior machinery to meet the demand. I am of opinion that our merchants and shippers are the greatest enemies to first-class manufacturers; they receive orders to send out abroad, say, certain machines, and ask for prices from manufacturers of all kinds, and generally select those at the lowest prices, and out of which they get the highest commission. The quality they know but very little about, consequently their clients receive a quantity of cheap rubbish. Some merchants profess to enquire into the quality, but not being engineers, they are very easily deceived by a sharp, clever salesman.

I know that there are firms here making cheap machinery for abroad whose trade at home is comparatively small. These firms, as a matter of course, use all means possible to push their trade by advertising and exhibiting at all foreign exhibitions; while many good makers are content with a trade at home, and to rely upon recommendations, instead of advertisements, &c., as they know they cannot contend against these low prices.

Then, again, there are many who abstain from exhibiting at foreign exhibitions, as they think they do this country a great deal of harm, and that instead of increasing their trade, they are only educating the foreigner.

Consequently I do not think that English exhibits at a foreign exhibition are fair samples of what our engineers can do. At the same time I am glad that attention has been drawn to the matter, as it is no doubt a very serious one for English engineers.

London, September 14th. H. J. W.

SIR,—I hope that the important questions raised in your article on this subject will not be suffered to drop. The time is opportune for stating the truth, which is just this—that we makers of machinery in this country are in the hands of middlemen. Take my own case. I build steam engines for export. Now I never see the user. These engines are bought from me by agents, and they pay promptly. I have made inquiries, and I find that these agents get at least 50 per cent. more money than I do. I have tried trading direct with South America, and I lost by it. I do not know Spanish. I employed an agent who did—a man who knew the country well—and he robbed me. Now, under the circumstances, what are we to do? I say plainly that I cannot make a good engine—no one can—for the price I am obliged to take; but if I did not take what I can get I might shut up my shops. As it is I get plenty of orders for engines of which I am myself ashamed; but I get a good living out of them.

So far as I can find out, the system on which Belgians trade is different from ours, and the makers of engines do not lose so much as we do. The middleman, Sir, is the incubus under which we groan; and I earnestly invite my fellow-sufferers to try whether it is not possible to put foreign trade relations on a better footing.

Birmingham, September 15th. NEMO.

THE TRAINING OF ENGINEERS.

SIR,—As a subscriber, I was astonished and pleased to see in your issue for September 4th the leader on "School and College Training for Engineers." I was intending to write you a short account of my school career, but your ideas are so thorough and so well-expressed that they leave nothing to be desired. I heartily congratulate you on your article, and hope it may be the means of altering the present system.

My idea is, that anyone intending to be a works' manager should spend, in the first place, two years in the pattern shop, and if the foundry is on the premises he would be able during that time to pick up a good knowledge of moulding, simply by watching and asking information from the men; then to spend three years at fitting and turning, and to proceed thence to the drawing-office for two years. This gives a total apprenticeship of seven years, which time ending at twenty-one, makes it necessary that the lad should leave school at fourteen. Now it will be evident to anyone that under these circumstances there is no time to learn such unnecessary subjects as Greek, Latin, &c. I think after three years fitting and turning a lad ought to be able to earn journeyman's wages, if it became necessary for him to do so.

But this is a subject worth discussing, and perhaps some of your correspondents may hold different views to me.

September 13th. LOCOMOTIVE.

WESTMINSTER ABBEY ORGAN.

SIR,—Allow me to congratulate you on the very excellent description and accompanying drawings of the Westminster Abbey organ which appeared in your issues of the 21st and 28th ult. I trust that this is a subject which will receive increased attention in the columns of THE ENGINEER of the future, for organ building of the present day embraces and exhibits in combination more modern mechanical appliances, and lays under contribution the kindred arts and sciences to a greater extent, than scarcely any other industry. An examinatiou of a few of the specimens of organ building as exhibited in the Inventions Exhibition will give ocular proof of my assertion.

I think, then, it will need no apology on your part to give to your subscribers, particulars from time to time of organs in course of erection, as there cannot fail to be much mechanical and scientific matter interesting to your readers, considered apart from musical details. In common with a great number of your Scotch readers, I would gladly welcome a description of the magnificent organ erected by Lewis and Co., of London, in St. Andrew's Hall, Glasgow, and also particulars of an organ built by the same firm and erected at Upper Norwood, which has the interesting peculiarity of being actuated both in the keyboard, draw-stop, and pedal actions solely by electricity. Once more thanking you for the appearance of the articles referred to. W. EADS.

Berwick-on-Tweed, September 9th.

BLOCK SIGNALLING.

SIR,—More than forty years ago my father—Mr. M. Browne, Coroner of Nottingham—told me that in connection with an inquest which he had held on a railway fatality, caused by a train being started too soon after its preceder, he had written to the *Times* a letter suggesting that no train should be started till its preceder had been signalled as beyond the next station. I take this to be "block signalling," and that he was the inventor. He tells me that his plan was afterwards urged at the British Association by Dr. Scorsby, who received a vote of thanks for it. He has no copy of his letter, but he says it was signed with his initials, "M. B.," and may be found in the *Times* for 1844. He will explain further if you care to refer to him; but if the matter is of importance, the best plan will be to find his letter. My father tells me that his idea tended rather towards the train moving the signal with a wire, but he thinks a juryman suggested the use of the telegraph, which was then beginning to be talked about in connection with railways. HUGH BROWNE.

Nottingham, September 11th.

SIR,—I have ascertained that Mr. Edward Umbers is still alive. I received a note from him this morning, in which he says he was not the inventor of the block signal. Now I should be pleased to know in what form block signalling was first recognised as such? From 1858 to 1862 I was at school with two of Mr. Umbers' sons, and at that time he was engaged in experiments on points and signals, and succeeded in moving them together either on or off at a fixed point by levers. This I consider was the block system in its first stage. Now, of course, after twenty-five years, and with the rapid strides made by the electric signals, we have far superior workings both in the signal apparatus and the points, but it has been the fruit of years of study and experience.

Dunchurch, September 16th. THOMAS HICKEN.

PATENT-OFFICE MANAGEMENT.

SIR,—I should like to direct attention through your columns to the continued bad management apparent at the Sale Department of the Patent-office. Last Saturday—a day on which many fresh specifications are published—I waited a quarter of an hour while my order was being executed, and nine other persons were similarly situated, and during all that time not a single official put in an appearance. In reply to an inquiry whether the staff were away for their holidays, I was told that they were busy upstairs. As all the orders are given in writing, no speaking being necessary, I would suggest, Sir, that the Government should employ in this department an unfortunate class of the community, viz., deaf mutes, which would be a philanthropic act, at the same time that purchasers would not be kept waiting while the officials were busily engaged in discussion elsewhere.

A PURCHASER AND A SYMPATHISER WITH DEAF MUTES.

September 15th.

STRAW BURNING ENGINES.

SIR,—We note that in your issue of September 4th, in an article "On Straw Burning Engines," you refer to a paper by the late Mr. Head, of Ipswich, read before the Institution of Civil Engineers on January 30th, 1877, in which Mr. Head gives the amount of straw burnt on the Head and Schemioth's system as about 21 lb. per horse-power per hour. In July of that year we made further improvements in our patent straw-burning engines, and since that time the consumption of straw has been reduced to 10 lb. or 12 lb. per horse-power per hour, and this amount is the gross weight of the straw used without deducting the weight of the ashes, as appears to have been done in the trial you allude to. We shall be glad to show one of our patent engines at work here, burning under 12 lb. of straw per horse-power per hour, to any one interested in the subject. RANSOMES, SIMS, AND JEFFERIES.

Ipswich, September 16th.

THE HOLYHEAD MAIL SERVICE.

SIR,—I believe in the winter of 1861 or 1862, the Connaught left Kingstown for Holyhead for a morning's passage, but turned back after being out a short time, in consequence of a heavy N.E. gale. This was before the turtle-back deck was added. This is the only occasion of ever failing to make a passage.

September 15th. PASSENGER.

[She waited half an hour, and when the storm moderated a little went to sea again, and made her trip.—ED. E.]

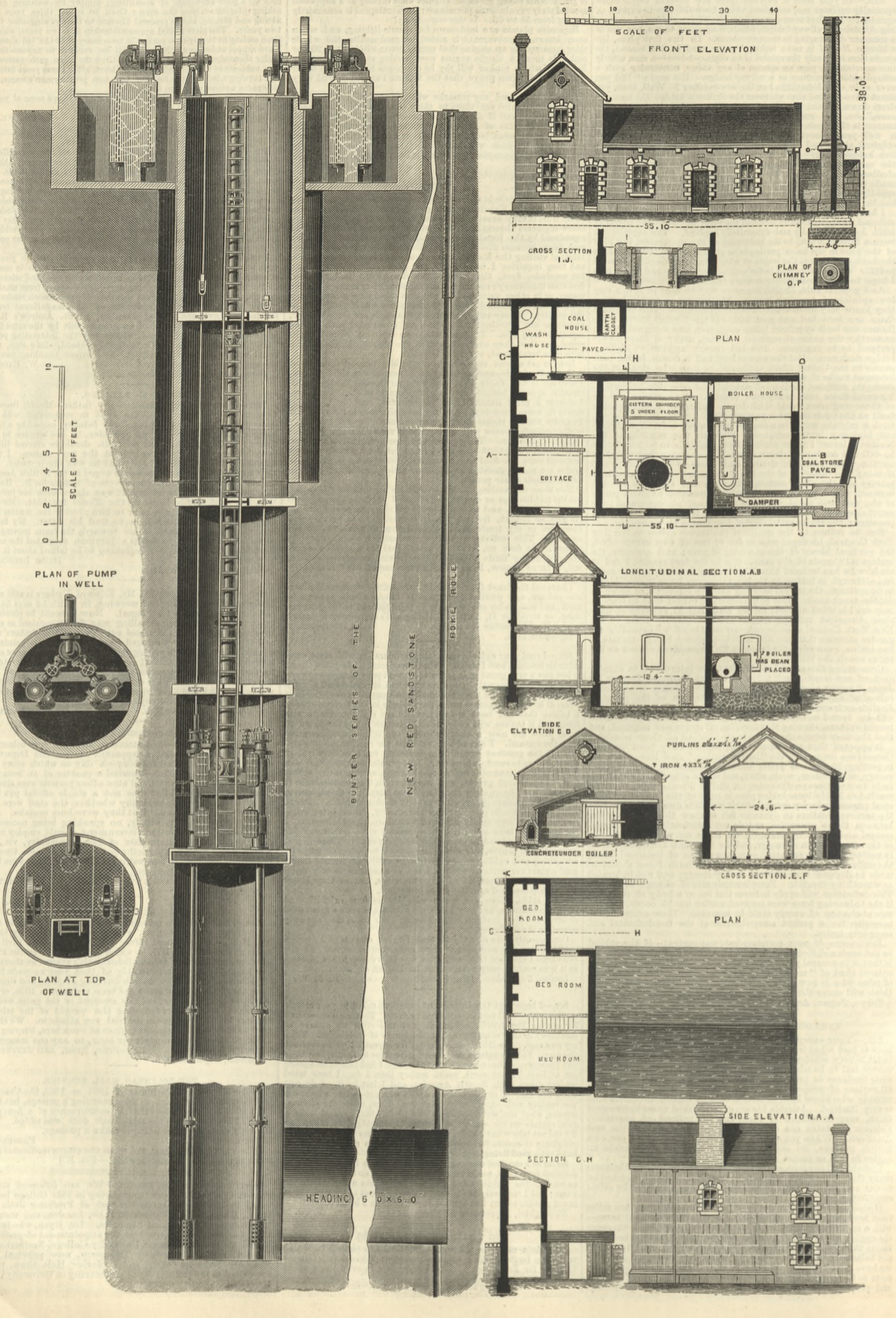
UNIVERSITY COLLEGE, BRISTOL.—We are informed that the vacant Chair of Physics and Engineering in this College has been filled by the appointment to the post of Professor John Ryan, M.A., King's College, Cambridge, D.Sc. London, and member of the Institute of Mechanical Engineers. Dr. Ryan, who is a practical engineer, has hitherto held the appointment of professor of mechanics and engineering in University College, Nottingham. At Bristol he succeeds Professor Thompson, now principal of the Finsbury Technical College, and Professor Hele Shaw, recently appointed to the professorship of engineering in University College, Liverpool.

* This is not true of the large engines.—ED. E.

WEM WATERWORKS.

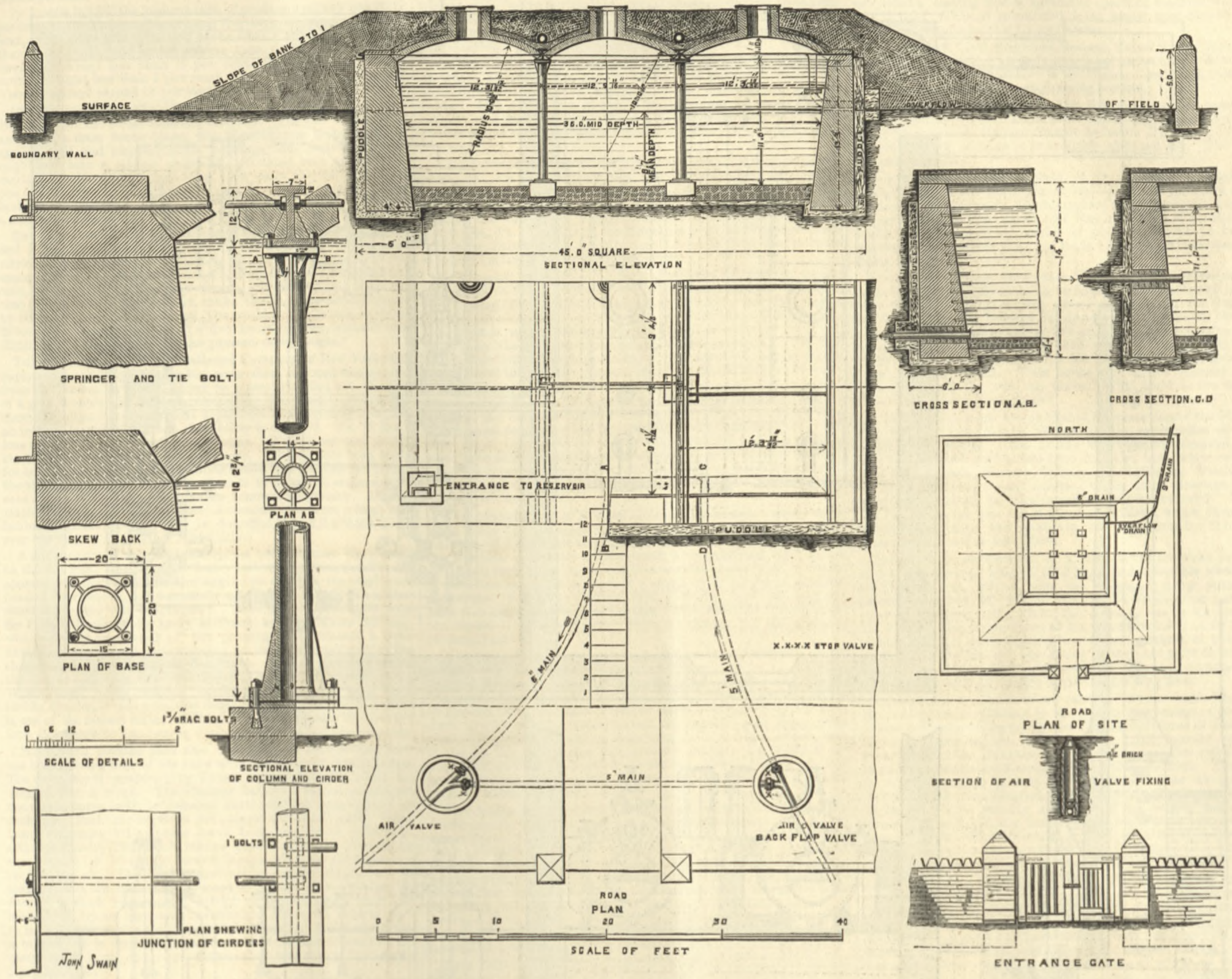
MR. T. S. STOOKE, C.E., SHREWSBURY, ENGINEER.

(For description see page 219.)



WEM WATERWORKS.

MR. T. S. STOOKE, C.E., SHREWSBURY, ENGINEER.



By the engravings on pages 218, 219, and 220, we illustrate the water supply works recently carried out for the Wem Union in Shropshire by Mr. T. S. Stooke, C.E. On page 218 will be found a section of the well and buildings. On this page we illustrate the storage tanks, &c., and the engine and top of the well. On page 220 will be found a general plan of the engine and boiler houses, and a section of the stack, and half elevation of the stack.

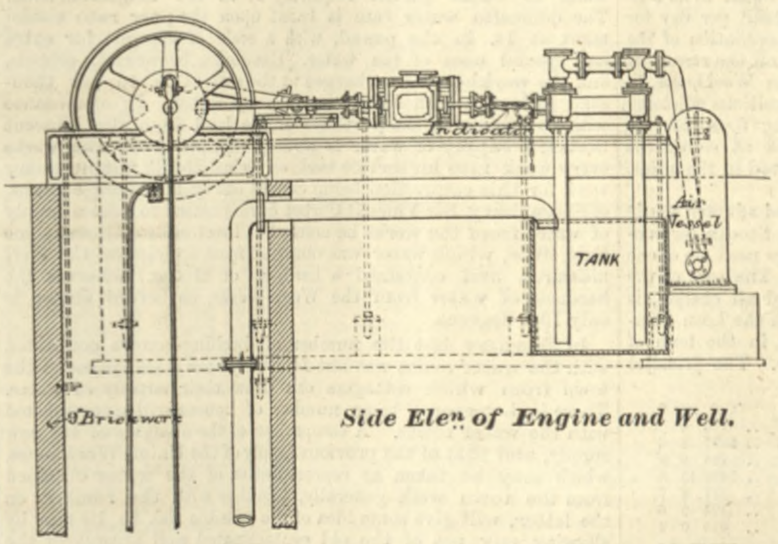
Previous to the construction of these works the water used was obtained from various wells in the town, but this supply became so impure that it is surprising no outbreak of disease occurred. Early in the year 1881 various plans and estimates were furnished to the authority, and subsequently a committee was appointed to report upon the supply from springs at Palms'-hill, but the county analyst gave an adverse report on account of the hardness of the water from the presence of an excessive quantity of lime salts. Finally, Mr. T. S. Stooke, C.E., was instructed to make a thorough survey of the whole district, with the result that he reported the best source for a constant supply of good water to be situated between Preston Brockhurst and Besford, about three and a-half miles south-east of Wem, from the Bunter series of the new red sandstone, by sinking a well near the village of Preston Brockhurst, on the property of Sir Vincent Corbet, Bart., at a point he selected about 700 yards to the east of Sir V. Corbet's waterworks. Mr. Stooke explained that the water from this source would be found to be of a much softer nature than any water would be that was obtained from the marl measures, and this has been proved to be the case.

On Sir V. Corbett, Bart., giving his sanction for a trial bore hole to be made at this site, the Board adopted Mr. Stooke's recommendation, and a test bore hole was put down to the depth of about 90ft., which gave a very satisfactory indication of an abundance of water.

The Local Government Board were then applied to for sanction to carry out the scheme, under the plans of Mr. Stooke, and an inquiry was held on the 22nd of August, 1882, and sanction given for a loan of £250 for the preliminary work of sinking the well, so that the quantity and quality of the water might be ascertained, with the understanding that if such was satisfactorily proved, the Local Government Board would sanction the necessary loan of money for the full and complete execution of the scheme.

Sir V. Corbet having met the Board of Guardians in a liberal manner by granting the two sites of land necessary for the execution of the works, a contract was entered into in September, 1882, for sinking the well. The well was carried to the depth of about 70ft., at which depth it was connected by a heading to the bore hole, with the object of securing storage. The well, of 6ft. diameter, was lined with brickwork, surrounded with tough clay puddle, to a depth of 22½ft. from the surface, in order to prevent effectually the percolation of any surface water into it. The yield of water at the completion of this contract was found to be upwards of 130,000 gallons in the twenty-four hours, being nearly five times as much as the estimated supply required for the district. A sample of this water was secured and sent to the Local Government Board, together with a report of the quantity pumped. The following particulars are taken from the report of Dr. Franklin, F.R.S.:—

Results of analysis expressed in grains per gallon:—	
Total solid matter	13·16
Organic carbon	·088
Organic nitrogen	·017
Ammonia	0
Nitrogen, as nitrates and nitrites	·055
Total combined nitrogen	·072
Previous sewage or animal contamination:—	
Chlorine	·98
Hardness:—	
Temporary	4·8
Permanent	6·0
Total	10·8



Side Elevn of Engine and Well.

"This water, although slightly turbid, contains but a moderate amount of organic matter, and chiefly of vegetable origin. It is of good quality for drinking, and, being fairly soft, it is also well suited for washing and all other domestic uses."

On this satisfactory result being obtained, the sanction of the Local Government Board was secured for the carrying out of the scheme.

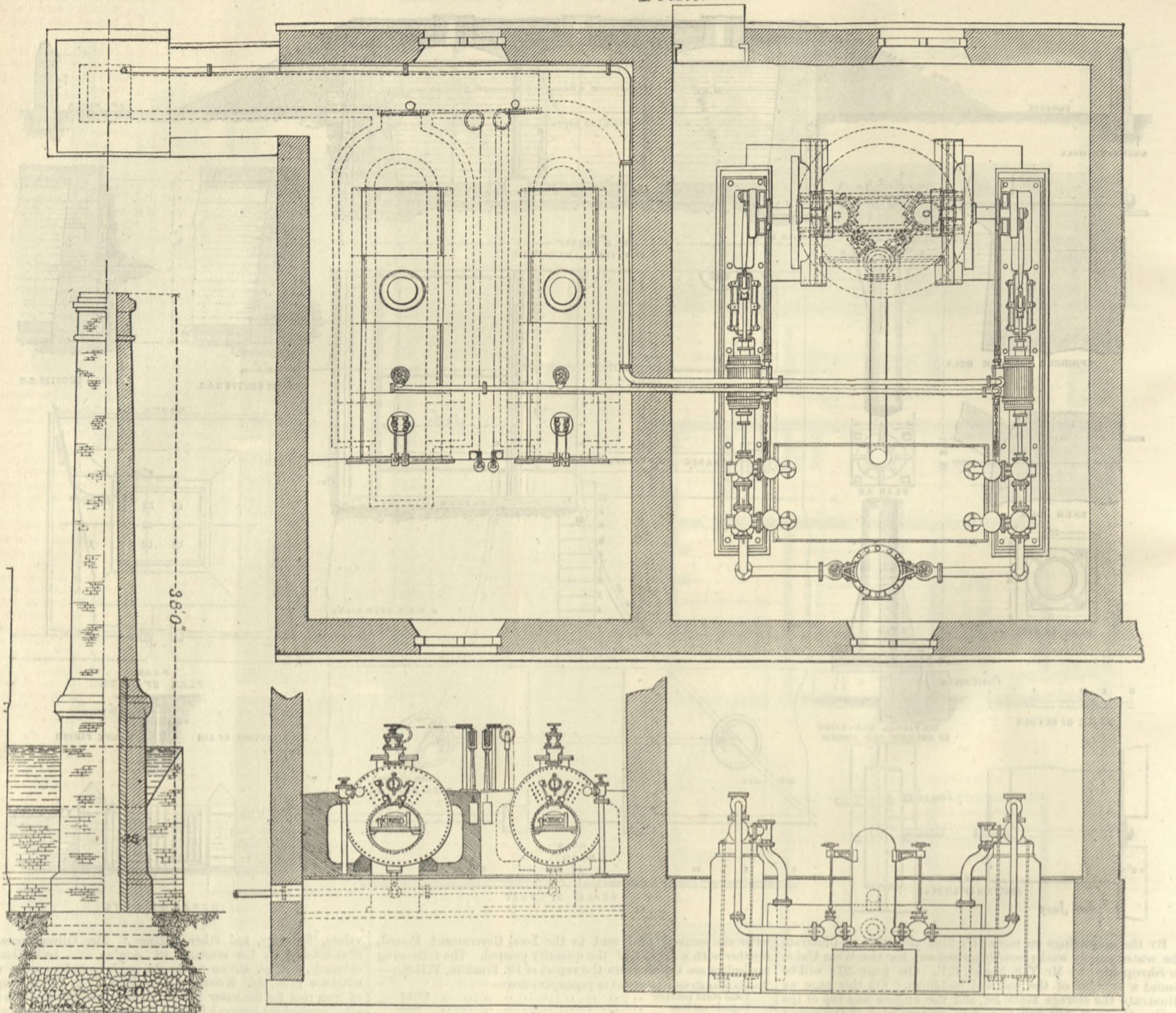
Mr. Stooke submittted to the Board of Guardians complete specifications and drawings for the execution of the work, and tenders were invited, which resulted in the following contractors, viz.:—Messrs. Renshaw and Co., Kidsgrove, for the supply, delivery, and erection of duplicate engines, boilers, and pumpwork; also for the supply of about 300 tons of cast iron pipes for mains, and columns, girders, and other ironwork for the covered service reservoir. Mr. William Davis, of Portmadoc, for laying the pumping and service mains, with all necessary connections. The Glenfield Company for the supply of all valves, fire-plugs, and other fittings. Mr. Oliver Jones, of Shrewsbury, for the erection of engine and boiler houses, chimney, cottage, service reservoir, and boundary walls, with entrance gates, &c. Messrs. Altree and Lea, for the supply of iron roof for the water tower at the workhouse, which firm also supplied the ironwork for the engine and boiler house roofs.

The works were commenced in May, 1883, and water was first delivered to the town on the 8th February, 1884, since which time it has been continued without intermission. The following is a short description of the works:—The pumping station, situated near the village of Preston Brockhurst, is about 3½ miles from Wem. It consists of a quarter of an acre of land, on which are erected the engine and boiler houses, chimney, and cottage, the buildings being of a substantial character, and built of the local white Grinshill stone, with redstone facings. The engines are horizontal non-condensing, and each engine is in all respects entirely separate from the other, so that in case of an accident occurring one engine is always available for maintaining the supply of water to the town. Each engine is 6-horse power, and lifts the water from the well into a cistern placed under the engine-house floor, from which it is forced from the ram pump of the engine through about 3000 yards of 5in. pipes into the service reservoir, situated at an altitude of 90ft. above the engine-house floor. The total lift from the bottom of the well to the reservoir is 160ft. The well is covered with iron plates, and is provided with access door, and iron ladders are fixed in it in order that easy access may be secured at all times to the pump work. The engineman is also provided with a lathe and smith's anvil and tools, in order that he may do the principal part of any necessary repairs.

The site of the service reservoir occupies a quarter of an acre of land, and is situated on the highest ground of Palm's Hill, adjoining the highway. The water from this reservoir gravitates to the town through about 3500 yards of 6in. pipes. The foundation of the reservoir is concrete, which rests on an excellent bed of marl. The retaining walls are of Grinshill rock-faced masonry backed with tough clay puddle. There are two rows of cast iron columns in the reservoir, resting on ashlar foundations, and connected at the top by cast iron girders, from which girders there are sprung 9in. brickwork arches, thus covering the entire reservoir. On this brickwork is laid 4in. of concrete to prevent the infiltration of any surface water, while 4in. agricultural pipes are laid on the haunches to carry off the surface drainage. 18in. of soil, turfed, is laid over the whole covered reservoir and the water is therefore thoroughly protected from the influence of the sun's rays, while, at the same time, due provision is made for efficient ventilation, and an entrance to examine the reservoir

WEM WATERWORKS.

Plan.



Front Elevation of Boilers. *End Elevation of Pumps.*

is secured by iron steps. The stop valves on the mains are arranged within the reservoir site of land, so that the town can be supplied direct from the pumping station without the water passing into the reservoir at all, if necessary. The reservoir has a storage capacity of 90,000 gallons, and overflows when the water is 11ft. in depth; the contents being equal to an estimated supply for three days of 15 gallons per head per day for 2000 persons, which is about the present population of the town of Wem. The service mains are laid in all the streets of the town, and are also extended to the Wem Workhouse, to which the water is supplied. At convenient positions adjoining cottage property fifteen anti-freezing drinking fountains are placed, two street watering posts are erected at convenient positions, and thirty-six fire hydrants are inserted in the mains, their position being indicated by F.P. plates.

The Board of Guardians have approved of and adopted a code of bye-laws and regulations, prepared by Mr. Stooke, for controlling the supply of water, and all the fittings used are of one make and stamped with the maker's name. The cost of the works, inclusive of the purchase of land, and all charges, is £5450, which money has been borrowed from the Loan Commissioners at 3¾ per cent. interest, repayable in the term of thirty years by sixty half-yearly instalments. The principal items of the cost are as follows, viz.:—

	£	s.	d.
Engines, boilers, and pumps	750	4	2
Cast iron mains	2077	2	2
Bore-hole well and heading..	264	9	0
Buildings, reservoir and boundary walls, &c.	1490	15	5
Drinking fountains, valves, and other fittings	221	6	7
Purchase of land and charges	191	2	6
Miscellaneous charges	455	0	2
Total	£5450	0	0

The actual supply of water to the town during the last few months has averaged about 9000 gallons per day, which is only about 4½ gallons per head of the present population. This quantity will be largely increased as the private connections to the houses are extended. At the same time the small quantity used tends to show that little or no waste takes place, a circumstance which is chiefly attributable to the conduits being placed in the streets where they are under constant supervision. The working expenses attending the pumping of the water to the town may be taken at £100 per annum, and this sum would only be increased by the cost of fuel for any additional delivery of water. Although the town has received a constant supply for the last twelve months, the water still rises to its old level in the well, viz., 32½ft. under the engine-house floor, thus showing a total depth of 38ft. of water. The storage room made at the bottom of the well has never been drawn on since the supply has been delivered to the town, and this affords clear proof of the superabundant water-yielding qualities of the new red sandstone in this particular district, and indicates that the Board of Guardians would be fully justified in entering into agreements for the supply of water to other parties requiring it in the neighbourhood. The domestic water rate is based upon the poor rate assessment at 1s. in the pound, with a scale of charges for extra and special uses of the water. Gasworks, breweries, schools, and the workhouse are charged at the rate of 1s. 4d. per thousand gallons, which supply is given by meter. In accordance with the terms of the purchase of the land from Sir Vincent Corbet, a supply of water is already pumped from the works every week into his service tank on Grinshill-hill, the necessary work for this connection being carried out by Mr. George Evans, of Shrewsbury, Sir Vincent Corbet having ceased to take a supply of water from the works he erected at Preston Brockhurst some time since, which water was obtained from springs on the marl measures, and contained a hardness of 27 deg., whereas the hardness of water from the Wem Works, as before shown, is only 10·8 degrees.

In February last the number of dwelling-houses connected with the water mains was but 84. There are stand pipes in the town from which cottagers can draw their supply of water. There is, however, a large number of houses still unconnected with the water mains. A comparison of the analysis of the new supply, and that of the previous supply of the Union Workhouse, which may be taken as representative of the water obtained from the town wells generally, together with the remarks on the latter, will give some idea of the possible risk to be run by allowing any use of the old contaminated well supply of the town.

Result of Analysis of Wem Union Workhouse, in grains per gallon.

Description.	Total solid matter.	Organic carbon.	Organic nitrogen.	Ammonia.	Nitrogen as nitrates and nitrites.	Total combined nitrogen.	Previous sewage or animal contamination.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.	Remarks
Wem Union Workhouse, April 29, 1884.	41·6	·228	·049	trace	2·54	2·59	25·186	3·58	15·0	22·1	37·1	Turbid, palatable. No poisonous metals.

On this analysis, Dr. Frankland remarked:—"This water contains a very large proportion of organic matter, which is to a great extent of animal origin, it exhibits also evidence of extensive previous pollution with sewage or other refuse animal matter, probably the soakage from drains or cesspools. It is a dangerous water, and quite unfit for dietetic purposes; it is excessively hard, and therefore unsuitable for washing and other domestic purposes. 100,000 lb. of this water had been polluted with an amount of animal matter equal to that contained in 35,980 lb. of average London sewage."

ECHAIG BRIDGE.

THE development of the new circular route in Argyleshire by the road from the Holy Lock on the Firth of Clyde to Inverary on Lock Fyne, in connection with the fine steamers running from Glasgow, directed attention to the state of the bridges on the route, and it was found that some of the bridges were too weak and decayed for the traffic of the heavy coaches laden with tourists, and accordingly the Argyleshire Road Trustees—Dunoon district—directed their engineers, Messrs. Bell and Miller, Westminster and Glasgow, to design bridges more suitable. One has just been completed and opened by the trustees over the river Echaig, which we illustrate on page 215. It is an ornamental girder bridge of iron, with stone abutments and masonry towers at the termination of the girders. It is 70ft. span and 20ft. wide between the girders. The roadway is formed of transverse lattice girders of wrought iron, sustaining cast iron arched plates filled in above with Portland cement concrete to the road level. The contractors were Messrs. Hanna, Donald, and Wilson, Abercorn Works, Paisley.

THE REPRESENTATION OF BRITISH COLUMBIA IN LONDON.—By an Order in Council, dated British Columbia, June 23rd, Mr. H. C. Beeton, of 33, Finsbury-circus, has been appointed Agent-General for the Province of British Columbia in London.—*Colonies and India.*

A PROPOSED PERSIAN RAILWAY.—The Russian papers state that M. Gasteiger, an Austrian engineer in the Shah's service, has arrived at Resht in order to make the necessary inquiries as to the construction of a proposed line of railway from that town to Kasvin. According to M. Gasteiger, the cost would be only 110,000 tomans, and the work would be completed in three years. As the toman has varied in value from 13s., it most recent approximate price, to £3, it is not easy to measure M. Gasteiger's proposition with precision; but it is, of course, something to know that the Shah approves it in principle.

RAILWAY MATTERS.

THE largest profit by a German railroad in 1883 was 9·59 per cent. by the Right Bank of Oder Railroad. Four German roads earned more than 8 per cent., two more than 7 per cent., but no other earned as much as 6 per cent., while fourteen earned less than 3 per cent.

IN Austria in 1883 the highest rate of profit on a railway was 16·12 per cent. by the Emperor Ferdinand Northern, and the next 9·40 per cent., while three others earned more than 8 per cent., two more than 7 per cent., and seven others more than 6 per cent. But twenty-six earned less than 3 per cent., twenty less than 2 per cent., and eight less than 1 per cent. In Poland, the Warsaw and Vienna Railroad earned 13 per cent.

ON Monday night, the 17th ult., an accident occurred near Brampton, on the Great Eastern Railway. The rear carriages of an excursion train broke loose, the Westinghouse brake instantly applied itself and stopped both portions, thus preventing what might have been a serious accident. Without such a brake the carriages would certainly have run back down the incline, and no one can tell what results might have followed. The action of the brake in this instance, and of the "leak-off" at Swadlincote, form a striking contrast.

THE following resolution has been passed by the Birmingham and Aston Steam Tramways Co.:—"The manager having submitted a scheme for the reduction of the working hours of the engine drivers, guards, and checkers, it was proposed by the chairman, seconded by Mr. Thomas Smith, and unanimously resolved, that as soon as the manager can make the requisite arrangements by obtaining the additional staff, the working time be reduced from fifteen hours as at present to twelve hours per day, without any diminution in the amount of the present rate of wages."

THE Manhattan Elevated Railroad Company, of New York, has experienced considerable trouble ever since the road was opened from the locomotive cabs shaking to pieces or rotting out, the life of a good wooden cab seldom exceeding five years. To obviate these difficulties the mechanical department have recently designed an iron cab from which great durability is expected. No. 12 sheet iron is used, stiffened with angle irons. Wood is not used at all, except for framing to hold the windows. Formers have been made for bending the sheets to the proper shape, and templets for laying the sheets out on, and the intention is to supply all engines with cabs of this description as fast as renewal is necessary. In this matter, as in many others, our American friends are a long way behind English practice. It is doubtful indeed if a wooden cab ever was seen on an English locomotive.

A BREAKDOWN of the Scotch express occurred near Warkworth on the 6th inst., which might have had more serious results. It appears that the guard saw the engine go wrong in the neighbourhood of Warkworth, and instantly applied the brake. We understand the engine was overturned. Amongst the passengers were Sir F. A. Milbank, M.P., Lady Milbank, and the Misses Milbank, who, with the remainder of the passengers, experienced a little unpleasant excitement, supervening on the shock occasioned by the sharp and abrupt stoppage of the train. Sir Frederick says one of the guards told him that but for the prompt application of the Westinghouse brake nothing could have saved the train from serious disaster, if not absolute destruction, as the Scotch express is one of the fastest trains in England, accomplishing the journey from Edinburgh to London—a distance of 397 miles—in nine hours.

FOR several months past the Pennsylvania Railroad Company has been lighting nine of its cars with incandescent electric lamps. The electricity is produced by Brush storage batteries, which are charged once a week. The storage battery is carried underneath the cars in boxes built to receive them, one-half being placed on each side. Each car requires six trays of four cells each. Swan lamps consuming 1·1 ampères have been used almost exclusively, although Stanley-Thomson's lamps have been tried. The parlour cars require ten 16-candle power lamps, while the passenger cars require but six. The lamps are all in parallel circuit, and so arranged that one-half may be used at a time. The wires are led through a clock mechanism, which registers the time they have been used. By an ingenious mechanical device, the clock is made to move half as fast when the switch throwing off half the lamps is turned. It is claimed that the cost of lighting the cars by the incandescent lamp compares favourably with that of lighting by compressed gas.

THE United States *Railway Review* contains a suggestive article on the names of American railways. "A foreigner," says our contemporary, "studying the guide book to find the way to some distant point, would fare poorly if he depended on the names of the railroads he read to get there. For instance, let him be landed in New York and seek a way to Chicago. In the list of railroads he would at once see New York, Chicago, and St. Louis. At once satisfied, he would immediately institute inquiries as to the location of the depôt of that road in New York. He would be surprised indeed to learn that the nearest terminus of that road was over 500 miles from New York; also that it did not extend within 300 miles of St. Louis. Another misleading name is that of the Boston, Hoosac Tunnel, and Western. This road does not touch a point mentioned in its corporate name. It is 153 miles from Boston, 1 mile from the Hoosac Tunnel, and ceases 20 miles west of the Hudson River, remaining in the east, surely. Of the same class of names is the Western and Atlantic Railroad of Georgia, which neither reaches the Atlantic nor the West, its termini being Atlanta and Chattanooga."

THE Patent Shaft and Axletree Company, of Wednesbury, in its last fiscal year turned out 24,625 pairs of wheels fitted to axles; and 6317 single wheels in addition, making a total of 24,625 axles and 55,387 wheels. Besides the wheels and axles sold to English roads, a large number were sent to India, Australia, and South America, and orders were received from the railroads in the United States, Canada, South Africa, and Japan. The extent to which the company's wheels are used on some English lines is shown by the fact that the Midland Company took 7000 wheels, and the Great Western 3000 pairs; 4893 pairs were furnished to the Indian State lines. In the company's mills 35,002 tons of iron and 12,752 tons of steel were made, and 6404 tons of steel were bought from other parties. The company does not confine its work to wheels and axles, but last year turned out a large quantity of bridgework, its chief contracts having been for the great steel bridge over the Ganges, at Benares, India, 3518ft. long, in sixteen spans, and for the ironwork of the Brighton station, on the London, Brighton, and South Coast Railway. The total output of finished iron and steel was about 1000 tons per week. During the last ten years over 50,000 pairs of wheels and axles have been sent to railroads in India alone.

SOME years ago Mr. Eames, of brake celebrity, brought over to this country an American locomotive which was to teach English engineers a good deal. The engine was tried on the Lancashire and Yorkshire Railway. It was afterwards taken to the Great Northern Railway and tried upon the main line, but it was found that it could not compete with any of the locomotives employed for hauling express trains on that road. After several trials had been made, it was left on a side track adjoining the running shed of the Great Northern Railway London Goods-yard, and after being advertised, was sold by order of the sheriff. The price obtained was only £160 sterling, the purchaser being a metal broker and merchant. It would have been expected that some attempt should have been made to sell the engine as it stood, or at least to sell the boiler, but it appears that the purchaser set to work to break it up for old metal, and was much disappointed at finding the fire-box not made of copper. Every portion of the engine and tender appears to have been broken up, the wheels having been actually broken into scraps on the spot where the engine stood, and the only portion of the engine left is the bell, which now hangs above the office of the locomotive department, a few yards from the side track where the engine was scrapped.

NOTES AND MEMORANDA.

MESSRS. C. G. HUSSEY AND CO., of Pittsburg, have just made six sheets of copper that are believed to be the largest ever rolled. Each sheet is 13ft. 9in. long and 9ft. 7in. wide.

As the result of careful experiment, it has been found that a single square foot of leaf surface in the case of soft, thin-leaved plants will, during fair weather, exhale aqueous vapour at the rate of 1¼ oz. daily. At night the rate is only about one-fifth as rapid as during the day, and during rainy weather there is absolutely no evaporation.

NORWEGIUM is the name of a newly-discovered malleable metal of white colour, with a tinge of brown. It presents, when pure, a metallic lustre, but on exposure to the atmosphere becomes coated with a thin film of oxide; its hardness is about that of copper, and its specific gravity is 9·4441. At 350 deg. C. it melts. It was found while examining a piece of nickel ore from Kragere, Norway.

THE average earnings for the 202 miners employed at Logan colliery, Pa., for the month of July, was 2.42 dols. per day, and for the 120 miners employed at Centralia and Hazel Dell collieries was 3.01 dols. per day. This is a daily average of 2.64 dols. for each of the 322 miners employed by Lewis A. Reilly and Co., of Centralia, Pa. Considering the difference in price to the consumer of the requisites of life, it really does not seem that the American is much better off than the English miner.

AT a recent meeting of the Paris Academy of Sciences a paper was read on "A New Method of Volumetric Analysis Applicable for Testing the Bioxides of Manganese," by M. Paul Charpentier. This method is based on the use of the alkaline sulphocyanides, and avoids certain tedious processes and sources of error presented by the methods of analysis hitherto employed. Its chief advantage is the extreme sensibility of the reaction, which enables the analyst to detect the presence of one-3,000,000th part of iron.

ACCORDING to United States practice, it is stated in the *Engineering and Mining Journal* that for steel wire ropes of uniform section, the weight of the rope may be counted as about one-third of a pound per foot for one ton—2000 lb.—working load. For iron wire rope, the weight per foot is half-a-pound per ton working load. So that at 4000ft. for iron wire ropes, and 6000ft. in depth for steel ropes, the weight of a uniform section rope would equal its working load; or, in other words, the rope would be fully loaded by its own weight.

THE manufacture of solid carbonic acid has been carried on for some time by a company at Berlin. Bottles of steel containing 8 kilogs. of liquid carbonic acid are sold. From these, by allowing the liquid to escape into a cloud vessel, a quantity of solid acid is obtained, which, by pressure into a wooden tube with a wooden piston, can be kept in the form of a small cylinder for a considerable time. A cylinder of about 1½in. diameter and 2in. long will take five hours to melt away into gas. The more it is compressed the longer it will last as solid. Here is a chance for the producers of small motors.

A NEWSPAPER correspondent describes the American watch manufactory at Waltham, Mass., and in speaking of the astonishing minuteness of some very essential parts of the watch says: "A small heap of grain was shown to us, looking like iron filings or grains of pepper from a pepper caster—apparently the mere dust of the machine which turned them out—and these, when examined with a microscope, were seen to be perfect screws, each to be driven to its place with a screw driver. It is one of the statistics at Waltham worth remembering, that a single pound of steel, costing but 50 cents, is thus manufactured into 100,000 screws, which are worth 11 dols."

THE following particulars of the beer industry in Germany, from *Kublow's Review*, do not indicate any probable early cessation of the demand for brewing machinery and plant:—A return of the beer production of the various countries last year shows that Germany ranks second, the first place being taken by Great Britain, whose production was 44,060,000 hectol., or 125 lit. per head of the population, there being 27,050 breweries in that country; while Germany, with 25,989 breweries, produced 41,211,691 hectol., an average of 90 lit. per head of the population. The breweries in Germany increased last year eighty-five, and the beer production increased 1,883,023 hectol.

THE following abstract is given in the *Journal of the Chemical Society* of a paper by Cailletet and Bouty—*Comptes Rendus*, 100, 1188-1191:—The electrical resistance of most pure metals decreases regularly with a reduction of temperature from 0 deg. to − 123 deg., and the coefficient of variation is practically the same in all cases. The resistance of mercury decreases at the point of solidification in the ratio of 4·08 : 1, and the resistance of solid mercury decreases with the temperature. Between − 40 deg. and − 92·13 deg. it is represented by the formula $R_t = R - 40 \text{ deg.} \dfrac{1 + a\,t}{1 - 40\,a}$, where $a = 0·00407$, a value closely approaching that for other metal. The values of a for several metals are as follows:—

	a	Limits of temperature.	
Silver	0·00385	+ 29·97 deg.	to − 101·75 deg.
Aluminium	0·00388	+ 27·70	to − 90·57
Magnesium	0·00390	0	to − 88·31
Tin	0·00424	0	to − 85·08
Copper	0·00418	0	to − 58·22
,, ...	0·00426	− 68·65	to − 101·30
,, ...	0·00424	− 113·08	to − 122·82

The variation in the resistance of platinum and iron differs from that of other metals below zero as well as above. The formula $R_t = R_o (1 + a\,t)$ holds good in the case of iron when $a = 0·0049$, but in the case of platinum the value of a, which is 0·0030 at 0 deg., increases as the temperature falls, and becomes 0·00342 at − 94·57 deg.; or, in other words, the lower the temperature the more closely does the value of the coefficient for platinum approach that for other metals.

AT a recent meeting of the Berlin Physical Society Dr. König produced a new apparatus for the measurement of the modulus of elasticity, which was constructed according to the suggestions of Herr von Helmholtz, and was utilised in the Institute for measurements of elasticity. The modulus of elasticity was determined by loading in the middle a bar of the substance to be examined, resting both ends on firm supports. The flexion which set in was measured by means of the cathetometer, and, its value being introduced into the formula of the elastic theory, furnished the modulus of elasticity. A source of error in these measurements arose from the circumstance that the bar resting on edges was in part pressed in and sank, as a whole. This depression was the greater as the loading was greater, and it added to the magnitude of the deflex. To avoid this disturbance in the account, Professor Kirchkoff, in 1859, placed horizontal mirrors on the two ends of the bar, and, by means of telescope and scale, observed at each side the change in situation of each mirror, a change which occurred in consequence of the deflexion under the loading in the middle, and which produced on both sides an opposite displacement of the scale. The sinking of the bar on account of the pressure on the edges, and even a slanting position on the part of the whole bar, exercised no influence in these measurements. The apparatus suggested by Professor von Helmholtz developed this principle still further. It had two perpendicular mirrors, with the reflecting surface directed inwards at the two ends of the bar; on one side stood a scale, on the other a telescope. The image of the scale fell on the opposite mirror, then on the second mirror, and thence into the telescope. If, now, the bar were loaded so that deflexion occurred, then the image in the telescope became displaced to the extent corresponding with the angular changes of the two mirrors. By glancing, therefore, into the telescope the whole amount of deflexion might be very rapidly and conveniently measured, and the loading altered at pleasure. The commencement of the elastic after-effect might likewise be directly observed with great facility.

MISCELLANEA.

COMING down the Nile is very different work from getting up against the stream. A pinnace is reported to have gone down stream at the rate of three miles in twelve minutes, or fifteen knots an hour.

THE Standard Steel Casting Company, at Thurlow, recently completed a casting for a hydraulic upsetting machine weighing over 12 tons. This, it is claimed, is the largest open-hearth steel casting ever made in the United States.

THE report of Civil Engineer Menocal, United States Navy, just published, adds to the already long list of unfavourable reports by competent authority, relative to the Panama Canal, both in respect to the finances and to the engineering problem.

MESSRS. ARCHIBALD SMITH AND STEVENS have just completed for the Countess de Torre Diaz, at her residence, 21, Devonshire-place, one of Stevens and Major's Patent hydraulic lifts, worked from a tank in the roof, so that it is available night and day. The lift is perfectly noiseless.

OWING to the great success of the Amateur Photographic Exhibition, held in Bond-street last spring, the directors of the London Stereoscopic and Photographic Company have again secured the same galleries for April and May next, when it is anticipated a still more interesting series of photographs will be brought together. Any profits that are made will be devoted to a charitable object.

AN instance of the cheapness with which small wares are now made in the United States can be found in the miscellaneous hardware needed about a house. Good steel screw-drivers, 9in. long, handles on, can be bought for five cents; door bolts for the same price; dead-latches for thirty-five cents; 3in. hinges for five cents; &c. &c. A good pair of white well woven web suspenders can be bought for fifteen cents; but a few years ago the same goods sold readily for fifty cents. This seems curious in a country where Protection is said to run up prices. What would be the value of these things under Free-trade?

A FEW months since we published full particulars of the Hawkesbury Bridge, New South Wales, for the construction of which tenders were asked. Out of the fifteen tenders received, eight were from English and three from American firms, while one each came from Canada, France, Sydney, and Melbourne. Twelve were for the manufacture and erection of the entire structure, while three were limited to the supplying of the material. Of the twelve, the lowest was for the sum of £700,000, which, it appears, is £50,000 less than the estimate, and as regards the three, the lowest sum named is £351,000.

THE death is announced of a most prolific American inventor, Azel Storra Lyman, who in 1857 began to develope his ideas of an accelerating gun, which was the subject of many subsequent patents, the last of which was for an accelerating cartridge, obtained in June last, when the deceased was in his 71st year. The various other inventions of Mr. Lyman included an air engine, a water gauge, a refrigerating car, several methods of preserving meat and vegetables, of separating gelatine and meat from bones, cans for preserving food and soldering apparatus, apparatus for concentrating milk, a rotary engine, and many others.

THE interference heretofore existing between Jacob Reese and James Henderson relating to the priority of invention of the basic process has been declared by the U.S. Commissioner of Patents in favour of Reese as the prior inventor. This appears to be an important decision, because Mr. Henderson based his rights on his English patent, dated November 8th, 1870—No. 2940. The life of the English patent is only fourteen years, and as the American patent based on an English one expires simultaneously with the English, it will be readily seen that if the decision had been in favour of Henderson the basic process would have become public property on the 8th of November, 1884, while the afore-mentioned decision, as well as many others, place the basic process under the control of Reese during the remainder of this century.

ON the night of the 9th inst. an installation of arc and incandescent lamps, supplied by the Maxim-Weston Electric Company, and fitted up under the supervision of Mr. W. C. Cockburn, their agent in Newcastle, was tested at Ashington Colliery. The aim of the Ashington Company has been to have their heapstead illuminated as perfectly as possible, and no expense has been spared to achieve that end. There are three dynamos, two of which are capable of supplying sixty circuits of 20-candle power, and thirty of 50-candle power. At present, however, only about fifty 20-candle and twelve 50-candle lamps have been fitted. The third dynamo is to work two arc lamps of 2000-candle power. The dynamos are driven by an 8-horse power engine, by Piggot, of Birmingham, with Pickering's governors. The incandescent lamps are distributed at the pit heap and screens.

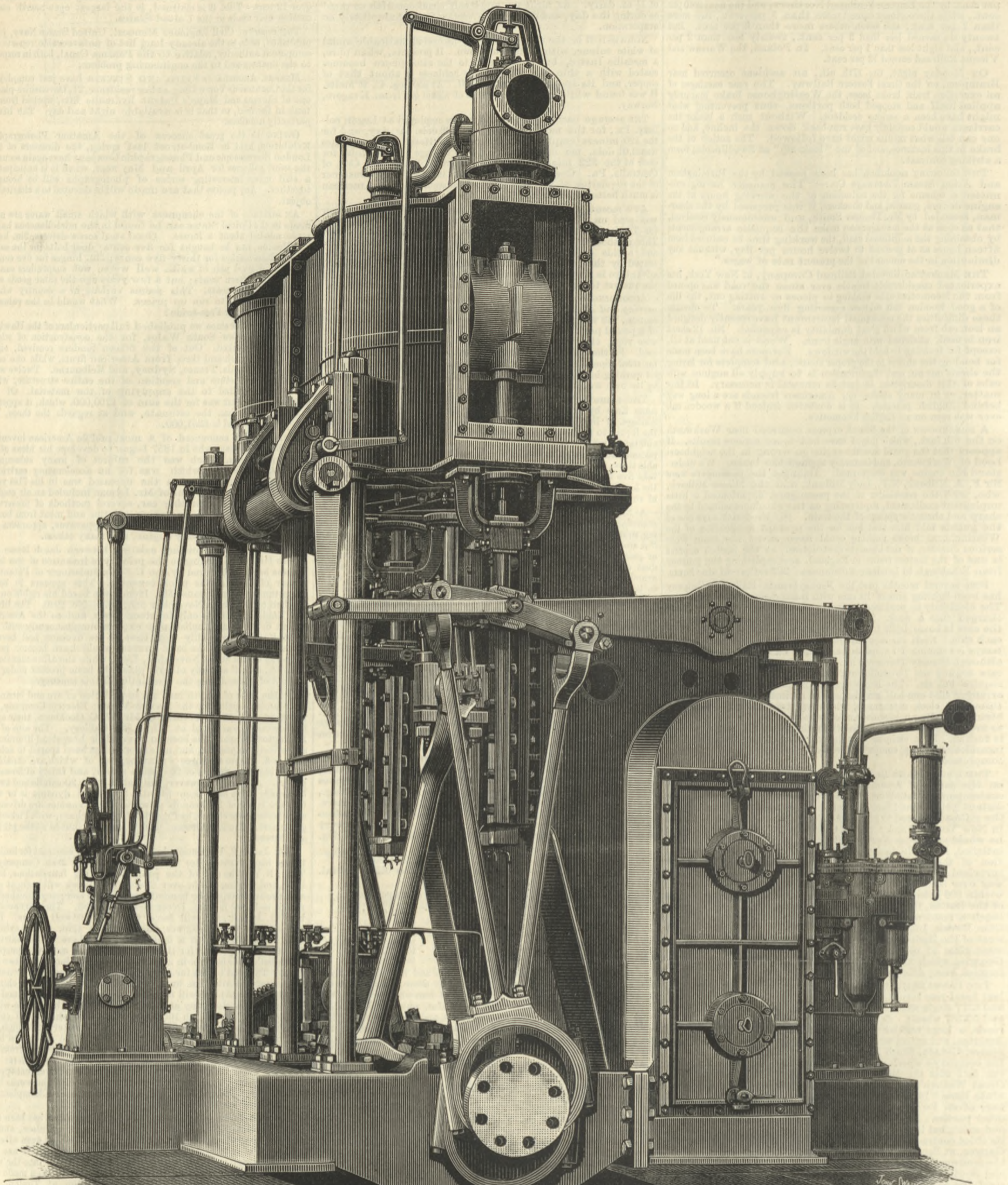
MR. JAMES P. WITHEROW has just signed a contract for building three blast furnaces for the Troy Steel and Iron Company, at Troy, N.Y. The cost of the plant, including foundations, buildings, and trestles, will be over £140,000. Work will begin at once, and the furnaces will be handed over to the company, finished and ready to be put in blast, December 31st, 1886. The furnaces will be 80ft. by 18ft., and will have twelve Whitwell stoves. There will be seven blowing engines, each with a 42in. steam cylinder, 84in. blast cylinder with a 60in. stroke. There will be thirty-six boilers to supply steam for the engines, pumps, and other purposes. Each boiler will be 46in. in diameter and 34ft. long, with two 16in. flues. The hoist towers for elevating ore will be massive iron structures equipped with 12in. by 12in. hoisting engines. The chimney for the complete plant will be built of wrought iron and lined with fire-brick to a clear way of 13ft. by 225ft. high. There will be three casting houses, each 165ft. by 50ft., boiler-house and engine-house. The water tank will be 30ft. in diameter, 32ft. high, and will be built of wrought iron plates. It will be placed on heavy iron columns 30ft. high. The iron will be tapped from the furnaces and carried directly to the Bessemer converters. The furnaces will be built on an island in the Hudson River just opposite the steel works. The island will be connected with the works by an iron bridge. The ore used will be a mixture of Champlain and Hudson River ore.

IT is said that a new substance for ship's armour has been satisfactorily tried. It is obtained from cocoanut cellulose, and has the property, when penetrated by shot and shell, or even after the explosion of a torpedo, of closing up as rapidly as it has been perforated, and thus preventing the influx of water into the ship's hold. Some important experiments have lately been made with the composition before a French commission at Toulon. The commission submitted the composition to a threefold test—against shot, shell, and torpedo. The target was a cofferdam made of a mixture of fourteen parts of pulverised cellulose and one part of cellulose in fibre. This composition was compressed to a felt-like mass, of which one cubic metre weighed 120 kilogrammes, or one cubic foot, about 8 lb. A layer of beams 4¾in. thick represented the side of the ship, behind which there was a layer of the new material 2ft. thick. Against this target a 7½in. solid shot was fired, which penetrated it, taking with it not quite one-fifth of a cubic foot of composition—a very small quantity, considering the size of the shot. But as soon as the shot had passed through the target the cellulose composition closed up again, and so firmly that a strong man was unable to force his arm through the opening made. A box filled with water was then fixed against the aperture, the contents of which ought to have acted in the same way as if the cofferdam had been washed by the sea. It was observed that a few drops of water began to percolate after the lapse of from ten to fifteen minutes, and even after the composition had become well saturated with water only between three and five pints of water escaped per minute, which could be easily intercepted by pails. As soon as the cellulose had become thoroughly soaked and grown denser it offered greater resistance to the percolation of water, which finally almost ceased to flow.

COMPOUND ENGINES AT THE ANTWERP EXHIBITION.

LA SOCIÉTÉ COCKERILL, SERAING, ENGINEERS.

(*For description see page 211.*)



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W. D. G.—*Several letters lie at our office for this correspondent.*

E. C.—*The engine would stop sooner. The use of a valve for destroying the vacuum in compound engines, and so preventing racing, was patented some years ago.*

W. B.—*The proof strain is not the breaking strain. The safe load is calculated by the formula* D = *diameter in eighths of an inch,* W = *safe load in tons. Then* $D = \sqrt{9W}$ *and* $W = \frac{D^2}{9}$.

J. E. B. (Chalk Farm).—*Some minds are so constituted that they are totally unable to understand a joke. Yours is evidently such a mind. This is not your fault, however, and we express our regret that you should have wasted your time in a search for Messrs. Tryett, Onne, and Co., 41, Elizabeth Martin-street, Birmingham.*

LEAD PENCIL MACHINERY.

(*To the Editor of The Engineer.*)

Sir,—I shall esteem it a favour if any of your readers will oblige me with the names of makers of machinery for manufacturing lead pencils.

London, September 16th. M. H. C.

JAM MAKING.

(*To the Editor of The Engineer.*)

Sir,—Can any reader give me the address of a maker of machinery for making jam? I require an apparatus to boil down at least one ton of fruit per day of ten or twelve hours. J. H. K.

Farnham, September 9th.

WROUGHT IRON FACTORY CHIMNEYS.

(*To the Editor of The Engineer.*)

Sir,—Will you please allow me to ask if any of your readers will kindly give me some particulars of factory chimney shafts made of sheet iron? I want to know about thickness of plates used, size of rivets, cost, and any other information respecting the construction of wrought iron shafts.

London, September 17th. A Builder.

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THE ENGINEER.

SEPTEMBER 18, 1885.

THE ELSWICK STRIKE.

The strike at the works of Sir William Armstrong and Co., Elswick—which we may hope has terminated—is very remarkable and suggestive. It was in most of its circumstances different from other trade disputes, and no doubt legitimately excited the interest that has been taken in it. The general facts are quite familiar to our readers. Nearly five thousand men gave the directors of the company their choice—either two managers, Mr. McDonnell and Mr. Brown, must go or they would go. The directors replied that they would not dismiss the managers, and the men turned out. It would seem that Mr. Brown is not regarded as so objectionable as Mr. McDonnell. If the latter gentleman would resign, they would condone Mr. Brown's past offences on condition that he was more circumspect in future. Numerous attempts were made to adjust the dispute. The men were asked to submit their grievances to arbitration. This their leaders refused. Then it was suggested that a ballot should be taken to decide whether arbitration should or should not be invoked, but the leaders refused to permit the men to express an opinion on the subject. Comment on this policy would be superfluous. Specific charges have been brought against Mr. McDonnell and Mr. Brown which have been categorically denied. The charges are of the most frivolous description. One man had his feelings grievously wounded by being told that he was "doing a lot of d——d nonsense" in fitting up some axle caps. Mr. Brown was accused of discharging a man who was never discharged, and of reducing wages which had never been altered. Indeed, it is very difficult to read the statement of the men without saying that they have been put to their last shifts to find grievances. One of them deserves mention. "Mr. McDonnell walked through the shops too haughty."

The circumstances of the case admit of being very briefly stated. The rapid growth of Elswick was attended with a certain laxity of commercial arrangements, as is very often the case under similar circumstances; and it is very probable that no very accurate information existed as to what various manufactured articles cost in detail, although the gross cost was, of course, known. The piecework system was practised, and in some way or other "extras" constantly had to be paid for. The directors believed that a time had come for setting their house in order, and to this end Mr. McDonnell was employed. He proceeded to introduce certain changes in administration intended to supply really accurate information as to cost, and at the outset he offended the men in a very simple way. At Elswick, as in most other shops, the time employed by the men on different jobs is entered in pencil on a small wooden tablet chalked for the purpose. These boards are collected every evening, and they are copied by clerks and entered up in the books. Now it was desirable that the information thus obtained should be supplied with promptitude to the head office; and to facilitate matters the men were asked to fill up their time on paper instead of on boards. This they flatly refused to do. They saw in the innovation a prospect that wages would be reduced. The matter was not pressed. The piece ticket system constituted another grievance. A man took a contract to make a certain number of articles at a given price; let us say, five gun carriages at £10 each. When a foreman arranged the price of a job with a man he took a ticket out of his pocket and wrote upon it the man's name, the article or articles to be worked, and the price arranged. He then initialled it, and handed the ticket to the man as his authority for going on with the work. When the work was done the ticket was sent into the office, and from it was calculated the amount that was due on the work. This system the men would not have at any price. Before it was introduced the heads of the firm were very much in the dark, as we have said, concerning the details of costs, and the men simply refused to supply the information. They plainly stated that if they supplied it wages or, in other words, prices would be reduced. This leads unavoidably to the conclusion that they did not like their employers to know how much they were really earning. It must be understood that all this time not a syllable had been said about reducing wages. So far as we can ascertain there was no intention on the part of the directors or anyone else that wages should be reduced. It is especially noteworthy that the strike did not represent, in the first instance, at all events, the wishes of the men as a body, but only of a comparatively very small number of leaders—in fact the "turbulent minority," who in all the relations of life do so much to shape the course of events. So far as we have been able to ascertain, the whole of the facts lie in a nutshell. The men employed at Elswick had very good times indeed of it, and some of the leading hands found it a species of El-dorado. Things went on so nicely that any change, it was felt, must be a change for the worse. The most influential of the directors were constantly called away on business of one kind or another, and matters to a certain extent were of necessity allowed to drift; Mr. McDonnell was introduced specially to fill a gap which never had been filled of late years, and this augured evil for the men. The strike was not against reduced wages, or Mr. McDonnell, or Mr. Brown, but against the introduction of any radical change in the system, or want of system, hitherto in vogue. This is the root of the matter; the bald statement may be decorated, or coloured, or veiled, but it remains the truth.

A great deal of nonsense has been written in connection with this subject about Mr. McDonnell. The northern papers have been full of him, and although the questions raised are, in one sense, personal, they cannot be passed over with propriety in silence. For eighteen years Mr. McDonnell was locomotive superintendent of the Great Southern and Western Railway of Ireland, and we know from personal experience that he was much liked and thoroughly respected by the large number of men under his control at Inchicore, to say nothing of the drivers and firemen. Mr. McDonnell brought the line to a very high state of efficiency. The shops at Inchicore left nothing to be desired and the rolling stock of the Great Southern and Western Railway is not inferior to that of any English line, and superior to that of not a few. A very few years since Mr. McDonnell was appointed locomotive superintendent of the North-Eastern Railway, and on leaving Inchicore he was presented with £250 worth of plate and an address, in which, we have not the least doubt, the men said what they felt. We happen to know something from personal experience of what the workshops of the North-Eastern Railway were. We certainly do not say too much when we assert that they needed improvement. The engines were in such a condition that the daily press in the north complained of them; and the North-Eastern Railway claimed pre-eminence as contributing to the annual roll of boiler explosions more than all the other railways in the kingdom. We believe we do not err when we say that until the advent of Mr. McDonnell there was an explosion every year. From a very early period the Gateshead men were opposed to Mr. McDonnell, and things were made very uncomfortable for him. The following statement made by Mr. McDonnell to a reporter of the *Newcastle Daily Chronicle* is worth reproducing:—"Up to my going the men had never had any written rules, and when the new rules came into force the men sometimes asked more than they were entitled to, and sometimes the foremen did not give them as much as as liberal interpretation of the rules seemed to imply. That was the cause of much of the mischief. Suppose there were two engine sheds in which the men were independently advanced—that is, advanced without any reference to each other. In one of these sheds a man has been advanced from being a fireman to being a driver, after five years' service, and had acted as driver for two years. In the other shed a fireman had been advanced to a driver after twelve years' service, and had acted as driver for one year. A reduction had to take place on account of a train being discontinued. According to the rules which were adopted, the junior man must go. Which is he? The rules say, the man who was driver for only one year, because seniority dated from the time of his appointment as driver, although he might have been longer firing. A question of that kind was exceedingly difficult to arrange without causing discontent amongst the men." Mr. McDonnell found firemen who had only fired two years being paid higher rates than men who had fired ten years, and drivers who had only driven five years paid higher than men who had driven fifteen years. It was impossible to put matters on a more satisfactory footing without giving offence somewhere. Again, it was asserted that Mr. McDonnell had attempted to infringe the nine hours' system. In point of fact, he did not interfere with it, except to bring all the shops under it, and to slightly augment the pay for overtime. But Mr. McDonnell gave offence because he was a reformer. It is perfectly well known to those behind the scenes that the North-Eastern shops present peculiarities which render changes, and especially changes wrought by a stranger, extremely unpalatable. How far the Gateshead men and their opinions have had anything to do with the course of events at Elswick we shall not pretend to say, but in the North it seems to be admitted that they have had an influence adverse to Mr. McDonnell. On the 2nd of September a letter, written by Mr. Crooke, of Darlington, was published in the *Newcastle Daily Journal*. Mr. Crooke deserves credit for speaking out, and the following quotations from his letter are useful contributions to the history of the subject. Mr. Crooke begins by saying that he is a member of a trades union, and he goes on:—"I never hesitate to speak out when I think it is my duty to do so, whether it is masters or workmen that I address, and I agree very largely with the doings of trades unions; but there are times when I cannot conscientiously do so, and this case is such a one. The workmen at Elswick have endeavoured to make a great deal of capital out of Mr. McDonnell's bad administration as locomotive superintendent of the North-Eastern Railway. I think I may offer my opinion as a North-Eastern locomotive man. I took a prominent part in the North-Eastern men's agitation of 1882 and 1883, and when Mr. McDonnell succeeded Mr. Fletcher the men throughout the whole of the North-Eastern line were almost ripe for rebellion, and the engineering department was in such a bad condition as to cause continual comments from the press. Mr. McDonnell boldly grappled with this state of things, and brought about a very marked improvement in the building of new shops, engines, &c., and he also endeavoured to settle the men's grievances, some of which were long-standing ones. I was one of a deputation of ten who on two occasions met Mr. McDonnell on the question of hours and wages, and after four hours' discussion he agreed to liberal terms, insomuch that many men—whose names I can give—have since the early part of 1883 been in receipt of an advance of 15 per cent., with a better regulation of hours. I may be confronted with the dispute he had at Gateshead; if so, I refer your readers to the *York Herald's* report of the interview between Mr. H. Tennant and the men's representatives, from which report it will be seen that many of the charges were without foundation. Also there has been a strike at Gateshead since Mr. McDonnell left the company, which he was not responsible for; and should this unfortunate dispute terminate in a stoppage of work, one thing is certain, viz., the heaviest burden will fall on the men, and those dependent on them will be the greatest sufferers. I think it scarcely possible that men of intelligence, such as those employed at the Elswick works, will refuse the offer of arbitration, if so their confidence in the nine charges they have made must be very small indeed. Rather let a fair and honest ballot be taken at once, and every workman be allowed to give his opinion unfettered by any unjust influence from his fellowmen. After this has been done in a calm and reasonable way, we may then hope for a peaceful settlement without the great calamity of a strike. I have wrote this letter without a hint from anyone, with an earnest desire to benefit the men concerned. Should such be the case I shall feel amply rewarded."

We have stated that at first the leaders of the strike refused to permit a ballot to be taken. We are glad to be able to add that they have been overruled by the men. By the aid of Mr. J. Morley, M.P. for Newcastle, an interview took place on Monday between Captain Noble, Messrs. Westmacott, Rendell, and Cruddas, representing the directors, and the Executive Committee representing the workmen on strike. Mr. J. Morley was also present. About three hours' discussion took place, at the conclusion of which it was unanimously agreed that the following propositions should be submitted to the men, viz.:—"(1) That a Council of Conciliation be formed, consisting of three members, one nominated by the directors, a second by the workmen from a list jointly agreed to, the third being chosen by the two gentlemen previously selected. The Council to hear and decide upon the whole general case of the workmen against Messrs. McDonnell and Brown as regards their conduct at the Elswick Works, including allegations of tyrannical manner. (2) The said Council to decide whether such charges are proved, and if so, whether they are such as to justify the demand that either Mr. McDonnell or Mr. Brown be dismissed, or be called upon to resign. (3) In case the recommendation of the above Council should not necessarily lead to the resignation of Mr. McDonnell, arrangements will be made in the future which will obviate the necessity of his being brought into direct or personal relation with the workmen. (4) If the above proposals be accepted, the system of piece tickets will be abolished, and other means of recording piecework be devised, with the concurrence of the workmen. It is further understood that piecework will be discontinued as far as possible." These proposals were submitted to the workmen on Wednesday morning. The result of the voting was that 2586 were in favour of accepting them in their entirety, and 250 were against that course. The strike may therefore be considered at an end.

SCIENCE TEACHING AND BEGGING.

BEGGING may appear a plain word to use in this connection, but we cannot correctly apply any other to the subject, because none other would mean exactly the same thing. The address of Sir Lyon Playfair, as President of the British Association, was from one point of view an able production, eloquently delivered, and interesting in the main, yet with an aim that should not be allowed to pass unnoticed. It was in reality an eloquent begging sermon without the usually accredited charitable motive and object. It laboured from beginning to end to show that we have not enough science teaching and not enough teachers, because we do not pay as much money as we ought, in Sir Lyon's opinion, to pay; nor as much as is paid by the Governments of Germany and some other countries for their teaching. He would have science supported by large Government grants and many more professorships created and maintained by taxation; the ostensible object of the professors being to teach, the real object being "research," insidiously hinted at as the one thing necessary in the battle of civilisation. Money does not come in fast enough; and the State is to be made to supply the demand which the address of the president and two of the sectional presidents make on behalf of the teaching community. The claims are made on the high ground of the great national value of abstract discovery; the measurement of the value of science by its applications to the useful purposes of life being objected to as based upon a degraded and incorrect view of science. Yet the whole of the evidence offered as proof of the value of science consists of instances of its practical application in the arts, and most of them refer to cases in which science teaching followed rather than led, as we pointed out last week. Reading some of these addresses would almost make one think that the discoveries which have revolutionised arts and manufactures, and facilitated trade, and made England rich, were all made either by scientific teachers; by scientifically trained men; or by those paid for scientific research. Yet everyone knows that there are very few indeed of these things that have been done by such men or by the scientific knowledge of any abstract discovery. Most of these addresses confound the value of sound education with the value to a nation of a great army of highly-paid science teachers or "researchers."

If discoveries and valuable departures from beaten tracks could be shown to have been made, even to a notable extent, by the highly-trained scientific scholars, there might be some reason for this general clamour on the part of the teaching community for State aid. This, however, cannot be done. Sir Lyon Playfair mentioned the names of Watt, Hargreaves, Arkwright, Crompton, and Cartwright; a reference which can hardly be said to support the claim of abstract science teaching as the great helper of those who initiated great industrial developments, while it certainly does not support the idea that the pre-eminence of the country is to be lost if we do not pay a lot of experimenters to try to make abstract discoveries. Germany is pointed to as a country in which the largest sum is voted by the State for science teaching, as much going to Strasburg University as is voted by the English Government in aid of all our universities. Admitting for the moment that this is the case, and that the German Government has no other motive in paying heavily for the Strasburg institution, it may be maintained that we have no need to emulate the German action in this matter. Germany is, perhaps, better taught in scientific matters than any other country; but Germany is, also, least original. If we exclude chemical subjects, we may ask, without doubt as to the answer, which of the two, England or Germany, has originated the most of the important developments in arts and manufactures? The answer is certainly England. Steam engines, railways, iron ships, steam navigation, Bessemer steel, spinning, weaving, agricultural machines and implements, all have originated in this country. Some of these and others not mentioned have been produced in spite of the adverse demonstrations of science authorities.

Practical men and some amateurs, with but small knowledge of the higher branches of science, have conceived new things, and after more or less difficulty have achieved their object. Then the science teacher comes along and developes a theory of the thing, and shows how it is that it works. Almost invariably the practical man precedes the scientific man in obtaining new knowledge. He obtains a number of facts, and he makes, say, a machine. He does not by any systematic method that he can show on paper develope his invention by means of a sententious generalisation of these facts, but he nevertheless performs a mental generalisation, the proof of which is his completed machine. It is only the conceit of the science teacher that makes him say that an Arkwright had no power of generalisation because he was not scientifically trained, and that therefore he laboured much more than he would have done to produce the result if he had been so trained. There are hardly any instances on record of the professor of theoretic mechanics producing any new and useful mechanical combination or machine. It is not generally true, as Sir Lyon Playfair would have us believe, that "the inventor may sometimes succeed without much knowledge of science, though his labours are infinitely more productive when he understands the causes of the effects which he desires to produce." Scholasticism is conservative, and the history of invention tends to show that those who produce new things are most often those whose minds are unfettered by that kind of learning which prevents the mind from leaving the scholastic lines of thought. Sir Lyon Playfair would have a Minister of Education and extensive aid for scientific research. We need hardly say that we wholly agree that education should be encouraged by every legitimate means, but that money should be paid by the State for the support of professional discoverers would not only be a great mistake, except as far as the recipients are concerned, but it would be productive of no results. Sir Lyon said, "The processes of mind which produce a discovery or an invention are rarely associated in the same person, for while the discoverer seeks to explain causes and the relations of phenomena, the inventor aims at producing new effects, or at least of obtaining them in a novel and efficient way." Here is a statement which is true as far as it goes, but is not all the truth. Trained or not trained, the inventor usually works in a direction not yet traced; and the aid that either scientific training or reference to the work of others can give him is often very limited. He is both a discoverer and an inventor. The discoverer who succeeds in explaining causes and the relations of phenomena is, on the other hand, an inventor in degree, inasmuch as he must so apply knowledge previously ascertained by experimental or other means, in building up the explanation of the new phenomenon. The discovery so made is, however, not very often of much importance in manufacturing arts. Arkwright would not have been helped by any such discovery of the causes of the working of any mechanical combination previous to his time, and no amount of such scientific discovery would have helped Jacquard in making his loom. Again, in other directions the science teaching of the laboratory and technical school trained professor would have prevented the attempt to punch a ½in. hole through a piece of iron 2in. in thickness; yet the man who tried it succeeded, and now the science teacher who is so necessary to progress can explain why he succeeded, and from his lofty standpoint looks down upon the work of the doer as wholly insignificant as compared with his talk on the flow of solids. Science follows in most things, just as in a minor instance it hastened to show, after it was done, why a man should be able to ride a bicycle.

Yet scientific teaching is absolutely necessary; but we must repeat that the idea of paying an army of professed discoverers is delusive in the extreme. Very few of those who are crying out most for Government aid are fitted for any such work; their laboratory and technical school training is based on a wholly insufficient field to enable them to do any good. There are a few men who could do good in this way, but they are not amongst the beggars for alms, either for themselves or for the students. They know very well that neither invention or real discovery can be commanded, and that their teaching is worth paying for by those who want it.

As to the relative amounts paid to the English Governments, the President's address omitted to mention the enormous sum spent by South Kensington; he did not state that enormous revenues, the proceeds of bequests, are yearly devoted to educational purposes in England, while only a comparatively small sum is thus obtained in Germany; that the Government of the latter country has an unmentioned object in its liberality towards Strasburg; or that for every man of eminent ability in Germany or any other country, we can give the name of at least one in this country.

DRAWING-OFFICE MANAGEMENT.

IT has been well observed that the drawing-office is the brain of an engineering works. In it the preliminary steps are taken to produce such machines as are usually dealt in by a given firm, or for the construction of those to perform some special work. It naturally follows that no department of a works, whether large or small, demands more careful management, in a two-fold sense of the phrase. Not only must the designs produced be carefully and considerately worked out, but inasmuch as the staff is on the whole expensive, time becomes of great value, and must, or should be, economised to the utmost.

The duties of a chief draughtsman are probably more anxious and harassing than those of any other head of a department in an engineering works. Besides being a thorough draughtsman, he must possess an intimate and practical familiarity with the possible and the impossible in construction, whether in the pattern-makers', the founders', the fitting, or the erecting shop. Besides this he must also, as we have already observed, know how to get drawings made with the least possible loss of time; and no one of his duties demands more judgment than this. In fact to succeed here, even fairly well, he must be himself a draughtsman, not merely in the common sense of the term, of being able to draw plans and elevations to scale, ink-in neatly, and figure dimensions accurately. More than this is required. Heads of firms and managing directors, with the best intentions in the world, very often hinder the progress of work in their drawing-offices by either directly, or through the chief of the office, ordering a trifling change in a detail, and become irate if the alteration is not introduced, and the "set" of drawings ready in an hour or two for tracing. Such men, howsoever clever and able—as in most cases they are—as business men in other ways, often wrong both their own interests and their draughtsmen also by this line of action. Were they experienced draughtsmen themselves, they would know that one alteration nearly always means many. A set of working drawings, once complete, form a symmetrical whole. They are like a pair of toothed wheels, the several parts, like the teeth of the wheels, fitting each into its own place; and as the alteration of one tooth necessitates corresponding change in all the others, so with a set of working drawings. Even an alteration in the position of a bolt, or a change in the thickness of a flange, is nearly sure to entail a hunt for the effect of that alteration through a whole set of drawings, and it frequently involves changes of other parts to such an extent as to involve the remaking of sheets of drawings. All this is productive of delay and expense even when done before the tracings have been sent out to the pattern shop or forge; much more when they have gone, and the patterns or forgings are partly made. Hence it is of paramount importance that the author of a given design should "know his own mind," thoroughly weighing and considering what he wants, and how best to design the machine to supply that want, and then to have the strength of mind not to give way to any impulse or "fresh idea" involving a change, however trivial it may seem at a first glance. Indeed, where the design in hand is for a machine to be made in numbers, it is, we are of opinion, more advisable to defer alterations, tempting though they may appear, on the original design, until the first machine is made and has been tried; for it may well happen that the first design is good, or, if needing alteration, needing it in quite a different direction to that contemplated; and thus time and money are saved in the drawing-office, and probably as well in the pattern shop or forge.

The practice pursued in some drawing-offices of unduly hurrying drawings through is extremely injudicious, perhaps worse—certainly as bad as allowing dawdling and laziness to prevail in an office. Occasionally heads of firms or chief draughtsmen, with a mistaken idea of economy, forbid the use of dotted lines, the showing of more than two views of a thing on a working drawing, and so on, and they have working drawings made to too small a scale, and, last and worst of all, prohibit the putting on of figured dimensions. All these things, however economical they may seem at first sight in the office, are fruitful sources of expense afterwards in the shops, parts not going together in the erecting shop, owing to oversights due to want of sufficient setting out of the work. Every draughtsman or practical man knows, or ought to know, that cases are not infrequent in which, however correct and practicable a design may look on two views—say front elevation and plan—when the third or side elevation is set out a very serious difficulty of construction will be discovered, and the cost of even a small "waster" will in most cases much exceed that of setting out the third view on paper beforehand. These remarks equally apply to the non-use of figured dimensions. The safeguard supplied by their employment repays over and over again the trivial expense of putting them on; nor does their advantage end here. Where foremen have to scale off their measurements, and a mistake is made, leading to a waster or two, it may be difficult to fix responsibility on the really culpable parties, as the draughtsman and the foreman will each stand by the exactness of his own scale. Nothing of this can of course occur if the dimensions are fairly and legibly written on. Besides this, when a man is working to a drawing with figured dimensions he can work from it with his eyes alone, having only to measure the work itself with rule and calipers, which of course he cannot do with unfigured drawings. Another point about efficient drawing-office management is the checking of quantities. Some heads of offices forbid one man asking another to check at least his leading figures. This prohibition is, in our opinion, unwise. The taking out of quantities is a thing on the accuracy of whose results very important financial issues always depend. The calculations, however simple, involve much figuring, and the misplacing or omission of a decimal point may cause a serious error in totals, and therefore the neglect or non-use of the check system is essentially a penny-wise-and-pound-foolish one. It may be all very well to say mistakes should not occur; of course not, but they do, and a wise man will always reckon on their probable, or, at all events, possible occurrence, and take his measures accordingly.

So far our remarks have been addressed to heads of departments. We will conclude this article with a hint or two to draughtsmen themselves. When working out a new design a man gets "stuck" at some difficulty. He should either wait a favourable time to apply to his chief, or else go to the foreman of whatever shop the drawing then in hand refers to, and ask him whether such or such a thing is practicable; and, as a rule, if the young fellow is civil and courteous to the various heads of departments he will get all the information he requires to go on with his drawing; he will have saved an overworked chief some trouble, and will moreover have gained invaluable information for himself. At the same time this practice must be followed with much tact. In some establishments it would probably be resented and forbidden, in others it may be done. Draughtsmen often think that their pay is disproportionately small compared with the wearing and anxious nature of their duties; but they must console themselves by bearing in mind that a drawing-office in a good works is a splendid engineering training school once those engaged therein advance enough in the confidence of the chief to get designing and working drawings to do. While there they are laying up—if they do not do so to some extent it is their own fault—a store of practical knowledge of their profession such as books or schoolmasters could never impart. Hence their mere salary alone is not the sole remuneration they receive. Besides, a chief soon "finds out" a good man, and puts not merely good office jobs in his way, but also when perhaps short-handed sends him on outdoor work as well, where fresh opportunities present themselves for acquiring useful knowledge as well as of improving his reputation in in the eyes of his employers.

COAL FOR ALEXANDRIA.

A VERY valuable table has been compiled of the quantities of classes of coal imported into Alexandria during the past year. It is worth while noticing that that port consumes a very large quantity of our coal, though that tonnage has not of late increased as has done the quantity taken into Port Said. In 1871 there were 330,000 tons taken into Alexandria, and only 102,000 tons taken into Port Said. But now there are only 360,000 tons taken in the last year into Alexandria, whilst the quantity taken into Port Said has risen to 726,000 tons. Passing, however, to the imports into Alexandria alone, we may notice the coalfields from which they were sent. Out of the 360,000 tons, there were over 181,000 tons sent from the northern ports of England—Blyth to West Hartlepool. From the ports of Hull and Grimsby there was the small quantity of 9800 tons sent; from Liverpool—North Welsh and Lancashire coal—the quantity was 38,700 tons; from the Scotch ports, 11,000 tons; and from the "Severn ports"—Cardiff, Newport, and Swansea—there was the balance, over 118,000 tons, received. It is plain that a part of this coal is from ports to which it is sent for other than purposes of pure exportation, probably to give a filling up for other cargo; and thus the chief places from which Alexandria is supplied with coal are the northern ports, chiefly the Tyne and the Wear, and the Welsh ports—mainly Cardiff and Newport. The Welsh ports seem to be increasing the quantity of coal they send to Alexandria, but in this instance the northern ports seem to hold their own better than they have done in many of the Mediterranean and in some other ports; and probably this may be due to the needs of the steamers using coal there for a special class for use in and near the canal. The fact that the total quantity of coal sent to the port has been nearly stationary for so many years is not very unsatisfactory, except so far as it is explained by the deplorable events in the East. This year we believe that the imports of coal into the port are on a more liberal scale, but the fact that the range of freights is so low may in degree be the cause of this; and it is certainly to be hoped that with a Government which should be more settled there may be a larger consumption of fuel in that port, for the growth in the use of fuel is one of the indications which are the most sure of greater prosperity and of a fuller and a growing commercial activity.

"SHEFFIELD."

To make good cutlery is one thing; to identify that cutlery as "Sheffield" work is another and a more difficult work, in the face of foreign competition. Our friends across the water, the French manufacturers, pay Sheffield the tribute of putting on their goods, which never saw the capital of Hallamshire, the word "Sheffield." French consumers buying their goods were ready enough to curse the perfidy of Albion, as they found they would not cut nor carve, but yielded and bent to every pressure. This fraudulent use of the word "Sheffield" has done terrible damage to the good name of Sheffield wares; and the local Chamber of Commerce, justly jealous for the repute of the old town, have been speaking plain things to the French Government on the subject. M. Jules Ferry replied that the French law was not available to English subjects, because it was a rule of French jurisprudence that foreign manufacturers could not invoke the privilege of such a law unless reciprocity had been established by treaty, and no convention of this kind had been made between England and France. The British Chambers of Commerce then took the matter up, and the result of their energetic action is to show that M. Ferry was wrong in asserting, and our own Government was culpably careless in accepting, such a commercial heresy. Both her Majesty's Government and the French Government seem to have been unaware that such reciprocity was granted by a treaty of as recent date as the 28th of February, 1882. By that treaty French citizens can come to an English court and demand the same protection as Englishmen in regard to the rights of property in marks showing the origin of goods; and that convention has granted expressly to English subjects the same protection in France as to Frenchmen. The British Chamber of Commerce of Paris, therefore, points out that it is quite unnecessary for the Government to negotiate a new treaty on the subject, and the only consecration the present state of the law requires is that it should be put to the test of an action against some person fraudulently using the word "Sheffield" as a mark, with intent to deceive the purchaser into the belief that the goods so marked were made in Sheffield.

ENGINEERS' STEEL CASTINGS.

An interesting contribution to the increased information which is now being obtained of the best manner of producing trustworthy engineers' steel castings was made at a meeting on Saturday of the South Staffordshire Iron and Steel Works Managers' Institute. Mr. B. F. McCallem delivered an address on this subject, and the discussion which it elicited was noteworthy. Mr. McCallem called attention to the great economies in fuel which had resulted from the introduction of the crucible gas furnace, and to the vital importance of possessing moulds which were at once extremely refractory and also porous. The making of a true steel casting was, he impressed upon the Institute, one of the most difficult things in the world. In his opinion, speaking from memory, a good casting should contain about ·3 carbon, ·3 silicon, and from ·6 to 1 per cent. of manganese. Such a casting, if free from other impurities, ought to possess a strength of between 30 and 40 tons, and an 8in. specimen should give an elongation of 20 per cent., or even more. It was because of the difficulties of mixing that many makers resorted to the addition of hematite pig. The discussion which followed the address turned very much upon the question of blow-holes. It was generally agreed that the best castings contained the most blow-holes, and cases were mentioned in which machine toothed wheels which had broken after two months' use presented a very solid appearance, whereas wheels which had given way after twelve months' use were quite porous. A celebrated inspecting engineer from London had recently visited one Staffordshire works, and had expressed his greater satisfaction at the irregular appearance of some of the castings inspected than as though there had been no blow-holes. "Directly I see a steel casting which does not present to the ordinary eye an irregular appearance, I begin to be suspicious," he had remarked. Mr. McCallem accepts, with some slight qualification, the verdict of the Institute as to the value of porosity in castings, and as a test this authority reminds them that a good steel casting will bend through a right angle before it will break.

MINES INSPECTION.

At the eighteenth annual Trades Union Congress, held at Southport last week, one of the chief resolutions submitted was in regard to the inspection of mines. Mr. Benjamin Pickard, secretary of the Yorkshire Miners' Association, carried his motion instructing the Parliamentary Committee to use every effort to secure the appointment of practical miners—meaning thereby manual labourers in the mines—as sub-inspectors of mines on similar conditions as those appointed as sub-factory inspectors. Mr. Pickard, in his resolution, added that: "Seeing their position is to examine and report to the chief inspector, this Congress is of opinion working miners may be found in the various mining communities fully qualified for the position of sub-inspectors." In Mr. Pickard's own district not a week elapses but some member of the mining community is brought before the magistrates charged with jeopardising the lives of himself and his fellow-workmen by the most astounding foolhardiness. At one time the collier will persist in smoking in a pit known to be fiery; at another he neglects to put in props and sprags, and this not only risks his own limbs, but may disturb the air-ways and assist to get together all the conditions for an explosion. Only a day or two ago the Barnsley magistrates sent to prison for one month, without the option of a fine, and also fined him £1 and costs for another offence of a similar kind, a man who damaged two safety lamps in such a way that the underviewer estimated the lives of 320 men were seriously imperilled. According to the delegate who seconded Mr. Pickard's resolution, there has been an average of 1217 lives per year lost in mines during the last decade. Strict scrutiny of the causes which led to these disasters would show that the miners themselves are their own greatest enemies; and if working men sub-inspectors will be firm and resolute underground, none know so well the ways in which human life is endangered down the pit.

LITERATURE.

Chain Cables and Chains. By Thomas W. Traill, C.E., R.N., the Engineer Surveyor to the Board of Trade. London: Crosby Lockwood and Co. 1885.

Under the above title Messrs. Crosby Lockwood and Co. have issued a handsome volume compiled by Mr. Thomas Traill, engineer surveyor-in-chief to the Board of Trade, and general superintendent of those chain and anchor proving establishments which are under the control of the committee of Lloyd's Register of Shipping. The letterpress consists of four chapters, giving information as to the methods adopted in the manufacture of chains and chain cables, the qualities of iron most suitable for the purpose, and a comprehensive history of the use of chains for cables; also several sheets giving the whole of the Acts of Parliament referring to chain cables and chains. A large portion of the volume is taken up by plates, illustrating in detail well-formed and badly-formed links and shackles of the various kinds used in chain cables, with facsimiles of the certificates issued, and the corresponding marks put upon cables by the various licensed testing establishments in the country; and by a number of sheets giving tables of the dimensions of each part of each kind of link or shackle used in cables of from $\frac{7}{16}$in. to $2\frac{1}{4}$in.

Many of these sheets are, however, superfluous. For instance, there are seven sheets differing principally only in colour, showing the certificates of the seven public proving establishments and seven others showing the corresponding marking on the links. The whole of the information gained from these fourteen sheets could easily have been derived from two sheets supplemented by a short letterpress description of the differences in the certificates, &c., of the various testing houses. The sheets giving the dimensions of the links, &c., are also practically in duplicate, one set giving the dimensions in decimals, and the other in thirty-seconds of an inch. Two sheets, viz., No. 30 and 39, are exact duplicates. These unnecessary sheets must have greatly enhanced the cost of the production, and in part account for the high price at which the volume has been issued, which will probably preclude an extensive sale of the work.

The book is well printed on good paper, in clear, bold type, and reflects credit on the publishers; but the language used certainly could have been much improved; in some parts it is difficult to understand the exact meaning intended to be conveyed by the author. The information conveyed generally is, however, very complete, and, considering the official position of the author, must be trustworthy.

From the chapter of historical notes we learn that although chains were of such great antiquity that Pharoah put a chain about Joseph's neck, yet it does not appear that they were used for cables until a comparatively modern date. The first patent on record for chains was taken out by Phillip White in 1634; but it was not until the commencement of the present century that they came into general use for cables. In 1808, apparently, the first chain cable was used in a vessel of 221 tons named the Ann and Elizabeth, built at Berwick and owned by Joshua Donkin. This chain was made at North Shields by Robert Flinn, who was thus the first to commence the manufacture of chain cables. The successors of Flinn remained in the chain cable trade until about seven years ago. Flinn's success induced others to enter into the trade, for we find that in the same year, viz., 1808, Samuel Brown, afterwards Sir Samuel Brown, obtained a patent for improvement in cables which he made with twisted links. The successors of Sir Samuel Brown are the well-known firm of Brown, Lenox, and Co., who are now the oldest firm in the trade. The first Government vessels supplied with chain cables were the Namur, a 74-gun ship, the Monmouth, a 64, the Crescent frigate and Alonzo sloop, which were each supplied with one chain cable. This was in the year 1810. In 1817 one chain cable was supplied to all sixth rates, and one and a-half to all fifth rates and larger vessels. In 1823 two such cables were supplied to all war vessels, and in 1828 all brigs and sloops had three such cables. In all cases, however, the vessels in addition carried their full complements of hemp cables. By the year 1854 we find that greater confidence had been obtained in their use, for in that year all screw ships of the line were supplied with five iron and one hemp, or with four iron and two hemp cables.

The first testing machine employed in proving cables was most probably Flinn's, for we read that in 1812 the shipowners of Shields had such confidence in Flinn's cables and his machine for proving them that they gave him a testimonial. The first good testing machine was made at Millwall in 1812 for Brown, who, by its means, found out the defects in design, workmanship, or material in the early chains, and as a result he greatly improved their manufacture, as he then began to side weld the links and to fit them with studs. Studs were also introduced in 1813 by Brunton, one of Brown's rivals in the trade.

In 1834, when Lloyd's Register was first established, their rules specified only the length of cables required in classed vessel. In 1846 they required that all new chains supplied to classed vessels should be tested, and since 1858 they not only have required all chain cables to be tested, but they have issued rules for their number, length, and size. At the present time Lloyd's Committee have all but one of the public proving establishments under their management, the superintendents being paid servants of Lloyd's, while the superintendent of the other establishment—that at Sunderland under the management of the River Wear Commissioners—is approved by them, and is therefore to some extent under their control.

In 1864 the first Act of Parliament on the subject of chain cables was passed. It enacted that after July 1st, 1865, no chain cable should be sold unless it had been previously tested as required by the Act. At present the law requires that all chain cables supplied to British vessels shall be tested in a specified manner at a proving establishment licensed by the Board of Trade. Although there is no list of them given in the book, we learn from the plates of the certificates that there are seven such establishments in Great Britain situated at Tipton, Netherton, Low Walker-on-Tyne, Chester, Cardiff, Glasgow, and Sunderland.

In order that a proving establishment may obtain a license from the Board of Trade, it must be under the control of one of the public bodies or corporations named in the Act of Parliament 34 and 35 Vict., c. 101; the whole of the testing machines in the establishment must be licensed, and there must be at least two such machines, one for applying what is known as the breaking strain, and one for applying the tensile strain. The machines must be fitted with levers and weights, capable of weighing the strain applied up to the full power of the machine. The total leverage must not exceed the proportion of 100 to 1; the lengths of the knife edges or fulcra of the levers must not be less than 1in. for each 5 tons strain coming upon them, and means must be provided for verifying the accuracy of each machine.

The testing of cables is performed as follows:—From every length of fifteen fathoms the superintendent selects a piece of three links, which is cut out and tested to the breaking strain appropriate to its size; if this strain developes any flaw, crack, or fracture in either of the three links the piece is considered to have failed, and a second piece of three links is selected, cut out, and similarly tested. If this also fails the length of cable is rejected; but if either piece successfully withstands the breaking strain, the remaining portions of the fifteen fathoms of cable are united by new links being put in on the premises, and the whole length is then subjected to the tensile strain. If it fractures under this strain the whole length is rejected, if it withstands it satisfactorily it is passed, marked, and a certificate given for it. If, however, a minor defect exhibits itself in any part of the cable after the test, such as a spile in the iron, a somewhat defective weld, or a crushed stud, while the quality of the material appears to be satisfactory, the stud may be replaced or the defective link cut out and replaced on the premises, and the whole length again tested by the application of the tensile strain. The same tensile strain is required to be applied to the shackles as to the links.

The statutory tests are not in themselves sufficient to ensure good cables, for a chain made from a hard brittle iron of high tensile strength may withstand a high breaking strain applied steadily, as is done by the testing machine; while it would be liable to fracture from the sudden jerks incidental to its use on board ship. The forms of the link also may be objectionable and the cable wanting in ductility on this account. In order to obtain a really good chain, Mr. Traill recommends that it should be specified to withstand an appropriate breaking strain in excess of the statutory breaking strain; and also that the iron used for the chain should be itself tested by pieces cut out from each side of one or two links, so that the strength, ductility, and welding properties of the iron may be ascertained. A good iron for chains is stated to be one having a tensile strength of about 23 tons per square inch, with a contraction of area of fracture of about 43 per cent., and an elongation of about 23 per cent. in a length of 10in., but Mr. Traill does not give these particulars as referring to the best iron for chains. The testing of the whole length of chain above the statutory tensile strain is strongly condemned by Mr. Traill, as also is the use of ships' cables for checking the way of the ships in launching, as such undue strains must permanently injure the cables. The statutory breaking "strain" for short link or unstudded chains is 24 tons per circular inch of the iron from which they are made, for all sizes of chains from $\frac{1}{4}$in. up to $1\frac{3}{8}$in., above which size there are no statutory tests. The "tensile strain" for short link chains is in every case one-half of the "breaking strain."

For stud link chains the statutory tensile strains are 18 tons per circular inch for all sizes, ranging from $\frac{7}{16}$in. up to $2\frac{5}{8}$in., and a less proportionate strain for the larger sizes, being 16·2 tons per circular inch for 3in., 14·4 for $3\frac{1}{2}$in., 12·6 for 4in., and only 10·8 tons per circular inch for $4\frac{1}{2}$in. chains. The size of cables, however, in ordinary use rarely exceeds $2\frac{1}{2}$in. The statutory "breaking strain" for stud link cables is 1·45 times the "tensile strain" for $1\frac{1}{8}$in. cables, 1·4 times the tensile strain for sizes above $1\frac{1}{8}$in., and 1·5 times the tensile strain for sizes below $1\frac{1}{8}$in.

In treating of the quality of cables, Mr. Traill lays great stress upon the question of the prices paid for them, as keen competition not only leads to the use of an inferior quality of iron, but also leads to the employment of unsuitably shaped links, and to these links being carelessly made. Several illustrations of improperly shaped links are given in the volume, and from one of them it appears that by elongating and at the same time narrowing the link in a given length of chain there will be 14 per cent. fewer links, and therefore proportionately fewer studs and welds, and consequently less cost for workmanship, while the total weight of wrought iron in the chain will also be about 6 per cent. less. This is not a very exceptional result, as greater differences from what might be called a standard weight are to be found in cables sold at so much per outfit, while in those sold at per ton, the links are often made shorter and broader, and are fitted with heavy studs, so as to bring the total weight equally as much in excess of the weight of a well-formed cable of the same size. It is important, therefore, that particular attention should be paid to the shape and size of the links of a cable, as well as upon its testing strength and the quality of the iron before deciding upon its quality. One very important point connected with the shape of link is the radius of the inner curve at the ends, as if this is too small, the links will lock together, and may even have a tendency to split one another. Mr. Traill recommends the radii of these curves to be made ·58 of the diameter of the iron used for the chain in the case of studded chains, and ·6 of the diameter in the case of unstudded chains.

We have stated that Mr. Traill strongly condemns the proving of chains above the statutory tensile strain, as he considers the chains must be injured by the high strains put upon them. As a matter of fact, the statutory test strains each link beyond the limits of elasticity, thus producing a permanent set; and taking this into account, it is clearly stated that the shapes of links given as the most suitable are the shapes assumed after the test has been applied. The annealing of chains after they have been in use for some time is advocated, as making them more trustworthy; but it is recommended that they should be retested and carefully examined after being annealed.

We have not space to enter into the methods adopted in manufacturing chains and cables, further than to say that all small chains up to about 1in. have the links welded at the ends, while in larger chains they are welded at the side. Full particulars of the most approved plans for making both links and shackles will be found in the chapter on chain-making, while some particulars of the brands of iron found to be suitable for chain-making purposes will be found in the chapter on "Iron for Chain Cables and Chains."

Twenty Years with the Indicator. By Thos. Pray, jun., C.E., M.E. 2 vols. New York: John Wiley and Sons. London: E. and F. N. Spon.

These two volumes have been written at different times by an author busily engaged upon practical and literary work. The second volume, in some respects, retraces the ground covered by the first, but it corrects errors made in the first. The leading feature of the work, as a whole, is the very large number of examples of indicator diagrams taken under every conceivable circumstance of incorrect design of valve or valve gear; incorrect setting of the gear; insufficient size of ports or pipes; defects of various kinds, and misapplication of indicator. These diagrams are explained at length, and the lessons they convey described fully. The second volume shows that the author had learned some things and unlearned others since the first was commenced, and his peculiar adjective form of condemnation of those who upon insufficient knowledge presumed either to make new forms of valves or gear, to decry the indicator, or to assume engineering positions they were not competent to fulfil, has been modified.

In the first volume the author describes the purpose, construction, and application of the indicator; gives Richards credit for his indicator, but pins his entire faith upon Thompson's improved indicator, and bestows profuse praise on this and its makers. He then proceeds to explain the primary use of the indicator diagram, and to give the numerous examples of diagrams already referred to.

In the course of his instructions he makes a good many useful observations — as, for instance, that an engineer called upon to indicate an engine will find it frequently necessary to "exercise a good deal of discretion in not knowing what somebody else tells him," and to know it only from his own positive knowledge. That is to say, he must take his own diagrams, make all his own observations, and work only on his own notes. He gives unqualified preference to the use of the planimeter for obtaining the mean pressure from a diagram, and assumes it to provide the only really accurate means to this end. He ascribes to a Mr. Bacon a very common method, and not the best, of constructing a theoretical curve of expansion, and, like a good many American engineers schooled in the Corliss form of engine, is of opinion that nothing but a very nearly instantaneous cut-off can be economical, that a slight fall in the steam line and rounded corner at cut-off must mean waste, and in the first volume does not give any true explanation of the rise of a practical diagram, on the expansion curve, above the curve drawn according to Marriott's law. His theoretical or perfect diagram is, in fact, a far from perfect diagram, as it does not embody all the circumstances and conditions of the behaviour of steam in a cylinder. He speaks of late admission, where not late but restricted admission is meant, and denounces a form of diagram which characterises some of the most economical engines afloat, because it has not the hyperbolic expansion curve and low pressure exhaust, and has some compression, the diagram being evidently taken when the engine was heavily worked. He compares this with a much smaller diagram, showing an earlier cut-off, an expansion line falling to the theoretic curve, the engine evidently working light, and the diagram having a perfectly square heel—a form which often indicates a late admission. It may be here mentioned that at p. 54, Vol. I. diagram 27 is mentioned, when diagram 26 is referred to. In several instances the author speaks of cushion as *owing* to high speed, apparently not seeing that the cushion is desirable and may have been purposely arranged for. If we pass over these points, and allow a little for American style, we may accept Mr. Pray's book as being very useful for the reason already mentioned, namely, that almost every ailment of a steam engine, as shown by an indicator diagram, has its illustration, and, with slight exceptions, its explanation in either the first or second of these volumes.

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Tunnelling Under the Hudson River. By S. D. V. Burr, A.M. New York: J. Wiley and Sons. London: Trübner and Co. 1885.

Gasworks: their Construction and Management, and the Manufacture and Distribution of Coal Gas. Originally written by S. Hughes, C.E. Revised and enlarged by W. Richards, C.E. Seventh edition. Weale's Series. London: Crosby Lockwood and Co. 1885.

The Journal of the Iron and Steel Institute, 1885. No. 1. London: E. and F. N. Spon. 1885.

Key to Magnus's Class-book of Hydrostatics and Pneumatics. By John Murphy. London: Longmans, Green, and Co. 1885.

The Art of Boot and Shoe Making. A Practical Handbook. By John Bedford Leno. London: Crosby Lockwood and Co. 1885.

EFFICIENCY AND DURATION OF SOME INCANDESCENT LAMPS.

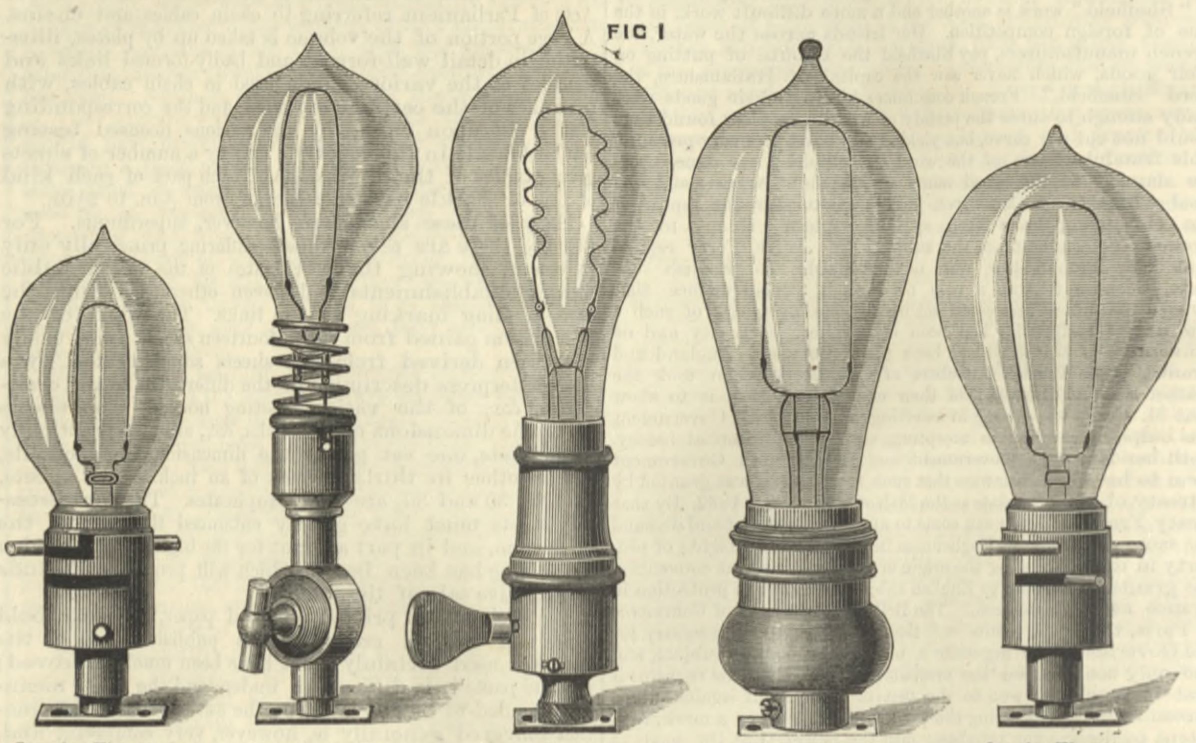
We have received a copy of the report of a special committee appointed by the president of the Franklin Institute to conduct examinations and tests of the efficiency and life duration of incandescent lamps. The report shows that the tests and examinations were more complete than any that have yet been made, and the report is more full than any previously published to our knowledge. The lamps, however, did not include several of those best known in this country, and thus the very elaborate investigation has been expended upon a somewhat limited range. Of the lamps known in this country only the Edison and the Woodhouse and Rawson lamps have been tested. The examiners were Lieut. J. B. Murdock, U.S.N., Professor W. D. Marks, Ensign L. Duncan, U.S.N., Dr. G. M. Ward.

The test began with the following lamps entered:—

20	Weston,	110½ volts.	Tamadine carbon.
20	Edison,	94—100	,,
10	Woodhouse and Rawson,	55	,,
10	Stanley-Thompson,	96	,,
10	Stanley-Thompson,	44	,,

The latter lamps were requested to be entered at 16-candle power. The committee, after a preliminary trial of several of the lamps, fixed on the potentials of 96 and 44 volts respectively for the two grades, as approximately representing that candle-power, and the lamps were entered at these potentials. No official information was furnished the committee as to the process of manufacture of any of the lamps. Their general appearance and the relative size is shown in Fig. 1.

FIG 1



Stanley-Thompson. (44 volt.) Woodhouse-Rawson. Weston Edison. Stanley-Thompson. (96 volt.)

The Weston lamp entered by the United States Electric Lighting Company has what has been called a "tamadine" carbon. The committee was not furnished with any official information as to the manufacture of the lamp, but the main features were shown by Mr. Weston in his private exhibit at the exhibition, afterwards presented by him to the Franklin Institute. Gun-cotton in the form of flat sheets was treated chemically to separate the nitryl from the cellulose. The resulting cellulose product is a tough, firm, translucent substance from which the strips are cut in a sinuous form and carbonised. The carbon is rectangular in cross section, but is placed in the lamp so that at the shanks, the longer side of the rectangle is in the line of the shanks, instead of at right angles, as in most other lamps. The connections are made at the terminals with minute steel screw bolts and nuts setting up with platinum washers. The bending of the carbon turns the long side of the rectangle so that it lies in different directions at different points. The lamp is mounted on a wooden base surrounded by a brass ring. The wires are led down through holes in the wood to the bottom of the base, where one is soldered to a ring and the other is held in place by a small screw, which is concentric with the ring and projecting below its plane. The socket contains two spring clamps against which the terminal ring and screw of the lamp press, the lamp being held in place by a lug on the brass ring fitting into a groove in the socket. The lamps and sockets in the test were readily interchangeable and the connections were good throughout.

The Edison lamps, Fig. 1, were similar in appearance to those generally used. The carbon was made from bamboo fibre. The lamps were mounted in the ordinary screw socket, which gave good contact with great facility of handling.

The Woodhouse and Rawson lamps, Fig. 1, displayed good workmanship, and were quite simple in construction. The carbon, which is rectangular in cross section, is cemented by a very neat joint to two platinum wires, which are kept apart by a glass bridge, and then passing through the base of the lamp have small loops formed in their ends, the loop being made rigid by embedding the ends in the glass. Two spring hooks in the socket hook into these loops, making contact. The lamps in the test were used with Swan sockets. The loops at the base of the lamp seem liable to injury. Two lamps were disabled by the breaking of these loops before the beginning of the test for duration. No information as to the nature of the carbon was in possession of the committee. Each lamp had the firm's name marked on the glass.

The Stanley-Thompson lamps, Fig. 1, had carbons apparently made from thread. No information was given other than that the lamps were made under the Stanley-Thompson patents. The small, or 44 volt, lamp was well made, so far as the glass work was concerned, the carbon being cemented to platinum wires, which were kept apart by a glass bridge, and then passed through the base of the lamp. The glass bulb of the lamp was set in a hollow in a wooden base, and most insufficiently secured by a cement apparently of plaster of Paris. The wires went through the wood to two small screws. Much difficulty was caused by the cement giving way, so that the wires formed the only attachment of the lamp to its base. The lamp was secured in its socket by two brass bars, projecting from the sides of the wooden base, fitting into slots in a brass cylinder socket. Connections were made by two springs at the bottom of the socket pressing against the screws in the base of the lamp. The sockets were not satisfactory, not being interchangeable readily, and difficulty was constantly met with in shifting the lamps. Several cases occurred of partial carbonisation of the wooden base between the wires, causing bad leaks, and in one case it had gone so far as to attract attention by the wood smoking. The wooden bases were blackened, and the leak may have begun over this blackened surface. The difficulties met with in the 44 volt lamp were also encountered in the 96 volt. In addition there seemed to be a point of weakness in the base of the glass bulb, several of the globes breaking at that point after the cement gave way. These accidents occurred in fitting the lamps to their sockets for the test of duration.

All of the above lamps except the Edison bore evidences of the carbons having been treated by a deposit from the hydrocarbon gas. The deposit on the Weston carbons was but slight. After the test for duration had continued about 500 hours, the Franklin Institute entered three new lots of lamps as already stated. These were:—Ten Weston lamps—paper carbon—70 volts; ten Woodhouse-Rawson lamps, 50 volts; ten White lamps, 50 volts.

The Weston lamps were the same in general appearance as the 110½ volt lamps. The carbon, it is understood, is made from paper, and subsequently treated to very heavy deposits from a hydrocarbon gas.

The Woodhouse-Rawson lamps were received indirectly from the manufacturers, and were similar in appearance to those already tested, but were more uniform.

The White lamps were somewhat similar to the Woodhouse-Rawson in external appearance, but the bulb was somewhat longer and narrower. The carbons were cemented to platinum wires, which were separated by a glass bridge, and had loops in their ends for hook connections in a spring socket. No details of the manufacture of these lamps were furnished.

The currents were furnished by an Edison "T" dynamo, worked by a Porter-Allen engine kindly lent for the test by the Southwark Foundry. Steam was obtained from a locomotive boiler, the property of the Franklin Institute. The potential was controlled by a Weston automatic regulator, which kept it within about a volt on either side of the normal. Three Edison bridge indicators were in use in different parts of the circuit. They agreed in their indications and proved to be very sensitive. A registering telemanometer recorded all variations of steam pressure with great accuracy. Although the code called for preliminary measurements for the obtaining of the reduction factor only, it was thought best to make electrical measurements as well, that the efficiencies of the lamps might be obtained in watts per spherical candle and comparisons instituted between the different lamps under test.

Photometric measurements.—The measurements of the spherical illuminating power of the lamps were made with the object of obtaining the average candle-power of the lamps, and to avoid the doubt as to the total amount of light which might arise from the various forms of carbon—many of them distorted in manufacture—used by different makers. Sixty-five measurements or more were made on each lamp. The method pursued may be the more easily understood by a comparison with the parallels and meridians of the earth, referring to points by their latitude and longitude. The lamp was placed in a vertical position, with the plane of the shanks of the carbon at right angles to the photometer bar. The side nearest the bar was marked for future reference. The top and bottom of the lamp were assumed as the north and south poles respectively, and the vertical circle at right angles to the plane of the shanks of the carbon as the prime meridian. The lamp, after adjustment as above, was first rotated horizontally, and thirteen measurements were made in the equator at equal angles of 30 deg., the last checking on the first. The mean of these measurements gave the "mean horizontal intensity." Starting again from the first position, the lamp was rotated in the plane of the prime meridian and thirteen measurements were made at equal intervals of 30 deg., the last checking the first, and making four measurements of the point 0 deg. latitude, 0 deg. longitude. The mean of these four was called the "standard reading." If any noticeable discrepancy was noticed the measurements at this point were repeated. As this point was that on which the calculations for the duration test were based, its careful determination was essential. The lamp was then moved 45 deg. horizontally, so that 0 deg. latitude, 45 deg. longitude E. was towards the photometer. It was then rotated in the vertical plane passing through that point and thirteen measurements made as before, at intervals of thirty degrees, the last checking the first. The lamp was next moved 45 deg. horizontally, so that 0 deg. latitude, and 90 deg. longitude E. was towards the photometer, and thirteen measurements made in that meridian as before. Lastly, the lamp was rotated till 0 deg. latitude, 135 deg. longitude E. was towards the photomoter and twelve thirty-degree measurements made in that meridian, checking with a thirteenth. This makes a total of sixty-five measurements on each lamp. As the sockets in use with all the lamps prevented the exit of any light from the bottom or south pole of the lamp, the reading at that point was always taken as zero. The measurements were combined as follows:—

The mean of four readings at the north pole of the lamp ..	1
Four measurements on each of the parallels at 60 deg. N. and 60 deg. S. on the prime meridian and 90 deg. meridian circle	8
Eight measurements on each of the parallels of 30 deg. N. and 30 deg. S. at the intersection of the meridian circles of 0 deg., 45 deg., 90 deg., and 135 deg.	16
Twelve measurements, 30 deg. apart, on the equator	12
One zero reading for south pole (base of lamp)	1
Making a total of	38

By laying down the points on a sphere it will be found that they are very nearly equidistant, being somewhat nearer at the equator than at the poles. The average of the illuminating power at these thirty-eight points is taken at the mean spherical intensity of illuminating power. Fig. 2 shows the location of the thirty-eight points. It is a photograph of a Mueller lamp of nearly spherical shape, around which four rubber bands are stretched to show the four meridian circles, and one rubber band to represent the equator. The square black patches show the thirty-eight points. In order to determine whether the arithmetical mean of these observations gives a close approximation to the mean spherical intensity, calculable from the observations taken, the sphere may be divided into zones, each extending 15 deg. on either side of the equator and the parallels of 30 deg. and 60 deg., and the spherical intensity be calculated from the area of these zones and the mean candle-power in each. See Fig. 3. The surface of the sphere is developed at the equator by means of a

FIG. 2.

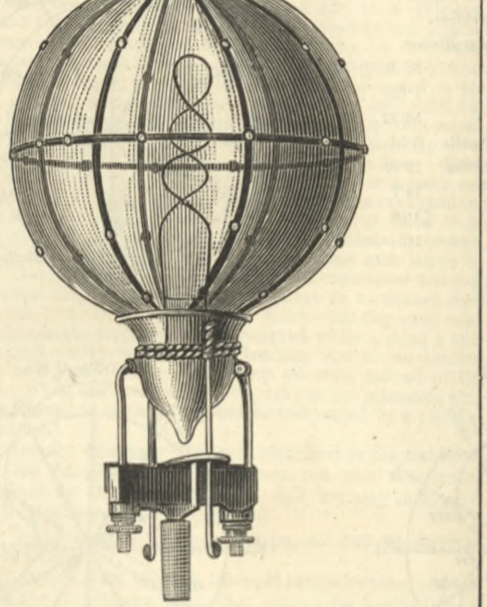


Fig. 2—Points observed in determination of spherical intensity.

tangent cylinder, at 30 deg. and 60 deg. latitude by means of tangent conical frusta and at the poles by tangent discs. If now we multiply the mean intensity of illumination of each zone by its area and divide the sum of these products by the whole area of the sphere, we obtain with very close accuracy the mean spherical intensity of illumination. The following formula gives the method:

$$\frac{\text{mean eq.} + \text{mean 60 deg. lat.} + 1{\cdot}73 \text{ mean 30 deg. lat.} + 0{\cdot}131 \text{ poles}}{3{\cdot}861} =$$

mean spherical candle-power. This method when compared with

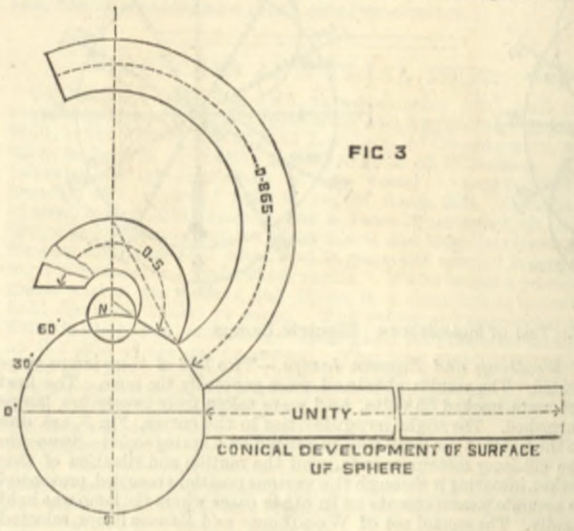


Fig. 3.—This figure is defective in showing the chords instead of the tangents of the arcs.

that in use gives: Stanley, large, No. 26, 13·09 candles; method in use, 13·10 candles; Edison, No. 2, 14·30 candles; method in use, 14·38 candles. The method adopted yields results giving slight preponderance to the illumination at the equator, but the difference is small, and this method yields itself readily to the mechanical con-

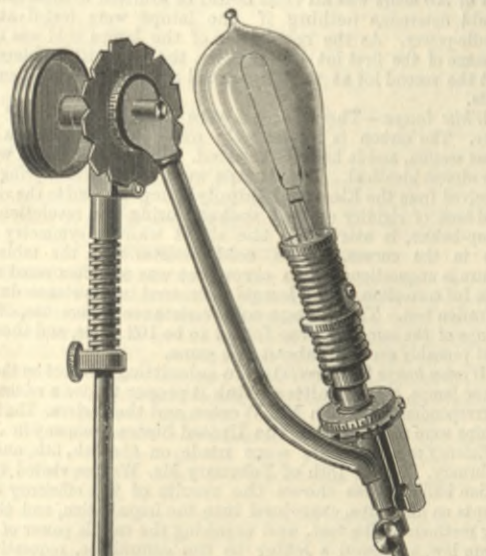


FIG. 4

Fig. 4.—Revolving lamp holder.

ditions of the lampholder. From the figure it will be seen that the holder permitted the lamp to be revolved about two axes at right angles in space. As the lamps to be measured in the preliminary efficiency test altogether required upwards of 10,000 photometric observations, it was quite important to avoid the adjustment of a graduated scale, and the horizontal and vertical axes were therefore fitted with notched plates with twelve notches each and spring catches. The plate for the vertical axis had two extra notches, one at 45 deg. and one at 135 deg. These notched discs permitted very rapid and accurate adjustment. The Methven standard two-candle slit was used in all the photometric measurements. The committee are indebted to the courtesy of Mr. Alexander P. Wright, of the United States Electric Light Company, for it and for the fittings for the photometer box. A certificate accompanied this standard signed by Messrs. Methven and Hartley. It was deemed wise to verify this standard independently, particularly to discover if any error due to personal equation of observer was present. Standard English candles, a candle balance and stop watch were used in the comparison. Ten series of five-minute observations showed an error of one per cent. as the result of 100 observations. Fig. 6 represents the standard Letheby-Bunsen photometer with 60in. bar, used in the efficiency tests. Two reflectors in the disc box reflected a circular Bunsen spot in paraffined paper. The disc was always moved toward the electric lamp on the left in the final balancing of the illumination of the two spots; the wish of the committee being to favour alike the electric lights when in doubt. It would appear, however, that very nearly exact justice has been done, since the Methven standard, which proved to have so little error, was treated in the same manner as the lamps. The particular lamp to be tested being placed in the lamp holder, the potential was adjusted by means of the resistances in circuit with the lamp, and the candle power, current and potential determined. The current reached the lamp through wires dipping into mercury cups in the piece of wood at the bottom of the lamp compartment. If a change occurred in the potential, photometric work was stopped until the potential was adjusted. Observations of current were taken about every four minutes. The "reduction factor" used during the test for duration was obtained by dividing the mean spherical intensity of illumination by the "standard reading" or the mean of the four observations at 0 deg. lat., 0 deg. long.

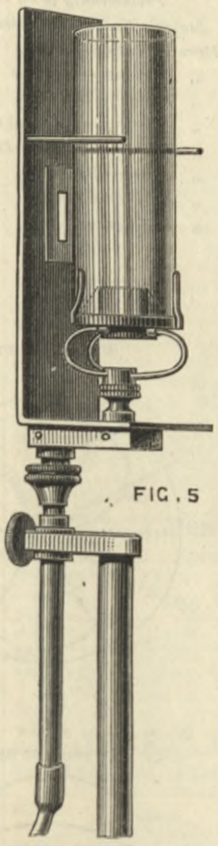


FIG. 5

Fig. 5—Methven slit and burner.

Electrical measurements. — The electrical measurements were made in a small room especially prepared for the purpose. The potential of the lamps was measured by a Wiederman mirror galvanometer in a circuit of high resistance. The instrument employed was made by Hartmann, and was chosen on account of good damping. It had a Siemens' bell magnet, suspended in a cylindrical cavity in a solid copper block. The mirror was attached to the suspending rod of the magnet. The fibre was about fifteen centimetres in length, and was without appreciable torsion within the deflections used. The deflection of the magnet was observed by a telescope and scale at a distance of 176 centimetres, afterwards increased to 180. The galvanometer resistance was about 2 ohms, two coils, one on each side of the magnet, being used in series, but a resistance of either 50,000 or 100,000 ohms was used in circuit with the instrument, the former being employed with lamps of less than sixty volts potential, the latter with others. During the preliminary measurements for efficiency the potential was regulated by an observer at the telescope, who watched the deflection and recorded the potential at regular intervals, signalling any change to the photometer room, where the potential was adjusted by a change of resistance in the lamp circuit. In

FIG. 6

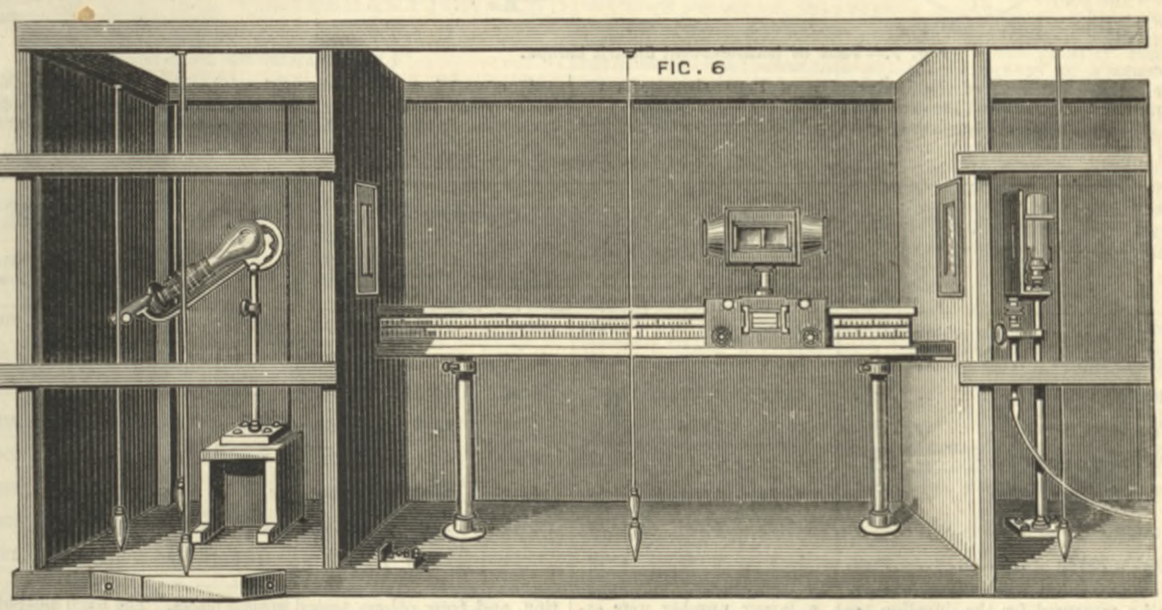


Fig. 6—Letheby-Bunsen photometer.

general this method worked well, but occasionally, through irregularity of the engine, the potential would fluctuate. Whenever the working conditions were bad the results were rejected and the measurements repeated. The lamp currents were measured by a tangent galvanometer specially constructed for the test by Jas. W. Queen and Co. It consisted of a single coil of six turns No. 8 wire, on a brass frame of 60 cm. diameter. The base was of wood, 2ft. wide, resting on levelling screws. Both galvanometers stood on large wooden posts, buried 2½ft. in the earth, and out of contact with the floors or walls of the building. The needle and compass were loaned for the test by Mr. Weston. The circle was divided to 10′ and could be read by magnifying glass to 1′ of arc. The maker's adjustments of the needle in the centre of the galvanometer coil were carefully verified. The code prescribed the method by which the electrical units should be reproduced, and was strictly adhered to.

Current.—The ampère was determined both by the silver voltameter and by calculations of the constant. During the test thirty-eight calibrations were made of the tangent galvanometer by the silver voltameter. Eight of these were purely experimental, to determine the best conditions, and several of the others were rejected on account of bad conditions. All those were accepted in which the current was steady, the deposit good, and the time accurately determined. The current was supplied at first by a gravity battery in multiple series, but later by a secondary battery. A solution of silver nitrate, one-half saturated, was used in a platinum crucible. The anode consisted of a spiral of silver wire one centimetre in diameter, closely wrapped in filter paper. The crucible was held in a loop of platinum wire. The time of deposit was either twenty or thirty minutes, depending on the strength of the current. The tangent was read on both sides. The deposit was generally in vertical striæ on the inside of the crucible. Some of the later calibrations were made with a 40 per cent. solution, and this gave a finer grained deposit. After the circuit was opened, the solution was carefully decanted from the crucible, and the deposit repeatedly washed, the washings being tested with sodium chloride. The washing was continued long after a cloudiness was obtained, and the crucible was dried at a gentle heat over a Bunsen burner. The weighings were made on a balance made by Troemner, of Philadelphia, to tenths of milligrammes. The weights used were verified by comparison with a set of standards in possession of Mr. Troemner. By Kohlrausch's formula the error is zero at 26° 17′. The voltameter determinations at different points can be compared by reducing them to 26° 17′ by means of factors derived from the formula.

Resistance.—The ohm was by the code to be the Paris or legal ohm. In the reductions the legal ohm was taken as 1·0112 B. A. units.

Electro-motive force.—The volt was determined by the fall of potential in a given resistance due to a known current. A reel of No. 22 German silver wire was made by winding the wire on fine glass rods, which were let at each end into pieces of black walnut. The turns of the wire were kept apart by means of silk cord around the posts. The axis of the reel was surrounded by a stirrer, by which the excessive heating of the wire while in the bath was prevented. This reel was immersed in turpentine, and later in refined petroleum, 300 deg. fire test, and while in use in calibrations the liquid was kept in motion by the stirrer and the temperature regularly recorded. The ends of the wire were taken to double binding posts at the top of the reel, to which the current and potential leads were connected. The resistance of the reel was determined, on January 5th, at the John Hopkins University, as 21·089 legal ohms at 15·2 deg. Cent. The reel was then placed in turpentine in the Exhibition building, and remained for three weeks before the efficiency measurements began. It was observed that the turpentine was becoming slightly greenish in colour, but no change in the resistance could be detected with certainty by the only bridge at that time in the possession of the committee. As chemical action of some kind was evidently taking place, the reel was removed to a bath of refined petroleum. After the efficiency measurements, the reel was again measured, and its resistance was found to have increased to 21·161 at 14 deg. Cent. In order to determine whether such a change could be due to the chemical action noticed, a gramme of the wire was placed in the turpentine, and in three weeks lost three milligrammes. It was therefore considered by the committee that there was no doubt but that the change of the resistance took place before the efficiency measurements, and the later determination was used in all reductions. After the Wheatstone bridge had been calibrated, the resistance of the standard coil was frequently checked. These measurements, extending from − 4 deg. Cent. to + 19, gave a coefficient of ·0004 for change of resistance per degree Centigrade. Calibrations of the potential galvanometer were made by measuring the currents by the tangent galvanometer, and simultaneously observing the deflection of the potential galvanometer. The lamp currents passing through the tangent affected the potential galvanometer, so that it was necessary to make double readings of the latter with the currents reversed in the tangent.

Measurements of efficiency.—The general method of making the observations for efficiency has already been stated. The committee aimed to test each lamp at its normal potential as stated by the makers, and to place it in the test for duration at the same potential, that the relation between efficiency and life might be traced. A few lamps were tested at two or more potentials. The efficiency measurements were begun at the earliest moment when it was thought that the arrangements for the test were sufficiently advanced to secure good results. The constant of the potential galvanometer had been determined from only a few calibrations, and the error of the tangent galvanometer was not known as well as it was later in the test. Owing to the chemical action of the turpentine on the German silver of the standard coil used in calibrations for potential, the resistance was underestimated and the potential constant determined by calibrations was too small. After the efficiency measurements were all completed, the observations were re-calculated, allowing for all known errors as determined by later measurements. The result was to raise the potential in almost every case above what was thought to be its value at the time the observations were made. In the following tables the potential is that at which the efficiency measurements were made as determined by the corrected calculations. The diagrams—of which we give but two as examples—show the curves of illumination in five planes passing through the centre of the lamp. The first is a horizontal plane, the equator, the others marked "vertical" are vertical planes, making angles of 45 deg. apart. The black line in each circle shows the plane of the shanks of the carbon; the parallel lines at 0 deg. of each circle represents the position of the photometer bar. The circles are drawn with a radius of sixteen of the scale of candle-power. The following points on the different circles are coincident.

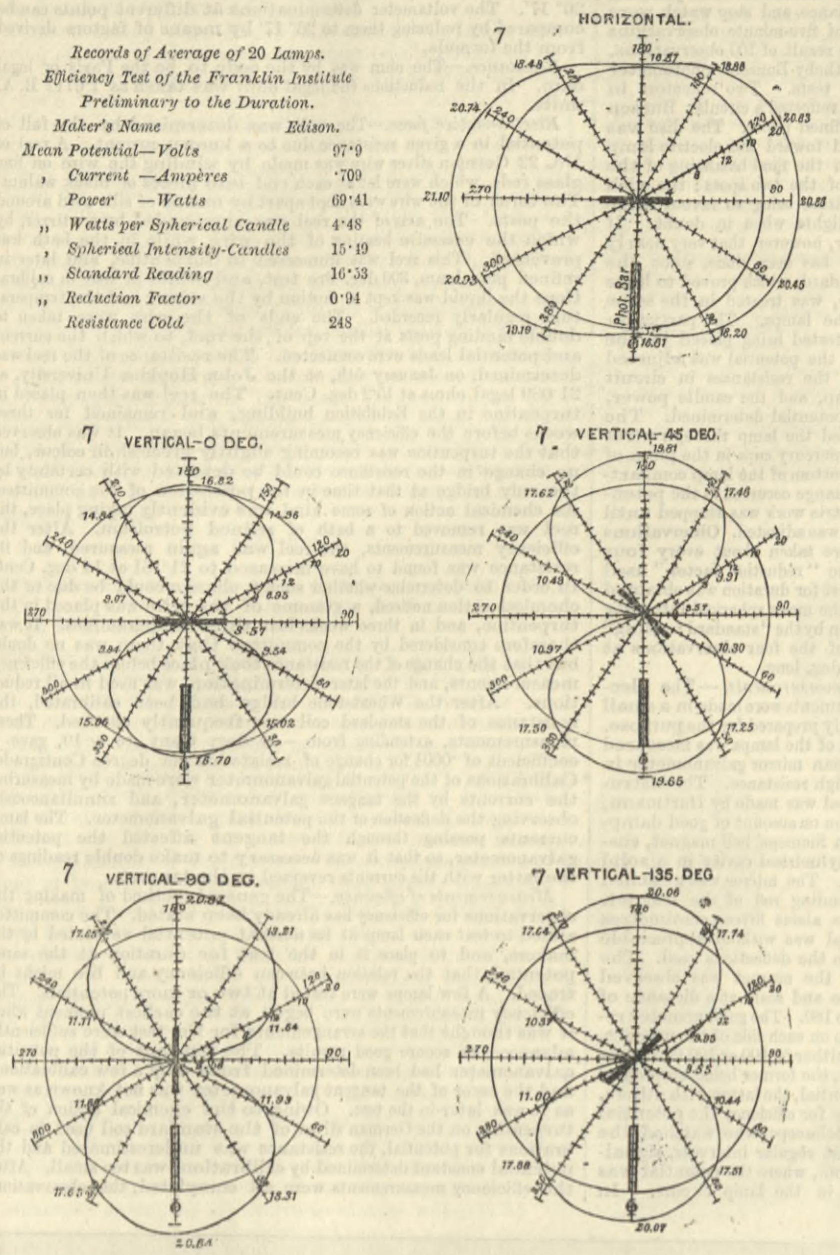
0 deg. on horizontal and	0 deg. on vertical	0 deg.
90 deg. on horizontal and	0 deg. on vertical	90 deg.
180 deg. on horizontal and	180 deg. on vertical	0 deg.
270 deg. on horizontal and	180 deg. on vertical	90 deg.

The four 90 deg. points on the vertical sections represent the light given off at the top of the lamp. The four 270 deg. points in the vertical sections correspond to the base of the lamp. The horizontal distribution is found in all the lamps tested to be dependent on the cross section of the carbon. If this is circular, as it is in the Stanley and White lamp, the curve of horizontal illumination is practically a circle, if rectangular, as in the Edison and Woodhouse and Rawson, the greatest illumination is given in that direction towards which the longest side of the rectangle is turned. Lateral twist causing the major axis of a rectangular cross section to lie in different directions at different heights in the lamp, produces a marked effect as is seen by the curve of the Weston lamp. The light given off at the top of the lamp depends in the same way on the amount of illuminating surface visible from that point. In the Edison lamp, which has a long carbon, the two branches being comparatively close together, but little illuminating surface is visible from the top of the lamp, and but little light given off. In the Weston lamp, however, the carbon is bent into a curve, more closely approximating to a circle; and the lateral twist given, the carbon turns the long side of the rectangle in the middle of the loop towards the top. These two causes result in turning a considerable illuminating surface in that direction, and consequently in giving a large proportion of light. The committee is indebted to Mr. C. H. Small, of the University of Pennsylvania, for the averaging of results and the construction of the light curves.

Edison lamps.—Although only twenty-three lamps were required to be measured for the duration test, a larger number were examined, and the efficiency results are appended. The first twenty of the lamps were tested for duration, and the curves in the diagram, Fig. 7, were calculated from them. But few peculiarities were observed in these lamps. One, through a peculiar distortion of the carbon, gave an almost circular curve of horizontal distribution, but the curves of the others were essentially the same as in the diagram. Owing to the causes already mentioned the potential of the lamps is generally $\frac{7}{10}$ths of a volt higher than the normal. The tables give all the data of the tests. The lamps were taken at random from 400 furnished by the company.

Stanley-Thompson lamps (96 *volts*).—Fourteen of the 96 volt lamps were tested for efficiency, four of the original having been broken in fitting them to sockets preparatory to the test for duration, and four others tested in their places. The high potential of lamps 37, 41, and 51 was due to an error of calculation, which, corrected after the efficiency test, gave the high figures recorded. The curves in Fig. 8 are the averages of the first eleven lamps in the table, and the averages in the plate are those of the first ten. The lamps were taken from a lot of fifty.

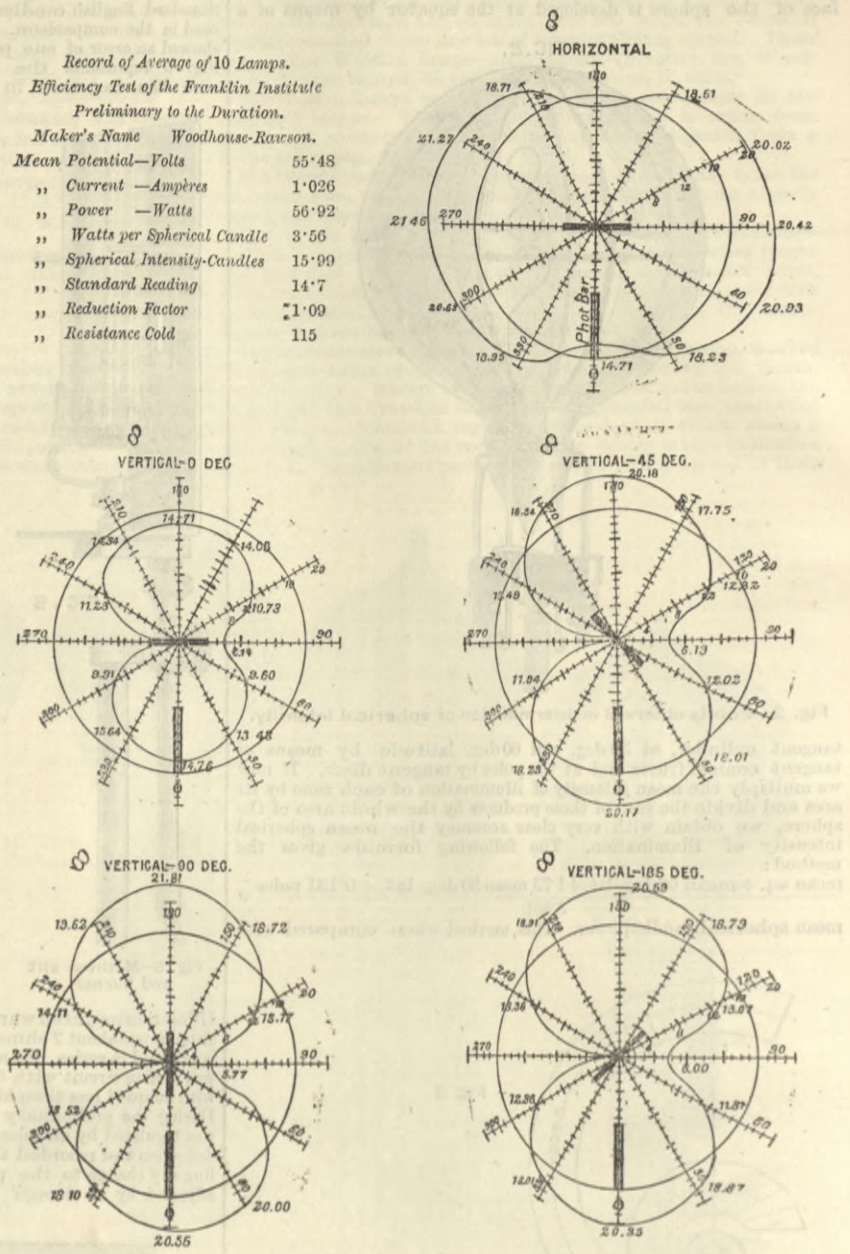
Stanley-Thompson (44 *volts*).—These lamps gave the highest average efficiency of any lot under test, but varied considerably from each other. The curves are essentially the same as those of the 96 volt lamps, except in giving less light at the top of the lamp The lamps were taken at random from a lot of fifty.



Records of Average of 20 Lamps.
Efficiency Test of the Franklin Institute
Preliminary to the Duration.

Maker's Name	*Edison.*
Mean Potential—Volts	97·9
, *Current —Ampères*	·709
Power —Watts	69·41
,, *Watts per Spherical Candle*	4·48
, *Spherical Intensity-Candles*	15·19
,, *Standard Reading*	16·53
,, *Reduction Factor*	0·94
Resistance Cold	248

Fig. 7.—Test of Incandescent Electric Lamps.



Record of Average of 10 Lamps.
Efficiency Test of the Franklin Institute
Preliminary to the Duration.

Maker's Name	*Woodhouse-Rawson.*
Mean Potential—Volts	55·48
,, *Current —Ampères*	1·026
,, *Power —Watts*	56·92
,, *Watts per Spherical Candle*	3·56
,, *Spherical Intensity-Candles*	15·99
,, *Standard Reading*	14·7
,, *Reduction Factor*	1·09
,, *Resistance Cold*	115

Fig. 8.—Test of Incandescen Electric Lamps

Table of Incandescent Lamp Efficiency.

Name.	Volts.	Ampères.	Watts.	Candles.		Watts per spherical candle.	Resistance.		Candles per Electrical H.P.	
				Mean spherical.	Mean horizontal.		Cold.	Hot, about.	Spherical.	Horizontal.
Edison	97·57	0·7065	68·92	15·47	19·24	4·459	247·5	140	169·2	210·4
Stanley 96-volt	96·56	0·554	53·61	13·59	16·30	4·04	345·1	175	189·1	226·3
Stanley 44-volt	43·98	1·053	46·32	13·42	16·44	3·554	81·1	41	216·1	264·8
Woodhouse 55-volt..	55·53	1·006	55·82	15·64	18·68	3·605	117·3	60	209·0	249·6
Woodhouse, second lot..	55·0	1·178	64·77	18·30	22·13	3·56	100·2	46	210·8	254·9
White 55-volt	49·99	1·107	50·83	12·44	15·05	4·05	—	48	182·6	220·9
Weston 110½-volt	111·42	0·530	59·04	16·43	18·07	3·713	407·9	210	209·8	230·7
Weston 70-volt	70·4	0·968	68·09	15·18	16·85	4·51	150·0	72	166·3	184·6

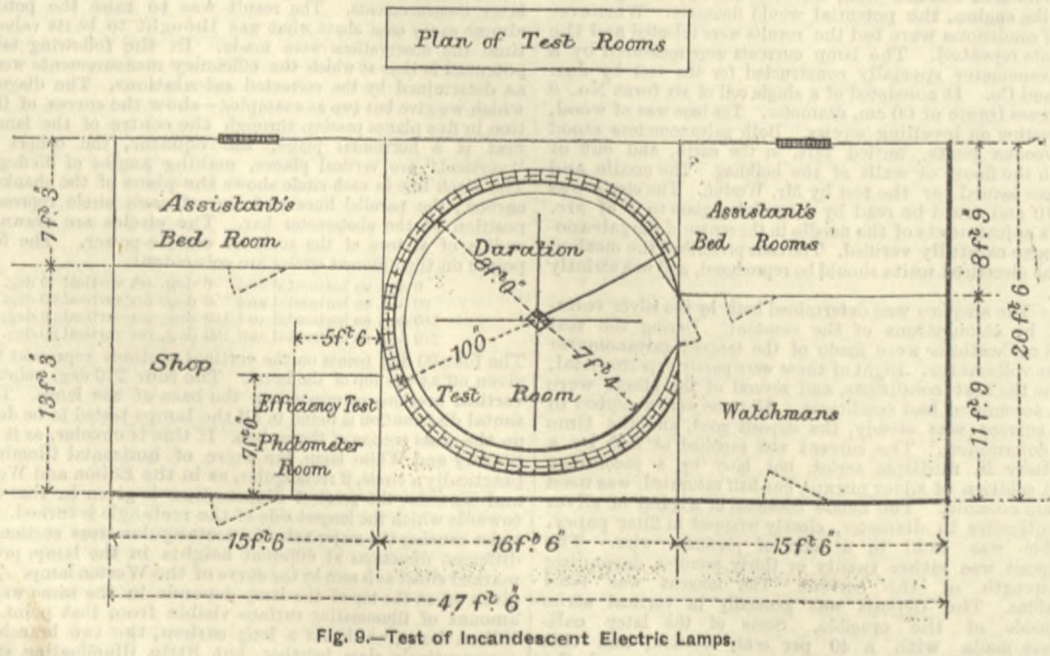


Fig. 9.—Test of Incandescent Electric Lamps.

Woodhouse and Rawson lamps.—Two lots of these lamps were tested. The results obtained were generally the same. The first lot were marked 55 volts, and were taken from twenty-five lamps furnished. The slight irregularities in the curves, Fig. 8, are due to the fact that the lamp was mounted on a spring socket—Swan—in the efficiency measurements, and the motion and vibration of this socket, in moving it through the various positions occupied, prevented as accurate measurements as in other cases where the lamp was held rigidly. The second set of Woodhouse and Rawson lamps, selected from fifty furnished, were marked 50 volts, and a paper accompanying them from the makers invoiced them as "20-candle power, 50 volt" lamps. They were tested by the committee, as the duration test on the former lot was unsatisfactory by reason of many of the lamps being connected two in series. On setting the new lot up at 50 volts, they were found to give only twelve spherical candles, and to have an efficiency of about five watts per candle. The Woodhouse and Rawson is known as a very economical lamp, and has of late attracted much interest on that account. A duration test of 300 hours was all that could be allotted to these lamps, and would determine nothing if the lamps were tested at so low candle-power. As the resistance of the lamps cold was the same as some of the first lot of 55 volts, the committee determined to test the second lot at that potential also, with a statement of the facts.

White lamps.—These lamps were taken from a lot of twenty-four. The carbon is apparently made of thread, has a circular cross section, and is heavily treated. The curves of the whole lot are almost identical. The lamps were tested with spring sockets received from the Electrical Supply Company, and to the vibrations and lack of rigidity of this socket during the revolutions of the lamp-holder, is attributed the slight want of symmetry observable in the curves. The cold resistance in the table of the figure is unquestionably an error, but was not discovered until too late for correction. The lamps decreased in resistance during the duration test. The average cold resistance before use, of several lamps of the same lot, was found to be 102 ohms, and those under test probably averaged about the same.

Weston lamps (110½ *volts*).—In submitting a report on the tests of these lamps, the committee think it proper to give a *résumé* of the correspondence between Mr. Weston and themselves. The 110½ volt lamps were received from the United States Company in January. Efficiency measurements were made on the 5th, 6th, and 7th of February. On the 18th of February Mr. Weston visited the exhibition building, was shown the results of the efficiency measurements on his lamps, examined into the installation, and the working methods of the test, and thinking the candle power of some of them low, addressed a letter to the committee, requesting a re-measurement of his lamps. The lamps were re-tested and the accuracy of the former measurements verified. Mr. Weston then said his lamps were a badly-made lot and withdrew them, but tests proceeded with the lamps on hand.

Weston lamps (70 *volts.*)—"Mr. Weston having expressed a desire to have measurements made on a lot of 70 volt paper carbon lamps, they were entered by the president of the Franklin Institute for test. The distribution of light is almost exactly the same as in the other lot. Ten lamps were selected from a lot of thirty-three received from Mr. Weston, tested for efficiency and afterwards subjected to a duration test of 523 hours."

The table of efficiencies in previous page is an abstract of eight tables given in the report:—

The figures given for the resistance hot are an approximate average of those given in the several tables from which the above summary is deduced.

Test for duration.—"For the duration test proper the three rooms of the Brush exhibit during the exhibition were utilised. The arrangements are shown in Fig. 9. The lamps were placed in boxes arranged in a circle in the middle room, which was securely boarded up, with the exception of one door opening into the watchman's room. This door was securely locked and sealed, except when measurements or adjustments were being made. A glass pane set in it allowed of inspection of the lamps when the door was closed. On the opposite side of the duration test room was a shop, in which all necessary electrical work was done. In a corner was the photometer room, containing the photometer used in the efficiency measurements—Fig. 6. The two rooms marked as assistants' bed-rooms were permanently occupied by the assistants connected with the test, Mr. A. L. Church, who was in charge in absence of members of the committee, and Mr. C. E. Billberg. The exhibition building around the three rooms was well lighted by extra lamps in circuit, and the whole was under the inspection of a watchman. When the committee finished their daily work in the duration test room, the door was locked and sealed in the presence of one of the committee, and remained closed until the next day, when the seal was examined before the room was opened. It was always found intact. While the room was closed, inspection of the lamps was made through the glass set in the door. These inspections were made every half hour, and whenever a lamp was observed to be out the time was recorded. The lamp was examined the next time the room was opened, and removed if found to be broken. It was feared that lamps might be accidentally broken, and provision was made in the code for replacing such lamps by others. In order to avoid breakage the lamps were never touched, except to adjust their position in the socket or to remove dust which had settled on them. Only one lamp—Stanley—was accidentally broken in the test, and this occurred while making a connection, by accidentally touching its leading wire to the binding post of the next lamp, giving the lamp 96 volts instead of the 44 required. When the room was open, no one not connected with the test was allowed to enter it, unless accompanied by a member of the committee."

Having given the efficiency figures obtained in the tests preliminary to the duration tests, we need not give the similar figures obtained by the latter ordeal, and we may summarise the duration or lift tables as follows:—

Edison.—Out of twenty Edison lamps, all but one survived the 1065 hours test.

Stanley-Thompson.—Of the ten 96-volt lamps by these makers, one survived the 1065 hours test, the remainder having lives of 882, 683, 525, 301, and less hours. Of the twelve 44-volt lamps, one survived the 1047 hours test, the remainder varying from 309 hours downward.

Woodhouse and Rawson.—Of the twenty of these lamps the highest life was 716 hours. Three survived the 332 hours test, and several lived over 400 hours.

White.—Of ten White lamps seven survived 310 to 312 hours, others gave much lower life.

Weston.—Of the Weston 110½-volt lamps six survived the 1065 hours test, one lived 823 hours, the remainder living much less time. Of the 70-volt lamps seven survived the 524 hours test, the others failed at a much smaller number.

LAUNCHES AND TRIAL TRIPS.

ON Thursday, September 10th, the steamship Ariel, built and engined by Messrs. Earle's Shipbuilding and Engineering Company, Hull, to the order of Mr. Edward Leetham, of the same town, was taken on her trial trip on the measured mile off Withernsea. The following are the dimensions of the vessel: — Length, 300ft.; breadth, 42ft.; depth of hold to top of floors, 20ft. She is built of steel, to class 100A1 Lloyd's, has a raised quarterdeck aft, long bridge amidships over engines and boilers, and topgallant forecastle forward with turtle-back sides, and is generally adapted for carrying a large cargo on a moderate draught. Water ballast is provided under engines and boilers, and there is a deep tank in the main hold for water ballast or cargo. The saloon and state-rooms are fitted in a large iron house on the bridge, and the officers are berthed at the sides of the engine casing. The four steam winches are made by Earle's Company, three of them being of the special long stroke compound type, and will be supplied with steam from a large donkey boiler as well as from each of the main boilers. The vessel is also fitted with Messrs. Amos and Smith's patent steam steering gear and Messrs. Harfield's steam windlass. The engines are on the three-crank triple-compound system—of which Messrs. Earle's Company have already turned out fifteen sets, and have now eight sets in hand—and have cylinders 23in., 35in., and 60in. diameter, by a 57in. stroke, made for a working pressure of 150 lb. to the square inch. During the trial these worked most satisfactorily, indicating 1470-horse power, and driving the vessel at a speed of 12·24 knots.

On the 10th inst. Messrs. R. Thompson and Sons launched from their Southwick yard an auxiliary screw brigantine, named the Waikna. Her length is 104ft.; breadth, 23ft.; depth of hold, 8½ft., and is built of steel to class 100 A1, at Lloyd's. She has a raking cutwater and neat round stern, is heavily sparred to give a large spread of canvas, and is fitted with lightning conductors to both masts. The cabin is very neatly fitted up aft, under raised quarter deck, with bath-room, &c.; accommodation is provided for the engineers in a house on deck, with a galley at fore end, fitted with Brownlee's cooking range and condenser. The crew are berthed in forecastle, the fore end of which is intended for a large sail room. The vessel has Clarke, Chapman, and Co.'s patent windlass and capstan, Hastie's patent pillar steering gear aft, steam launch, with compound surface-condensing engines, two lighthouses forward, teak skylights and companion, &c. The engines are by Messrs. A. Shanks and Co., of Arbroath and London. The boiler, which is of novel construction, has a working pressure of 150 lb. per square inch, and made by the Hazelton Boiler Company, of New York.

PRODUCTION OF PHOSPHATES IN THE UNITED STATES.—The production of washed phosphate rock in South Carolina during the year ending May 31st, 1884, was 431,779 long tons, worth 2,374,784 dols., or 53,399 tons more than in the previous year, with an increase of 104,504 dols. in value. The average spot price, 5.50 dols. per ton, was 50c. less than in the preceding year. The recent discoveries of phosphate rock in the adjoining States of North Carolina, Alabama, and Florida, will probably lead to a still further increase in production. Of manufactured fertilisers, 967,000 short tons, worth 26,110,000 dols., were made in the year ending April 30th, 1884, and 1,023,500 short tons, worth 27,640,000 dols., were made in the year ending April 30th, 1885.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—This body met at Ann Arbor, Mich., August 26th, Professor J. P. Lesley, of Philadelphia, presiding. A number of papers of greater or less interest were read and discussed. W. R. Nichols, of Boston, presented a paper on "Sanitary Chemistry;" J. Birkett, of Hoboken, N.J., a paper on "Rankine's Second Law of Thermodynamics;" E. Orton, one on "Unfinished Problems," relating to the geology and chemistry of coal; Edward Atkinson, of Boston, gave an interesting address on "The Production and Preparation of Food;" E. S. Nicholls, on the "Chemical Behaviour of Iron in the Magnetic Field;" C. F. Mabery, of Cleveland, read a paper on the "Cowles Process for the Electric Reduction of Aluminium, Boron, Silicon, &c.," a process already discussed and illustrated in the *Engineering and Mining Journal*. Edward A. Orton, of Colombus, Ohio, read a paper describing the new oil and gas-fields of North-western Ohio, in which he said that there is but a small product of petroleum, but gas is found in large quantities. At Findlay there are six wells with a yield of between three and four million feet a day. At Bowling Green there are three more, and one at Fremont, making the total daily product about 4,000,000 cubic feet. He also touched on the source of the product, its horizon being some distance below the fields of Eastern Ohio and Western Pennsylvania.

AMERICAN NOTES.

(*From our own Correspondent.*)

NEW YORK, September 5th.

AS indicated some weeks ago, the projection of important engineering enterprises is announced, among them the building of elevated roads in cities, the construction of cut-offs by railroads, the building of tunnels, the construction of several short lines of railroad of from five to twenty miles, the development of new territory that will contribute traffic, the construction of piers, the improvement of lake harbours, the enlargement of the Erie canal to facilitate grain from Chicago to New York, and numerous other enterprises of like character. The railroad builders have not as yet undertaken very important work, although brokers have in some cases placed contracts for delivery of steel rails during the first quarter of next year on terms believed to be 27 dols. or 28 dols. The railmakers have advanced prices on small lots to 28 dols. to 30 dols., and hope to be able to secure these rates for large lots by means of restricting next year's production to 750,000 tons.

The bridge builders have during the past week secured large orders for material, and the works are crowded for ninety days in several cases, and are likely to book large orders that will keep them running steadily through the winter.

Manufacturers of agricultural implements throughout the West are in the market for material for the next six months. They regard present prices as the lowest possible, and are apprehensive that on the opening of next spring prices will be advanced in view of the favourable probabilities for next year. A much more satisfactory feeling prevails in business circles generally from financial and commercial down to manufacturing, and there is a more liberal movement of merchandise already. In all branches of trade supplies are light. Manufacturers are receiving orders mostly for small lots for early delivery. In some cases orders have been placed for material to be delivered from three to six months hence. Should this feeling extend, it is likely to result in an advance in prices as soon as manufacturing capacity is filled up for sixty or ninety days. In some branches this limit has already been reached, and for prompt delivery of small lots a 5 to 10 per cent. advance has been successfully established. The manufacturers of textile machinery have a large amount of business in hand. The hardware manufacturers report an improved inquiry for tool and builders' hardware. The bar mills of Ohio and Pennsylvania have gained orders. The pipe mills are busy. The demand for old material is improving, and in consequence of the absence of stocks prices have advanced on old rails; while in Scotch pig, Bessemer, and spiegeleisen it is impossible to effect large sales.

A contract has been placed for the erection of three large blast furnaces at Troy, New York, 150 miles north of this city. They will be of the most approved pattern, and with every appliance that will cheapen cost of production. They are for the Alabany and Renssalaar Iron and Steel Company.

There is an increasing demand for merchant, crucible, and tool steel.

Indications point to a heavy demand for agricultural implements and machinery. The demand for small railway material is improved. The supply of iron from Virginia and Alabama is likely to increase. Though the cost of production is very light it is being reduced as compared to the cost of Pennsylvania furnaces. Lehigh irons are selling at 14·50 dols. to 15·50 dols. for forge; merchant bars, 1·70 dols. to 1·80 dols.; iron nails, 2·15 dols. to 2·30 dols.

The production of copper is heavy, and exports are large. Lead and zinc are quiet and firm. Soft basic blooms are 33·50 dols.; billets, 38 dols.; Siemens-Martin, 40 dols.

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

(*From our own Correspondent.*)

THERE is an increase in the demand for finished iron from local consumers. Some iron merchants reported to-day—Thursday—in Birmingham that they had "only to go into consumers' works and factories to bring out orders." Consumers are also less particular than formerly about the price which they pay. This is very gratifying. Export orders are coming forward with rather more vigour, and the result is more activity at the mills and forges than has been seen for some time past.

Prices do not show much alteration upon the week, but they are fully as firm as they were. Certain of the sheet makers state that they are booking orders at the advance of 5s. recently quoted, which makes galvanised black sheets of 24 gauge £7 5s. per ton, and 27 gauge £8 5s. Merchant singles are quoted £6 17s. 6d. per ton. A few exceptional galvanising firms quote a further advance of 2s. 6d. per ton upon corrugated sheets, making 7s. 6d. in all since spelter began to strengthen; but the advance is not easy to obtain. Quotations of average makes of 24 gauge galvanised sheets, bundled, delivered Liverpool, vary from £11 to £12 per ton, according to brand.

Messrs. J. Lysaght are losing no time in pushing forward preparations for an early start at the Osier Bed Ironworks, Wolverhampton. Their desire is to render themselves as galvanisers independent of the black sheet market. The Osier Bed Works stand on 7½ acres of ground, and the facilities are exceptional. Railway sidings run into the works, and they are also served by an arm of the canal, which is to be enlarged.

It may not be generally known that Messrs. Lysaght have resolved to establish a wire netting and galvanised hollow-ware factory at Geelong, situated forty-five miles from Melbourne, Victoria, in addition to the similar establishment covering four or five acres which for two years they have been running at Paramatta, fourteen miles from Sydney. Thus the firm will have netting factories in two of the chief Australian colonies. The machinery for the new works is being manufactured at the firm's Bristol establishment.

Marked bars remain firm at the list price of £7 10s. per ton. The medium qualities are quoted at £6 10s. down to £6 2s. 6d., and £5 10s. is about the price asked for the common sorts.

Steel manufactured in Wales and in the North of England continues to be offered at very favourable prices. Some Welsh Siemens-Marten steel billets are £6 15s. delivered; steel strip possessing splendidly smooth edges, £6 10s.; plating bars, £6; and spring steel, £6. Bessemer billets for fencing are £4 5s. A big order for fencing strip is this week upon the market.

Observant ironmasters here are just now expressing concurrence in Mr. Riley's statement at the recent meeting of the Iron and Steel Institute, that the Thomas-Gilchrist steel process is most likely to prove of greatest value in the open-hearth furnace. Mr. R. Smith Casson, the president of the Staffordshire Institute of Iron and Steel Works Managers, strongly holds this view, and Mr. B. F. McCallem, of Glasgow, has just expressed a similar opinion before the Institute. He even says that he is given to understand that at the Brymbo Works, Wales, ingots are being produced on the basic open-hearth principle at the very low figure of 65s. per ton. The Patent Shaft and Axletree Company, Wednesbury, is contemplating making some trial of the new combined systems.

Foreign pigs still show most movement. One or two hematite agents were quoting this afternoon an advance of between 1s. and 2s. upon a month ago, making certain Lancashire sorts 54s. delivered. Representatives of some Welsh hematite firms were unable to accept contracts without first submitting offers to principals. Makers believe that the market must advance, and they have therefore adopted this precaution. One agent states that he has during the past fortnight received offers amounting to £20,000 tons of best west coast ores, for which the quotation is 18s. 6d., besides offers for 4000 and 5000 tons of hematites.

Doncaster pigs are quoted this week at 42s. delivered to stations, and Lincolnshires are again 41s. 6d. Derbyshire pigs remain steady at 39s. to 40s., and Northamptons 38s. to 39s.

Native pigs of best makes are again quoted at 57s. 6d. to 60s. for hot-blast sorts, though the Earl of Dudley will accept nothing less than 62s. 6d. for hot-blast pigs, 82s. 6d. to 85s. for cold-blast. Best pigs of the Capponfield—native—brand, 46s. 6d.; and common, 33s. 6d. easy. Darlaston pigs, from Northampton ores, 39s.

In discussing the probabilities of the revival, makers this afternoon reminded buyers that when the revival of August, 1879, appeared in the North of England, it was not until Cleveland pigs had risen 6s. per ton that manufactured iron began to advance. By the end of September a 6s. rise had been established, and then manufactured iron began to rapidly improve.

"The immense girders erected at the Rugby Station were from Germany," was a statement made at the close of last week by a local candidate for parliamentary honours. Knowing the statement to be wrong, since the Horseley Engineering Company obtained the whole of the contract, I called in at the works this week and learned that they now have nearly completed the manufacture of all the ironwork. Their erections on the down side of the station are pretty much finished, and the up side is now being started on. Eleven out of the eighteen large steel girders, all of the company's own make, are already up. They are each 112ft. long, and weigh from 16 to 18 tons. The biggest girder which the company has put in is a box girder of 111ft. length, weighing about 50 tons. The high roof is about 48ft. high, and the low roof has a span of 78ft. The two roofs together will cover a length of 1064ft., and the total length of the platform is 1414ft. The weight of the whole contract, which includes also a lot of columns, is about 2000 tons.

Messrs. H. P. Parkes and Co., of Tipton, are just now manufacturing a new patent triple arm portable anchor, for which are claimed holding powers equal to two ordinary anchors. The new anchor has four arms, two of which act as tripping toggles, and when the anchor is in use three arms are buried in the ground. The arms are fitted into the shank so as to allow an oscillating motion, and the whole is taken to pieces for easy stowage. The anchor is the invention of Mr. Charles Boyce, and can be made in wrought iron or cast steel. Mr. Boyce is also the inventor of a patent swivel shackle to obviate the wear and tear which ensues from the twisting, folding, and knotting of anchor cables. This shackle is likewise being manufactured by Messrs. Parkes, and it is claimed that its use will save from 25 to 30 per cent. of the present wear on cables.

Some steam and hand-power pump makers who were lately on only half time are now pretty fully employed. The export demand is finding expression on account of the Cape, South America, the East Indies, Australia, Italy, Holland, and the Levant generally. Some large orders have recently been booked in Wolverhampton for powerful steam pumps for colliery work in the North of England and in South Wales. They are provided with 40in. steam cylinders, and will lift from a depth of 1000ft.

The chain-makers of South Staffordshire and East Worcestershire, numbering about 2500, turned out on strike on Saturday for an advance in wages ranging from 25 to 37½ per cent.

Happily the attempt to stir up the operatives in the nail trade to strike for an advance in wages has resulted in an ignominious failure.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The recent spirit in the market has not been long maintained, business is already settling down to about its previously quiet tone, and although it is scarcely probable that prices will again recede to the very lowest point at which orders less than a month ago were being competed for, it is evident, as I have all through pointed out, that there is no improvement in the actual condition of trade to maintain any material advance. Buyers have no doubt been induced to give out business that probably would not otherwise have come into the market, but any present legitimate requirements have soon been fully satisfied, and there is no disposition to enter into speculative transactions on the basis of the prices that are now being asked by makers. On the other hand, makers have sold so much, that for the present they are not compelled to press further sales; and although they are now doing very little business, they are holding firmly to the advanced rates, the only indication of weakness that is as yet making itself apparent being where second-hand holders of iron, who have bought at the low prices, are showing an anxiety to realise at under the full rates asked by makers.

There was again a good average attendance in the Manchester iron market on Tuesday, but the inquiry was very limited as compared with that of last week, and the actual business offering was extremely small. For local and district brands of pig iron makers were firm at about 39s. to 39s. 6d., less 2½, as their minimum for delivery equal to Manchester; during the week sales to a moderate extent have been made on about the basis of these figures, but further buying of any weight has been checked, and they are only being got where buyers are absolutely compelled to come into the market. Outside brands are not being held so firmly as they were, and both Scotch and Middlesbrough iron is to be bought at under makers' prices.

Rather more business is reported to be stirring in hematites, and a slight advance upon the minimum rates that have been ruling of late is being got, but the average basis of the general selling prices is still extremely low, and trade continues without animation.

In the manufactured iron trade there has been a tolerably large amount of business coming forward from merchants, and most of the forges are now supplied with sufficient work to keep them fully employed for the present. Makers, however, have not been able to establish any actual advance, but they are decidedly firmer in their prices, and are declining to sell at all largely for forward delivery at present rates. In a few instances advances of from 1s. 3d. to 2s. 6d. per ton are being quoted, but these advanced quotations are little more than nominal, and the average prices which are still actually being taken remain at about £5 5s. for bars, £5 15s. for hoops, and £6 15s. per ton for local made sheets.

The condition of the engineering trades remains without material change, and in many branches extreme slackness is reported.

In my last week's notes I referred to an order for twenty large travelling cranes for the new workshops of the Lancashire and Yorkshire Railway Company at Horwich that had been secured by Messrs. Hetherington and Co., of Manchester, and a few additional details as to the special construction of these cranes, which are being built from recently improved designs, will be of interest. Each of the cranes is to be constructed to lift 30 tons, and to be tested up to 40 tons, and will have a span of 45ft. One speciality is the large introduction of steel into their construction; they are to be made with steel girders, steel crab sides, and steel worms, with phosphor bronze worm wheels. In the details of their construction there is a very nice arrangement of tumbler bracket for carrying the cross shafts, which is worked without any links. There are three speeds of lift, and the lift is perfectly vertical, thereby bringing an equal strain upon each of the girders. The cranes are to be driven by 1½in. diameter endless ropes.

The relaying of the roadway in connection with the electric tramway at Blackpool having been completed, the Government inspector has now given his certificate for the opening of the line. The whole of the electrical arrangements are, however, not yet perfected, and whilst these are being completed, and also to enable the line to become thoroughly set, it is to be worked for the present by horses, the electrical opening being deferred until the 28th inst. The electrical contractors for the line—which is the first application of Mr. Holroyd Smith's patent, of which I gave a description some time back—are Messrs. Smith, Baker, and Co., of Manchester; and during the past week I was at their works, where I was shown the switches and other appliances for the tramway, which are now being completed. I also had an opportunity of inspecting several special tools that have been expressly designed for their electrical work. One of these was a very handy vertical drilling machine, arranged to be driven either by the foot with a treadle or by a strap. The framework is very light and portable. On the left side is placed the large driving-wheel, the bearing of which is adjustable by means of a screw and slot, which enables the band to be readily tightened up. The stand for holding the work is fixed to a vertical pedestal, on which it can be swung round, raised, or lowered as required. The drill has a 3in. stroke, and is actuated by hand by a balanced arm at the top of the frame, in connection with which there is a stop arrangement for regulating the depth of the stroke. The driving is very simple, all wheel-gearing being dispensed with, and it is effected entirely by cord and pulleys. The machine is designed to drill in brass or iron holes up ⅜in. diameter, and it does its work with a quickness and precision that would render it a very efficient tool for any class of light engineering work. In fact, Messrs. Smith and Baker, although the lathe was designed specially for their own work, have already supplied a number of these lathes to many of the brass finishers and engineers in the district. I also came across another very handy tool in a wood moulding machine that would be found very adaptable for the fitting-up shop in a shipyard. In this machine all complication of design or working parts has been avoided; it is fitted with a rising and falling spindle, with a special arrangement for holding the tools by which they are given a lead, so that there is no tearing of the wood, but a clean, sharp surface is left after the cut. The tools are also all very simple, and can be changed and re-set in a minute and a-half for either inside or outside moulding, rounding corners, grooving, and rebating, &c., all of which can be done with the machine by any ordinary workman.

Messrs. Smith and Baker are largely engaged on telephone work, and as I have not seen it publicly referred to before, it will be interesting to notice the latest development in this direction in the shape of an automatic call office. This is an ingenious arrangement, by means of which stations for the use of non-subscribers can be established, and they can be put in communication with subscribers. The apparatus is entirely automatic; there are two apertures, into which either 3d. in copper for local, or 6d. in silver for distant stations, can be dropped. The placing in of the coins rings up the central office, and the automatic call station is put in communication with the subscriber required. Conversation can then be held for the space of three minutes, at the end of which time the connection is automatically cut off and the fact signified to the central office. This arrangement has now been working several months very successfully in Manchester and Liverpool.

At the quarterly meeting of the Manchester Association of Employers and Foremen, held on Saturday, after the usual formal business and the election of new members, of whom seven were admitted, a resolution was unanimously passed on the motion of Mr. Thomas Ashbury, C.E., seconded by Councillor Asquith, conveying to Mr. Daniel Adamson, C.E., Alderman Bailey, and the other members of the provisional committee of the Manchester Ship Canal, their warmest congratulations on their successful carrying through Parliament of the Ship Canal Bill, and adding the strong belief that the canal when made would be of incalculable advantage to the numerous industries in which the members of the association were engaged, as well as of incalculable benefit to the district generally, and that therefore it was worthy of the hearty and substantial support of all classes of the community. Alderman Bailey, the president, in responding on behalf of the promoters, very pertinently observed that the enormous waste of money at present involved in the present method of passing private bills through Parliament, of which they had so flagrant an illustration in the Manchester Ship Canal Bill, might very well form a question for investigation by the present Commission on Trade, as the waste of money thus entailed was a serious tax upon the engineering branches of industry.

Any movement towards improvement in the coal trade of this district is still confined to the demand for house fire coals, which are moving off more freely in anticipation of a possible advance in prices next month, and in some instances collieries have got on to about full time. All other descriptions of fuel are, however, still bad to sell, and both common round coals for ironmaking and steam purposes, and burgy and slack for engine purposes, are a drug in the market. Best coals are rather firmer, but otherwise prices are quite as low as ever, and at the pit mouth average 8s. 6d. to 9s. for best coals; 6s. 6d. to 7s. seconds; 5s. to 5s. 6d. common; 4s. 3d. to 4s. 9d. burgy; 3s. 6d. to 3s. 9d. best slack; and 2s. 6d. to 3s. per ton ordinary sorts.

Barrow.—No change can be noted in the condition of the hematite pig iron trade of this district. There is absolutely no new feature to report. The deliveries to the Continent are for the moment heavier than they have been of late, but this represents in the main the Baltic trade, which has to be completed within the ensuing few weeks in order to secure deliveries before the frost closes the ports. The home trade remains especially quiet, and little or nothing is doing on foreign or colonial account. Prices remain steady at late values, 42s. 6d. being the quotation for mixed parcels of Bessemer iron, net at works, prompt delivery. Forward deliveries are 1s. per ton more money. Stocks of iron remain very large at both works and store yards. The steel trade is quiet in every branch and new orders are very scarce. Shipbuilders are indifferently employed, and orders are not coming in to any extent. A few inquiries are being made for various classes of shipping; but quotations have to be very low to secure contracts, while shipping owners do not themselves feel very confident of the necessity of ordering shipping at present. Iron ore is quieter in demand at late rates, 8s. 3d. to 10s. per ton being the value of ordinary qualities at mines. Coal and coke dull. Shipping rather better employed than for some time.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THERE is unquestionably a stronger feeling in local markets, though it appears to be mainly due to reports of improvement in other quarters, which naturally react on values here. I cannot hear of any distinct advance in prices as a general rule, but it is the case that firms decline to book forward at present quotations, which, however, are so abnormally low that any change must be for the better. It is very much the fashion to look to America as the key to the Sheffield trade. Though this is not quite so much the case as in previous years—notably twenty and fifteen years ago—it is still true that on the United States the Sheffield district pretty largely depends for business in the higher grades of steel, and one or two important specialities. But our colonial markets have greatly developed since the days when America was our only great customer—notably Australia, India, British North America, and British East Indies, while local firms have cultivated business even wider afield. The productive power in the United States has increased to such an extent that England can only hope to have the overflow, and every year this power is increasing, with the inevitable result of lessening the business which leaves the American shores.

Three important companies in coal, iron, and steel are the Staveley—coal and iron; the Sheepbridge—coal and iron; and the Brightside Steel Works—Messrs. Wm. Jessop and Sons. Both the Staveley and Sheepbridge have held their annual meetings since my last letter. The Sheepbridge Company was unable to declare any dividend on the ordinary shares of the company. An inquiry was made as to the quality of the company's ironstone field in Rutland. The chairman replied that they were making very good iron from it, and said the iron made at Sheepbridge was never better than what was now being produced there. The ore got from the field in Rutland might show a greater percentage of iron, but so far as the iron itself was concerned, the directors had every reason to be satisfied, not only with the ironstone field in Rutland, but with its field in Northamptonshire, and also in Lincolnshire. The Staveley Company has confirmed dividends of 30s. on the A and C shares, and of 5s. on the B and D shares. These are at the rate of rather over 4 per cent., as compared with 5 per cent. for the previous year. The directors of Messrs. William Jessop and Sons announce that, in the existing state of trade, they deem it prudent to wait the result of the whole year before declaring a dividend. Their operations are pretty largely ruled by the United States, which is still their chief market for superior kinds of crucible steel.

There has been an improved business done with Hull from South Yorkshire collieries during August than for the corresponding period of 1884. Last month the weight of coal sent to Hull was 126,920 tons, against 118,064 during August of 1884. For the eight months up to August, however, the result is a decrease—806,136 tons for 1885, against 834,544 for the corresponding period of 1884. The export trade is decidedly better, there being 90,393 tons exported during last month, against 79,030 for August, 1884; the eight months' trading shows 390,504 tons, against 369,729 for the corresponding period of 1884. Russia was the chief increasing market last month, North Russia taking 35,009 tons, against 15,601 for August of 1884. Italy, Belgium, Denmark, and Germany all show increased business; Sweden and Norway a heavy drop—16,310 tons, against 27,636 for August, 1884.

The usual September advance of 6d. per ton in the price of coal has now been generally secured, and a good deal of business has been done during the last ten days in house coal. Large shipments of steam coal have been made at Hull, Goole, and Grimsby, but coalowners state that the prices obtained were not at all satisfactory. The miners' strike at Ilkeston has collapsed, the terms offered by the manager having been accepted by a sufficient number of men to work the colliery. Those who declined the terms are now seeking for employment elsewhere. A stoppage of 2s. 6d. per man for sending out too large a proportion of slack caused a dispute of short duration at the Monk Bretton Colliery. The owner afterwards agreed to return the stoppages, and the men resumed work. The deputation which waited upon the owners advised the men to be more careful what sort of stuff they sent out, as in some cases the proportion of slack was certainly too great.

A slight increase in cutlery orders for the colonies is reported; the beginning of the Christmas season is felt in orders both in cutlery and silver and electro-plate, and altogether there is more doing in these departments. The harvest prospects are scarcely so bright as they were, continued wet having militated against loading the grain, and several close hot days caused sprouting. On the whole, however, there will be less damage done than was at first apprehended, and the yield will generally be good in the midland and adjoining districts, all of which will tend to influence business favourably.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

A CONSIDERABLE amount of business was done in Cleveland pig iron throughout last week at the advanced rates; but at the market held at Middlesbrough on Tuesday the tone was somewhat quieter. Fewer sales were made, and most merchants reduced their quotations 3d. to 6d. per ton. Makers, however, being well supplied with orders, did not alter their prices. They still ask 33s. 6d. per ton for No. 3 g.m.b. for prompt delivery, and expect to do still better shortly. For forward delivery 3d. to 6d. per ton more is asked. The reduction in price was first made by certain merchants who had bought at the minimum price. They sold several small lots at 32s. 9d. per ton. There is a poor demand for forge iron, and it is still obtainable at 31s. 9d. per ton.

The stock of pig iron in Messrs. Connal and Co.'s store at Middlesbrough continues to increase rapidly. The stock on Monday last was 88,819 tons, being 1117 tons increase for the week, and 38,577 tons since the beginning of June.

Warrants were on Tuesday offered at 33s. 6d. per ton, being 6d. less than at the previous market.

Shipments of pig iron from the Tees are proceeding satisfactorily, 38,384 tons having been sent away this month up to Monday last, as against 34,948 tons during the first fourteen days in August.

There is a slightly improved demand for finished iron, but orders are given out slowly, and the mills are scarcely fully occupied. Makers have not yet advanced their quotations, but they will be compelled to do so shortly owing to the rise in the value of raw material.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE warrant market has not been quite so strong this week. A considerable quantity of warrants have changed hands, the sales having had the effect of somewhat reducing prices. The movements in the warrant market are still considered purely speculative, and not the result of any improvement in legitimate business. Shipments of pigs are still unsatisfactory, those of the past week amounting to 7557 tons, as compared with 7877 tons in the preceding week, and 13,167 tons in the corresponding week of 1884. There are 89 furnaces in blast, against 94 at the same date last year. Stocks continue to increase, the week's addition to the stock in Messrs. Connal and Co.'s stores being upwards of 1500 tons.

Business was done in the warrant market on Friday at 42s. 11d. to 43s. 2½d. cash. Monday's market was firm at about the latter quotation. On Tuesday forenoon the quotations were 43s. 2d. to 43s. 1½d. cash, there being a slight reaction in the afternoon in consequence of a large amount of warrants having been disposed of. Business was flat on Wednesday, and warrants declined to 42s. 6d. cash. This—Thursday—forenoon they recovered to the extent of about 3d. a ton, and in the afternoon the rates were fully maintained, closing with buyers at 42s. 9d. cash.

The current values of makers' iron are:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 46s. 6d.; No. 3, 44s. 3d.; Coltness, 50s. 6d. and 46s.; Langloan, 48s. 6d. and 45s. 6d.; Summerlee, 47s. 6d. and 44s.; Calder, 52s. and 44s.; Carnbroe, 46s. and 43s. 6d.; Clyde, 46s. 6d. and 42s. 6d.; Monkland, 43s. 3d. and 41s. 3d.; Quarter, 43s. and 41s.; Govan, at Broomielaw, 43s. 3d. and 41s. 3d.; Shotts, at Leith, 47s. 6d. and 46s. 6d.; Carron, at Grangemouth, 51s. and 47s.; Kinneil, at Bo'ness, 44s. 6d. and 43s. 6d.; Glengarnock, at Ardrossan, 46s. and 42s. 6d.; Eglinton, 42s. 6d. and 39s. 9d.; Dalmellington, 44s. and 41s.

There is more demand for hematite, the quotations of which for Nos. 1, 2, 3, f.o.b. at Workington and Maryport, being 43s. 6d. a ton.

Since last report a few additional orders have been received by Clyde shipbuilders, mostly for sailing vessels of a medium size, steamers being at present not wanted. In spite of these contracts, a number of firms on the Clyde have but indifferent prospects before them for the ensuing winter.

The general engineering and founding trades are in a backward state in some of the manufacturing centres of the West of Scotland, and at Carron and Johnstone numbers of workmen are being discharged.

Messrs. D. G. Stewart and Co., Glasgow, have obtained an order for about 4000 tons of pipes required for an extension of the waterworks at Ayr. The price to be paid for the pipes is stated at £20,837.

The past week's shipments of iron and steel manufactures from Glasgow included a locomotive for Calcutta, valued at £2200; machinery worth £13,151; sewing machines, £3780; steel goods, £7817; and iron manufactures to the value of £39,000.

In the coal trade business has been moderately active. The week's shipments embraced 19,302 tons from Glasgow, 439 at Greenock, 1884 at Irvine, 7007 at Troon, 8477 at Ayr, and 18,417 at Grangemouth. The prices do not show any material change. A few additional orders are coming in for household consumption.

The leaders of the miners have issued a manifesto to all the colliers of the country, calling upon them to carry out the eight hours' day, and to work only five days a week. Another conference of delegates was held this week in Glasgow, with the object of furthering the movement for an increase of wages. The reports given in showed that little, if any, progress had been made in this direction.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE movement for amalgamating the Rhymney and Taff Vale railways is beginning to assume a more practical form. Hitherto it has been the subject of discussion between the shareholders, and of comment by the local and technical press; but now a circular letter has been industriously circulated by G. Sayce and Co. to their clients, the Rhymney shareholders, and the telling arguments adduced must, I should imagine, prevail.

Railway movements are on foot. The Taff Vale Company is going to start its extension, the Barry Railway its, and the Rhymney and Great Western its connection with the important colliery of Nixon and Co. at Merthyr Vale. In the face of growing competition, the Taff Vale, instead of losing heart, is redoubling its efforts. I believe the contract for connecting the main line with Cyfarthfa was £90,000, and it is being carried out with vigour. This, and the action of the Rhymney and Great Western, imply a confidence in the future of Cyfarthfa which should encourage the district.

At present, although prospects in iron and steel are looking up, the depression has been so long that it will take some time to regain lost ground. The tone of things is decidedly better, both in iron and steel, rail and bar. Prices are stiffening perceptibly, and though it is early yet to speak with confidence, I may say that a more satisfied feeling begins to exist. The compact little works, the Britannia, is full of activity, and the leading works have been fairly employed.

The iron returns to the end of August have just been completed, and show favourably. For instance, the iron exports for the month of January from Cardiff only amounted to 2159; July they amounted to 13,590, and August 9532. Newport showed a total of 10,931 for January; for February only 1197, but July amounted to 7479, and August reached 12,384 tons. Swansea from January to August only exported 2961 tons, but its July total was 1072 tons; August only 19 tons.

Little or no improvement can be reported in the house and steam coal trade.

At Cardiff there is a slightly better tone perceptible, and shippers and owners augur an increase in demand as the iron trade improves. At present trade is unmistakeably flat. The clearances from Cardiff last week only amounted to 124,000 tons, which was less by 6000 tons than last week. Newport complains still more bitterly, having a larger house coal area. The new patent fuel works at this port are beginning to do a trade. This week a large cargo was sent to Palermo.

I see that the Dowlais Company is adding to its successes in the way of securing contracts; it has now the contract to supply the Channel Squadron at Greenock. Small coal is lessening in demand, and prices are not so firm as they have been. Pitwood, too, is down to about 16s.; in fact, in all matters appertaining to coal there is weakness. Whether this will continue long is a matter of speculation. I fall in with a few who think that a turn for the better is at hand.

Mr. Walker is pushing ahead at Barry Docks. A township may be expected to spring up in the district, for I see that cottages in the adjoining villages are rented at unusually high prices—as much as 12s. a week. I should consider it a master-stroke of policy for the Taff to secure Barry, and those who know Mr. Geo. Fisher will give him the credit of possessing admirable strategic powers, and to be quite alive to the necessity of securing it. Barry at work means a reduced dividend to the Taff—10 per cent., I should say, instead of 15. The Taff coal rate from the Rhondda is three-farthings per ton; Barry will be a halfpenny. This will necessitate a reduction by the Taff of their rates, and we may be certain that Davies and Son, and the Ferndale, and other large shareholders in the Barry, will send as much of their coal as possible by their own line and docks. They now send two-thirds of all the coal sent from the Rhondda.

The speculators in Barry should be gratified with the fact that steamers in the carrying of coal are almost driving sailing vessels out of the market. Given a stormy winter and sailing vessels, and Barry might put up the shutters.

In the absence of Mr. W. T. Lewis—who with Sir Geo. Elliot has arrived in Canada on his mission to inspect the collieries of Nova Scotia and the ironworks of the States—Mr. Tylor took the chair at the usual meeting of the Miners' Provident Society. The statement of the secretary showed a most flourishing condition. Four-fifths of the whole of the colliers of the district are now enrolled, and a capital of £25,000 is at the bank. Still, one does not like to see that for disablements £3256 3s. was paid out, while widows only received £326 in the past quarter. This means, I am afraid, that a lot of men are "upon the fund"—some genuine disablements, of course, but a lot of imposition as well. I know this has destroyed almost every benefit society in Wales, and requires very great watching. A man will get a hurt—a legitimate one; the doctor is kind, and the result is sick-pay for weeks when a few days should be sufficient. The better plan would be to estimate financially an injury, and pay down the amount, the doctor giving his verdict as to the time necessary to enable the man to resume work. The society deserves every help, and this would aid it.

Tin-plate may be regarded as *in statu quo*. The idle week may, and is expected to, be followed with increased demand, and as stocks are falling rapidly, and makers continue firm, buyers must give way. Only small consignments have been sent away to the Continent and America during the week.

In the Forest of Dean, good foreign orders for iron are coming in, and extra furnaces have been started.

Mr. Bates, chief colliery manager at Cyfarthfa, will retire, it is said, on completing three months' notice.

ELECTRIC LIGHTING IN DETROIT.—One of the papers read at the recent convention of the National Electric Light Association in New York described the tower system of electric lighting in the city of Detroit. The author, Mr. W. W. Leggett, said that about a year ago his company made a bid of 95,000 dols. for lighting the entire city, an area of 10½ square miles, and secured the contract. The territory included in the centre a business section of about a square mile; surrounding this a belt about a mile in width, densely shaded, and containing the finest residences; outside of this belt a semi-suburban section. The company built 90 skeleton iron towers, three of which were 175ft. in height, the others 150ft. These they placed in triangles, 1000ft. to 1200ft. apart in the centre of the city and 2500ft. to 3000ft. apart on the outskirts. On these towers were placed an aggregate of 358 2000-candle power lights, and in certain places, for special reasons, 23-pole lights were used. Mr. Leggett advocated the use of towers not less than 150ft. nor more than 175ft. high, of lamps of 2000-candle power, and of not more than four to a tower, excepting on a central tower, where there might be six in order to obtain the best results. These conclusion he reached as the results of careful experiments. He lighted his lamps half an hour after sunset, and stopped engines one hour before sunrise, every day in the year. He had displaced 4780 gas and naphtha lamps, and lighted a territory greater by two square miles than had been done by the gas and naphtha people. The bid of his company had been a little less than that of the gas and naphtha companies for a slightly smaller territory.

NEW COMPANIES.

THE following companies have just been registered:—

Halifax Graving Dock Company, Limited.

This company proposes to construct, maintain, and work engineering, graving, dry, and other docks in the city of Halifax or elsewhere in Canada. It was registered on the 8th inst., with a capital of £150,000, in £10 shares, with the following as first subscribers:—

	Shares.
S. W. Halliday, Sidcup, accountant	1
Percy Mitchell, 21, Queen's-road, Brownswood Park, N., accountant	1
*C. W. Harrison, 17, Austin Friars, merchant	1
*G. Brooke Mee, 9, Great St. Helen's, merchant	1
F. C. Mahon, 161, Gresham House, merchant	1
Reginald Brett, Suffolk House, Laurence Pountney-hill, barrister	1
Horace E. Billing, 9, Great St. Helen's, merchant	1

The number of directors is not to be less than five nor more than seven; the first are Rear-Admiral John Bythesea, V.C., C.B., C.S.I., 22, Ashburn-place; Lieut.-Colonel the Hon. E. H. Legge, 26, Sussex-gardens; W. T. McCullagh Torrens, M.P., Brooks' Club; George Moffat (Gillespies, Moffat, and Co.), 6, Lime-street, and the subscribers denoted by an asterisk; remuneration, £1000 per annum, and a further sum of £100 for each £1 per cent. dividend on the ordinary share capital in excess of £5 per cent. per annum.

J. S. Stone and Company, Limited.

This company was registered on the 4th inst., with a capital of £12,000 in £5 shares, to acquire the manufactory, works, warehouses and premises, of Mr. John Smart Stone, of Dock-street, Newport, Monmouth, wagon, cart, carriage, and agricultural implement manufacturer, and general merchant. The subscribers are:—

	Shares.
J. S. Stone, Newport, Mon., agricultural implement manufacturer	200
R. Stratton, Newport, Mon., farmer	20
G. Fothergill, Newport, Mon., tobacco manufacturer	20
R. H. Richards, Newport, Mon., merchant	20
C. Pearce, Newport, Mon., wine and spirit merchant	20
J. W. Hewetson, Newport, Mon., carriage builder	160
E. Phillips, Newport, Mon., brewer	20

The subscribers are to appoint the first directors, who act *ad interim*; qualification, 20 shares, or equivalent stock. The company in general meeting will determine remuneration.

Lancashire Automatic Retort and Oil and Colour Works, Limited.

This company proposes to acquire and work patents for improvements in apparatus for the distillation of coal shale and similar substances, and also to acquire buildings, plant, machinery, and appliances for the distillation, production, or manufacture of oils, colours, and such like substances. It was registered on the 4th inst., with a capital of £25,000 in £1 shares. An unregistered agreement of 2nd inst., between Wm. Sunderland and Charles Burton, is to be adopted. The subscribers are:—

	Shares.
S. Kynaston, 47, Burlington-street, Aston, Birmingham, foreman	1
Captain G. Webb, A Court, 9, Temple-row, Birmingham	1
F. Baxter, 47, New-street, Birmingham, clerk	1
G. B. Smith, 45, Bacchus-road, Birmingham, clerk	1
J. Craig, Handsworth, Birmingham, surveyor's assistant	1
G. F. Oakes, Balsall Heath, Birmingham, law stationer's assistant	1
J. York, 80, Great Colmore-street, Birmingham, law stationer	1

Registered without special articles.

Mangotsfield Victory Colliery Company, Limited.

Registered on the 9th inst., with a capital of £10,000 in £1 shares, to acquire the mineral rights and business of the Mangotsfield Collieries, Gloucester. The subscribers are:—

	Shares.
Edwin Halliday, Fishponds, Gloucester, miller	1
William Dando, Fishponds, Gloucester, boot manufacturer	1
J. T. Lovell, Fishponds, Gloucester, nail manufacturer	1
W. A. Pearce, Fishponds, Gloucester, painter	1
A. H. Carter, Fishponds, Gloucester, engineer	1
S. A. Stone, Easton, Bristol, engineer	1
W. Morrish, Fishponds, Gloucester, cabinet manufacturer	1

Table A of the Companies' Act, 1862, will apply.

New Electro Amalgamator Company, Limited.

This company proposes to take over the assets and contracts of the Electro Amalgamator Company, Limited, upon terms of an agreement of the 21st ult. It was registered on the 9th inst., with a capital of £6000, in £1 shares. At a meeting of the old company held on the 6th ult., it was resolved not to wind up, but to sell the assets and contracts to a new company, in consideration of its paying all the debts of the company (not to exceed £3600) in cash, and also one-third of the net profits, after repayment out of the profits of the amount of £6000 subscribed, the shares of the new company to be offered *pro ratâ* to the shareholders of the old company. The subscribers are:—

	Shares.
Peter Jerome, 14, Great Tichfield-street, articled clerk	1
G. N. Dicks, 84, Ashbury-road, Lavender-hill, clerk	1
C. Jones, 9, Tokenhouse-yard, clerk	1
D. T. Roper, 20, Sudbourne-road, S.W.	1
W. M. H. Young, Radlett, Herts, secretary of a company	1
J. F. Marshall, Kent Cottage, Kingston, clerk	1
Arthur W. Boon, 10, Warner-road, Camberwell	1

The number of directors is not to be less than three nor more than five; the first are Captain F. Howlett, 8, Colville-terrace, Notting-hill; Wm. Strapp, Frenches, Redhill; and Septimus Short, Sheffield. Most of the articles of Table A of the Companies' Act, 1862, are adopted.

Universal Telephone Company, Limited.

This company proposes to work the patented inventions of M. Kazimir Stanilas Dembinski, of Brussels, for improvements in microphones and electrical apparatus for the transmission and reproduction of sound. It was registered on the 4th inst., with capital of £400,000, in £1 shares, with the following as first subscribers:—

	Shares.
E. Brailsford Bright, C.E., 31, Golden-square	1
J. Brailsford Bright, Inner Temple, barrister	1
Col. G. B. Malleson, 27, West Cromwell-road	1
C. Barber, 32, Fenchurch-street, colonial broker	1
W. J. Steele, Annandale Lodge, Blackheath	1
Col. R. F. Webb, 6, West Cromwell-road	1
J. J. Fleming, 198, Elderfield-road, Clapton, clerk	1

The number of directors is not to be less than three nor more than nine; the subscribers are to nominate the first and act *ad interim*; qualification for directors—other than those to be nominated by the subscribers—20 shares; remuneration, £1500 per annum, and in addition thereto £5 per cent. of the net profits remaining after payment of 10 per cent. per annum dividend. M. Dembinski, the founder, is appointed electrician to the company.

Stone Court Chalk, Land, and Pier Company, Limited.

This company proposes to acquire the Stone Court Estate, at Stone, Kent, and to carry on business as manufacturers of, and dealers in, bricks, chalk, lime, Portland and other cement, whiting, and other composition. It was registered on the 9th inst., with a capital of £75,000 in £100 shares, with the following as first subscribers:—

	Shares.
Alfred Strong, The Red House, Ealing, architect	1
George Parr, Constitution-crescent, Gravesend, architect	1
T. Reeve, 50, Shepperton-road, N., clerk	1
J. Field, 6, Broadway, tea dealer	1
W. Hawgood, 80, Holland-road, Kensington	1
J. W. Chamberlaine, Paternoster-row, law stationer	1
J. Martin, 3, Newgate-street, public accountant	1

The numbers of directors is not to be less than four nor more than seven; subscribers are to appoint the first and act *ad interim*; qualification, £500 in shares; the company in general meeting will determine remuneration.

THE COMMISSION ON TRADE.

THE following questions are to be sent to British Consuls abroad on behalf of the Royal Commission on Depression of Trade:—(1) What are the chief branches of British trade which are connected with your district? (2) How have they been affected during the period from 1880-84-85 as compared with the preceding fifteen years in regard to—(*a*) volume; (*b*) gross value; (*c*) net profit. (3) Can the condition (*a*) of trade and industry generally and of British, and (*b*) of British trade in particular, in your district be fairly described as "depressed" at the present time as compared with the last twenty years? (4) If so, when did the depression begin? when did it reach it lowest point, and what are its most prominent symptoms? (5) Has its progress hitherto been uniform or irregular, and what do you anticipate that its course will be in the immediate future? (6) If such depression exists in your district, does it extend to all branches of trade and industry, and if not what trades or classes of trades would you except? (7) Have the different trades and industries affected been uniformly affected (*a*) in point of time, and (*b*) in point of intensity? (8) Should you say that (*a*) the demand for, (*b*) the supply of, and (*c*) the return on capital in your district is above or below the average of the last twenty years? (9) Is the rate of wages in your district (*a*) for skilled and (*b*) for unskilled labour above or below the average of the last twenty years, regard being had to the quantity and quality of the work produced? (10) What special impediments exist to the extension of British trade in your district, and what measures can you suggest either to remove them or to promote the further extension of the trade? (11) Has any transfer taken place of the trade between your district and Great Britain to other countries? (12) Has any increase taken place during the last few years in the pressure of local or general taxation on the trade and industry of your district? (13) Are there in your district any commercial museums, pattern or sample rooms, export agencies, or other institutions to promote trade which are accessible to all merchants and manufacturers; if so, describe them briefly, showing their origin, the cost of establishment and maintenance, and any observation you may have to offer with respect to them. (14) What are the conditions of credit in regard to wholesale and retail trade? (15) Can you give any information with respect to the imitation or fraudulent marking of goods for the purpose of passing off foreign productions as British goods? Further, Mr. Storey has suggested that specific inquiries should be made as to the present rate of wages for skilled and unskilled labour abroad.

SANITARY INSTITUTE OF GREAT BRITAIN.—The eighth autumn congress will be held at Leicester from September 22nd to September 26th. Section 1: "Sanitary Science and Preventive Medicine." President—Arthur Ransome, M.A., M.D., M.B., L.S.A., F.R.S. Vice-presidents—William Collingridge, M.A., M.D., C.S.S. Camb.; Henry Lankester, George Shaw, M.D., J.P. Honorary secretaries—J. F. J. Sykes, B.Sc. Pub. Health, M.B., L.R.C.P., M.R.C.S.; William Johnston, M.D.; C. A. Moore, M.D. Section II.: "Engineering and Architecture." President—Percival Gordon Smith, F.R.I.B.A., Architect Local Government Board. Vice-presidents—H. H. Collins, F.R.I.B.A.; J. Gordon, M. Inst.C.E.; W. Jackson, M. Ogle Tarbottom, M. Inst. C.E. Honorary secretaries—W. R. E. Coles, Joseph Goddard, F.R.I.B.A.; J. B. Everard, A.M.I.C.E. Section III.: "Chemistry, Meteorology and Geology." President—William Marcet, M.D., F.C.S., F.R. Met. Soc., F.R.S. Vice-presidents—F. T. Mott, F.R.G.S.; J. G. F. Richardson, J.P.; Henry C. Stephens, F.L.S., F.C.S.; G. J. Symons, F.R.S. Honorary secretaries—H. Percy Boulnois, M. Inst. C.E.; Rev. E. Atkins, B.Sc.; J. G. Burgess.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Applications for Letters Patent.

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

8th September, 1885.

10,587. Spinning Mules, W. H. Blackwell and E. E. France, Hooley Hill.
10,588. Flax Spinning Frames, W. J. Adeley, Belfast.
10,589. Non-corroding Writing Pens, &c., F. W. Hayward, Norwich.
10,590. Driving Belts, S. Platt and J. Haley, Halifax.
10,591. Delivery Mechanism of a certain class of Cylinder Printing Machines, F. Payne, Halifax.
10,592. Feeding Mechanism of a certain class of Cylinder Printing Machines, F. Payne, Halifax.
10,593. Condensing the Steam from Portable Pans, &c., B. Hainsworth, Halifax.
10,594. Photographic Cameras, J. R. Gotz, London.
10,595. Crushing Mills, F. A. Huntington, London.
10,596. Packing for Stuffing Boxes, F. Hocking, Liverpool.
10,597. Making Infusions of Tea, &c., J. T. Whittaker, Glasgow.
10,598. Preservation from Oxidation of certain Salts of Iron, A. E. Robinson, Edgbaston.
10,599. Closets, &c., for Indoor Use, W. J. Young, Greenock.
10,600. Telephone Repeaters, C. A. Allison.—(*M. G. Farmer, United States.*)
10,601. Attachment of Taps to Casks, F. B. Hanbury, Maidstone.
10,602. Plate Washing Machine, R. and S. H. Chidley, London.
10,603. Solitaire, &c., Fastener for Cuffs, H. Sainsbury, London.
10,604. Testing Quality of Milk, F. Bosshardt.—(*Urs Egger, Switzerland.*)
10,605. Combined Table and Writing Desk, I. W. Moore and H. Salomon, London.
10,606. Curative Voltaic Batteries, R. M. Kennedy, London.
10,607. Vapour Inhalers, R. M. Kennedy, London.
10,608. Harness for Horses, W. Armes, London.
10,609. Covering Hats with Cotton Stocking Net, A. Luson, London.
10,610. Velocipedes, O. Macarthy, London.
10,611. Controlling the Pressure of Gas, F. H. Wenham, London.
10,612. Ink for Printing in Gold, &c., S. S. Furse, London.
10,613. Home Fire-escape, F. Harris, London.
10,614. Box for Sending Flowers by Parcels Post, E. Everington, London.
10,615. Boiler Feed and Alarm, A. H. Reed.—(*T. Barber, United States.*)
10,616. Military Water Bottle and Case, P. B. Barnard, Canada.
10,617. Automatically Closing Taps of Casks, T. Blake, London.
10,618. Boots, &c., S. Lennard, London.
10,619. Corrugated Boiler Furnaces, C. E. Smith, Glasgow.
10,620. Railway Signal Lamps, &c., S. T. Dutton, London.
10,621. Smelting Pyrites, J. Dixon, F. J. Blades, W. S. Douglas, D. Garlick, and W. Malcolm, London.
10,622. Boring, &c., Pulleys, W. P. Thompson.—(*W. J. Muncaster and M. McKaig, United States.*)
10,623. Bookbinders' Gold Saving Cleaning-Boxes, T. Daniels, jun., London.
10,624. Compressors for Hawsers for Ships' Use, A. Gilchrist and R. Smith, Liverpool.
10,625. Water-saving Flushing Cistern, J. T. Vaughan, London.
10,626. Lubricators, W. P. Thompson.—(*F. H. Bolte, United States.*)
10,627. Boring, &c., Machine, W. P. Thompson.—(*W. J. Muncaster and M. McKaig, United States.*)
10,628. Advertising on Tin Plate, A. Winkler, Liverpool.
10,629. Card Winding Machine, T. Voile and T. Smith, London.
10,630. Steam Trap, O. Imray.—(*C. Richard, France.*)
10,631. Brush Stock Boring Machinery, C. L. Watchurst, Lee.
10,632. Velocipedes, W. Clark.—(*J. M. Dillon, United States.*)
10,633. Opening and Closing Windows, G. V. Rowden and W. J. Edwards, London.
10,634. Valves and Valve Gear, J. Yate.—(*La Société Anonyme de Constructions Mecaniques d'Anzin, Etablissements de Quillacq, France.*)
10,635. Floats for Water Supply, B. Finch, Fulham.
10,636. Fasteners for Gloves, &c., H. H. Lake.—(*W. S. Richardson, United States.*)
10,637. Bottle Stands, J. Betjemann, London.
10,638. Spring Casters for Chairs, &c., J. C. Chapman.—(*F. Bouhon, Belgium.*)
10,639. Attaching Nose Bags to Horses, H. W. Hart.—(*W. H. Murray, U.S.*)
10,640. Facilitating the Lowering of Venetian Blinds, J. W. Morison, London.
10,641. Horseshoes, F. G. Broxholm, London.
10,642. Centrifugal Machines, E. Edwards.—(*E. Rothe, Germany.*)
10,643. Flushing Cisterns, M. Syer, London.
10,644. Automatic Dial Gong Ticket Punches, P. C. Smith and R. W. Thomas, London.
10,645. Nut and Bolt Spanners, H. Sainsbury, London.
10,646. Electric Generators, H. H. Lake.—(*S. F. Van-Choate, U.S.*)
10,647. Stopping Ships, &c., J. N. Sears.—(*W. Hadden, U.S.*)

9th September, 1885.

10,648. Stationary Boiler Flues, J. B. Cooper, Whitehaven.
10,649. Bassinette and Perambulator Handles, W. H. Brassington, Manchester.
10,650. Temporary Fixing of Flexible Films to Rigid Supports, W. K. Burton and T. Bolas, London.
10,651. Oil Lamps, G. O'C. Holloway.—(*L. Bruers-Duboscq, Belgium.*)
10,652. Steering Tricycles, A. T. Shellard, Bristol.
10,653. Gas Engines, J. Magee, Glasgow.
10,654. Guard for Carving Forks, B. Clayton, Nottingham.
10,655. Furnaces, &c., W. L. Wise.—(*J. Marquart, Germany.*)
10,656. Cut-off Motions for Engines, H. S. Booth, Manchester.
10,657. Evaporating Sea Water Nitrate, &c., F. B. Dœring, London.
10,658. Metallurgical Apparatus, C. M. Pielsticker, London.
10,659. Closing Doors and Gates, H. Sainsbury, London.
10,660. Securing the Ends of Driving Bands, G. F. Dawson, L. Firth, and A. Ashworth, London.
10,661. Preparing Crystal Soda and Caustic Soda from Tank Liquor, A. P. Laurie, Glasgow.
10,662. Double-tracing Wheel, M. H. Sedway, London.
10,663. Regenerative Hot-air Furnaces, E. Edwards.—(*E. Fourcault and E. Jacques, Belgium.*)
10,664. Breech-loading and Repeating Fire-arms, R. Paulson, Langwith.
10,665. Ball Castors, J. B. Clive, London.
10,666. Generating Gas from Oils, C. W. Bradshaw and J. Carpenter, London.
10,667. Steam Hammer, A. Taylor, London.
10,668. Roofs for Houses, H. M. Moody and J. Pope, London.
10,669. Combined Flush and After-flush Cisterns for Closets, C. Edwards and W. Richards, London.
10,670. Transposing Notes on Pianos, &c., L. A. Groth.—(*F. Kaim and Sons, Germany.*)
10,671. Cutting Rollers for Felt Hats, J. and O. Oldham, London.
10,672. Stair Rods and their Attachments, E. Townshend, T. H. Thompson, and P. Shaw, Birmingham.
10,673. Alarms or Whistles for Tramcars, &c., A. Whowell and E. Chadwick, London.
10,674. Navigable Dredging Vessels, J. Taylor, Liverpool.
10,675. Football Kicking Machine, A. Pohlman, Halifax.
10,676. Regulating, &c., the Cut-off of Steam and other Engines, W. Stevens, Leeds.
10,677. Self Oil-feeder, H. Carrière, London.
10,678. Magnifying and Subduing Light, W. J. Hall, London.
10,679. Automatic Lever and Alarum Striking Bolt for Locks, J. Harris, London.
10,680. Automatic Alarum Fastener for Shutters, &c., J. Harris, London.
10,681. Steering Gear of Velocipedes, W. Phillips, London.
10,682. Detachable Handle Bars for Velocipedes, W. Phillips, London.
10,683. Heating Bakers' Ovens, J. Martin, Liverpool.
10,684. Lawn Mowers, H. Abbott.—(*S. A. Haines and Co., United States.*)
10,685. Leggings, &c., E. Cooper and G. C. Crabbe, London.
10,686. Stoppers for Bottles, J. Edwards, London.
10,687. Washing Coal, C. Sheppard, London.
10,688. Signalling on Railways, T. T. Powell, London.
10,689. Wheels and Pulleys, A. Greig and G. Achilles, Leeds.
10,690. Reflectors, M. Heale, London.
10,691. Shirts, J. Aitken, Edinburgh.
10,692. Combined Table and Pianoforte, W. Alsop, London.
10,693. Horseshoes, R. Dick and J. Dick, Glasgow.
10,694. Condensing Exhaust Steam, A. McNab, Glasgow.
10,695. Packing for Pipe Joints, F. C. Guilleaume, London.
10,696. Flushing Apparatus, R. B. Evered, London.
10,697. Apparatus for Cork Bottles, E. Gervais, London.
10,698. Working of Blast Furnaces, C. Cochrane, London.
10,699. Buoyant Fabrics, F. W. Brewster, London.
10,700. Making Ammoniac Bichromate, J. J. Hood, London.

10th September, 1885.

10,701. Scales, W. Kloen, Birmingham.
10,702. Injectors, J. Fletcher, Ashton-under-Lyne.
10,703. Fastenings for Bags, &c., J. A. Jacobs, London.
10,704. Baskets, T. Craven, Manchester.
10,705. Taking-up Motion of Looms, G. W. Rhodes, Manchester.
10,706. Washing Machines, A. R. Strachan and W. Byers, Gateshead-on-Tyne.
10,707. Driving Printing, &c., Machines, A. H. Seggie, Edinburgh.
10,708. Bassinette Backrests, W. H. Brassington, Manchester.
10,709. Protectors for Hats, F. W. Cheetham, Manchester.
10,710. Safety Axle, W. H. Spooner, Birmingham.
10,711. Anthropometrical Measuring Staff, J. W. Waddington, Bradford.
10,712. Apparatus to be Attached to Tram-cars, &c., to Protect Passengers from Cold, &c., G. R. Smith, jun., Birmingham.
10,713. Pedals for Velocipedes, C. J. Morgan, London.
10,714. Photographic Holders, W. H. Richards and W. D. Wilkinson, Birmingham.
10,715. Cutting Fabrics, J. P. Robertson and D. R. Dawson, Glasgow.
10,716. Target for Small-arms Practice, G. Edwards, Worcester.
10,717. Securing Doors, &c., S. Henshaw, Ashton-under-Lyne.
10,718. Oil Lamps, &c., G. Asher and J. Buttress, Birmingham.
10,719. Steam Generators, J. Cran and W. J. Darling, Glasgow.
10,720. Combined Pencil Point Sharpener and Protector, with Rubber, &c., W. and J. S. Hughes, Portmadoc.
10,721. Collecting, &c., Rain-water, T. Mercer, Liverpool.
10,722. Boats' Rowlocks, L. George, London.
10,723. Dyeing Black upon Fabrics, C. J. Cox.—(*A. Jeannolle, France.*)
10,724. Carpets, &c., G. Marchetti, London.
10,725. Automatic Dating, &c., of Tickets, P. Everitt, London.
10,726. Illuminated Signs, &c., F. Bramley, Tottenham.
10,727. Cutting Fustian, &c., J. and T. Marshall, J. Pickles, and T. Hargreaves, London.
10,728. Support for Plants, J. Makin, J. Southern, and J. K. Young, London.
10,729. Thread-winding Machines, J. Booth, London.
10,730. Metallic Valves, A. Beldam, Liverpool.
10,731. Protection from Fire, D. Alexander, Sheffield.
10,732. Disideratum Dessicator, H. Compton, East Indies.
10,733. Rulers, J. R. M. Mallett, London.
10,734. Pedals for Velocipedes, R. F. Hall, London.
10,735. Railway Carriage Couplings, H. E. Newton.—(*A. Türpe and J. Henze, jun., Germany.*)
10,736. Lamps, G. Smith, London.
10,737. Gas Regulator, G. Smith, London.
10,738. Infants' Chairs, H. J. Haddan.—(*T. Opel, Germany.*)
10,739. Shuttles, R. Scott, London.
10,740. Kilns, G. Butchard, London.
10,741. Shutters for Cameras, J. G. Benster.—(*S. S. Benster, United States.*)
10,742. Separating Silver from Lead, W. Pritchard-Morgan.—(*F. Ellershausen, France.*)
10,743. Moustache Protector, V. de Stains, London.
10,744. Rotary Screens, E. Hare and C. Cousins, Lincoln.

11th September, 1885.

10,745. Feed Apparatus for Steam Boilers, W. Burns, Glasgow.
10,746. Bird Cages, C. Mohr, Birmingham.
10,747. Gas Heating Stoves, J. F. and G. E. Wright, Birmingham.
10,748. Stay Busk Fittings, F. R. Baker, Birmingham.
10,749. Presses for Lawn Tennis Bats, W. O. E. Meade-King, London.
10,750. Utilising Heated Air as Motive Power, A. Langdon, London.
10,751. View Meters, F. W. Branson, Leeds.
10,752. Plant for Manufacturing Wrought Iron or Steel Railway Sleepers, E. Dawson, A. T. Harvey, and J. Bow, Glasgow.
10,753. Cameo Art Needlework, H. Whipp, Bradford.
10,754. Packing for Hydraulic Machinery, H. Foster, Newcastle-on-Tyne.
10,755. Cooking Ranges, J. E. Russell, Glasgow.
10,756. Decorticating Fibrous Substances, J. Smith, Jersey.
10,757. Crystal Horseshoe Photograph Frame, H. Johnson, London.
10,758. Treating and Finishing Velvets, E. Weild, London.
10,759. Brushes and Mops, H. Stockman, Hampton.
10,760. Suspension Bridges, G. Garson, Glasgow.
10,761. Facing Tiles or Plates for Concrete Constructions, C. Smith, London.
10,762. Corks, Bungs, &c., Stoppers, F. and H. G. Jacobsen, Glasgow.
10,763. Combined Gas Lighting, Gas Extinguishing and Alarm Apparatus, J. F. Morrison, Glasgow.
10,764. Steam Boiler, &c., Furnaces, H. C. Paterson and R. Miller, Glasgow.

10,765. Coupling and Uncoupling Apparatus, W. Carter, jun., Glasgow.
10,766. Foot Balls, P. A. Martin, Birmingham.
10,767. Bags or Pouches, S. E. Statham, Rusholme-by-Manchester.
10,768. Electro-magnetic Lever Motor, J. C. Sellars, Liverpool.
10,769. Brush Attachment, T. Cox, Leeds.
10,770. Winding Yarns, &c., J. Dodd, G. Bancroft, and T. Walker, Manchester.
10,771. Flash Lights, A. Kinnear, London.
10,772. Cowls, J. Johnson, London.
10,773. Applying the Electric Light to Speculums, &c., T. P. and A. T. Salt, London.
10,774. Imparting Military Instruction to Infantry, C. Fulton.—(*T. J. Haymes, Gibraltar.*)
10,775. Machines for Printing Tickets, &c., J. M. Black, London.
10,776. Checking the Accuracy of Gas Meters, &c., W. B. Davis, Torquay.
10,777. Woven or Knitted Cord Furniture, J. Springer, London.
10,778. Increasing the Brilliancy of Coal Gas, H. E. A. Wallis, London.
10,779. Adjusting Platens of Cutting Machines, R. Brown, London.
10,780. Manufacture of Brass and Copper Wire, G. Christie, Glasgow.
10,781. Mixing Air with Gas, &c., G. A. Schoth, London.
10,782. Spring Mattresses, &c., J. Y. Johnson.—(*L. A. Mathias, France.*)
10,783. Detaching Coal, Stone, &c., C. Armstrong, London.
10,784. Belt Clamps or Stretchers, J. Batley, London.
10,785. Handles of Cricket Bats, W. Sykes, London.
10,786. Propelling Vehicles by Gas, &c., Engines, G. Daimler, London.
10,787. Harvesting Machines, A. C. Bamlett, London.
10,788. Reaping Machines, A. C. Bamlett, London.
10,789. Fire-escapes, W. Gluse, London.
10,790. Cranes, W. Pitt, London.
10,791. Protecting against Danger from Fracture of Overhead Electric Wires, J. G. Chidley, London.

12th September, 1885.

10,792. Looms for Weaving, J. Barker and J. Grindrod, Manchester.
10,793. Ornamenting the Sides and Ends of Bassinettes, &c., W. H. Brassington, Manchester.
10,794. Ever-pointed Pencil Cases, W. E. Wiley, Birmingham.
10,795. Weaving of Dhootas, W. Gadd, Manchester.
10,796. Extracting Shives or Bungs from Casks, J. Smith, Burton-on-Trent.
10,797. Ornamenting the Bodies of Bassinettes, W. H. Brassington, Manchester.
10,798. Submerging Vessels by Mechanical Power, &c., H. W. Jones, London.
10,799. Cutting Pile Fabrics, J. J. Mann, Salford.
10,800. Treatment of Coarse and Inedible Fish, &c., S. D. Cox, London.
10,801. Warming, &c., Railway Carriages, F. G. Myers, Northampton.
10,802. Flushing Syphons, S. H. Adams, Monkbridge.
10,803. Brush, E. W. Cloversley, Freemantle.
10,804. Ammonia, J. B. Hannay, Glasgow.
10,805. Indicating Temperature or Pressure, J. Murrie, Glasgow.
10,806. Washing Clothes, T. Hogarth and J. Carnegie, Edinburgh.
10,807. Fixing Lamp Fittings, &c., F. C. Hockley, Fenny Stratford.
10,808. Producing and Colouring Photographs, &c., W. Trenemen, London.
10,809. Metallic Scraper Mats, J. Brookes and H. Garner, Smethwick.
10,810. Metallic Curtain Rods for Bedsteads, J. Brookes and H. Garner, Smethwick.
10,811. Purlins for Glazing Purposes, J. D. Hatch, London.
10,812. Woven Wire Mattresses, G. H. Horrell, London.
10,813. Mantelpiece, &c., W. H. and G. Barker, London.
10,814. Gas Stoves, H. C. Turner, London.
10,815. Carding Engines, J. and E. Townsend, London.
10,816. Electric Indicator, N. G. Thompson, London.
10,817. Switch for Electric Lighting, N. G. Thompson, London.
10,818. Churns, D. Anderson and D. Hunter, Glasgow.
10,819. Burglar Alarms, W. Brownlie, Glasgow.
10,820. Buttons, Studs, &c., J. Millar, Glasgow.
10,821. Feed-water Heaters and Purifiers, W. Fairweather.—(*Milton W. Hazelton, and the Babcock and Wilcox Company, United States.*)
10,822. Lamps, T. C. J. Thomas, London.
10,823. Disposing of Sewage in Bulk, J. McIntyre, London.
10,824. Shafts and Axles, N. and W. Nathan, London.
10,825. Packing, &c., Explosives, O. Imray.—(*C. E. Bichel, Germany.*)
10,826. Cut-off Valves for Engines, O. J. Ellis, London.
10,827. Solitaires or Fastenings, W. West, London.
10,828. Carriage Lamps, W. Howes, London.
10,829. Fastenings for Gloves, &c., D. I. Emery, London.
10,830. Electrical Apparatus, W. P. Thompson.—(*L. Lenaerts, Belgium.*)
10,831. Tightening Apparatus for Woven Wire, &c., E. Billington, jun., Liverpool.
10,832. Electric Indicator, W. P. Thompson.—(*L. Lenaerts and H. L'Ollivier, Belgium.*)
10,833. Air Burning Gas Iron, H. E. Cooper and J. Smith, London.
10,834. Colouring Matters, H. H. Lake.—(*Wirth and Co., Germany.*)
10,835. Fastening Rails to Sleepers, G. S. Kopff, London.
10,836. Pulverising Sugar, &c., J. R. Woodburn, St. John's, New Brunswick.
10,837. Wrapping Tobacco in Packets, H. H. Wills and W. Rose, London.
10,838. Pigments, A. J. Ward, London.
10,839. Filters, H. L. Doulton, London.
10,840. Locks and Latches, L. C. Mensing, London.
10,841. Material Resembling Gutta-percha, F. J. L. Tytler, London.
10,842. Treating Acid Vapours from Chemical Works, G. F. Redfern.—(*J. Walckenaere, Belgium.*)
10,843. Reed Instruments, G. Leah, London.
10,844. Hanging Carriages, &c., W. H. Bailey, London.
10,845. Brass Ornaments for Bedsteads, E. Peyton, London.
10,846. Annealing Iron and Steel, C. B. Holland, London.
10,847. Weighing Apparatus, A. G. Brookes.—(*F. C. M. Meyer, Germany.*)

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10,848. Valves, A. Horne, Liverpool.
10,849. Utilisation of Bye Products, &c., J. R. Hill, Bury.
10,850. Bobbins, &c., J. Bles, Manchester.
10,851. Washing Machines, H. Avison, London.
10,852. Attaching Chucks, &c., to Spindles, P. A. Allen, Hammersmith.
10,853. Cleansing, &c., Grain, &c., E. Scholes, Manchester.
10,854. Chain Mattresses, I. Chorlton and G. L. Scott, Manchester.
10,855. Fustian Cords, J. Schofield and J. E. Bentley, Manchester.
10,856. Transparent Granulated Gelatine, W. Gill, Belfast.
10,857. Spinning Machinery, J. Wagstaff, Halifax.
10,858. Self-filling Water Cart, W. P. Abell, Hinckley.
10,859. Lubricator for Slides, &c., G. Correll.—(*H. Correll, Germany.*)
10,860. Spring Lock, H. Sulley, Birmingham.
10,861. Water-closets, J. Macleish, Glasgow.
10,862. Coupling Railway Vehicles, J. Graham, Edinburgh.
10,863. Water Waste Preventer for Water-closets, R. Oates, Leeds.
10,864. Door Knockers, T. A. Milo, London.
10,865. Tube Motor for Propelling Ships, W. H. Daniels, London.
10,866. Combined Fire-alarm and Fire-escape Apparatus, E. Aldis, London.
10,867. Punching Machines, A. Nicholson and R. Burrows, London.
10,868. Book-binding, C. Chivers, London.
10,869. Paddle Wheels, W. H. Daniels, London.
10,870. Stopping Bottles, A. C. Calmour, London.
10,871. Reflecting Gas Fittings, J. C. Rothwell, London.
10,872. Manufacture of Bowls, R. Hough and J. Simkin, London.
10,873. Screws with Secured Nuts, A. Schapiro, London.
10,874. Device for Supplying Steam Boilers with Water, J. Stephens and A. Smith, London.
10,875. Hanging Curtains, E. G. Lloyd, London.
10,876. Candles, Night-lights, &c., E. B. Watson and H. B. Fulton, London.
10,877. Contact Makers, J. G. Livesay, London.
10,878. Sheet Metal Working Machines, L. Jackson, Yorkshire.
10,879. Treating of Sewage, C. T. Kingzett, London.
10,880. Cooking Stoves, W. A. Barlow.—(*J. Sottorf, Germany.*)
10,881. Stopper for Bottles, A. B. White, London.
10,882. Pile Drivers, H. H. Leigh.—(*M. Hambrock, Germany.*)
10,883. Tobacco Pipes, D. H. Shuttleworth-Brown, Surrey.
10,884. Bricks, &c., J. T. Welch, London.
10,885. Tricycles, J. White and J. Asbury, London.
10,886. Construction of Foot Paths, W. B. Wilkinson, London.
10,887. Steam Generators, T. and W. Toward, and J. Meek, London.
10,888. Electric Advertising Apparatus, E. L. Berry, London.
10,889. Fare-boxes for Vehicles, H. Gardner.—(*Z. I. Pratt, United States.*)
10,890. Stands for Exhibiting Wearing Apparel, A. W. and G. B. Childs, London.
10,891. Electrical Indicators, H. G. Ellery and J. Gent, London.
10,892. Pneumatic Signalling Apparatus, H. G. Ellery and J. T. Gent, London.
10,893. Apparatus for Recording High Temperatures, G. F. Redfern.—(*L. Evesque and M. H. Fontès, France.*)
10,894. Safety Valve Apparatus, V. N. Cowburn and A. Johnson, London.
10,895. Silos, W. C. Johnson, London.

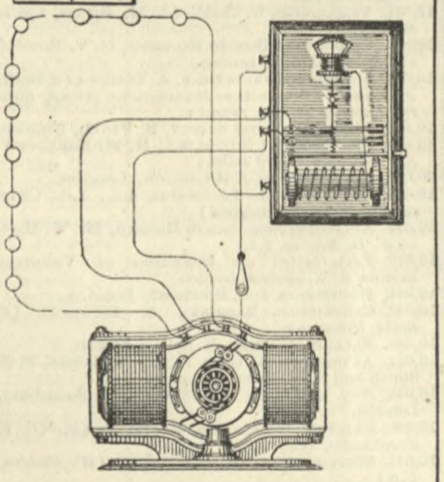
SELECTED AMERICAN PATENTS.

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

323,470. Cut-out for Dynamo-electric Machines, *Charles J. Van Depoele, Chicago, Ill.—Filed November 15th*, 1884.

Claim.—(1) In a system of electric lighting, a dynamo-electric generator having an armature with two independent circuits—one the main and the other the field circuit—and a by-pass or circuit of low resistance around the field magnets, said by-pass being normally open while the machine is in operation, in combination with an electro-magnet in the main circuit, said magnet being adapted on the breaking of said main circuit to close the by-pass circuit, thereby diverting the current from the field magnets in order to stop the production of current in the armature coils on the breaking or interruption of the main circuit, as described and set forth. (2) In a system of electric lighting in which the field circuit of the dynamo or generator is supplied by an independent current from its armature or by a shunt from the same, an electro-magnet in the main circuit operating a short-circuit-

323,470



ing device whenever the main circuit is interrupted or broken, said short-circuiting device shunting through a low resistance the current supplied to the field magnets in order to deprive the latter of their magnetism, and thus to stop the production of current in the machine. (3) In a system of electric lighting wherein the field magnets of the dynamo are excited by a derivation from the main current, an automatic circuit closer, and means, substantially as described, for holding down, as long as the working circuit is closed, a contact bar, putting the field coils of the dynamo in operative condition, and for short-circuiting the field circuit whenever the main circuit is broken or interrupted, for the purpose set forth.

323,503. Combined Ejector and Injector, *David M. Fergus and James A. Griffiths, Philadelphia, Pa.—Filed September 3rd*, 1884.

Claim.—(1) In a combined ejector and injector, the combination, with the ejector chamber C^1, of the pipe N, arranged as shown, cast integral with the body or shell and extended or projected into said chamber and carrying the steam nozzle F, said nozzle being above the water supply pipe C and aligned axially therewith, substantially as shown and described. (2) In a combined ejector and injector having the ejector located below the injector, and the tubes of the former transverse to the axial plane of the latter, both being contained in a single shell or body, a water chamber P, having for its boundaries the walls of the shell and the two bridges which sustain the combining and discharging tubes of the ejector and injector, the discharging end of the ejector tube, the steam nozzle of the injector, and the receiving end of the injector combining tube being located in said chamber, substantially as shown and described. (3) In a combined ejector and injector having a water chamber P, in which are located the discharge end of the ejector tube, the receiving end of the injector combining tube and the injector nozzle, the combination, with said chamber and the chamber Q, in which is located the discharging end only of the injector tube I, of a passage p^1, and valve L, whereby the lifted water is caused to be directly discharged from the ejector on the injector tubes and to submerge the latter, and the passage way between said chambers opened in the preliminary lifting and closed when the injector is forcing, substantially as shown and described. (4) In a combined ejector and injector in which the ejector

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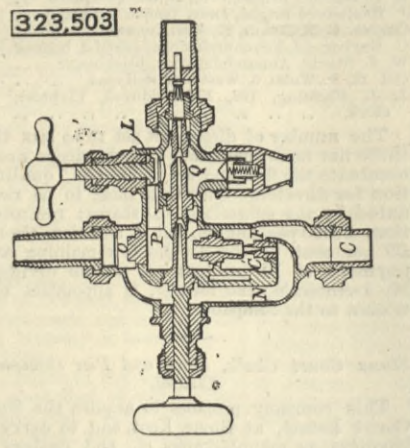
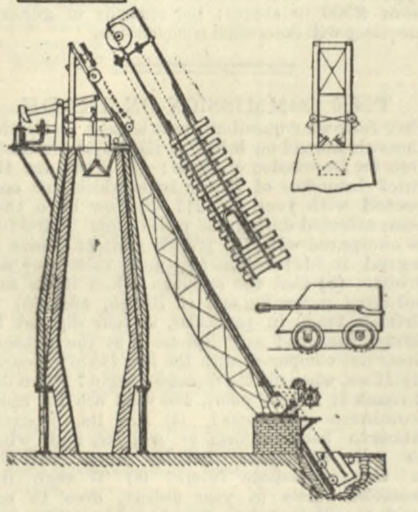


tubes are aligned with the steam inlet of the machine, the plug O, which closes up the entrance opening for said tubes, substantially as shown and described.

323,634. Blast Furnace, *Fayette Brown, Cleveland, Ohio.—Filed January 13th*, 1885.

Claim.—(1) In combination with a furnace having a bell or cone at its top or mouth, and a suitable stationary hoisting motor or machine, a car or carriage, and ways for the same to travel on, the combination being such, as described, that the loaded car may be hoisted from the lower terminus of the track to the upper terminus thereof and its contents dumped into the top opening of the furnace and on to the apex of the cone or bell, as set forth. (2) In combination with a furnace having a bell or cone at its top or mouth, and a suitable hoisting motor or machine, an inclined

323,634



track or roadway, and a car or carriage, whereby the loaded car may be hoisted from the lower terminus of the track to the upper terminus and its contents dumped into the top opening of the furnace and on to the apex of the bell, as set forth. (3) In combination with the furnace provided with a bell or cone, the roadway leading directly to the top opening of the furnace, and the hoisting machine, a car or carriage which travels from the hoisting machine to a point directly over the top opening of the furnace, and means whereby the car is automatically dumped on its arrival at said point, and so as to discharge its contents directly into said top opening, all substantially as shown and described.

323,653. Electric Motor, *Moses G. Farmer, Newport, R. I.—Filed March 27th*, 1885.

Claim.—(1) In an electro-magnetic motor, the combination with a sectional helix or helices and a reciprocating core or cores, of one or more commutators arranged to be moved by the movement of the core or cores, and independent commutator brushes connected with the helix sections, respectively, and arranged to make contact successively with the conducting plates of the commutator, whereby the inductive section or portion of the helix is kept near the end of the core as it moves, as set forth. (2) In an electro-magnetic motor, the combination, with sectional helices and reciprocating cores, of a cylindrical commutator, of insulating material, for each pair of helices, having

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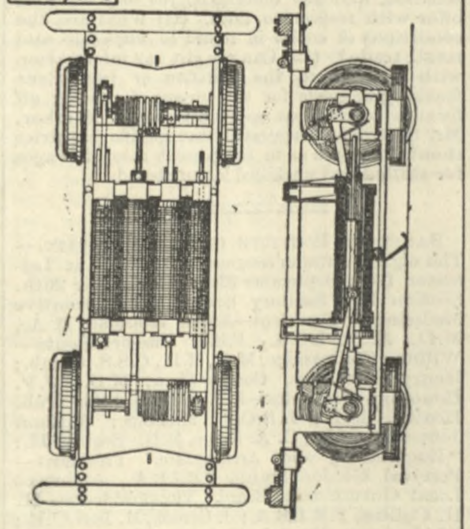

spiral contact strips, and adapted to be revolved by the movement of the cores, brushes bearing on the commutator, and electrical connections from the several sections of a helix to said brushes, as set forth. (3) The combination, with a series of four co-operating sectional helices and reciprocating cores, of two cylindrical commutators, of insulating material, having spiral contact strips and adapted to be revolved by the movement of the cores, brushes bearing on the commutators, and electrical connections from the sections of two of said helices to the brushes of one commutator and similar connections from the sections of the remaining helices to the brushes of the other commutator, as set forth. (4) The combination, with one or more sectional helices and reciprocating cores, of one or more commutators, each composed of an insulating cylinder revolved by the movement of the cores, and two sets of spiral contact strips secured to the opposite sides of the cylinder, two sets of brushes bearing on the spiral contact strips and connected with the sections of the helices, and electrical connections for directing the current to either of the two sets of contact strips, whereby the direction of movement of the cores may be reversed, as set forth. (5) In an electro-magnetic motor, the combination, with a sectional helix and reciprocating core, of a commutator adapted to be revolved by the movement of the core, and consisting of an insulating cylinder provided with continuous circular contact strips, and spiral or diagonal strips connected therewith, brushes bearing on the spiral strips and connected with the sections of the helix, and brushes connected with the circuit wires bearing on the continuous strips, substantially as set forth. (6) The combination, with a sectional helix and reciprocating core, of a commutator adapted to be revolved by the movement of the cores, and consisting of an insulating cylinder provided with continuous circular contact strips, and two sets of spiral or diagonal strips connected therewith, brushes bearing on the spiral strips and connected with the sections of the helix, other brushes bearing on the continuous strips connected with one of the circuit wires, and permanent connections from the other circuit wire to the several sections of the helix, as set forth. (7) The combination, with the main coils of an electro-magnetic locomotive, of coils of high resistance in multiple arc with the main coils and surrounding the lower portion of the wheels, as and for the purpose specified. (8) The combination, with the main coils of an electro-magnetic locomotive, of coils of high resistance in multiple arc with the main coils and surrounding the lower portion of the wheels, and means for making or breaking the circuit through said coils without affecting that through the main coils, as and for the purpose set forth. (9) The combination, with the sectional helices and reciprocating cores of an electro-magnetic motor or engine, of commutators for directing the current through the sections of the helices in the manner described, and having two sets of contact strips, electrical connection for conveying the line current to one set of said strips at a time, and a switch for shifting the current from one set to the other, as and for the purpose set forth.

323,805. Deep Well Pump, *L. and J. P. Griscom, Pottsville, Pa.—Filed November 16th*, 1883.

Claim.—The combination of the tubing, bucket, and sucker rod of a deep well pump, with weighted bar I,

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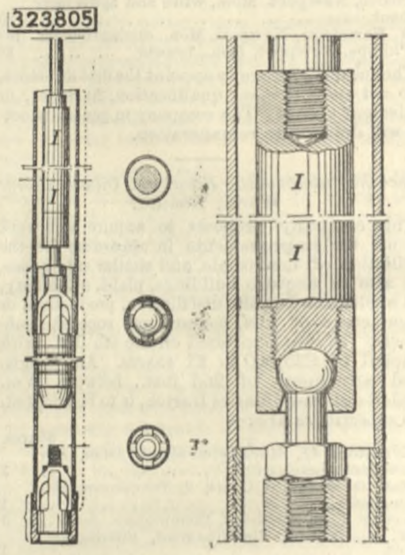

rigidly attached to the lower end of the sucker rod to obviate buckling of the rod on the downstroke, substantially as shown.

323,828. Injector, *Thomas P. Proctor, Boston, Mass.—Filed January 23rd*, 1885.

Claim.—(1) In an injector, the combining tube and main steam nozzle, combined with the main valve containing a lifting nozzle, and the controlling spindle passing through the main valve and into the combining tube, substantially as described. (2) In an injector, the combining tube having a convergent inlet opening, and the main steam nozzle, combined with the main steam valve having a lifting nozzle formed therein, and the controlling spindle passing through the main valve and into the combining tube, the said spindle being provided with a collar operating to move the main valve with relation to the main nozzle, substantially as described. (3) In an injector, the combining tube having a converging inlet opening, and the main

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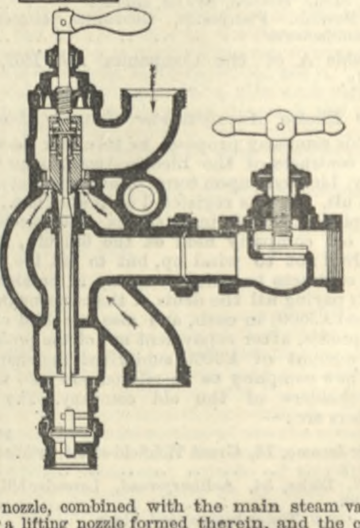

steam nozzle, combined with the main steam valve having a lifting nozzle formed therein, and the controlling spindle passing through the main valve and into the combining tube, the said spindle being provided with a collar operating to move the main valve with relation to the main nozzle, and the said spindle also having diverging and converging portions controlling the passage through the combining tube, substantially as set forth. (4) In an injector, the main casting having inlet and discharge openings at its ends, and a liquid inlet chamber and secondary or overflow chamber enclosed therein, combined with a steam nozzle at one end of the water chamber, and a combining tube passing from the water chamber through the secondary chamber, the inlet opening of the said combining tube communicating with the inlet chamber, and the discharge opening of said tube communicating with the secondary or overflow chamber and with the discharge opening of the injector, substantially as described.