THE UNARMOURED NAVIES OF ENGLAND AND FRANCE.

In The Engineer of Sept. 12th we published an article setting forth the position of the British ironclad navy as compared with that of France, and we now purpose to deal with those portions of the respective navies which are composed of unarmoured and so-called protected vessels. If in our previous paper we were in a position to prove that our ironclad navy is hardly a match for that of France, we are now compelled, unhappily, to admit that we are in the same predicament as regards our unarmoured cruisers. This is just as serious a matter as our deficiency in ironclads, for while we regard the former as the defenders of our shores, we chiefly rely on the swift and powerful cruiser to ensure us an uninterrupted supply of food. It is not our purpose to enter into a lengthy lament on the decay of our naval power, or to abuse the authorities who have allowed matters to come to such a pass; we simply desire to lay before our readers as clear a statement as possible of the true condition of the Royal Navy, feeling assured that a remedy will not be long wanting when the public at large have fully realised the magnitude of the danger to which they are at present exposed. As the number and power of an unarmoured navy is generally supposed to be governed by the extent of commerce, colonial provisions, &c., to be protected by the same, we will refer briefly to this subject before dealing in detail with the French and English cruising fleets.

The British mercantile marine is composed of some 21,500 vessels—including 3650 steamers—with an aggregate measurement of about 9,200,000 tons, whilst that of France consists of about 2900 vessels—including 700 steamers—with an aggregate measurement of 1,055,000 tons. The number of steam vessels of war, including transports, despatch boats, &c., which are available for the protection of the respective merchant navies are 337 vessels, with 2058 guns, for that of England; and 317 vessels, with 1680 guns, for that of France. It will thus be seen that whereas the French mercantile marine is protected in the ratio of one ship of war to nine merchantmen, no less than sixty merchantmen are allotted to the care of each British war vessel. In order to place the British merchant navy on an equal footing with that of France, as regards man-of-war protection, it would be necessary to add 2053 vessels to the Royal Navy, which is, of course, out of the question, and greatly in excess of what is needed. All that is really required is a sufficient number of swift and heavily-armed cruisers to keep those of France in check; and in order to do so effectively the British Navy should be numerically related to that of France in the degree of at least three to two. In how far such is the case may be gathered from the figures which we have quoted above, and on nearer inspection it will be found that even our slight majority of twenty vessels is almost entirely composed of paltry gunboats.

The French Government are fully aware of the enormous hold the possession of an efficient fleet of cruisers gives them upon the friendship of England, and a glance at the French Navy List will show how admirably most of their cruisers are suited to the task of destroying an enemy's commerce. Readers of naval history are aware that throughout the old French wars it was generally the policy of the officers in command of the enemy's cruisers to avoid our ships of war as much as possible, and to devote their chief attention to the destruction of our commerce. This was usually attributed by our sailors to pusillanimity on the part of the French, but without reason; and it is probable, as we have recently pointed out, that in the event of hostilities with France we should have a repetition of the old story. There are at present building at La Seyne and St. Denis eight small vessels which are deserving of considerable attention. These are the torpedo despatch boats of the Sainte Barbe type, which have a displacement of only 280 tons, but are expected to realise a mean speed of 17 knots per hour. They are each armed with two long 5½in. breech-loading guns, three machine guns, and with two torpedo tubes. Vessels of this class could hover about our ports regardless of anything we could send against them, as they might easily avoid our heavy cruisers, and their great speed would enable them to find shelter long before even the Iris or Mercury could get within range.

Before proceeding further with this subject, we will give a short summary of the entire naval forces of England and France, viz.:—

	England.		France.
Ironclads, built and building... ...	62	(incl. Hero)...	70
Armoured torpedo rams...	1	... ...	—
Armed torpedo cruisers	1	... ...	12
Cruisers of 3000 tons and upwards	18	... ...	10
,, 2000 to 3000 tons ...	17	... ...	12
,, 1000 to 2000 tons ...	37	... ...	30
,, 700 to 1000 tons ...	37	... ...	19
Screw vessels under 700 tons ...	95	... ...	77
Armed troopships, transports, &c.	14	... ...	46
Paddle vessels, yachts, &c.	22	... ...	30
Torpedo depôt ships	1	... ...	1
Obsolete steam vessels	32	... ...	10

This table gives England a majority of twenty-seven in cruisers of 700 tons and upwards; but this advantage disappears to a great extent if we add to the list of French cruisers fifteen "transport-avisos," which type of vessel is a match for many of our sloops and gun vessels, as the following example will show:—H.M.S. Sappho is a screw sloop of 940 tons, mounting two 7in. and two 6in. muzzle-loading guns, and capable of steaming at a speed of 10·6 knots; whilst the French Nièvre is a "transport-aviso" of 1597 tons, mounting four 5½in. steel breech-loading guns, and possessing a speed of 11·5 knots per hour. The French despatch transport is therefore better adapted for a cruiser than the English sloop-of-war, as she is considerably swifter under steam, and, owing to her large dimensions, a better sea boat.

On the outbreak of a war with France there would be a great demand for fast cargo steamers, to run between this country and foreign grain ports, as the premium for insurance against capture would detain the greater number of our merchant vessels in port, or compel them, at least, to put to sea at long intervals and under powerful man-of-war convoy. Fortunately for the general British public, the entire passenger traffic between Europe and America would be transferred to the German, Danish, Dutch, and Belgian lines, so that our magnificent Transatlantic steamers would be available as grain carriers—unless, indeed, they were sold to foreign owners. This fact is perfectly well known to the French naval authorities, and they have accordingly studied to give their cruisers as high a rate of speed as possible. Their endeavours have been crowned with success, as the French unarmoured navy includes no less than twenty-eight cruisers capable of steaming at speeds ranging from 15 to 18 knots per hour; whereas England possesses only eighteen vessels of similar steaming powers, or ten less than France. As these facts are somewhat startling, we will give a few particulars of the respective vessels in each navy, viz.:—

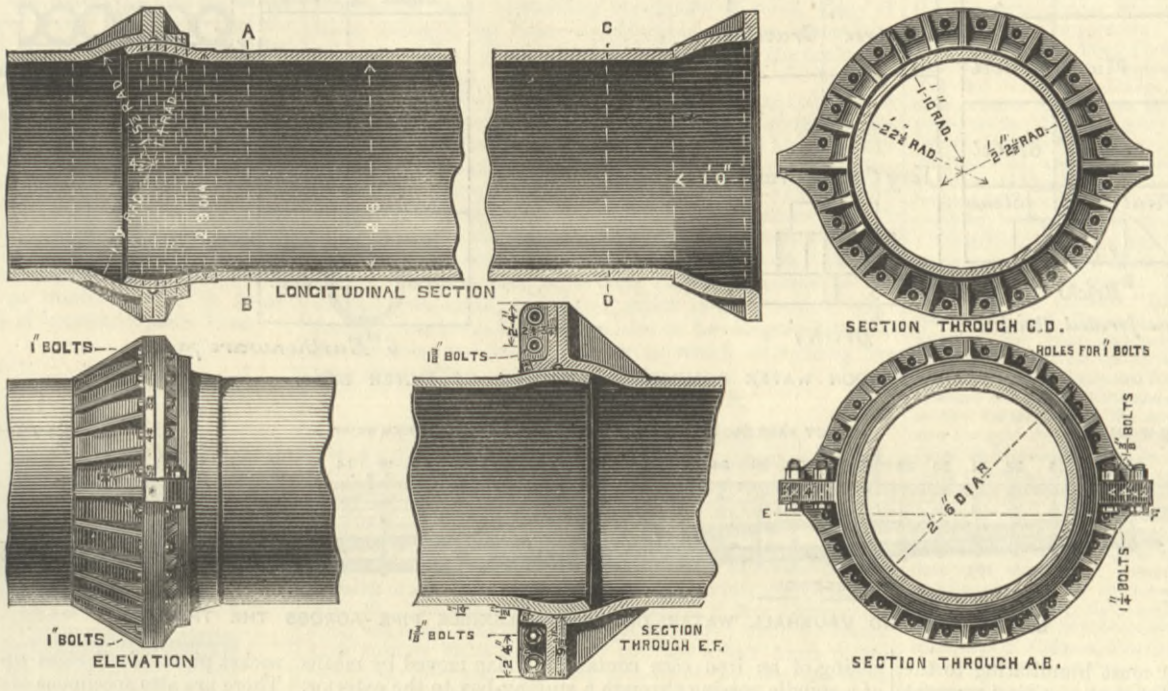
French Cruisers				British cruisers.			
Name.	Tons.	Guns.	Speed	Name.	Tons.	Guns.	Speed
Duquesne	5522	22	16·8	Inconstant ..	5782	16	16·6
Tourville	5616	22	16·9	Shah	6040	26	16·3
Sfax	4488	8	*17·0	Raleigh ..	5200	22	15·4
Dubourdieu	3355	24	*16·0	Bacchante ..	4130	16	15·2
Duguay Trouin ..	3189	10	15·9	Boadicea ..	4140	16	15·0
Villars	2268	15	15·5	Iris	3735	10	18·6
Roland	2268	15	15·0	Mercury ..	3735	10	18·9
d'Estaing	2236	15	15·4	Volage	3078	12	15·4
Nielly	2236	15	15·2	Mersey	3550	14	*18·0
Primauget	2236	15	15·3	Severn	3750	14	*18·0
Du Petit Thouars	1962	10	15·1	Thames ..	3750	14	*18·0
Seignelay	1943	8	15·0	Arethusa ..	3748	10	16·7
Sané	1876	6	15·1	Leander ..	3748	10	*16·0
Eclaireur	1627	8	15·0	Phaeton ..	3748	10	*16·0
Milan	1546	5	*18·0	Amphion ..	3748	10	*16·0
Condor	1268	5	*17·0	Scout	1430	4	*16·5
Epervier	1268	5	*17·0	Alacrity ..	1400	4	*16·0
Faucon	1268	5	*17·0	Surprise ..	1400	4	*16·0
Vautour	1268	5	*17·0				
Hirondelle	1036	3	15·6				
Bombe	280	2	*17·0				
Couleuverine ..	280	2	*17·0				
Dague	280	2	*17·0				
Dragonne	280	2	*17·0				
Flèche	280	2	*17·0				
Lance	280	2	*17·0				
Salve	280	2	*17·0				
Sainte-Barbe ..	280	2	*17·0				

It will be seen that the English cruisers are, as a rule, more powerful than those of France, being built chiefly for battle, whilst many of the latter are principally intended for the capture or destruction of merchant vessels. A speed of 15 knots per hour may be regarded as the lowest limit for an efficient modern cruiser, as such vessels should not only be able to overhaul strange merchant ships, but also—and this is a very important point—have some chance of avoiding an enemy of greatly superior force. It is surprising, therefore, that many of our newest cruisers, which embody all the most modern improvements in naval architecture and armament, such as steel hulls, armoured decks, torpedo launching apparatus, &c., should be so greatly deficient in speed. We have, for instance, that splendid corvette the Comus and her eight sister ships of the "C" class, which are well protected in vital parts, heavily armed, and carry a numerous crew, yet the highest rate of speed attained by any of these corvettes is only 14·2 knots per hour. Should the Comus, for example, fall in with any single one of the twenty-eight French cruisers enumerated above, the enemy will be in the position either to fight or to avoid combat, just as he pleases. Of cruisers with speeds ranging from 14 to 15 knots, England and France each have eleven, viz., English cruisers:—Euryalus, Rover, Active, Calliope, Calypso, Cleopatra, Conquest, Curaçoa, Canada, Cordelia, and Constance. French cruisers:—Iphigénie, Naïade, Magon, Forfait, Lapérouse, Champlain, Fabert, Dupleix, Chateau Renaud, Desaix, and Rigault de Genouilly.

* Estimated Speed.

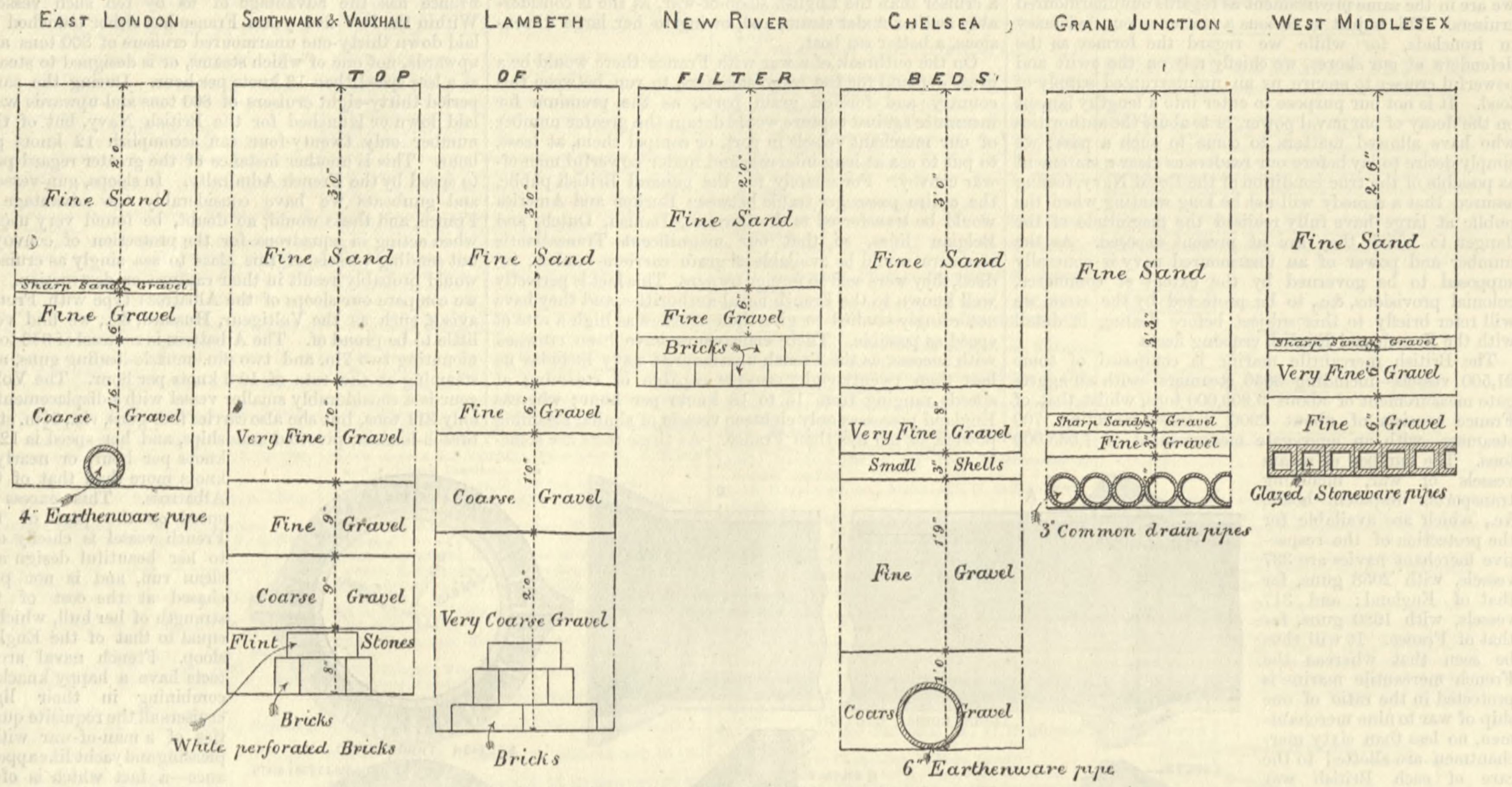
We have now dealt with the swift cruisers of both navies, and have arrived at the unpleasant conclusion that France has the advantage of us by ten such vessels. Within the last five years France has either launched or laid down thirty-one unarmoured cruisers of 800 tons and upwards, not one of which steams, or is designed to steam, at a less speed than 12 knots per hour. During the same period thirty-eight cruisers of 800 tons and upwards were laid down or launched for the British Navy, but of this number only twenty-four can accomplish 12 knots per hour. This is another instance of the greater regard paid to speed by the French Admiralty. In sloops, gun-vessels, and gunboats we have considerably the advantage of France, and these would, no doubt, be found very useful when acting in squadrons for the protection of convoys; but sending vessels of this class to sea singly as cruisers would probably result in their capture or destruction. If we compare our sloops of the Albatross type with French avisos, such as the Voltigeur, Hussard, &c., we find very little to be proud of. The Albatross is a vessel of 940 tons, mounting two 7in. and two 6in. muzzle-loading guns, and steaming at the rate of 10·6 knots per hour. The Voltigeur is a considerably smaller vessel with a displacement of only 811 tons, but she also carries four guns, viz., 5½in. steel breech-loaders, pivotted amidships, and her speed is 12·48 knots per hour, or nearly 2 knots more than that of the Albatross. This excess of speed on the part of the French vessel is chiefly due to her beautiful design and clean run, and is not purchased at the cost of the strength of her hull, which is equal to that of the English sloop. French naval architects have a happy knack of combining in their light cruisers all the requisite qualities of a man-of-war with a pleasing and yacht like appearance—a fact which is often deeply felt by our officers on foreign stations. It is not, however, of the general design of our cruisers that we complain, for as fighting vessels they appear to be all that can be desired, but we wish to draw attention chiefly to two circumstances, viz., that our unarmoured Navy is numerically insufficient, and that a very large portion of the vessels composing the same are deplorably deficient in speed — probably the most important requisite of a modern cruiser. It will be remembered that an opinion was at one time prevalent to the effect that a high rate of speed could only be attained by vessels of very large dimensions, until Sir E. J. Reed demonstrated the fallacy of this assumption by designing the Pallas. The Iris and Mercury, designed by Mr. N. Barnaby, and the Sfax, of the French Navy, designed by M. Bertin, which are the swiftest cruisers of the respective navies, are vessels of considerable size; but Herr Dietrich, chief constructor of the German Navy, has shown that a high rate of speed can be got out of a cruiser of, comparatively speaking, insignificant dimensions. We refer to the Blitz, launched in 1882, which is a vessel of only 1380 tons. She carries an armament of one 4¾in. and four 3⅜in. Krupp guns, as well as torpedo discharging apparatus, and is propelled at a speed of 16·2 knots by engines of 2816 indicated horse-power. The successful performances of this craft have, no doubt, induced our own and the French naval authorities to follow suit, the former with the Alacrity and Surprise, and the latter with the vessels of the Condor type.

We have already observed that speed is, in our opinion, the most important requisite of a modern cruiser, even if it is purchased to some extent at the cost of her fighting power. Messrs. Sir W. G. Armstrong, Mitchell, and Co. have, however, proved that an enormously powerful armament can be combined with a high rate of speed in vessels of moderate or even small dimensions. The Protector, for instance, is a vessel of only 900 tons; yet she steams 14·2 knots, and carries one 8in. and five 6in. breech-loading guns. The Japanese cruiser Tsukushi is another vessel of the Elswick type. She has a displacement of 1500 tons, steams 17 knots, and mounts two 10in. and two 4¾in. breech-loading guns. The largest vessels of this class at present afloat are the Italian Giovanni Bausan and the Chilian Esmeralda, sister-ships. The Esmeralda has a displacement of 3000 tons, a mean speed of 18·3 knots per hour, and carries two 10in. and six 6in. breech-loading guns. It is not probable that her designer, Mr. W. H. White, will rest satisfied with these results, and we may therefore expect to hear of even still greater achievements ere long. Unfortunately, the British Navy has not as yet derived any benefit from the experience and enterprise of the Elswick firm; and while Italy, Austria, Japan, China, Chili, and other possible enemies are availing themselves of our national resources, we are "fascinated" by the activity prevailing around us, and are seemingly incapable of energetic exertions. The smaller foreign naval Powers, notably Germany, are watching the gradual decline of our

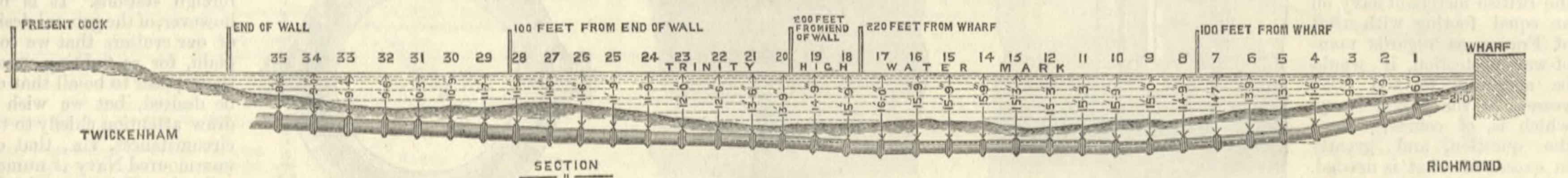


SOUTHWARK AND VAUXHALL WATER COMPANY—DETAILS OF FLEXIBLE PIPE ACROSS THE THAMES.

naval supremacy with evident satisfaction, as their second-rate fleets are thus brought into greater prominence. The German Navy is composed of seventy-four steamships, including twenty-seven ironclads, which force is sufficient to secure an overwhelming majority to the navy of either France or England, should the interests of the Empire necessitate its active participation on one side or the other in the event of war between England and France.



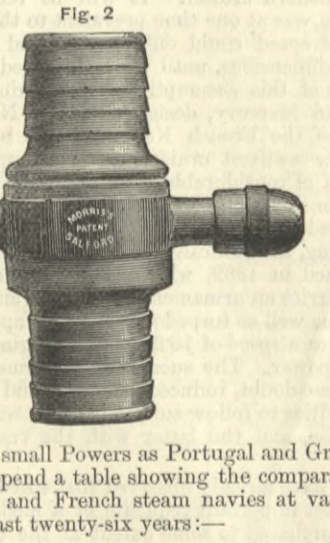
LONDON WATER COMPANIES — SECTIONS OF FILTER BEDS.



SOUTHWARK AND VAUXHALL WATER COMPANY — FLEXIBLE PIPE ACROSS THE THAMES.

It cannot be denied that it is most humiliating to the pride of the "first naval Power" that at a critical moment her supremacy may be destroyed by the alliance with

Fig. 2



France of even such small Powers as Portugal and Greece. In conclusion, we append a table showing the comparative strength of British and French steam navies at various periods during the last twenty-six years:—

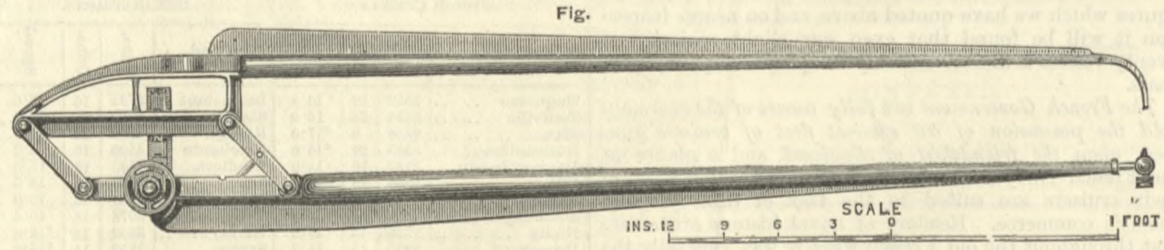
1858	England	530 steamers	8 ironclad
,, ...	France	265 ,,	8 ,,
1868	England	412 ,,	48 ,,
,, ...	France	336 ,,	44 ,,
1878	England	339 ,,	54 ,,
,, ...	France	283 ,,	56 ,,
1884	England	337 ,,	63 ,,
,, ...	France	317 ,,	70 ,,

THE LONDON WATER COMPANIES AT THE INTERNATIONAL HEALTH EXHIBITION.

No. II.

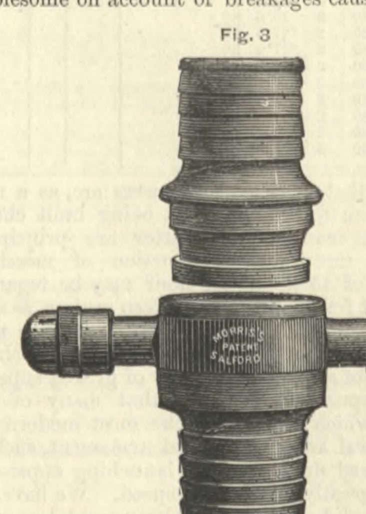
Most of the companies exhibit a number of samples of old water fittings and pipes, many of which are of considerable interest. Towards the end of the sixteenth century the water supply of the City of London seems to have been distributed by means of leaden pipes; but as these were probably found too expensive, they were shortly replaced by wooden pipes formed out of the trunks of elm trees, cut into lengths and bored out from 6in. to 12in. in diameter, according to the pressure they were required to carry. The joints of these pipes were made by forming one end into a conical spigot, and recessing the other to correspond, the several lengths being simply driven into one another. Such pipes as these were first laid down about 250 years ago, and they were very generally used in London up to about the year 1807, and to a later date in many provincial towns. It need hardly be mentioned that they were extremely defective, inasmuch as about one-fourth of the water supply was wasted by leakage, and the decay of the wood was so rapid that the pipes had to be replaced every twenty years. The valves and fittings of these pipes were also of an exceedingly primitive description, the former, even at a late date, consisting of an iron case containing a flap moved by means of a spindle passing through a stuffing-box to the exterior. Numerous examples of these fittings may be seen at the stand of the New River Company, the oldest of any of the existing water companies; and here, as well as in several parts of the corridor surrounding the pavilion, may

Fig.



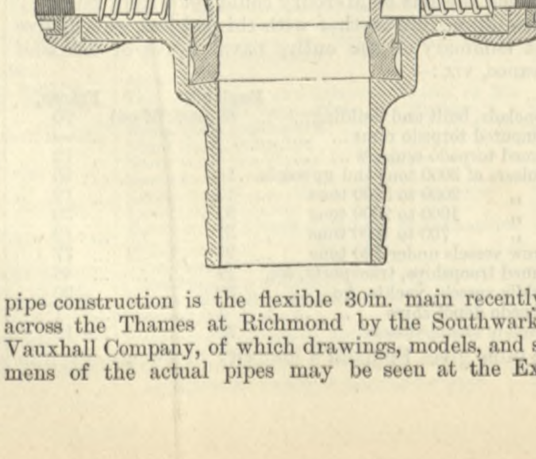
also be found specimens of the old lead and elm pipes. In the beginning of the present century cast iron began to be substituted for wood, and with this dates the commencement of the modern systems of distribution. At first flange joints were used, but were found exceedingly troublesome on account of breakages caused by expansion

Fig. 3



and contraction from variation in temperature, and so were speedily abandoned and replaced by a spigot and socket somewhat similar to what is now used, but in which the joints were made by driving wood and iron wedges into the socket. These, however, though less troublesome than the flange joints, were still the cause of considerable annoyance and expense, as the water saturating the wood in course of time caused it to expand and burst the sockets. Ultimately the present common socket joint, with yarn and lead packing, or lead without yarn, was introduced, and perhaps there is now no part of the whole system which gives as little trouble in maintenance as these joints. Almost at every turn in the Water Companies' Pavilion the visitor is confronted with examples of common socket pipes of all sizes up to, we believe, 4ft. diameter. There are also specimens of pipes with conical turned and bored joints in which no lead is required, a system which is favourably looked upon by many engineers. A recent example of pipe-laying with turned and bored joints was carried out at Blackburn not long ago by Mr. Bryan, the present engineer to the East London Water Company. This main was 36in. diameter, and weighed altogether some 22,000 tons; and in order to allow for expansion and contraction, every tenth pipe had an ordinary lead joint. Perhaps one of the most remarkable instances of special

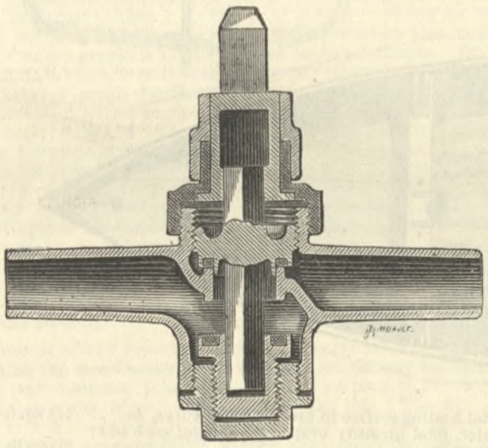
Fig. 4



pipe construction is the flexible 30in. main recently laid across the Thames at Richmond by the Southwark and Vauxhall Company, of which drawings, models, and specimens of the actual pipes may be seen at the Exhibition. Our engravings, which have been prepared from plans kindly supplied by Mr. Restler, the engineer to the company, fully show the construction and nature of the work. The main body of the pipes is 1¼in. thick. At one end is a spigot about 8in. long, which is truly turned as a portion of a sphere 2ft. 11in. diameter. At the other end is a socket, bored accurately to receive the spigot, and provided with a loose cap in halves, also bored, which, when bolted in its place, holds the spigot firmly in the socket, but not so tight as to prevent it moving round its centre. A recess is formed in the socket, at the joint of the cap, for receiving a vulcanised india-rubber ring for preventing leakage. This main is, we believe, the first successful example of its kind. It was put together on barges and sunk by means of guide piles, being afterwards tested by compressed air.

In casting pipes, more especially if of large dimensions, it is not only necessary to have each length of the specified weight, but it is also of extreme importance to have the metal distributed in equal thickness all around the circumference in order to preclude, as far as possible, all chance of breakage after laying, with consequent expense in removal and replacement. To facilitate accurate inspection in regard to this point, Mr. A. W. Scott, Park-lane, Stoke Newington, has designed a special calliper, which is exhibited by the New River Company, and illustrated by us in Fig. 1. It consists of two long arms, strongly though lightly constructed, which are connected at one end by a parallel motion in such a manner that, whatever may be the distance between the steel points at the end of the arms, it is accurately registered on a suitable scale. One of the arms is of T section, and is provided with a fixed curved end. The other is tubular, and contains a sliding bar, which projects at the outer end and forms the second measuring point, a steel screw being provided for adjustment. The other end of the sliding bar is fitted with a rack gearing into a pinion worked by a small hand wheel, so arranged that by travelling the bar out or in the points can be kept opposite each other as the callipers are opened and closed. A pinion and hand wheel are provided for opening and closing, and the distance between the arms is such as to admit of the instrument being used for gauging the thickness of curved pipes as well as straight lengths. For columns and other castings special callipers are made. We understand that a number of the principal water and gas companies are already using Mr. Scott's instrument; and we have no doubt it will be found extremely useful in the hands of inspectors and others.

Fig. 5



Sluice valves are exhibited in great abundance, but demand no special notice. There are also a number of models and sections of actual pipes and cocks illustrating different methods of connecting house service pipes to constant pressure mains without shutting off the supply. Of these we may specially draw attention to the arrangement of Mr. Morris, the engineer to the Kent Company, which includes a special apparatus for drilling and tapping the pipes when under pressure and fixing the connection. Some of the companies have large displays of fire fittings, hydrants, &c.; but the only novelty appears to be the patent instantaneous coupling for stand pipes and fire hose, made by Mr. John Morris, Salford, which is exhibited by the East London Water Company. Figs. 2, 3, and 4 show the details of this coupling, which, as will be seen, is extremely simple. It consists of a spigot having a shallow groove around its outer circumference, and a socket with two or more sliding catch pieces, the joint being made by simply pushing the spigot well up into the socket, so that the catches, which are kept up by spiral springs, engage in the groove. Leakage is prevented by an india-rubber ring acting in the manner of a cupped leather, so that the higher the pressure the tighter the joint. By thus entirely dispensing with the use of screws, it seems to us that a great advance has been made. Those practically acquainted with the extinguishing of fires know only too well how important it is to be able to bring the jets into action at the earliest possible moment after an outbreak, a fraction of a minute often being of the greatest value. Anything that facilitates this should be looked upon as of paramount importance, provided it is not deficient in other respects; and though we do not go so far as to state that Mr. Morris's coupling is the best that can be devised, it is certainly to our minds a step in the right direction, and as such it deserves the attention of all those interested in the abatement of fires. The chief advantages claimed are that the joint can be made by unskilled persons in less than half the time it would take a trained fireman to couple up by screwing; no key is required; the operation of coupling is performed with nearly the same facility in total darkness as in the light, and that a twist can be taken out of the hose while the pressure of water is on, the groove in the spigot admitting of its being readily turned round. All these are of importance. Mr. Morris's coupling has been well tried in many provincial towns, and has, we understand, invariably given satisfaction.

It would be interesting to have some details of the experience of different engineers in regard to the preparation of filter-beds and the results of filtration. Each company shows a full-sized section of its filter-beds, and, to the uninitiated, the series appears more like an exhibition of the number of different combinations that can be obtained with the three or four materials of which the beds are composed, than examples of actual work. Surely with one description of water one form of filtration must be better than another, and at the present time, when so much is being said about the presence of impurities in potable water, it should be worth some one's while to thoroughly investigate the matter, and ascertain what is really the best plan. The annexed sketches show the filtering media employed by the various companies. The head of water over the beds varies considerably, but the rate of filtration is practically the same for all the companies.

Fig. 5 shows a section of Bell's patent double-valve fullway cock, as exhibited by the Southwark and Vauxhall Company, which has been specially designed to meet the requirements of the Metropolitan Water Company, under the Board of Trade regulations. There is no stuffing-box, and the screwed spindle does not rise when the cock is opened. In order to effect repairs, the top cover can be unscrewed, and the upper valve removed, without shutting down and emptying the main, escape being prevented by the lower valve, which is screwed up to its seat in the process of unscrewing the cover, by means of the square spindle which, as will be seen from the engraving, imparts whatever movement is given to the cover to the internal nut forming the lower valve. It is, therefore, impossible for the cover to be removed until the lower valve is properly upon its seat. The cocks are made of gun-metal, and tested to 600ft. head. The Diamond Rock Boring Company show cases containing specimens of cores, many of them brought up from considerable depths in sinking artesian wells. They also exhibit many of the tools employed in boring.

Though the foregoing is not by any means an exhaustive review of the principal exhibits of interest brought together by the water companies, it will suffice to generally indicate their nature. Whether it is in regard to statistics, maps and plans, models and drawings of engines and works, or in regard to the numerous appliances used in obtaining and distributing water to the consumer, the exhibition is practically exhaustive, and Sir Francis Bolton, who organised it, as well as the engineers to the several companies, on whom much of the work of preparation has necessarily fallen, are to be congratulated on the complete and taking manner in which everything has been arranged.

A RACE ACROSS THE ATLANTIC.

The great ocean race between the National and Cunard Liners, the America and the Oregon, was brought to a conclusion at 2.41 Greenwich time on Wednesday. It resulted in favour of the Oregon by about five hours, the America not reaching Queenstown until 8.5. The Oregon left about twenty minutes in advance. The weather was very fine, and the average daily running of the Oregon was over 400 miles, while on Tuesday it was 430. The Oregon made the passage in 6 days 12 hours 27 min., while the America took 6 days 18 hours; but the National Line steamer had a stoppage of two and a half hours on the second day after starting, owing to some of the bearings getting heated, while the Oregon had a stoppage of only ten minutes. Up to two o'clock on the day of starting the Oregon seemed to be gaining a little on the America, but three hours later the America appeared to be creeping up. Soon after, however, she was lost to view, and from that moment neither vessel sighted the other, so that matters were rather tame on board both steamers. The America went a little more to the south than did the Oregon, and her course was eight miles longer, the entire journey accomplished by the Oregon being 2819 miles, while the America did 2827. The following are the runs of the America: —Up to noon on the 9th she made 441 miles; on the 10th, 302; on the 11th, 395; on the 12th, 375; on the 13th, 393; on the 14th, 428; on the 15th, 393. The Oregon's runs are as follows: —Up to noon on the 8th, 47 miles; on the 9th, 426; on the 10th, 402; on the 11th, 406; on the 12th, 410; on the 13th 420; on the 14th, 430; on the 15th, 278. It is a noteworthy fact that the consumption of coal of the America is 180 tons per day, and that of the Oregon 280 tons. Taking the best day's run of the Oregon, 430 miles, we find that she burned coal at the rate of ·655 of a ton per mile nearly. The last run of the America was 428 miles, corresponding to a consumption of ·42 ton per mile. Whether it is worth while to burn 600 tons of coal extra to shorten the passage across the Atlantic by five hours, may perhaps be questioned. The last word has not been heard on this subject however, and the Oregon has her work cut out for her if she continues to race her rival. Meantime the Alaska, the greyhound of the Atlantic, seems to be out of the racing business altogether.

PUMPING ENGINES.

On page 296 we illustrate a pair of high-pressure horizontal engines, with one pair of double-action plunger pumps, fixed behind the engines on a continuous bed, made by Messrs. Richard Bradley and Co., Victoria Foundry, Wakefield, and designed for forcing water from the bottom of a pit to the surface. They make these engines and pumps of various sizes, but this is from a photograph of a pair supplied to Messrs. John Naylor and Co., of Pildacre Colliery, Ossett. The cylinders of the engines are 14in. diameter, having a 3ft. stroke. The pumps are double-acting, 6in. diameter, with inlet and outlet clack boxes, fitted with brass clacks. These engines are fixed at the bottom of the shaft, 120 yards from the surface, and running up to thirty revolutions per minute, raise 22,000 gallons of water per hour. This firm has just supplied a pair of engines and pumps of the same design as above, but with cylinders 16in. diameter, to Strafford Main Colliery. They are fixed 200 yards from the surface. Also to Messrs. Locke and Co., of St. John's Colliery, Normanton, which engines have replaced a set of 13in. lifting pumps, and consequently dispensed with all cumbrous spear rods and legs, &c., and which are all giving great satisfaction. The advantage of the pumps is in having long stroke, consequently less wear and tear on the valves or clacks than pumps having short strokes and running at greater speeds. All the working parts are very easily got at for inspection and repairing. These engines can also be adapted for hauling by disconnecting the pumps when not required for pumping, in which case disc couplings are supplied, or where sufficient storage of water can be provided, the engines could be economically used for hauling and pumping at the same time. In proof of the efficiency of these pumps, the same engines that were used by Messrs. Locke and Co., for working their 13in. lifts, which were only able to deal with 150 gallons per minute, are now working two sets of these pumps direct from the piston-rod end, as illustrated, and are able to deliver to the same height 300 gallons per minute. These engines have been running night and day since April, 1882, without having any repairs done to them whatever.

Calculating Scales.—There are not many calculating scales which commend themselves to our notice, and very few to which we should not prefer a piece of chalk, or a pencil and blackboard or paper to chalk or pencil upon. We are able, however, to give Mr. Lala Ganga Ram, A.I.C.E., Executive Engineer of the Indian Public Works Department, credit for producing a calculating scale, which we have been able to use in a few minutes. He has made three scales, one for scantling and stresses of beams and trusses, another for thickness of retaining walls, and the third for strains on girders. Of these we have received a copy of the second, and can recommend it as a scale that can be learned in a few minutes, and will save a good deal of time. If the other scales have anything like its simplicity they will acquire a very large sale. Mr. Lala Ganga Ram had better devote his mind now to a simple scale for continuous girders, and so save some of our correspondents much trouble; it must be simple—we can only allow him as much timber and work as there is in his retaining wall scale.

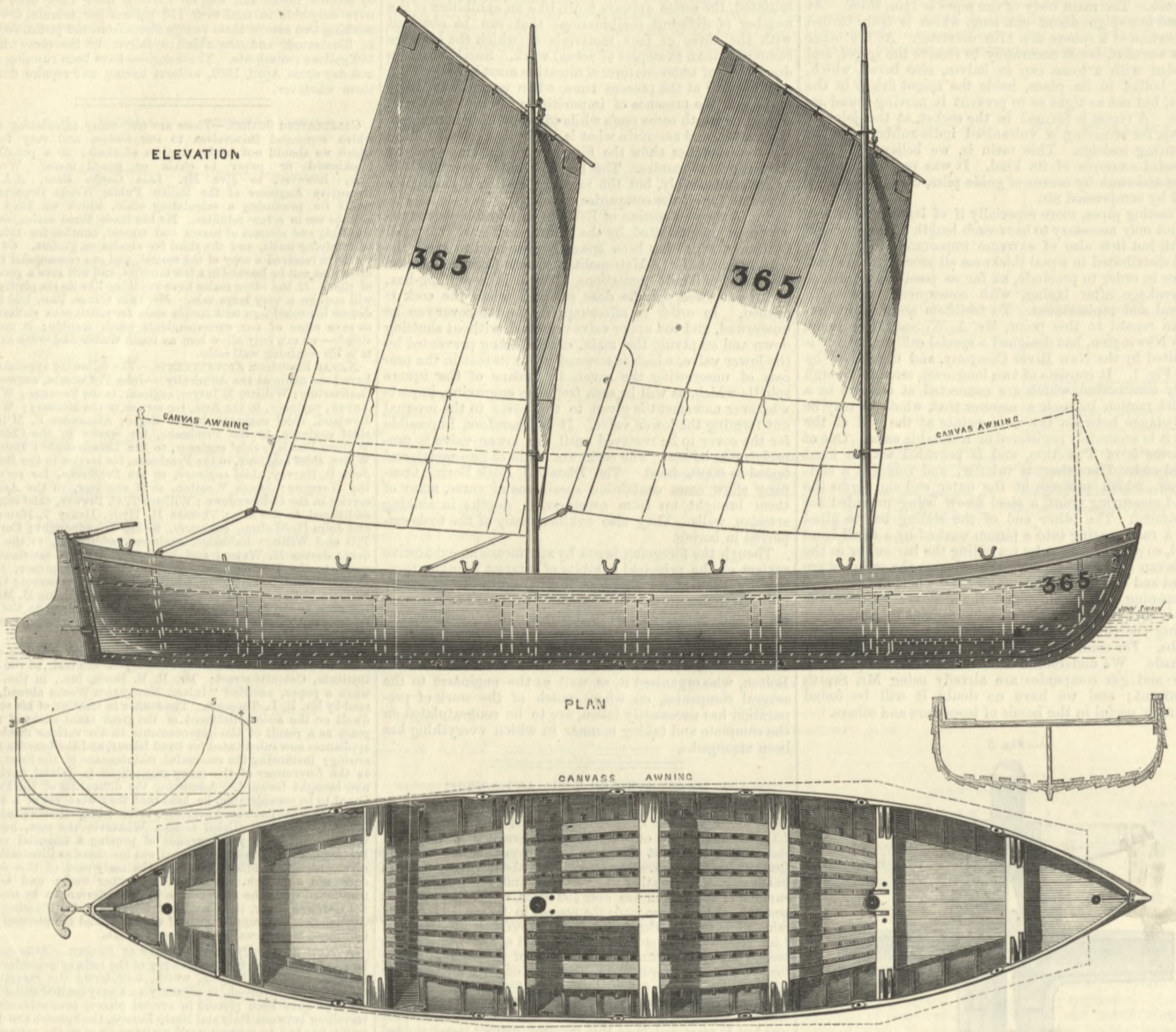
Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—John T. Coombs, engineer, to the Starling; William M'Intyre, engineer, to the Revenge; William Annan, engineer, to the Asia, for service in the Mercury; William Rowland, chief engineer, to the Eagle; Alexander F. M'Intyre, chief engineer, to the Pembroke, for service in the Chasseur; William Barclay, chief engineer, to the Dreadnought; Henry W. White, chief engineer, to the Pembroke, for service in the Benbow; John R. Harvey, chief engineer, to the Pembroke, for service in the Warspite; James Wootton, chief engineer, to the Asia, for service in the Camperdown; William T. C. Brewer, chief engineer, additional, to the Asia; Thomas H. Hyde, Henry T. Hammond, and John H. Walton, engineers, to the Dreadnought; Cornelius Pitt and William Rabbidge, engineers, additional, to the President; James H. Watson and William J. Waugh, assistant engineers, to the Dreadnought; William Walker, engineer, to the Decoy; John Kerr, engineer, additional, to the Audacious; George William Noll, assistant engineer, to the Wye; William H. Michell, engineer, to the Mallard; John G. Stevens, engineer, to the Cambridge, for service in the Gorgon; Edward J. Rutter, assistant engineer, to the Asia, as supernumerary.

Liverpool Engineering Society.—The ninth meeting of the session was held on Wednesday evening, the 8th inst., at the Royal Institute, Colquitt-street; Mr. R. R. Bevis, jun., in the chair, when a paper, entitled "Inland Navigation Works abroad," was read by Mr. R. L. Tapscott. The author in treating of his subject, dwelt on the accomplishment of the great canal works of recent years as a result of the improvements in the various mechanical appliances now substituted for hand labour, and the benefits thence arising; instancing the successful maintenance of the Suez Canal as the forerunner of the many suggestions for inland navigation now brought forward. Admitting the difficulties of the Panama Canal to be considerable, he held that they were yet of a similar nature to what have been overcome before; but, all taken together, presented an unparalleled series. Whatever the cost, however, the work had every appearance of proving a financial success. Passing on, the Amsterdam Canal was instanced as illustrating the surmounting of difficulties which the early part of this century dare not approach. Amongst the other works and schemes mentioned were the entrance to the Mediterranean by means of the Garonne River, the flooding of the Sahara, the draining of the Zuyder Zee, the improvement of the Neva, and the piercing of the isthmuses of Malacca, Florida, and Corinth.

A New Trans-Pyrenean Railway System.—Attention has long been drawn to the insufficiency of the railway accommodation between France and Spain, which, considering the magnitude of the interests involved, is certainly on a very limited scale. While the Alps have been pierced in several places, revolutionising the travelling between Italy and North Europe, the Spanish and French traffic has had to content itself with two lines on the extreme east and west of the Peninsula—the one from Gerona to Port Vendres by Banyuls, the other from Hendaye to Irun. The reason of this, of course, is, that it has not been considered feasible to tunnel through the Pyrenees from a commercial point of view. The international traffic by these two lines at the present time is at the rate of about 60,000f. per kilometre, but the great increase that has arisen on the Italian lines since the increased accessibility, quite justifies the idea that the Spanish trade with France languishes for want of communication. It is certain that the existing lines from Bordeaux and Bayonne to Madrid, and from Cette to Perpignan and Barcelona do not meet the requirements of the age, and it certainly seems preposterous that a city like Toulouse, with 150,000 inhabitants, should be obliged to make a round by Perpignan or Bayonne, a distance of from 250 to 300 kilometres, to keep up its trade with northern Spain. It is now proposed to make two great trunk lines across the Pyrenees—the one called the Noguera-Pallaresa line, the other that of Canfranc. The first of these will start from Toulouse, and passing through St. Girons, will cross the Pyrenees not far from the head waters of the Garonne, near the Pic de Maladetta, and from thence to Lerida, which is already in connection with Saragossa and Madrid. This, however, will not be the only advantage, for a direct southward communication would be opened up from Lerida to Tortosa, Vinaroz, Valencia, and Carthagena, effecting a saving between the last-named city and Paris of 366 kilometres. Moreover Carthagena is not more than six or seven hours from Algeria; and although a considerable portion of traffic, both goods and passengers, would continue to be despatched from Marseilles, many would prefer the more rapid journey by rail to Carthagena, which at the very outside, would place Paris at only 50 hours from Oran. The present postal arrangements between France and her Algerian colony are not satisfactory, and would be very greatly improved by the proposed line. The actual amount of Pyrenean tunnelling will not exceed seven kilometres—4⅜ miles—or, including the approaches on either side, about 36 kilometres—23 miles. The second, or Canfranc line, does not offer so many advantages, at all events in an international sense. It will leave the existing railway from Dax to Pau and ascend the valley to Oloron, tunnelling for nine kilometres a little to the west of the Pic du Midi, and descending into Spain at Taca, from which it will pass through Huesca to Saragossa. The actual distance from Paris to Madrid will not be very much shortened by this line, though it is expected to tap a good deal of trade between Bordeaux, Saragossa, and Arragon. Some opposition has been offered to this Canfranc line, though it is in favour on the Spanish side, and more especially with the Arragonese. Two other schemes have been proposed in substitution, the one making a descent from the Pyrenees to Pampeluna, and thus differing still less from the distances of the present Irun and Hendaye line; the other, called the Roncal scheme, which quits France near Manleon, and after a tunnel of six kilometres, enters Spain at Castejon, so as to join the Madrid and Saragossa line at Baïdes. This latter route would really shorten the distance between Paris and Madrid by 100 kilometres, but it has a serious objection in the fact that the Spanish section of it would traverse a very mountainous and inhospitable region, containing only one town, Soria, and that with not more than 6000 inhabitants. While, therefore, the Noguera-Pallaresa trunk line would open up a rich international and local trade, there are scarcely sufficient advantages either in the Canfranc or Roncal schemes to make them successful commercial undertakings.

BOATS FOR THE KHARTOUM EXPEDITION.

MESSRS. COCHRAN AND CO., BIRKENHEAD, BUILDERS.

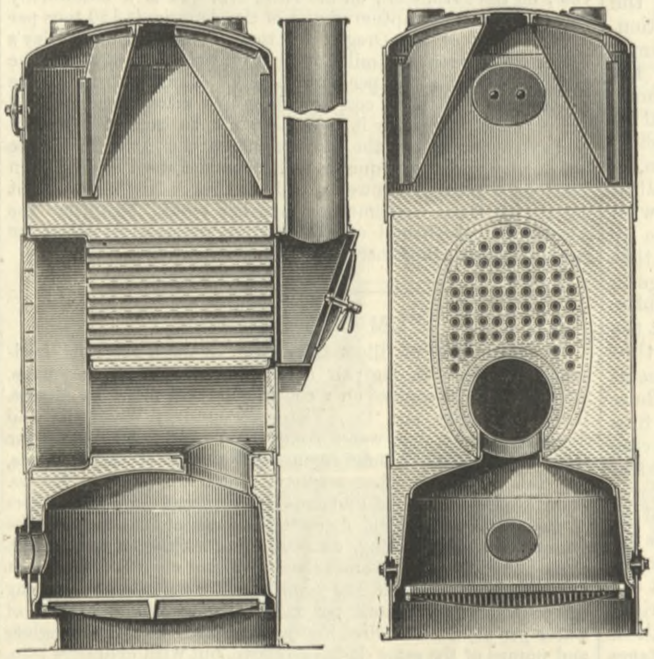


THE accompanying engraving illustrates one of several boats built for the Nile by Messrs. Cochran and Co., Birkenhead. They have been built to the following specification:—Length, 32ft.; breadth, 6ft. 9in.; depth, 2ft. 9in. Keel: Sided, 2¼in.; moulded, 3in. Stem and post sided, 1⅞in. Floors: Sided, 1in.; moulded, ¾in.; kilned, nineteen; grown to shape or solid, four. Sided, ⅞; moulded, beam end, ¾, upper end, ½; number not less than 60. Gunwales: Deep, 1⅜; thick, 1⅛; secured to transom with knees. Thwarts: seven, 7in. wide, with two iron knees at each end. Planks: ⅝in. thick, not fewer than fourteen each side. Mast thwarts: two, 8½in. wide at middle, tapered to 7in. at side. Keel, gunwales, copping to gunwales, rubbing pieces, bilge keels—two each side—floors, futtocks, to be of Canada elm. Garboard strakes, top strakes, keelson, hog piece, risings, rudder, to be of English elm. Planks: Any kind of pine except pitch pine, free of knots, or of English fir. Stern bench, 12in. wide, secured with knees, two portable seats, back-board; foot-boards, four on each side; bow and stern flats; to be of fir. Stay band, stern band, keel band—¼in. half-round—to be of iron galvanised. Rowlocks: Galvanised iron, one at each end of each thwart, one at bow and one at stern, each to have a lanyard. Two boat hooks, six pushing poles, 15ft. long, tipped with iron. Two grapnels, with six fathoms 3in. rope to each. Three hard wood rollers, 4in. diameter, 4ft. long, with iron hoops each end. Oars to be of ash wood, 15ft. long, 12 in number, with copper strip on blade, but without leathers. Awnings to be of light canvas, two wood poles, and with hooks secured to the mast. Rudder to be fitted complete with yoke; a spare rudder, with appendages, to be provided at the rate of one for every ten boats. Rig as per sketch, with light canvas, and with 12ft. hoist of sail; to be provided with usual tack and sheet hooks, mast clasps, belaying pins, &c.; the masts to be long enough to admit of 2ft. more hoist of sail. The boats are to be copper fastened throughout, and to have three coats of paint, the third coat to be a light colour.

The whole of the work is to be carried out generally in accordance with the foregoing particulars, and all the usual and necessary items of fittings not here enumerated have to be carried out without extra charge, and it is to be distinctly understood that the price named for building the boat is to include the entire cost of building and fitting her for the service intended. The whole of the work has to be completed to the satisfaction of her Majesty's officers, and a fine of 20s. per diem per boat will be inflicted for every day a boat is delayed in completion beyond the time named in the contract. The boats are to be delivered at Liverpool free of cost.

THE HYDE DUPLEX BOILER.

THE accompanying engraving illustrates a vertical boiler made by Messrs. Tinker, Shenton, and Co., of Hyde, near Manchester. The engraving explains itself. One of these boilers has recently been tested by Messrs. W. N. and R. Dack, with the following results:—The boiler is 4ft. ¾in. diameter inside by 10ft. high over all, being made to work at a pressure of 75 lb. on the square inch, the top being supported and strengthened by four gusset stays. The fire-box is made semicircular on top with an uptake joining a cross tube of 16in. diameter. The gases travel along this tube, which crosses the boiler, into another uptake or chamber; then through fifty-four cross tubes of 2¼in. outside diameter. The gases pass twice diametrically



across the boiler. The total heating surface, taking fire-box and uptake cross tubes, &c., is 174 square feet. The first and second trials were made on October 8th and 9th, 1883, the coals used being Wigan slack, bought and taken in the ordinary course.

Tests with Wigan slack:

Duration of experiment, from 2.15 p.m. to 4.15 p.m.	2 hours
Steam pressure average	55 lb. sq. in.
Quantity of coals burned	210 lb.
" " per hour..	105 lb.
" " per square foot of fire-grate	15 lb.
Area of grate surface—3ft. diameter	7 sq. feet
Total heating surface in fire-box, cross tubes, &c. ..	174 sq. feet
Water, total quantity evaporated during each test; average	2114·9 lb.
Water evaporated per hour	1057·45 lb.
Water evaporated per square foot of heating surface.	6·07 lb.
Water evaporated per lb. of coal	10·06 lb.
Temperature of feed-water	160 deg.
Equivalent quantity of water evaporated at 212 deg.	10·88 lb.

In a third trial Wigan hard 7ft. coals were used.

Test with Wigan 7ft. coals:

Duration of trial, from 2.25 p.m. to 4.55 p.m.	2½ hours
Steam pressure average	60 lb.
Quantity of coals burned	200 lb.
" " per hour..	80 lb.
" " per square foot of fire-grate	11·42 lb.
Area of grate surface	7 sq. feet
Total heating surface in fire-box, cross tubes, &c. ..	174 sq. ft.
Water, total quantity evaporated during test	2261 lb.
Water evaporated per hour	904·4 lb.
Water evaporated per square foot of heating surface.	5·2 lb.
Water evaporated per lb. of coals	11·3 lb.
Temperature of feed-water	160 deg.
Equivalent quantity of water evaporated at 212 deg.	12·2 lb.

A STEAMER TO RUN UNDER WATER.—There is being built at the Delamater Ironworks an iron steamboat designed to run under water. It is 30ft. long, 7½ft. broad, and 6ft. deep. Water ballast under control of the crew will enable them to sink or float her, and by the device of two rudders, whose planes are at right angles to each other, she can be pointed in any direction. The usual outfit of electric engines, compressed air, and diving suits, with which readers of Jules Verne are familiar, is included in the design. In war times she can also be used as a torpedo boat.

THE MANCHESTER SHIP CANAL.—Some time since—July 2nd—an article appeared in the Liverpool *Daily Post* suggesting what the writer considered the best course for the Ship Canal. This course has now been adopted by the promoters for their ensuing application to Parliament. The following is from the article referred to:—"The plans show a total length of thirty-one miles of training walls laid in the bed of the river, the principal channel being in the centre of the river with a training wall on each side of it, and subsidiary training walls to form channels to the river Weaver and Ellesmere Port. If only one training wall is used on the Cheshire shore, extending from Runcorn Bridge to Eastham Ferry, a length of only twelve and a-half miles would be required. The deep water entrance to the canal could be made at Eastham; Runcorn, Ellesmere Port, and the Weaver would be accessible at all states of the tide; the bed of the river would be undisturbed, and the dock at Garston uninjured. The upland water would be allowed to flow down the bed of the river as it does at present, and the 'fretting' action would be preserved, by which the silting up of the estuary is prevented. In order to compensate for the space reclaimed from the river, the promoters should be compelled to dredge a certain quantity of sand from the river bed annually. If two training walls are employed, so as to form a channel on both the Lancashire and Cheshire shores of the Mersey, only 21½ miles of training wall would be required, as compared with the proposed length of 31 miles."

RAILWAY MATTERS.

CAMELS are, it is said, to be employed as the motive power on the last section of the railway built by Russia through the Trans-Caspian desert, toward India.

As it is not very likely to be elsewhere recorded, it may be here mentioned that on the 10th inst. a twelve coach Midland Scotch express ran clean through Bedford station before it was stopped, in consequence of the failure of the leak-off vacuum brake.

DURING the week ending September 20th, 1884, in 32 cities of the United States, having an aggregate population of 7,427,300, there were 3224 deaths, which is equivalent to an annual death-rate of 22·6 per 1000, which is 3·1 less than the rate of the preceding week.

Vanity Fair has recently been writing something about continuous brakes. As it did not possess the information necessary to enable it to tell the truth on the subject, it fell into errors, and has had the good sense to employ some one who has the necessary knowledge to form a trustworthy opinion, and *Vanity Fair* now announces its conviction the Westinghouse air pressure brake is far the best.

THE Italian Minister of Public Works has received the project of a contract for that portion of the Macerata-Albacina Railway between San Severino and Tolentino, 10 kilometres (over six miles) long, and of an estimated cost of 3,287,000 lire (£131,480), of which sum 3,000,000 lire (£120,000) for work and materials included in the contract, and the balance to be placed at the disposal of the management to provide for expropriations, unforeseen works, &c.

THE *Railroad Gazette* remarks that state railroads of Prussia not only advertise for proposals when they have rolling stock and materials to buy, but they advertise the bids received. From such an advertisement we learn that when the Breslau Railroad Directory advertised for ten tank locomotives, six wheels coupled, cylinders 14in. diameter, the eleven bids received varied from 6850 dols. to 8487 dols.; for a set of reserve axles for these engines the bids were from 900 dols. to 1625 dols.

ABOUT a fortnight ago a French mail train had a narrow escape, some one having tampered with the signals, near Carcassonne railway station. A similar attempt to prevent the signalling disc from working was repeated on Thursday last to no purpose. A strict watch over that portion of the line was forthwith instituted, and has resulted in the apprehension of two lads, both nine years of age. These children were perceived by those lying in wait in a neighbouring hedge placing stones in the groove at the foot of the signal post. On being asked why they had done this, their reply was that they were anxious to see a train run off the line.

MR. G. R. DIBBS, the acting minister of works for New South Wales, at a recent meeting foreshadowed the railway policy of the Government of that colony. He stated that the system of light lines for level plains in the interior would be included in the ministerial policy; and he expressed a hope that the colonial Parliament would this year sanction the construction of 600 or 700 miles of railway. He also alluded to important statistics, showing, that last year the railways of New South Wales paid a net profit of about three-quarters of a million sterling, and that even after deducting the interest due on borrowed capital there was still an actual profit of £72,000.

THE French railways have extensive tourist arrangements, but they are not so convenient as those of Germany. The chief trouble is, that the tourist is not at liberty to arrange his trip as he pleases, but must confine it to one or at most two of the six main systems which radiate from Paris. The companies also require five days' notice previous to the issue of any such tickets. On the other hand, it must be said that the French railroads give circular-trip tickets for much shorter routes than the German; and are more liberal in their arrangements both with regard to baggage and to stop-over privileges. The French tickets are for the most part good for thirty days only; but on very long routes they are made out good for forty-five, or even for sixty days. The discount from the regular fares varies from 20 per cent. up; it is usually about 30 per cent.; but there are certain cases—for distances above 3000 miles—where it reaches 55 per cent. The rates are not calculated, as in Germany, by pre-arranged discounts from the regular price of each coupon, but by adding up the total distance to be traversed, and charging mileage rates for the whole on a rapidly diminishing sliding scale, so that any extra addition to a long route costs practically nothing.

IN a recent official report some interesting particulars are given concerning the construction of a new line of railway between La Guayra and Caracas, this being the only railway in Venezuela, with the exception of an unimportant mining line. The new railway, which is about twenty-three miles long, is of 3ft. gauge, laid with steel rails weighing 50 lb. to the yard, and with cross-ties of vera, a wood similar to lignum vitæ. It has a maximum grade of 3½ per cent., which is continuous from La Guayra to a point 17 miles distant, with the exception of three short horizontal sections at water stations. It has a minimum curve of 140ft. radius; indeed the entire line is a succession of curves and reverse curves through colossal excavations and over stupendous precipices. The total excavation to grade the road bed amounts to 1,650,000 cubic yards, or nearly 40 cubic yards of excavation to each linear yard, two-thirds of which is through rock, and of which a great part was removed by dynamite. There are three viaducts and eight tunnels in the line of the railway, four of the latter being excavated through solid stone, from one of which the track debouches upon a rocky shelf, at a sheer perpendicular of 1600ft. above the gorge of Boqueron. The cost of this railway, equipped with six locomotives, fifteen passenger and sixty freight cars, amounted to about £400,000, nearly all of which has been contributed by English capitalists. The line was built under the supervision of General W. A. Pile, formerly minister of the United States to Venezuela.

OUR train stood at a way station; by the side of the track stood a hand car, with the name, "The Bird," painted on it. The section boss and men were waiting, the *Chicago Herald* says, for the passenger to get out of their way. "How did you come to name your car that?" was asked of the boss, who puffed at his black clay pipe and replied:—"That was the result of a incident, your honour. 'Twas a good many years ago, when I was a green'un on the section. One evening I was in a hurry to get from the 342nd mile-post, where we had worked that day, into town. Ye see, I had a girrul thim days—the same whats now down there in the cabin attendin' to the kids. It happened the track inspector was helpin' of me align a bad curve, an' so whin No. 8 come along, he signals her and gits aboard, it being a Saturday night and him anxious to git home over Sunday, ye know. An idea struck me all of a sudden, and so I said, 'Get out the ropes, byes, and hitch her on behint.' The byes did it, too, and soon we was whizzing toward town. 'The 'taties won't be cold this night,' said one of the byes, gleefully. 'That beats workin' of our passage all to pieces,' said another. At first we enjoyed it, but purty soon we got to goin' faster and faster, when it wasn't so funny. The handles of the machine went up and down like mad; we had to let go our hold, an' if one of 'em had struck a man of us, it 'ud have killed him dead. We had to hang about the edges of the car, an' it hobblin' up and down an' jumpin' around like a rubber ball. I had just whipped out my knife to cut the rope with whin, begob, a wonderful thing took place. That hand-car just raised herself off the rails and sailed right out behind like a flag. Up in the air like a streamer, three fut if an inch from the track—an' it's the solemn truth I'm tellin' ye—we flew along like a birrud. The handles stopped workin', 'cause the wheels didn't touch nothin' but air, an' the danger of bein' brained was over. We was a-runnin' a mile a minute thin, and for six miles we sailed in the air like a balloon. When we slacked up we were so lucky as to hev the wheels of our hand-car come square down on the rails. Thin I cut the rope, glad, you kin bet, to reach the end of my first and last journey in the air. That's how my car comed to be named 'The Bird.'"

NOTES AND MEMORANDA.

THE *Scientific American* gives the following relating to a barrel of flour:—"The cost of the barrel itself is 35 to 40 cents. It ordinarily requires from 30 lb. to 40 lb. of coal to drive the machinery to make a barrel of flour. Four bushels and 40 lb. of wheat, or 275 lb. in all, are required to produce a barrel, or 196 lb. of good flour; bran and screenings, 69 lb.; loss not accounted for, 10 lb."

M. FOUSSEREAU has found the specific resistance of distilled water, in the same apparatus, to vary from 118,900 to 712,500 ohms, that is to say, in the ratio of 1 to 6. He accounts for this in three ways: (1) by the solution of the surface of the containing vessel; (2) by the solution of matter from the air; (3) to the effect of the dissolved matter during distillation. Experiment proved that the addition of one-millionth of potassium chloride reduced the resistance one-third.

M. GARBE has laid down the two following laws in connection with Lipmann's capillary electrometer:—(1) The capillarity constant of mercury is greatest when the electrical difference at the meniscus is *nil*, and, as a rule, its value is independent of the sign of this difference. (2) The electrical capacity at a constant surface of an electrode plunged in a liquid is purely a function of the electrical difference, independent of the sign of that difference, and is, *Nature* says, least when that difference is *nil*.

M. BEETZ has made a standard cell which is a modified form of Latimer Clark's mercurous sulphate cell. It consists of a tube in which a compressed cake of mercurous and zincic sulphates is placed; at one end of the cake the zinc pole is placed, and at the other end the mercury pole. On short-circuiting, the following results were obtained:—Five minutes, 1·440 volts; one hour, 1·439 volts; four hours, 1·439 volts; six hours, 1·437 volts; twelve hours, 1·434 volts; forty-eight hours, 1·468 volts. The resistance was 15·700 ohms.

M. DUTER has made some very interesting experiments on magnetic shells. He finds that, if thin discs of steel be placed in the field of a powerful electro-magnet so as to magnetise them through from face to face, when they are removed from the field, they have almost entirely ceased to be magnets; but the faint trace left still showing that the discs were magnetised as shells. Again, M. Duter built up a series of steel discs, either separated by thin paper or cardboard, or placed directly together. This series was then magnetised with the discs in the same position as before; now on removing the whole from the field he found he had a permanent magnet, fairly powerful and regularly magnetised. His next step was to take the magnet to pieces by separating it disc from disc; each disc was then found to have almost ceased to be a magnet, but on placing them together again he found that he still had a permanent magnet, but weaker than before.

SOLDERING on cast iron differs but slightly from soldering on an already tinned surface as sheet tin. If the iron is white iron or a thin casting that has become chilled in the casting—iron not amenable to the file—it should be cleaned from surface impurities by scraping, or scouring and washing in potash water. Then dip it for an instant in clear water, and wash it quickly with undiluted muriatic acid of the ordinary commercial strength. Go over it at once with powdered resin and solder, with the soldering iron, before the surface has had time to dry. Another plan, and a better one for soft gray iron castings, is to file the surface clean, wash as before, wipe it over with flux made of sheet zinc dissolved in muriatic acid until it is surcharged, or is a saturated solution, and has been diluted with its own quantity of water. Then sprinkle powdered sal ammoniac on it, and heat it over a charcoal or clear hard coal fire until the sal ammoniac smokes. Dip at once into melted tin, remove, and rap off the surplus tin.

A NEW development of telegraphy has been instituted by Michela in Italy. *Nature* says he has constructed a machine by which signs corresponding to various sounds can be telegraphed. Thus we have practically a telegraphic shorthand, to which the name "steno-telegraphy" is given. Michela's apparatus has now been in regular use for some period in telegraphing the debates of the Italian Senate. The transmitting apparatus briefly consists of two series of ten keys, each of which corresponds to some particular sound. Each key acts in reality like a Morse key, and thus transmits a current to the receiving instrument. The receiving instrument consists of a combination of twenty Morse receivers, to each of which is attached a style which marks on the receiving paper its proper sign, thus producing a stenographic message. Great speed in transmitting is claimed for this method, and the following figures are given as comparative:—

Morse simple	500 words per hour
Hughes simple	1,200 ,, ,,
Wheatstone	1,800 ,, ,,
Steno-telegraphic	10,000 ,, ,,

ACCORDING to an article "On the Decomposition of Cements by Water," by H. Le Chatelier, in the *Chemisches Centralblatt*, he has studied the progressive decomposition of cements by water. Hydrated cements when treated with excess of water give up lime; it has hitherto been supposed that the dissolved lime was free lime, and it was determined in this manner, hence the varying results obtained in different laboratories. These amounts are proportional to the water used, the calcium salts ceasing to be decomposed when the water contains a certain percentage of lime. The free lime may, however, be determined by solution by using very little water at a time, and only removing it on becoming saturated—1·3 grms. CaO per litre. In this manner no calcium compounds will be decomposed, calcium ferrite, the least stable compound of all, only beginning to decompose when the solution contains about 0·62 grms. CaO per litre. It was found in this manner that the slowly hardening cements always contain a large amount of free lime, whereas the quick setting are almost free from it. By the progressive action of water each of the constituents is decomposed in turn, giving a particular amount of lime per litre in the water, which amounts remain constant for each lime compound decomposed. The question cannot be completely answered, as in the solution of the lime there are certain stopping places, corresponding to which there have been as yet no lime compounds prepared synthetically. The author is therefore inclined to the opinion that silico-aluminates and silico-ferrites are formed in hardening, although he has not as yet succeeded in preparing them artificially.

AT the Montreal Meeting, Prof. Frankland communicated the results of a study of the phenomena attending the discharge of accumulator-cells containing alternate plates of lead peroxide and spongy lead: (1) The energy of a charged storage-cell is delivered in two separate portions, one having an E.M.F. of 2 volts and upwards, the other an E.M.F. of 0·5 volt and under. One of these may be conventially termed *useful*, and the other *useless*, electricity. (2) The proportion of useful electricity obtainable is greatest when the cell is discharged intermittently, and least when the discharge is continuous. (3) Neither in the intermittent nor continuous discharge at high E.M.F. is the current, through uniform resistance, augmented by rest. At low E.M.F., however, the current, after continuous discharge of the high E.M.F. portion, is greatly augmented, but only for a few minutes. This augmentation of current at low E.M.F. after rest is hardly perceptible when the high E.M.F. discharge has been taken intermittently. (4) The suddenness of fall in potential indicates two entirely distinct chemical changes, the one resulting in an E.M.F. of about 2·5 volts, the other in one of about 0·3 volt. (5) The chemical change producing low electromotive force is the first to occur in charging, and the last to take place in discharging, the cell. It is the change which occurs during what is called the "formation" of a cell, and for economy's sake, a reversal of this change should never be allowed to take place. (6) Currents of enormous strength can be readily obtained from storage batteries coupled up in parallel, viz. a current of 55,000 amperes from only 100 cells. Such a current reduces to insignificance the output of the largest dynamo ever built. It is to be hoped that currents of this magnitude will open up new probabilities of research into the construction of matter.

MISCELLANEA.

FOUR telegraph wires are being added to the west coast system between England and Glasgow, in addition to those recently put on.

THE Britannia Company, of Colchester, obtained the prize medal for lathes at the International Exhibition, Crystal Palace, London, 1884.

THE sixth annual National Exhibition and Market of Brewers', Licensed Victuallers', and Mineral Water Trade Machinery and Appliances, opens at the Agricultural Hall, on Monday next, October 20th.

OUR Birmingham correspondent says the recent exhibition of gas appliances at Westbromwich has proved a complete success. The orders received for gas stoves have more than exceeded the most sanguine expectations of the gas committee of the Corporation.

A CRANE, to lift 150,000 kilogs., is being erected on a quay at Hamburg, for lifting the 125-ton guns from Herr Krupp's works. The largest crane existing on the Continent is the 120-ton crane at Antwerp. We shall shortly illustrate a crane of these large proportions.

ON Sunday last about midnight, the heavy surf beating against one of the lock gates at Havre dislodged it, and the mass, which is made of steel, weighing some 80 tons, barred the entrance, preventing the exit of ships. Until this obstruction is removed arriving vessels will have to make for Cherbourg.

ARRANGEMENTS have been made for holding a conference in connection with the Plumbers' Congress at the Technical Institute, Health Exhibition, South Kensington, on the 20th inst. The mayors of forty of the principal towns in England have already accorded their co-operation to this object, and many of the leading practical plumbers in and about London are giving their assistance.

A MEETING was held at Newcastle on the 8th inst. to arrange for the formation of an institution of engineers and shipbuilders for the North of England. Mr. C. W. Hutchinson (of Messrs. Armstrong, Mitchell, and Co.) occupied the chair. It was decided to form an institute for the reading and discussing of papers on engineering and shipbuilding subjects. Another meeting will be held on the 22nd to complete the arrangements.

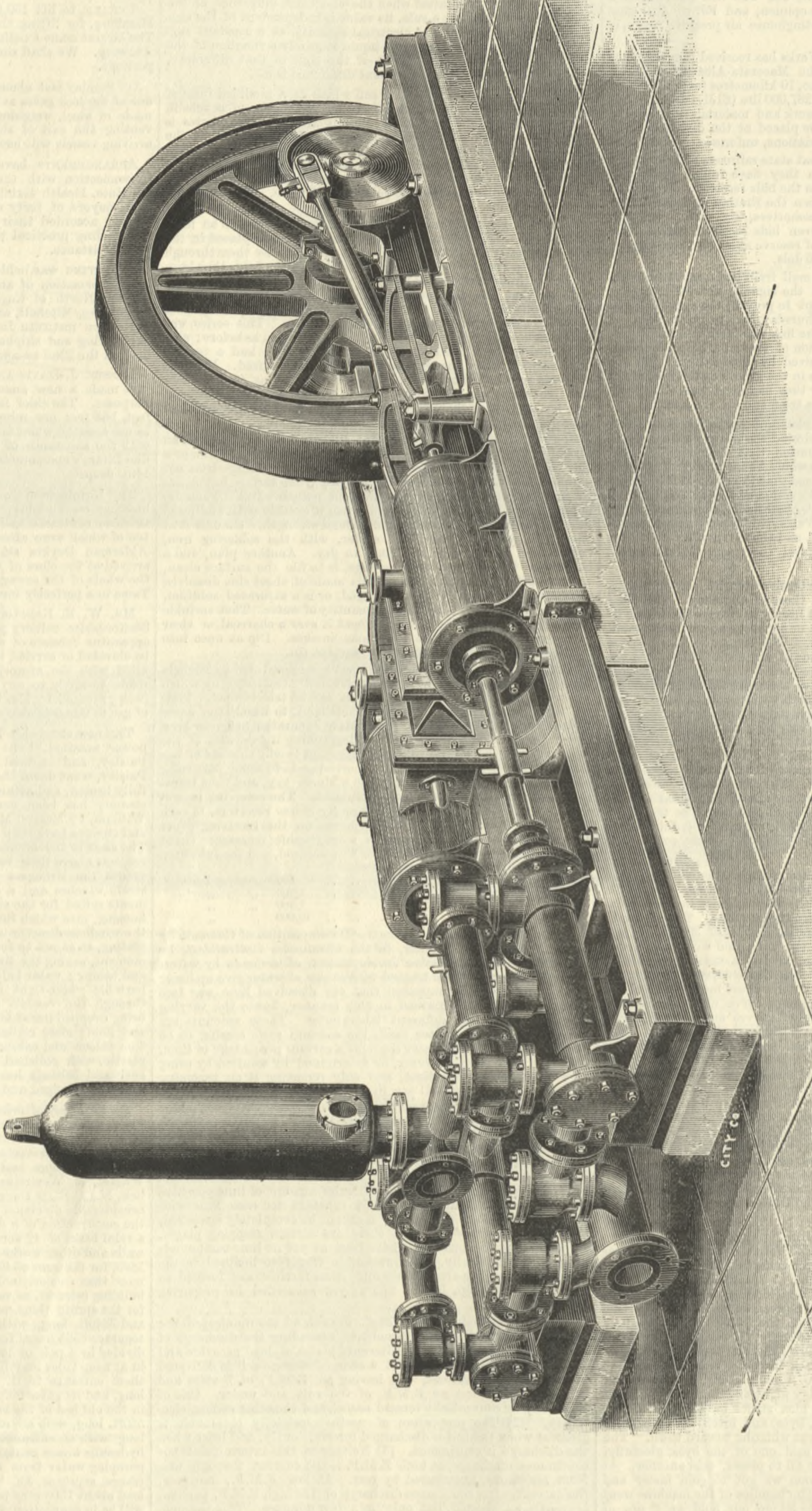
MESSRS. J. DAVIS AND SON, of All Saints Works, Derby, have just made a new anemometer more particularly for mining purposes. The chief feature in it is that it indicates not simply feet, but feet per minute or per second, making it unnecessary to use a watch when taking an observation. It thus also dispenses with the assistance of a lamp carrier. In appearance it is much like Biram's anemometer, and is only about 4in. in diameter and 1¼in. deep.

THE Birmingham Tame and Rea District Drainage Board held a meeting on Tuesday. The Works Committee announced that thirteen contracts had been entered into for various operations, ten of which were already completed and the others far advanced. Alderman Deykin stated that the Board had now practically arrived at the close of their operations, and that at that moment the whole of the sewage of Birmingham was flowing into the river Tame in a perfectly innocuous condition.

MR. W. E. EARFORTH is just now introducing to the North Staffordshire colliery proprietors a new fire-damp detector. The apparatus consists of a small india-rubber ball or bag, which may be elevated or carried to any part of the workings of a mine, and filled with the atmosphere of the place. The detector can be made to apply to any kind of lamp. An instrument which has been patented by Mr. Liveing for the detection and measurement of gas in mines is also attracting attention.

THE new steamship Ben Nevis, 200 tons burthen, and 54-horse power nominal, built by the Abercorn Shipbuilding Company, Paisley, and engined by Messrs. Hanna, Donald, and Wilson, Paisley, went down the Clyde on the 9th inst. on her official trial fully loaded, and attained a speed of eleven miles per hour. This steamer has been designed for Mr. D. P. McDonald, of Fort William, by Messrs. MacNicoll and Co., Glasgow, and both hull and engines have been superintended by them during construction. The class is the highest at Lloyd's, and the steamer is in many respects above their requirements, being considered by competent judges the strongest coasting steamer afloat. There are two steam winches and a donkey boiler, and all the latest improvements suited for the size and trade, such as Scott's patent anchor housing, into which Smith's patent stockless anchors are hove by the windless direct into position for the voyage within the line of plating, so as not to foul anything, and yet ready to let go at any moment, saving the time, trouble, and danger involved in catting and fishing; water ballast, in partial double-bottom and in peaks; portable water-tight iron casings in hold over the piping going through the vessel's side; water-tight sliding door, capable of being dropped instantaneously in the bulkhead between stoke-hole and hold; close ceiling for grain; galvanised steel propeller, &c. The saloon and cabins are upholstered in the new material, veloplastic, with polished oak panelling, gilt trusses, &c.,; and side keels and beltings have been fitted, formed of steel plating bent round and flanged and rivetted to the shell plating.

ON Saturday afternoon the first sod in the construction of the Preston Dock and other works in connection with the improvement of the navigation of the River Ribble was cut by Mr. Alderman Gilbertson, chairman of the Ribble Committee of the Corporation. A pontoon bridge had been thrown across the river by Mr. T. A. Walker, of Westminster, contractor for the works. Mr. E. Garlick, M.I.C.E., is the engineer of the works, which will comprise a considerable diversion of the river, the present bed to be filled up; the construction of a dock of 40 statute acres, with entrance gates; a tidal basin of 4½ acres, with lock and lock gates; and training walls and other works—the whole to be completed by the 1st July, 1889, for the sum of £456,600. The diversion is to be deepened 5ft. more than was originally proposed, for the advantage of the shipbuilding interest, as vessels may then be launched without waiting for the spring tides as at present. The dock will be 600ft. wide, and 3240ft. long, with a jetty running down the east end, giving together 8565 lineal feet of quayage. The lock will be 550ft. long, divided by a pair of gates. By means of the basin vessels coming in at neap tides may lie afloat in the same depth of water as gave them entrance to it. This basin will be 300ft. wide and 750ft. long, and its gates 60ft. wide. A timber pond will be constructed in the old bed of the river. There will be two graving docks—one 550ft. long, with an entrance of 66ft. wide, and the other 350ft. long, with an entrance of 50ft. Near the graving docks will be a hydraulic house containing the power for working the lock gates, pumping water from the graving docks, working six coal-tips and cranes, capstans, &c. It is estimated that these six coal-tips will load about 1000 tons per hour. Railways from the dock and lock will be in connection with the Ribble Branch, the West Lancashire, the Manchester, Sheffield, and Lincolnshire, and the Blackpool lines. The training walls will be extended beyond Lytham. It is intended to utilise the soil from the excavations in raising the land about the dock and the immediate neighbourhood above the height of the greatest floods; and the walls of the different works will be carried up to the same level. Vessels will be able to sail straight into or out of the dock; and the lock will be capable of docking a vessel 550ft. long. To prevent waste of water, the lock will be divided into two chambers of 325ft. and 225ft. long respectively. The channel of the river, from the dock to the sea, is to be dredged and scoured to a depth of 30ft. below high water of ordinary spring tides, and with a fall of 3in. to the mile. The sill of the dock will be 29ft. below high water of ordinary spring tides; and the bar at the sea, sixteen miles distant from the dock, will be 34ft. below high water at ordinary spring tides.



NON-CONDENSING PUMPING ENGINES, PILDACRE COLLIERY.

MESSRS. RICHARD BRADLEY AND CO., WAKEFIELD, ENGINEERS.

(*For description see page 291.*)

FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame Boyveau, *Rue de la Banque.*
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TO CORRESPONDENTS.

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

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

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

S. J.—*Mr. C. S. Madan, Mansfield-chambers, St. Anne-square, Manchester.*

Engineer.—*Take out a second patent as an improvement on the first, which, if it has not gone past the provisional stage, you may perhaps drop.*

A Constant Subscriber.—*It would be impossible to tell what the engine and boilers are worth without seeing them, but roughly speaking, we should say that they would be cheap at £400. Either of the boilers ought to give you plenty of steam for 25 indicated horse-power.*

E. P.—*If your valve has much work to do, you must pack it with a couple of small Ramsbottom rings at each end, taking care that the rings cannot get into the ports. If you can command very accurate workmanship a solid piston can be made practically tight by turning a number of small grooves in the piston. The lubricant accumulates in these, and will practically pack the piston.*

C. F.—*The mode of suspension you speak of is well known in the navy as applied to swinging cots in officers' berths. We cannot say whether the arrangement you propose is new or not, but we fancy not, because almost every conceivable method of suspension has been tried. Nothing short of a long search at the Patent-office would settle the question. The action would no doubt be as you surmise.*

WIRE NET MACHINERY.

(*To the Editor of The Engineer.*)

Sir,—I should feel obliged if any of your readers could give me the address of any manufacturer of wire net making machinery.

Sheffield, October 11th. H. W. S.

FILTERS.

(*To the Editor of The Engineer.*)

Sir,—Can any of your readers give me names and addresses of makers of powdered or granular filtering media for use in domestic filters; also, what are some of the best media for filtering air? H. S.

October 11th.

[Cotton wool is a nearly perfect air filter.—Ed. E.]

MIDLAND RAILWAY CONTRACTS.

(*To the Editor of The Engineer.*)

Sir,—I notice an error in last week's Engineer. The paragraph I refer to is where you speak in "Railway Matters" of contracts being let by the Midland Railway Company to Handyside and Co., Derby; Eastwood, Swingler, and Co., and Messrs. Butter, of York. The latter name I presume you intend to apply to me, as the contract, or rather one part of it, has been given to me. Perhaps you will kindly correct your report in your next issue. John Butler.

Stanningley Ironworks, near Leeds, October 15th.

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DEATH.

On the 9th instant, at Ellore, Madras, of cholera, Alfred Brace Cruse, Assoc. M. Inst. C.E., eldest son of Thomas Cruse, Warminster, aged 41.

THE ENGINEER.

OCTOBER 17, 1884.

LOCOMOTIVE CRANK AXLES.

The Penistone catastrophe was primarily caused by the breaking of a crank axle. The results were so disastrous that attention has been strongly directed to crank axles ever since. In another page will be found a letter signed "W. P.," which deserves some notice. In the half year ending June, 1884, we learn from the Board of Trade returns that no fewer than eighty-five crank axles broke on British railways. This is, at first sight, alarming; but we are reassured when we find that the number of lives lost by the breaking of crank axles is very small. Indeed, it is almost impossible to have a safer accident, if we may use the phrase. As a rule, when a crank axle breaks the engine still keeps on the road. The driving wheels, if the axle is provided with inside and outside bearings, can hardly get away; and when single bearings are used, either inside or out, the wheel can only be thrown against the frame. In fact, it has little latitude for any motion save that of revolution. It is to be remembered, too, that the gyroscopic action which renders a bicycle stable no doubt tends to steady a pair of large driving wheels revolving some hundreds of times in a minute. Again, many crank axles are broken just at starting. The wheels slipping, only one rail is sanded, when the pull of the pistons and the momentum of the wheel on the unsanded rail twists the crank shaft across. Be all this as it may, such a lesson as that taught at Penistone demonstrates quite clearly that very terrible consequences may follow on the fracture of a crank axle; and imminent peril must be incurred should a train running with a broken crank axle pass over points or crossings, or even encounter a weak place in the road. The best possible safeguard against evil consequences ensuing from the breakage of crank axles is no doubt a perfectly efficient continuous automatic brake. Brake or no brake, every possible precaution should be taken to obtain crank axles that will not fail. In pursuit of this object engineers have of late years turned their attention to steel, and steel axles are used in considerable numbers. The question has, however, been raised, is steel better than iron for the purpose? According to the Board of Trade returns, it seems that it is not. Let us consider how far such figures as we have in the Government report support this conclusion.

Of the eighty-five crank axles which broke, fifty-eight were of iron and twenty-seven of steel. At first sight this seems to be pretty conclusive against iron, but the figures as they stand convey little information. The number of iron axles in use is much greater than the number of steel axles, and this being the case, it is to be expected that more failures would be recorded of the former than of the latter. To a certain extent, a much more accurate test is the mileage run; and this is very unfavourable to steel. The iron axles which broke had an average life of 206,124 miles, while the steel axles made only 166,687 miles, the mileage in favour of iron being no less than 39,437. If we take the average performance of an English locomotive at 18,000 miles per annum, it will be seen that the figures we give represent for iron a life of about 11½ years, and for steel a life of about 9¼ years. But something yet remains to be said; the conditions under which the axles are used may materially modify the results. It has been known for many years that iron axles, at all events, will last twice as long with inside bearings only as they will with outside bearings. It is further to be remarked that the figures we have quoted give an abnormal length of life both for iron and steel axles. Taking a wider average, it may be stated that the life of an iron crank axle with inside bearings is but 60,000 miles, and that of one with outside bearings but 30,000 miles. We do not say that at the end of this mileage the axle will break, but that on close inspection flaws or bending or other mischief will so manifest itself that the axle must be considered unsafe. What the figures are for steel we are unable to say; possibly some of our readers can throw light on this point. If it can be shown that the steel and iron axles of the Board of Trade report were all used under the same conditions as regards the position of the bearings, then, indeed, "W. P." has made out a bad case for steel. Again, if it turns out on examination that the greater number of steel axles had inside bearings and the greater number of iron axles outside bearings, then the case for steel will appear worse than ever; and when we remember that inside bearings have been used more extensively in modern engines than they were some years ago, it seems to be more than probable that the old iron crank axles were worse off than the steel axles fitted to the engines of to-day. Of course, too much weight must not be attached to this view of the matter. As the figures stand, then, we repeat that the Board of Trade returns are decidedly adverse to steel as compared with iron; and the makers of steel crank axles would do well to go further into the question, and obtain and publish full particulars of the load, service, and assumed cause of the failure of each and every steel axle. We should then have some really valuable data to go upon which are lacking now.

Meanwhile, it must not be overlooked that after the best has been said that can be said, steel does not stand in a very favourable light as a material for cranks. Judging from its homogeneity, ductility, and extreme toughness, it ought to be very much better than iron as a metal for crank axles, and not only this, but so much better that, no matter what the conditions of their use, as regards outside and inside bearings, the Board of Trade ought not to have more than half a dozen failures or so to record for six months, instead of twenty-seven. If the number of steel axles is, say, one-third of the number of iron axles, then the percentage of failures is fearfully high for steel. The proper proportion under such a condition, the failures of iron crank axles being fifty-eight, would be a fraction over nineteen, whereas it is actually, as we have seen, twenty-seven. Nothing can be more obvious than that we have here a case for inquiry. But until the matter has been sifted to the bottom, locomotive superintendents will do well to think twice before they order steel crank axles instead of iron. It may be asked how and why a crank axle of a material so excellent as steel is known to be should be less durable than iron. The answer is that steel is full of anomalies in its behaviour. It must not be forgotten that at this moment next to nothing is known concerning the effects of long-continued vibration on steel. It is generally assumed—and with some appearance of justification—that iron axles lose their fibrous character and become brittle by long-continued use. Why should not precisely the same condition obtain with steel? If such a change can take place, then the axle which breaks is really a different material from that which it originally was. That steel makers may cry out and assert that such changes cannot take place in a beautiful soft steel is likely enough; but an outcry cannot alter facts. There is, too, another point which deserves notice. It was long a reproach to iron crank axles that they could not be forged sound. Is it quite certain that steel axles are much better in this respect? At the last meeting of the Iron and Steel Institute one gentleman ventured, in the course of discussion, to ask—Was it certain that cogging an ingot gave as good a result as hammering it? The President told him that it was useless to raise such a point for discussion, as the success attained by one great firm—which he named and we do not—was sufficient proof that cogging was as good if not better than hammering; but the voice of the meeting was against the President, and he had to give way and permit the question to be discussed. That it is possible for two opinions to exist on the point at all is sufficient proof that absolute soundness is not invariably secured by either process, and very curious statements were heard concerning the impossibility of welding up congenital defects in an ingot either by cogging or hammering. Something also was said about steel being injured by hammering. The fact is that everything is not yet known about steel, and the sooner an attempt is made to acquire much wanted information which cannot be obtained by a testing machine of the ordinary kind, the better. We have no desire to raise the old controversy concerning the relative merits of iron and steel. The makers of iron have no reason to be ashamed of the way in which they have come out of the fight. Our principal object in writing as we do is once more to try and turn attention from that branch of inquiry which begins and ends with breaking samples of steel by pulling them asunder, or bending them, to a path as yet by comparison almost untrodden. Let us have a careful investigation of the effect of vibration, percussion, and alternating flexure on steel, and note the result. It may, perhaps, be found that a much harder steel than that now used for crank axles would prove better than anything yet attained. As matters stand, the advocates of iron crank axles are not likely to want a stone to fling at their antagonists so long as the Board of Trade reports on railway accidents are available.

STEAM ENGINE ECONOMY.

It is very commonly assumed that two conditions are essential to steam engine economy, namely, (1) the steam pressure must be high, and (2) the engine must be compound. Opinions are divided as to whether jacketting is essential or not, some engineers holding that it is, others that it is not. We have persistently maintained in this journal (1) that compounding is not essential to economy, and (2) that high pressures are not necessary. We shall in a moment adduce some facts which bear on both these points; but in order to avoid all misconception it is indispensable that we should make our meaning quite clear. We admit, then, that compound engines are, as a rule, to which there are exceptions, far more economical than simple engines; and that within certain limits high pressures give better results than pressures which are lower. But we maintain that the advantage gained is not due to compounding or to high pressures, but to a combination of conditions in which compounding and high pressures alone are very unimportant factors. The work to be got out of a pound of steam depends on the extent to which it is expanded, and it can be more conveniently expanded in a compound than in a simple engine. This is the secret of the success of the compound engine. Again, the higher the pressure the further may expansion be pushed without augmenting the size and weight of the engine. On these two facts hang the whole superiority of modern over old-fashioned steam engine practice. These statements are disputed by many persons. It is held, for example, that compounding prevents a great deal of cylinder condensation, because the high-pressure cylinder is saved from the cooling influence of the condenser. This is known as the "heat trap theory." It is also maintained that there is something specially conducive to economy in high pressure—that, in a word, it is good, *per se.* The facts we are about to cite bear on both these points.

In the report for 1883 of Mr. Michael Longridge, chief engineer to the Engine, Boiler, and Employers' Liability Insurance Company, King-street, Manchester, there is a very interesting section or chapter devoted to indicator diagrams, of which many examples are given. With these, however, we are only indirectly concerned. Mr. Longridge supplies in this section particulars of a very exceptional, if not unique experiment. If the compound engine be more economical than the simple engine, on the basis of the heat trap theory, then the mere act of compounding an engine, all else remaining unchanged, ought to effect a considerable economy. It is next to impossible to find particulars of such a case. Engines are often MacNaughted, or otherwise compounded; but invariably the pressure is raised at the same time, so that the conditions are materially modified. In the case cited by Mr. Longridge, however, a horizontal condensing engine, with a cylinder 38in. diameter and a stroke of 5ft., and making forty revolutions per minute, was compounded by placing a 24in. cylinder behind the other. Nothing else was changed. The diagrams from the engine, both compound and non-compound, are excellent. The pressure in both cases was 59 lb., and the vacuum 12½ lb. Steam was expanded in the non-compound engine about nine times. When compounded the steam was cut off at about half-stroke in the high-pressure cylinder. It is not easy to say where in the low-pressure cylinder; but inasmuch as the whole work done was, non-compound, 329 indicated horse-power, and compound, 307·5, there cannot have been much difference in the ranges of expansion in the two engines. We can check the figures to a limited extent by the well-known formula for average pressures when the initial pressure and range of expansion are known, and by this rule the steam was expanded nine times. The initial cylinder pressure was 66 lb. absolute. The hyp. log. of 9 is 2·2925, say 2·3, and $\frac{(1+2{\cdot}3)\ 66}{9} = 24{\cdot}2$ lb. The average from the indicator cards, as given by Mr. Longridge, is 23·95 lb. When compounded the average pressure in the small cylinder was 30·96 lb., the initial pressure being 72 lb., and in the condensing cylinder 10·30 lb. As, however, the expansion curve of the low-pressure diagram does not approach to a hyperbola, the formula given above will not apply. At all events, it will be seen that the difference between the ratios of expansion must have been inconsiderable, and the compound engine had a small advantage in the shape of higher initial pressure. We have no doubt that most of our readers will be prepared to say that, under these conditions, the addition of the second cylinder effected a large saving in fuel. As a matter of fact, however, it did nothing of the kind. The consumption of coal remaining practically unaltered by the change. No actual tests were made, only the results of practical work being taken. Before the change coal was used for ordinary work at the rate of 3·6 lb. per horse per hour; after compounding at the rate of 3·56 lb. We may therefore conclude that the weight of steam used per horse per hour was the same in both cases. Mr. Longridge assumes it to have been 22 lb. per horse per hour, which assumption is, we think, very likely to be accurate; and he gives a table to show the quantity of water present in the cylinder at various periods of the stroke, according to the indicator. In the simple engine, there was at the end of admission—that is to say, at the point of cut-off—34·1 per cent. of water; at about half-stroke there was 27·7 per cent.; and at the end of the whole expansion, 14·6 per cent.; that is to say, 19·5 per cent. was re-evaporated in the cylinder. In the compound engine there was at the point of cut-off in the small cylinder only 13·2 per cent. of water, and at the end of the stroke in the small cylinder, only 9 per cent; but at the end of the whole expansion there was no less then 32 per cent. of water in the large cylinder. These figures lend the strongest confirmation to the arguments we have always used, namely, that whatever saving might be effected on the heat trap principle in the small cylinder must be more than lost again in the low-pressure cylinder, because the whole weight of metal to be warmed up and cooled down at each stroke is larger in the compound than in the simple engine.

Mr. Longridge, commenting on the whole case, after explaining what takes place in a simple cylinder, goes on to point out that in the compound engine the action is somewhat different. "Owing to the smaller surface and lower range of temperature in the smaller cylinder, the initial condensation is not so great as in the simple engine. Also because the ratio of expansion is generally less, the re-evaporation is usually less—indeed sometimes there is none. Then on the opening of the steam port of the larger cylinder there is further condensation, and in this cylinder, at least, expansion is seldom carried far enough to re-evaporate any considerable quantity of the water formed; so that finally the total quantity of steam condensed is nearly or quite as great as in the simple engine, the difference being that condensation takes place principally near the end of the expansion, when the steam pressure is low, instead of at the beginning when it is high; in other words, by means of the compound engine work is got from high-pressure steam which would have been condensed in a simple engine. This is what the compound engine gains, and it is what the advocates of the compound system always point to as a conclusive proof of the superiority of that system. The advantage is undoubted, but let us see what must be set against it. First, the high-pressure steam above mentioned acts upon a small instead of a large area. Secondly, the compound engine loses the work which would have been done by the water re-evaporated towards the end of the expansion had a simple cylinder been used. Thirdly, the total cooling surface in the compound engine is much greater than in the simple for a given load and ratio of expansion; and since the total range of temperature is the same in both, the total loss by condensation may easily be as great in the one case as in the other, notwithstanding the heat trap theory. The reason that compounding has so often been attended with such marked economy is not that the steam has been worked through two cylinders instead of one, but that with the change of cylinders higher pressures have been used, and a better distribution of the steam obtained." We quote the foregoing passage at length because it expresses very fully the views we hold ourselves, and we are glad to have the testimony of a man who has had such wide opportunities for arriving at first conclusions on our side.

We have yet to deal with the argument that high-pressures *per se* are conducive to economy. This is a point, however, on which very little need be said. We quote one experiment from Mr. Longridge's report which will do more, perhaps, to teach the truth than whole pages of letterpress possibly could:—"As some of the parts of a McNaughted beam engine proposed for insurance were too weak for the initial pressure, and the ratio of expansion 1 : 12 could be reduced without any loss, and perhaps even with a slight gain, the owners were advised to reduce the boiler pressure 10 lb., and to cut off later in the smaller cylinder. They consented to try the experiment, and finding, as was predicted, that no more coal was burnt, and also that the engine and gearing ran more smoothly, they have continued to work at the lower pressure ever since." Mr. Longridge gives diagrams which show the effect of the alteration, and are in themselves evidence that no more steam is used, but, on the contrary, rather less; for measuring the steam accounted for by the indicator from the diagrams just before the opening of the exhaust to the condenser, we find a consumption of 15·4 lb. per indicated horse-power per hour, with an initial absolute pressure of 90 lb., and not more than 14·9 lb. from diagrams taken after the change, the absolute initial pressure being 76 lb., so that so far as is shown by the indicator, an initial pressure of 76 lb. and a ratio of expansion of 1 to 7 or 8 appears to be more economical than an initial pressure of 90 lb. with a ratio of expansion of 1 to 12. But this is not all—over and above the steam shown by the indicator there is the steam condensed during the admissions to the two cylinders. This cannot be measured from the diagrams, but few will dispute that it will be greater with the earlier than with the later cut off. Indeed, the high-pressure diagrams are evidence of the fact, the expansion curve on that from the bottom end of the cylinder being fuller than that on the diagram from the top, and both being fuller than those taken after the pressure was lowered, thus showing that the earlier the steam is cut off the more water is evaporated during the expansion, and therefore the more steam is condensed during the admission. The steam present in the bottom end of the cylinder, when the ratio of expansion was 1 to 12, increased during the expansion by 30 per cent., while the curves on the low-pressure diagram, with an expansion of 1 to 7 or 8, only show an increase of 21 per cent., the valves being in the same condition as regards being steam-tight in the one case as in the other.

LEAD MINING IN DERBYSHIRE.

The hardy and thrifty lead-winners of the Peak of Derbyshire are likely to have a painful time of it this winter. At a special meeting, held in Sheffield on Tuesday, the shareholders of the Milldam Mining Company, finding they could no longer continue bearing excessive losses season after season, resolved to close the workings, which are situate at Eyam, and sell all the plant and machinery. This will throw over one hundred men out of employment. The financial loss will fall upon Sheffield investors, seventy in number, who own 3000 shares in which £5 5s. per share has been paid. The company, which was formed thirty years ago, is the last of the public companies in North Derbyshire formed for the purpose of working the lead mines in that division of the county. At one time, during the Russian war, the company paid dividends of 20 per cent. per annum. Lead then fetched £24 to £25 a ton; it is now £12 a ton at the mines, and it costs 3s. a ton to get it to the market, which is Manchester. During the Carlist campaign the company did well enough, and the Franco-German struggle sent the price up £2 a ton. No dividends have been paid for several years, and all hope of working at a profit has now been abandoned. There have been immense fortunes made out of these mines underneath what are known as "the old man's workings," the local allusion to the ancient Romans who won the lead in their days. At the Eyam mine the men once came on a cavern literally filled with lumps of solid lead as large as a man's fist. This enabled them to pay dividends of £1 per month on shares of £3 each, or equal to 400 per cent. per annum. The shares themselves bounded up from £3 to £65. But the bright days of lead-getting in the Peak are past, and for years the poor miners have lived—or rather subsisted—on the barest pittance imaginable. In South Derbyshire lead is still a profitable industry, Mr. Wass, from his Millclose mine at Darley Dale, drawing, it is said, a profit of £20,000 a-year. There is nothing for the lead-owners in North Derbyshire but to cease working and wait for better times. A great European war would send up prices at once.

A PITIFUL STRIKE.

After having caused the enforced idleness throughout three months of probably eight thousand hands, and so prevented the earning by them of quite £150,000, the strike of colliers in South Staffordshire has this week come to an end. The strike was against the drop in wages of fourpence "per day," or stint, in the thick, and twopence per day in the thin-coal seams, ordered by the arbitrator, whose interposition the men had united with their employers in seeking. From the first there was scant probability of the success of the movement, since the chief employers deemed it a point of honour to have the arbitrator's award enforced; and the resistance would have been but brief if numerous employers of small bands of miners who supplied the land-sale market chiefly had not deemed it well to keep on their pits at the old rate. The colliers so employed contributed the main sinews of war. But they had begun to tire, and contributions from other sources having fallen off, the strike hands have been forced in by sheer necessity. Salve to the wound of humiliation is attempted to be afforded by the Central Strike Committee in the shape of instructions to the men returning to work, to at once serve their employers with notice to pay the former wages a fortnight hence. There has been plenty of violent language during the strike, and but for the vigilance of the police there is reason to fear that there would have been plenty of obstruction also. As it was, many men would have resumed early in the strike but for the threats which were brought to bear upon a company of pitmen who, after only a few days' work on the arbitrator's terms, in a notable instance, again joined the strike hands. Explosives had been placed under the boiler of a pit engine of Earl Dudley, where, too, the operatives were at work at the drop. But the nocturnal raids and the blowing-up of the dwellings of colliers at work, that distinguished earlier strikes in the same part of the kingdom do not seem to have been this time reported.

THE STEEL RAIL TRADE.

The dulness in the rail trade seems to have grown more intense so far as the export branch is concerned. Last month the tonnage of the steel rails exported was only 34,232 tons, the quantity for the corresponding month of the past year being 63,242 tons. For the first time for a considerable period there seems to have been no shipment of steel rails to the United States for a whole month. The value of the rails does not vary very much for the two months, but the volume of the trade varies very greatly, as above stated. It may be added that there is a slight recovery in demand from Russia, and from the British East Indies; but most other of our chief customers contribute to the decline. Nor is the immediate prospect the most assuring, for it is well known that some of the chief of our rail mills find it extremely difficult to secure continuous work, and that others find it needful to work intermittently. It should be added that there was a very slight increase in the exports of iron rails, but the quantity of these now made is so small that it does not perceptibly alter the total of the rail exports. From the East it is believed that some orders are likely to be speedily given out, but the trade in steel rails—for the other kind is scarcely worth taking into account—is likely for some time to come to be scanty and slight, and those producers of steel are doing right who are adding to the variety of the articles that they produce. In the production of material for tin-plates, of plates for vessels, and of other classes of what have been hitherto used in malleable iron, there may be work for some of the steel rail works during the time of recuperation of the demand for the article, for the recovery from the present depression will be the speedier because of the completeness of the prostration of the manufacture now.

LITERATURE.

Heat. By P. G. Tait, M.A., Sec. R.S.E. London: Macmillan and Co. 1884. 355 pp.

The reason for publishing another book on heat would not appear obvious to most readers of the subject, but it would generally be assumed that Professor Tait had something worthy of putting into a new book before he commenced an addition to those already existing. The chief reason he gives in his preface, namely, that the works of Clark-Maxwell are for the study, that of Balfour Stewart for the physical laboratory, while his own is designed for the lecture-room. We may admit the reason because the book is good, and taken with the fact that the author was asked to develope an article which he contributed to the hand-book of the Loan Collection at South Kensington in 1876, there is sufficient excuse for publishing it. None, however, is needed. An original book by one competent to deal with its subject is always welcome, and if Professor Tait had not had something to say in his own way it would have surprised those who are accustomed to his writings.

In the first chapter of the book, which is of small octavo size, fundamental principles are treated, and in this he lays down the principle that "nothing can be learned as to the physical world save by observation and experiment, or by mathematical deductions from data so obtained," and in dealing with this he shows the necessity for an amount of caution in interpreting the evidence of our senses as to heat, that makes one feel that confidence in the interpretation of our observations can only be in their possible or probable incorrectness. An illustration of the extent to which our senses are called into operation in physical matters is found in the question, why do some things, such as a paper weight, feel cold to the touch, while the table-cloth upon which it is lying feels warm, though the thermometer will assign the same temperature to both? The answer is that "the sense of touch does not inform us directly of temperature, but the rate at which our finger gains or loses heat." The subject is pursued in an interesting manner, and one which must give students a very clear conception of fundamental principles, and of the difference between what should be conveyed by the words heat and temperature, thus leading to a discussion of the remark, "Heat, though not material, has objective existence in as complete a sense as matter has." This is apparently a paradox, but it is cleared up when it is remarked that "our conviction of the objective reality of matter is based mainly upon the fact, discovered solely by experiment, that we cannot in the slightest degree alter its quantity." Heat being a form of energy, its objective reality is on the same experimental evidence proved by the law of conservation of energy, or, as our author puts it, "its constant mutation satisfies the test which we adopt as conclusive, of the reality of matter." The second chapter is introductory, and is chiefly a statement of the limits of the subject under consideration, which is treated successively under the heads Nature of Heat; Effects of Heat; Measurement of Heat and Temperature; Sources of Heat; Transference of Heat; and Transformations of Heat. The chapters dealing more immediately with these subjects are preceded by one entitled, Digression on Force and Energy, and another, which is a preliminary sketch of the subject. The first of these is an interesting chapter, in which Newton's third law is examined. The reader is told that while he may raise a hundredweight a few feet, and so place it in position for doing work, he may tug as he pleases at a ton, but as he cannot move it, he does no work; the ton did not acquire any velocity; force is a mere name, but the product of a force into the displacement of its point of application has an objective existence. Thus "the horse-power of an agent, or the amount of work done by an agent in each second, is the product of the force into the average velocity of the agent." Hence "force is the rate at which an agent does work per unit of length." Passing over the further illustrative consideration of this subject, we come to the preliminary sketch, which is what it pretends to be, on the several sections mentioned above—the inter-relation of the first, fourth, and sixth, namely, nature, sources, and transformations of heat, heat making it necessary to deal with these at greater length than the others, thermo-dynamics being the most important of any treatise on heat. Following this are chapters on the dilatation of solids, liquids, and gases; thermometers, melting, and solidification, vaporisation and condensation, specific heat, thermo-electricity, combination and dissociation, conduction, convection, radiation, absorption, units, and dimensions, Watt's indicator diagram, elements of thermo-dynamics, and nature of heat.

In the space of a notice like this of a book which is well written throughout, it is impossible to dwell on any part in particular. Clearness of expression marks equally those parts which are in substance generally accepted laws, and those which contain original thought on some of the more recent lines. The digest of Regnault's experiments on the sensible, latent and total heat of steam is remarkably clear, and the same may be said of the chapter on conduction; but in mentioning some names, such as Forbes, the author seems to think that his readers all know to whom or of whose work he is referring. In dealing with the Watt indicator diagram, he dwells at length upon the value of the diagram as an exposition of the fundamental principles of thermo-dynamics, its purposes and value from a mere steam engine point of view not being treated at any length. The usual accuracy does not characterise the following explanation of the principle involved in the indicator:—"A pencil is so attached to the piston-rod of the engine that it shares the to-and-fro motion of the piston, and its consequent position at any instant thus indicates the volume of the contents of the cylinder. The pencil, however, has another motion in a direction perpendicular to the first, such that its displacement in the new direction is at every instant proportional to the pressure of the contents of the cylinder. Thus as the pencil moves over a fixed sheet of paper it traces a line, every point of which represents a pair of simultaneous values of volume and pressure of the working substance. In some forms of the instrument the pencil has one of the two motions and the paper the other." It is difficult to see how a diagram could be obtained from the first described arrangement of pencil holder. Before concluding we must return to some remarks made on the units of measurement question, as many English readers will be glad to know that they are the views of an author of Professor Tait's acknowledged ability.

He says:—"There can be no question about the fact that the *metre* is inconveniently long, and the *kilogramme* inconveniently massive, for the ordinary affairs of life. The average length of the arms of shop-girls, and the average quantity of tea or sugar wanted at a time by a small purchaser, have no conceivable necessary relation to the ten-millionth part of the quadrant of the earth's meridian passing through Paris, or the maximum density of water. But the standard *yard* and *pound* were, no doubt, originally devised to suit these very requirements as regards the average dimensions of the shop-girl or the paying powers of the ordinary customer. Yet this invaluable superiority of our *units* over those of the metrical system is, with an almost over-refinement of barbarism, thrown away at once when we come to multiples or sub-multiples. The very lowest attempt at consistency should have rendered it impossible for anyone who employs the decimal notation to use any but the decimal system of multiplication and subdivision of units. All the monstrosities of the old logic, with its *Barbara celarent*, &c.; or of the Latin grammar, with its *As in presenti*, &c., seem almost natural and proper when compared with a statement like this:—12in. = 1ft.; 3ft. = 1 yard; 220 yards = 1 furlong; 8 furlongs = 1 mile. And even this is nothing to the awful complex of poles or roods, grains troy and avoirdupois, drachms and fluid ounces." This is given as a digression, but it is, like the author's omission of an index, an important one. The book is certainly the best lecture-room treatise on the subject, but for engineering classes it needs to be followed up by a book not yet written, though Box's practical treatise approaches requirements.

BRAKE RETURNS TO THE BOARD OF TRADE.

With regard to the interest recently excited upon the brake question, it will not be out of place at this moment to find what is to be learnt upon the subject from the last return to the Board of Trade, showing the progress and the failures of continuous brakes for the half-year ending June last.

The total carriage stock in the United Kingdom amounted to 48,864 vehicles, which shows an increase of 956, or 2 per cent., on the last return. Of this stock, $44\frac{1}{2}$ per cent., or 21,646, are fitted with brakes which, to use the expression of the Blue-book, "appear" to comply with the Board of Trade conditions; $31\frac{1}{2}$ per cent., or 15,550, make no pretence of doing so; and 24 per cent., or 11,668, are as yet not fitted with any brake at all. The increased proportion of automatic brakes is so far a satisfactory feature. Of the stock fitted with all kinds of brakes, 58 per cent. are automatic; while of those which are, strictly speaking, continuous, and not sectional, 75 per cent. are automatic; and 90 per cent. of the increase during the half-year consisted of brakes on the same principle. But satisfactory though this increase is, it must be noticed that it arises almost wholly from the same companies which have been proceeding with the fitting of their stock for some years, and that, as a matter of fact, although the proportion of non-automatic brakes is less than hitherto, there are more in use than ever. Nothing could show more clearly the obstinacy of certain companies who, although repeatedly warned, and having experienced frequent examples of the inferiority of their system, have persisted in fitting their stock in utter contempt of the injunctions of the Board of Trade, and the general feeling of the country. The present return contains as many as forty cases of the Smith vacuum brake having allowed trains to overrun platforms, so that it is in every way probable that if a calamity does not arise from other causes, the failure of this brake will provide one. Whether the Penistone disaster, which occurred subsequent to the date of this return, has had any effect in checking the ill-judged action of the London and North-Western and other companies remains to be seen. There is no further need to discuss the non-automatic brakes, and we may now proceed to point out a few facts in regard to those brakes which profess to be both continuous and automatic, and which "appear" to comply with the Board of Trade conditions, though, so far as some are concerned, we have no hesitation in saying they do no such thing. The brakes under this head amount, as we have said, to 21,646, and 97 per cent. of these, referring to three systems, are fitted in the following proportions, viz:—Westinghouse, 12,645, or 58·4 per cent.; Sanders-Bolitho—leakhole—6500, or 30·0 per cent.; Smith's automatic-vacuum, 1881, or 8·6 per cent. There are, therefore, it seems, about twice as many of the Westinghouse as of any other automatic brake, and they are in use on practically the whole of the Scotch lines, as well as upon four of the principal, and some of the smaller railways in England. The leak-hole system is in use only on the Great Western and Midland Railways, and as it has often been condemned as dangerous by the Board of Trade inspectors, it is only reasonable to conclude that it cannot be held to comply with the Board of Trade requirements, and in all probability will not be allowed to exist much longer. There is, therefore, only left as a competitor of the Westinghouse the automatic vacuum brake which is being pushed by the Vacuum Brake Company, and which, excluding a few in Ireland, is only in use on 1800 vehicles, nearly all of which belong to the Lancashire and Yorkshire and London and South-Western Companies. It is a matter which remains to be decided whether the Board of Trade will consent to accept this apparatus as embodying those qualities which they consider a good brake should possess. We have never concealed our opinion that it does not do so. It is not instantaneous in action, and cannot be satisfactorily worked on long trains. It cannot be used automatically or otherwise on slip portions; the guard of such portions has no control over his own or any other part of the train; and the fact that it cannot be uncoupled without applying the brakes to all the carriages, on which it must then be released by hand, renders it, for this last-named reason alone, impracticable for extensive use. We should not have referred to this system as a possible competitor of the Westinghouse brake, were it not that, from the letters which have appeared from Mr. Martin, the chairman of the Vacuum Brake Company, it would seem that his company has decided to stake its existence on this form of apparatus, and even goes so far as to suggest that the four responsible advisers of the Board of Trade would recommend it for general adoption. This is, of course, ridiculous. It is, we repeat, entirely unfit for general adoption, as was proved by the action of the Great Western and Midland Companies, who, after trying a similar brake, were obliged to have recourse to the dangerous leak-off arrangement, with the view of avoiding delays.

With the object, however, of giving an importance to its own system which by no means belongs to it, the Vacuum Company continues to issue circulars professing to contain the results to be obtained from the Board of Trade Returns, but which on this occasion are even more misleading than usual. The test it selects by which the respective merits of the various systems are to be arrived at, is the number of miles run in proportion to the number of reports of every kind recorded. This, as we have frequently pointed out, can never be made a test of the capabilities of a brake, since efficiency is left out of the question altogether, and it is obvious that the fewer conditions with which a brake complies, the less it is likely to figure in these returns. The failures are, after all, the exception, while the miles run are the rule. Such a system can, at the best, give a negative aspect, and can only be employed at all when the reports of two brakes of exactly the same principle, complying with the same conditions, and working under similar circumstances, are recorded on precisely the same basis. It is in this way, for instance, perhaps possible to compare the working of the simple vacuum brake on the Metropolitan Railway with that of the non-automatic Westinghouse on the District line, and the result is immensely in favour of the Westinghouse; 624,000 miles having been run during the six months without a single failure of any kind. The only brake professing to be constructed on similar principles to the Westinghouse automatic, is the Smith automatic vacuum, though we are far from putting their efficiency on an equality, or from saying that the returns for each are made upon the same basis. But in the circular referred to, the Vacuum Company avoids the comparison of these two systems by lumping together the leakhole brakes with its own automatic vacuum; the very large mileage of the former is thus obtained, as also the further advantage of the singular omission on the part of the Midland Company to return more than six delays on the part of its own brake. When we come to compare the working of the Vacuum Company's brakes alone, we are met with a further astonishing feature in the method of comparison employed by them, viz., that it has altogether omitted the seventy-one failures reported by the Lancashire and Yorkshire Company against its system. This, moreover, is the result not of accident but design, the reason being that the Lancashire and Yorkshire Company, alone of all those using brakes, is still unable to return the mileage of its trains. This is, of course, no excuse for such unfair and reprehensible conduct. When those who elect to be judged by the relation two self-chosen factors bear to one another, it is a curious way of arriving at the truth to leave out both because one is absent, and the Lancashire and Yorkshire Company might just as reasonably have made no return of failures at all. It is certain that miles were run, and there is a way of getting at an unknown quantity which might have suggested itself to the compilers of this useless mass of figures. There can be no injustice in taking the average mileage of all the other engines fitted with the Smith automatic and non-automatic brakes, and crediting the Lancashire and Yorkshire with the same amount. In thus adding nearly a million miles to the total we are probably doing more than justice, considering the size of the line, and the fact that with 50 per cent. more engines fitted, the South-Western Company only return less than $1\frac{1}{4}$ millions of miles. If, now, we insert all the failures—which amount to 106 instead of 35—we get an average of only 21,000 miles run per failure with the Smith automatic vacuum brake, against 39,000 with the Westinghouse! This is a somewhat different result to that attempted to be shown in the circular where automatic vacuum brakes are credited with running 141,000 miles per fault; and, be it remembered, this is not our system of comparing brakes, it is the Vacuum Company's own method. Further, if its brake had been used to the same extent as the Westinghouse, the failures would have amounted to 711 instead of 106.

Having abandoned its own non-automatic brake, it is somewhat inconsistent on the part of the Vacuum Brake Company to continue issuing statements which can only be intended to show that such brakes are superior to any others. The absurdity of this system of comparison may further be indicated by taking the six principal brakes mentioned in the returns, and placing them in their order of merit, which we find to be—(1) Westinghouse non-automatic, (2) leakhole brake, (3) chain brakes, (4) Smith's non-automatic, (5) Westinghouse automatic, (6) Smith's automatic vacuum! The leak-hole system has, we know, been frequently condemned; the chain brake has been given up by the London and North-Western Company in the same way as the Vacuum Brake Company has now deserted its simple vacuum brake; and yet all the brakes are superior to its own, according to its method of comparison. Would it not be wiser for the Vacuum Company to leave figures alone for the future?

A study of the reports against the automatic brakes reveals various points of considerable interest. The value of the Westinghouse brake would appear to vary from 10,000 miles per report on the Midland up to 95,000 miles per report on the North-Eastern; yet the apparatus is the same upon both lines. The reason for such a discrepancy will readily occur to most of our readers. When we examine the reports against this brake, we find that over two-thirds are due to burst hose alone, and that the whole of them are due to the failure either of men or material, and not of the brake itself. We notice seven cases of cocks being shut, which have resulted in overrunning; but such cases are, as we have before shown, easily to be avoided by the brake being put on from the rear of the train, and thus compelling the driver to take it off before he can start. There are no cases due to frost, while with vacuum brakes this is a considerable source of trouble; and as regards the parts peculiar to the Westinghouse apparatus, the results shown in the following table are most interesting and instructive:—

	In use.	Reports.	Miles run.
Triple valves	12,413	15	15,506,447
Pumps	1,496	11	
Drivers' valves...	1,496	0	
Couplings	28,806	3	

All these reports are attributable to the neglect of servants or failure of material, and led to only trifling delays. It should be pointed out, also, that thirteen out of the fifteen cases against the triple valve occur on the Midland Railway alone in running only 374,000 miles; so that, in fact, over 15,000,000 miles have been run in six months with only two slight delays due to triple valves, out of nearly 13,000 in use. We consider this a very remarkable illustration of the perfection of design for a given purpose, and such results speak volumes for the real simplicity, as well as the efficiency, of an apparatus which it would be very difficult to parallel. It must be remembered what is the work performed. It has been found by experiments on several lines that the number of applications of the brake averages one per train per mile, and this would give 15,000,000. Allowing ten triple valves to a train, we get the enormous total of 150,000,000 movements of these valves in the six months, and out of these only two resulted in delay. It is, in fact, not an easy thing to prevent a triple valve from working, and a remarkable testimony towards their efficiency comes to hand from the Western of France Railway. Some time since 500 carriages fitted with the brake were kept waiting for their brake couplings, and in consequence the brake was not used on these vehicles for twelve months. Upon their being put into traffic it was found that the triple valves and other parts worked perfectly without anything being done to them.

So far as the manufacture is concerned, the simplicity of a hole is beyond question, and yet this alternative for a triple valve on the Great Western Railway would appear to be inferior to it as a means of avoiding delay. There are more triple valves in use on the North-Eastern than holes on the Great Western, and yet while none of the former have caused a single minute's delay, eleven leak-holes have been the cause of 85 minutes' delay on the Great Western line. That delays are not to be avoided in the use of an automatic vacuum brake by substituting a ball valve for a hole, is also obvious from the list of failures on the South-Western line, where 245 minutes' delay occurred in running some 1,230,000 miles, or on an average 5000 miles per minute, whereas on the North-Eastern Railway $4\frac{1}{2}$ million miles were run with the Westinghouse with a delay of only 194 minutes, or 23,000 miles per minute. The same reasoning holds good with regard to a comparison between the efficiency of the Westinghouse pump, and its analogue the ejector; for while the latter has gone wrong twenty-nine times, the former is, as we have shown, only mentioned eleven times. It is true, as Mr. Harrison remarked in his recently published report, that these delays are very trifling, and are not as great in two days as what occurs every hour under the block system. It would be well if the delays occurring on the underground lines since the completion of the Inner Circle were of as little account, and the cause as easily remedied as those due to automatic brakes.

The Construction of the Antwerp Exhibition building is rapidly progressing. The heavy ironwork is nearly finished, and the main outlines of the structure are now clear. Of the 75,000 square metres destined for the chief divisions of the Exhibition, 45,000 are already roofed. The buildings will be finished by the end of the year. The central gallery of the Exhibition has a length of 333 metres, and is of corresponding width. Demands for space arrive in great numbers, and annexes will have to be added to the principal buildings. It is regretted at Antwerp that the English Government is keeping aloof from the enterprise. There are, however, so many ties connecting the city with England that a very large participation of English exhibitors is counted upon.

Machine Tools for the French Government.—We have previously referred to the number of special machine tools that have recently been made in the Manchester district for continental shipbuilding yards, which would seem to indicate a determination to push forward this branch of industry abroad. One of the most important customers that the English tool makers have had is the French Government, which has given out, amongst other work, orders for large special machine tools evidently designed for work in connection with the construction of light armoured steel cruisers; and in view of the recent criticism with regard to the British Navy, this is a point to which some attention might very properly be called. Some time back an illustration and description was given in The Engineer of an exceptionally powerful shearing machine for cutting up steel plates 1in. in thickness—such as are used for the swift cruisers—which had been constructed by Messrs. De Bergue and Co., of Manchester, for the the French Government, and the above firm are now completing a second machine of a similar character which is to be delivered to the French Government Dockyard at Cherbourg. As it is only in one or two points that the present machine differs from the previous one made, it will only be necessary to indicate briefly its main features. In this machine the cutter slide is carried upon two massive standards, with cutters 10ft. 6in. in length, and the main frame or standard is designed to enable a cut to be taken 3ft. from the edge of the plate and to cross-cut plates any length up to 7ft. 6in. wide. The top bar is also provided with a very substantial and effective stop motion by which the action of the top slide can be arrested without stopping the driving gear. The top slide is worked by a massive steel excentric shaft driven by spur gearing of 4in. pitch, and a special feature in the design is that the bottom shear is contained in the main standard without being a separate casting, which, whilst making the bottom shear more rigid, tends to simplify the foundation, which for a machine of this size is usually a complicated piece of work. The driving power is self-contained, the engine and the shearing machine being securely bolted together, and the engine, which has an 18in. diameter of piston, with 20in. stroke, is fitted with a special governor and equilibrium throttle valve. The total weight of the machine and engine combined is upwards of 35 tons.

WESTON'S ELECTRIC LIGHT APPARATUS, PHILADELPHIA EXHIBITION.

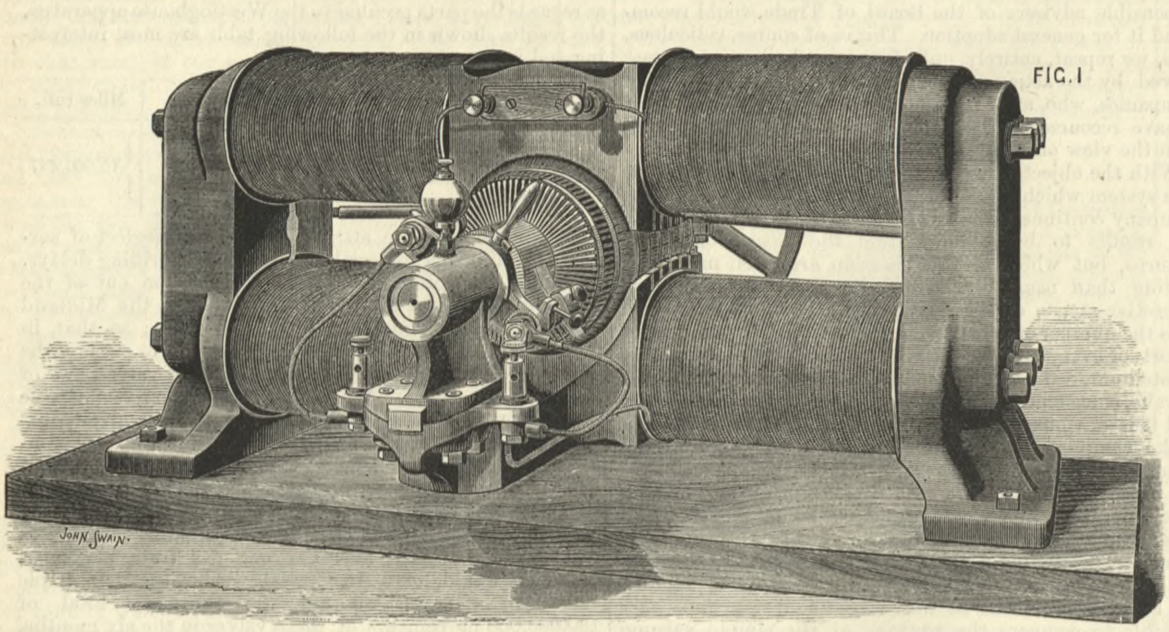


FIG. 1

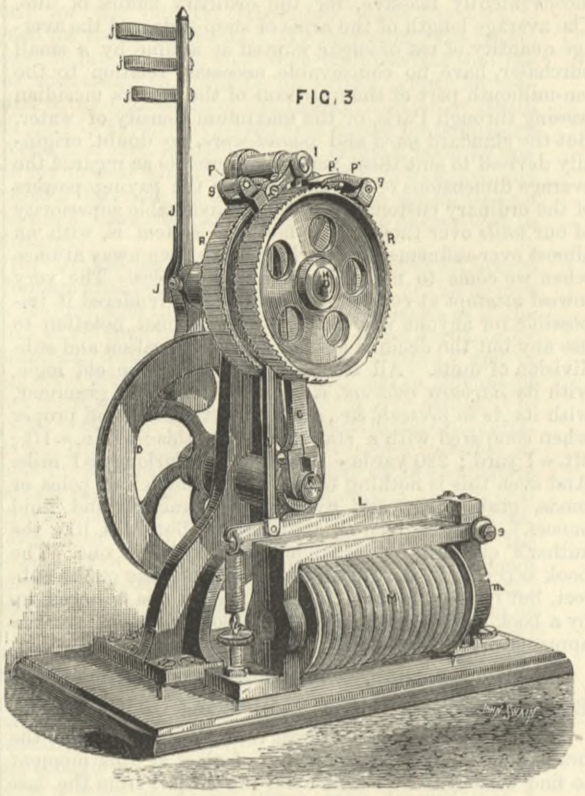


FIG. 3

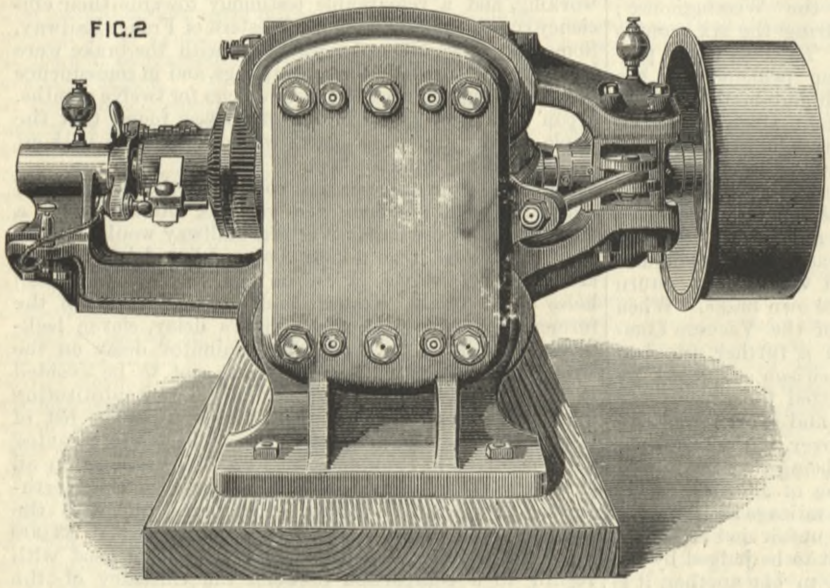


FIG. 2

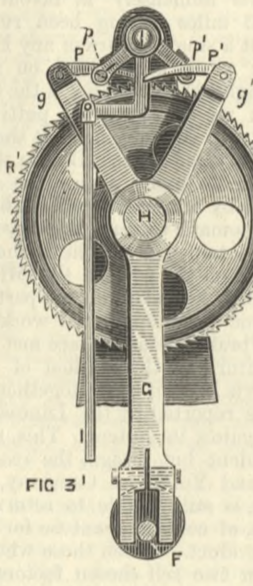


FIG. 3'

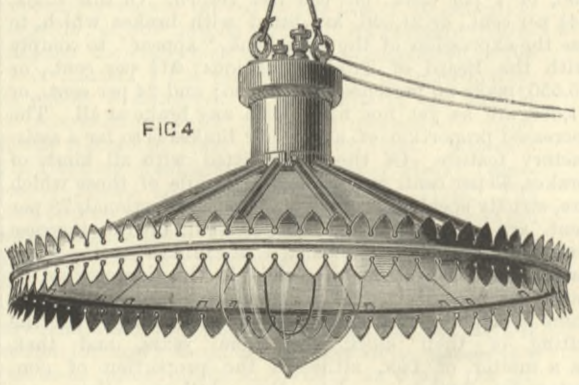


FIG. 4

THE PHILADELPHIA ELECTRIC EXHIBITION.

One of the most interesting exhibits is that of the United States Electric Lighting Company, who exclusively adopt the various inventions of Mr. Edward Weston. We have already published particulars of the Weston dynamo machine and arc lamp; both these have, however, undergone considerable change, and the standard patterns now in use are quite unlike those of a year ago. The Weston dynamo machine, shown by a side view in Fig. 1, has circular field magnets in the smaller sizes, while the larger has oval, as represented in Fig. 2, which shows an end view of the most recent type for incandescent lights. The dynamo machine is strongly built and stiffened with a wrought iron bar, the framing being bored out where it receives the two bearings to a hollow, which materially saves fitting. The current is controlled by an automatic regulator, Figs. 3 and 3', in which M is an

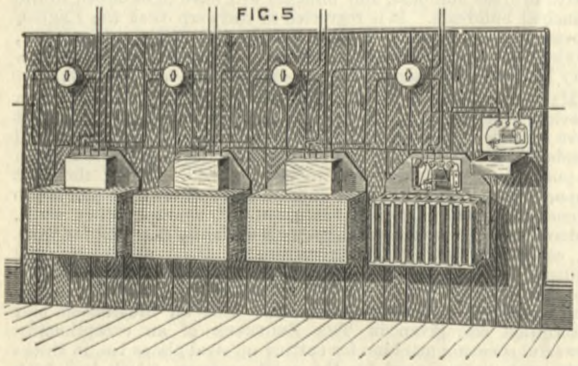


FIG. 5

electro-magnet on the main circuit attracting the armature *m*, which is kept away by the action of the spring S. The pulley D is rotated and causes a horizontal movement to be given to the pawls P' and P, which are set so as just to slip over the ratchet wheels R' and R; but should the current increase, the attraction of the armature *m* causes one of the pawls to gear into its wheel and occasion a rotary movement to be given to the arms *j*, and thus put a resistance in the circuit of the field magnets by means of the contacts *j* J J which slide on a commutator. A movement in the reverse direction is brought about by the spring S when the current is weakened. This regulator is applied to all the machines at the Exhibition, and is far more practical than the old form, in which the brushes were moved over the sections of the commutator.

The United States Company has a fine display of machines for incandescent lighting, one of which supplies five hundred and thirty 116 volt lamps on a show-board, arranged after the fashion of the old oil lamp illumination. In outward design they are similar to those used for arc lighting, but are wound with a shunt of fine wire, the low resistance of the armature—in the 200-light machine only $\frac{9}{1000}$ of an ohm —and the intense magnetic field, in which it revolves as close to the poles as possible, enable the electro-motive force to be kept practically constant and independent of the changes in the external circuit. One of these dynamos works fifty of the new incandescent lamps, which are each of 125-candle nominal power; they are slung in shades, as shown in Fig. 4. An installation, or, in American parlance, "outfit" of high power lamps has been working some time at the Pennsylvania Railway Depôt; they have been put in to demonstrate the superior economy this system of lighting has over the arc. Already considerable rivalry exists between the advocates of the two methods of utilising the electric light. The Edison Company states that the economy of incandescence over arc is very great, and quote as an example the case of a mill using forty arc lamps, for which they have substituted 250 Edison

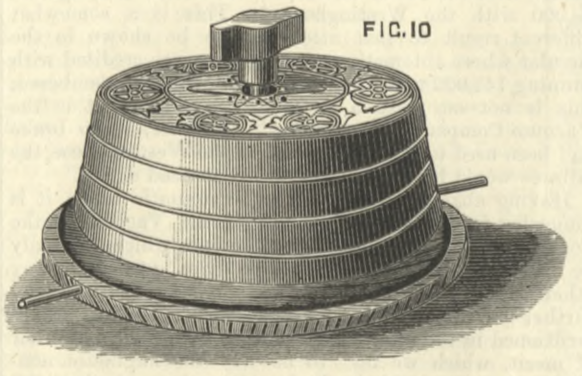


FIG. 10

lamps, costing hourly 1·08 dols., as against 1·99 dols. for the arc system, exclusive of interest in both cases.

The electro-motive force adopted by Mr. Weston is 600 volts, the lamps being in multiple series of four; a special resistance is inserted between each of the lamps, which is either inserted automatically or by hand, the object being to avoid extinction or destruction of those in series should an accident happen to any one or more of them. The regulator and resistance boxes are shown in Fig. 5; on the right is another electro-magnet, which cuts out all the resistance by opening the circuit as soon as all four lamps are extinguished, and thus saves the power which would otherwise be wasted.

The new lamp, Fig. 6, which is adopted throughout the system, has a filament totally different to that formerly used by Maxim; it is composed of a substance called tamidine, which is manufactured in the following manner: —The raw material is celluloid, or a species of hardened gun-cotton, which has long been employed as a substitute for ivory, and is often seen in various forms. It is supplied in sheets which are first split to the required thickness, then treated with sulphide of ammonium to remove the oxygen, the sheets are then rolled to a flat smooth surface, out of which the filament is punched with steel dies of such great accuracy that of the 5460 loops which make one ounce there is scarcely any variation in electrical resistance. The loops are then carbonised in a nickel muffle, after which they are twisted and fixed in the lamps, a powerful current being sent through after the vacuum has been perfected in order to dispel any gas in the filament and expand that remaining in the bulb. The light is very brilliant from these lamps, on account of the natural lustre and shape of the filament. The approximate dimensions are, for the 16-candle lamp, diameter of bulb, 2½in. by 5in. deep; resistance, cold, 400 ohms; and for the 125-candle, 5in. diameter by 9in. deep; resistance, 125 ohms. For street lighting the lamps are fixed on a cast iron standard,

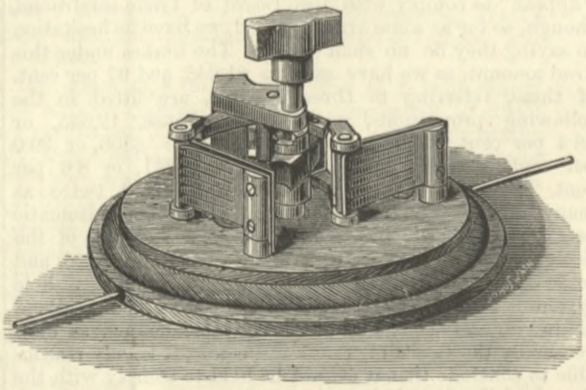


FIG. 9

Fig. 7, which shows the ordinary American practice adopted of furnishing electric light posts with steps, the attendant trimmer having a seat strapped to him which he fixes to the top of the posts by means of two hooks; the wires run, as shown, from the top of one post to the next. The lamps are fitted into a new form of socket shown in section by Fig. 8; the glass bulb is fitted into a brass socket furnished with an insulated projection which engages with a spring, the other connection being made with the socket. To secure the lamp it is turned round so that pins project into the hollow at top of the holder, which has a switch in its base. This arrangement is simple and well designed, and in common with the many exhibits of Mr. Weston, is the outcome of practical experience with many kinds of fittings. Some trouble has been experienced with the switches used for incandescent work, and a standard form has been adopted, Figs. 9 and 10, in which the contact pieces are separated some distance when the current is turned off; a cam action is employed which necessitates good machine work to insure accuracy. The Weston arc lamp has also undergone considerable alteration and has lost its original simplicity; the interior parts are shown by Fig. 11, and consist of two solenoids A and B acting on a clutch in the usual differential manner, with the addition of an automatic cut-out which comes into action should the arc

consists of a small dynamo A connected by means of a flexible shafts to the pulley D. The arrangement bears a strong resemblance to that shown by Mr. Gordon at a meeting of the Society of Telegraph Engineers last year. The United States Electric Lighting Company has taken up the manufacture of carbons on a large scale, and has

FIG. 11.

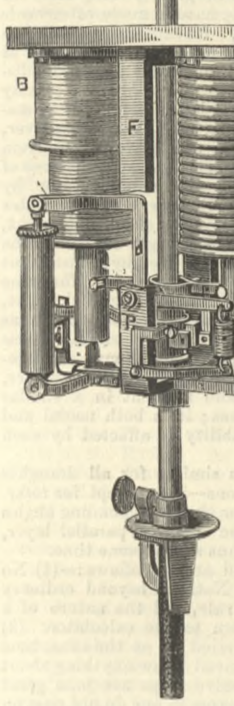


FIG. 12

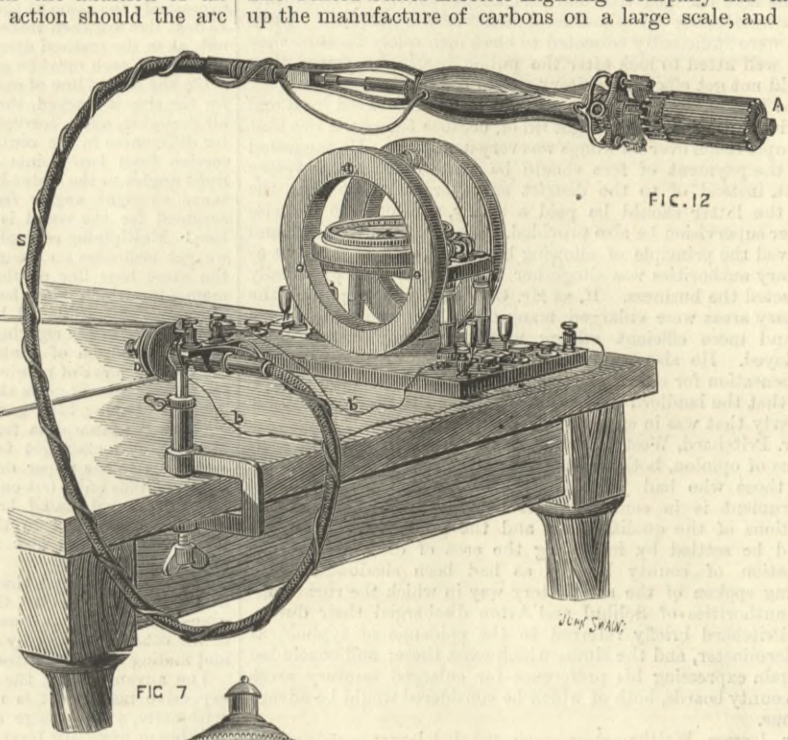


FIG 7

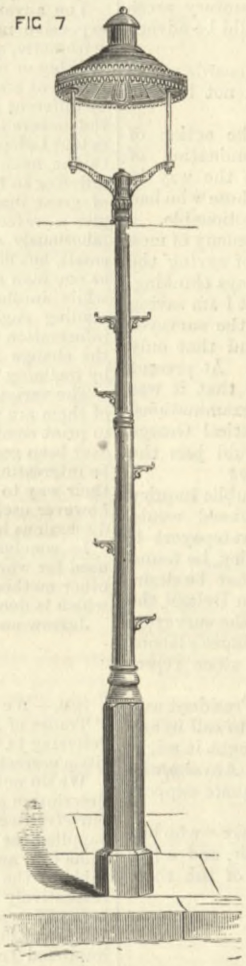


FIG 6

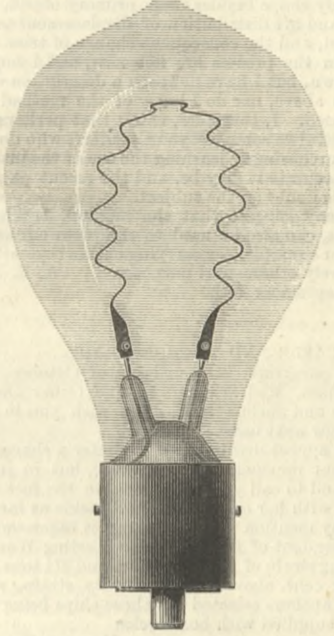
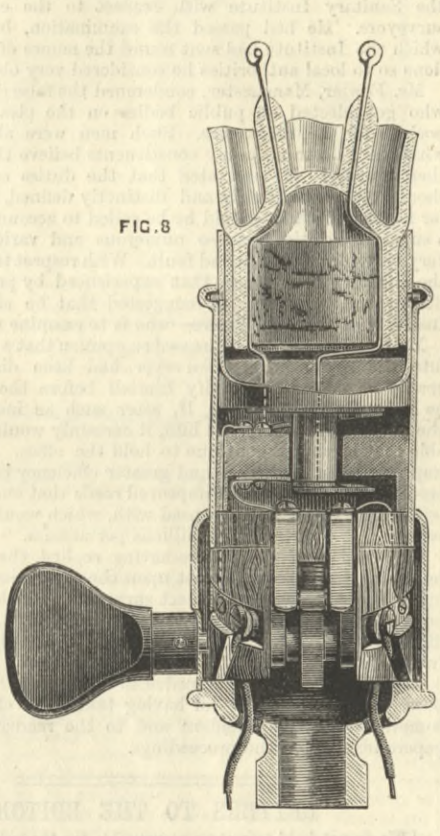


FIG. 8



burn too long or irregularly; it also closes a by-pass circuit until the arc is struck, and prevents a bad lamp from robbing the current of the others on the series.

A very large assortment of instruments is exhibited, including a new form of Clark's standard cell; also an apparatus for exploring the strength of a magnetic field, Fig. 12, which

samples of the process in various stages, a number of motors at work driving various machine tools of Messrs. William Sellers' make; and the inevitable cascade produced by a small centrifugal coupled to a dynamo attracts great crowds to this interesting exhibit.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.

The Home Counties Branch of this Association held a special meeting at the Health Exhibition, London, last Thursday afternoon. Sir Charles Dilke, President of the Local Government Board, occupied the chair, and members from all parts of the country attended. Amongst those present were Mr. Edwin Chadwick, C.B., Professor Rollason, Captain Douglas Galton, R.E., F.R.S., Major Fowler, of the Lea Conservancy Board; Mr. Lawes, Newcastle-on-Tyne, president of the Association; and several ex-presidents of the Association, with the secretary, Mr. T. Cole, C.E.

There were three papers, all bearing on the subject of sanitation and local authorities, and it was decided they should all be read previous to any discussion.

Mr. Lewis Angell, West Ham, read a paper on the origin, constitution, and objects of the Association. He explained that the Association had arisen from the felt want of such an organisation; and then strongly pressed the point that new houses should be strictly supervised whilst they were being erected. For this purpose a special staff of men should be employed, and be paid by fees paid by the builders. Such powers had been obtained at Eastbourne and West Ham by private Acts of Parliament, and he argued that the same principle should be applied to the whole country by a Government Act. The reason why the erection of new houses was not efficiently supervised was that the local surveyor had too many diverse duties, and was not provided with an adequate staff. He also referred to the want of building bye-laws outside the metropolis, and said that, even where adopted, they were frequently not properly enforced. The laying of drains should be made one of the first things done; and the law relating to the dedicating of private streets to the public—a subject bristling both with practical and financial difficulties—needed considerable amendment. After pointing out other defects in the existing Public Health Act, and bye-laws framed under it, Mr. Angell referred to the obstruction offered to sanitary improvements by interested members of local authorities—men who had secured their return to promote their own personal interests, and protect jerry builders and small property owners from their natural enemy, the local surveyor. It was impossible to speak out on this subject, because surveyors had not the protection which the Local Government Board extends to workhouse officials. He urged that such protection was not only needed, but was desirable, and that the status and functions were quite as good and as important as those of a poor-rate collector, over whom Government spreads its protecting ægis. Passing to the qualification of sanitary officers, he argued in favour of their efficiency, except in small towns and very exceptional cases, and then referred to a junior association—the Sanitary Institute of Great Britain—seeking to impose on local surveyors an examination of competency, of which the Institute should be the sole judge. The members of that Association would, in their own interests, assent to the principle of examination, but it would be preferable that such an examination should be conducted by the Institution of Civil Engineers, or the Royal Institute of British Architects, each with charters half a century old. There were also the Universities, or the Civil Service Commissioners, or a joint Examining Board might be formed of some of these bodies. Whilst wishing the Sanitary Institute every success in educating the public and promoting sanitary progress, as professional engineers they declined to admit the claims of a new *dilettante* society to examine them. His object had been to show that, as sanitary officers, they are, and have been for years, actively interested in their duties; that, as a class, they are neither incompetent nor negligent, but "cribbed, cabined, and confined," and they respectfully suggested to their critics that they should direct their attention to legislation, and to the constitution of bodies by whom they are controlled.

Professor Henry Robinson, M. Inst. C.E., F.G.S., and F.M.S., followed with a paper on "Sanitary Legislation and its Enforcement." He said it is a fact that, in many respects, even the mild existing legislation is not put into force. This arose from two causes—the ignorance or indifference of the sanitary authority to carry out the powers with which they are entrusted, and the difficulties and expense in the way of any individual ratepayer who desired to compel a sanitary authority to do its duty. He suggested as officials were controlled by members of sanitary authorities, many members of which had interests directly antagonistic to any action being taken, and that a too-zealous official soon got removed, that the Local Government Board should take prompt action on the memorial of a ratepayer, and take the necessary steps to remedy any evil. He held that all officers of health should be examined, as many most unfit and incompetent persons were appointed by local authorities to administer the Public Health Act; and having acted for some time as one of the examiners of the Sanitary Institute of Great Britain, he had had opportunities of testing the fitness of many men holding important positions of this kind. There were many houses throughout the country which do not conform to the elementary rules of house sanitation. The Legislature had very properly made it a penal offence to sell adulterated or bad meat. Surely it was equally culpable to receive rents for houses which breed fever and destroy the vital energies of the occupants, even where it does not destroy life. This class of property is generally represented on local boards, and there should be a swifter means than is now used to remedy this evil. Stringent regulations were required respecting defective drains, water fittings, and plumbers' work. Every man engaged in this class of work should be certificated and registered, as the only adequate protection to the public against existing bad work and consequent mischief. England might in this respect advantageously copy the example set by the city of New York, which in 1881 obtained an Act to secure the registration of plumbers, and the supervision of plumbing and drainage in the cities of New York and Brooklyn.

Mr. H. Percy Boulnois, M. Inst. C.E., borough engineer of Portsmouth, also contributed a paper on the effect of municipal government upon sanitation. The water supply, he held, should always be in the hands of the local authority, but often this was not the case, from the fear of interfering with vested interests, or the first cost of acquisition. In some instances there was worse neglect by permitting an insufficient or impure supply of water to be used, instead of providing a pure and sufficient supply. The sewerage of a district, which must of necessity be in the hands of the local authority, was second only in importance to the water supply. Permissive legislation led frequently to nothing being done, and the difficulties connected with the removal and disposal of sewage were made the excuse for inactivity. The supervision of house drains was generally inadequate, and a mere form, and it would require a far larger staff of officials to attend to it properly than a local authority is at all likely to supply. With respect to defective house drainage, some easier and less cumbersome mode of procedure than that afforded by Section 41 of the Public Health Act is required to secure a prompt remedy. The delay entailed rendered action almost useless in such cases, and a few authorities had been obliged to obtain private Acts. Scavenging was also a most important duty. The duty was often greatly neglected, and the practice of storing large heaps of house refuse, to effect a sale of some portion, and thus bring in a small revenue, was much to be deprecated. Some improvement was needed where new streets are required, as great cost for compensation has frequently to be incurred. Mistakes as to soil and position were often made in the selection of cemeteries, and as population increases cremation will doubtless have to be substituted for the present system of burial. He also strongly urged that all public works should be of the best and most substantial work, but frequently a false economy resulted in the lowest tender being accepted.

Captain Douglas Galton opened the discussion on the three papers, and defended the Sanitary Institute for having instituted voluntary examinations. At first many incompetent persons were examined, but recently the results had been much more satisfactory. It was necessary for the protection of the public that persons who undertook sanitary work should be properly qualified. He did not contend that the Sanitary Institute should be the examining body, but that there should be some competent examining body. He held, too, that some sort of protection should be given to such an officer in the discharge of his duties.

Mr. E. Chadwick, C.B., advocated larger and more extended areas of local government, as calculated to secure the employment of better qualified and more efficient officers, especially where towns had large and populous suburbs outside the borough boundaries. Qualified service was cheap service, and sanitary officers should have their qualifications tested by the central authority. The economy to be dealt with by sanitation is a burden three times greater than the burden of the poor rates, and the eradication of that burden by skill and responsibility was the greatest of all economies. There was no economy equal to the prevention of preventible sickness and mortality. They had proved that mortality was preventible by sanitation in towns where the death-rate had been reduced by one-half or a third. He hoped this would be extended by legislation, in which he trusted the chairman would take an active part, to the housing of the poor and the removal of the slums, of which they had in the metropolis and elsewhere very practical examples.

Mr. Ellis Clarke, of Hove, strongly advocated the appointment of a Minister of Health, whose whole attention should be devoted to sanitary matters. He held that the dignity of that Association had been somewhat compromised by the attitude which the Sanitary Institute of Great Britain has taken up with regard to the examination of surveyors. He ridiculed the idea of a man obtaining a university qualification, as Captain Galton had suggested, for a salary of £120 a year. He agreed with Mr. Chadwick that the enlargement of areas, especially in rural districts, would lead to the employment of better qualified and more competent men. The remedy for this, he thought, was a County Government Bill. There could be no doubt that the staff at the disposal of a surveyor was in many cases wholly insufficient. Having dwelt upon the impossibility of a surveyor under ordinary circumstances carrying out the requirements of the model bye-laws with respect to buildings, he expressed approval of fees being charged to builders in order that the supervision essential for the public health may be provided. The question of protection was a delicate and difficult one, but he said emphatically that it is perfectly impossible for local surveyors to do their duty in the way the Local Government Board would wish them to do. They might one week have to prosecute persons under the bye-laws, and have to apply to the same individual a short time afterwards for an increase of salary. He hoped Sir Charles Dilke would see a way of giving to a surveyor, in carrying out the Public Health Act, that consideration which his difficult position certainly requires.

Mr. Jones, Ealing, spoke in favour of fees for proper inspection of new buildings being made universal and compulsory. This would enable a local board to employ an adequate staff of competent men to supervise the erection of buildings. He felt they were right in pressing this point upon the President of the Local Government Board. He also urged that there should be power given to compel the drains to be laid at the commencement of a building, and not be allowed to cover them up until they had been properly inspected. He held, too, that when a surveyor had been articled to a person of repute, had served his time, and had had practical experience, he held a position beyond what could be given by a certificate of the Sanitary Institute, without any disrespect to the latter body. As to protection to surveyors, he thought there was a great deal of truth in the remark of Sir Henry Rawlinson, that when a surveyor and his board quarrelled, the sooner they parted the better. If an officer retains his position under the protection of the Local Government Board, he could not find his life a very happy one.

Sir Charles Dilke, who was received with applause, was the next speaker. He said that the defects which he had met with, as President of the Local Government Board and as member of the Royal Commission on the Housing of the Poor, had not been in those departments which came under the control of surveyors. He was glad to see the enormous improvements which had been made in sanitary matters by the bodies under whom the members of that association chiefly served. The great reduction in the death rate showed most important strides had been made, and to no one was the credit more due than to Mr. Chadwick. The exceptions he had met with were very largely in rural districts not within the control of any urban sanitary authority at all, but as to sanitary matters managed by boards of guardians. There were also enormous drawbacks to the sanitary condition of the metropolis still in existence. This was owing partly to the conflict of authorities, and also to the natural difficulty of dealing with the aggregation of population in the metropolis. After speaking of the different surveyors who had authority in the metropolis, Sir Charles said it seemed to him that it would be impossible to get rid of the drawbacks which exist in the metropolis without some change in the conflicting authorities. With respect to what he had seen in the country, he might say that there were still places where the drinking water of cottages is drawn from small ponds into which all the excreta from the cottages pass. He noticed the other day such an example at a station between Birmingham and the well-known Marston-green—cottage homes belonging to the Birmingham board of guardians. He had not met with any such an unsanitary state of things in urban sanitary districts. After alluding to the typhoid outbreak at Kidderminster as the most serious epidemic of the year, and to epidemics elsewhere, Sir Charles said that all these, so far as he had seen the reports, seemed to be due to causes which did not come under the province of surveyors. So, also, with respect to the pollution of the Thames, the Lea, and the Cam, there was no negligence or want of attention to their duties on the part of the surveyors. He was happy indeed to congratulate the surveyors of this country on the progress which has been made, and there was little fault to be found with matters which come under their care. The complaint that many members of local boards are personally interested against sanitary reforms was not a new one. It was a charge he had made in Parliament, and could undoubtedly be substantiated by official information which came into his hands almost every day. How was that difficulty to be overcome? It was suggested in one paper that the local government should take prompt action and remedy any existing evils on the complaint of an individual ratepayer. As to the Local Government Board doing the work itself, or becoming responsible to the public, it must be felt there were enormous difficulties in the way. Under certain circumstances the board would have power to step in and do work, but this was a power which had not been acted upon, and except in some great emergency where the public health was likely to suffer, it was not probable this power would ever be exercised. The question of the examination of local surveyors had been brought under the notice of the Royal Commission on the Housing of the Poor, and it was probable some allusion would be made to it in their report, and possibly some suggestion might be made on the subject. With respect to what had been called "protection" for local surveyors, reference had been made to the case of Poor-law officers. It was a very difficult matter indeed to support officers against the wish of those by whom they were appointed, and in very few cases could it be attended with anything like real success. If a local authority wanted to get rid of an officer, they would manage to make it impossible for him to remain. Only where there was a casual majority of one or two would it be possible effectually to support an officer against the wish of a local authority. He also pointed out that the Local Government Board contributed substantially to the salaries of Poor-law officers, and therefore had some right to interfere in exceptional cases. If, as had been suggested, County Government Boards were established, there might be introduced the right to appeal from a small elected body to a larger one covering the same ground. This would not be so objectionable as the central authority in London would be, and such a county body might be a proper court of appeal from a small local authority. With respect to suggestions which had been made as to the direction which legislation should take on these and other points, he had no doubt the Royal Commission to which he had alluded would recommend legislation on various matters, but he did not think they would recommend either violent or sweeping changes. The general drift of their report would be to better enforce existing legislation than to suggest any greatly increased legislation for the future. He pointed out, however, that there are now enormous difficulties in the way of getting even the simplest Government Bill through Parliament, and suggested to the Association that they would be much more likely to obtain a prompt remedy for any grievance if they could induce private members on both sides of the House to take the matter up.

Mr. White, Oxford, spoke of the difficulty of getting satisfactory bye-laws adopted where the sanitary authority was distinct from the corporation, and where the latter owned a quantity of old property, crowded upon a small space, which could not be rebuilt in the same way if proper bye-laws were in force. He suggested that, in such exceptional cases, the Local Government Board should not be so strict in insisting upon the adoption of their model bye-laws, but should approve of the best code that could be carried. He objected altogether to the suggestion of Professor Rollason, that the Local Government Board should act promptly on the complaint of individual ratepayers. There was far too much of this at present, and there was often a great deal of troublesome correspondence about trifles that could readily be explained. He expressed strong doubts as to the value of any certificate of examination, and said he had had several men in his office who had passed such examinations very satisfactorily, and he was not far wide of the mark when he said that the men who had come out the best in examinations were the least use in the office. He should like to see the surveyor strengthened, as his position was frequently a most difficult one, but he held the only true and permanent remedy was to educate the constituency by whom local authorities are elected. Until they were sufficiently educated to elect men solely because they were well fitted to look after the public health, he feared they should not get efficient sanitary work done.

Mr. Lemon, Southampton, said the conflict between local and district surveyors must be got rid of, because the result was that the supervision over buildings was very inefficient. He suggested that the payment of fees should be made to the local vestry direct, instead of to the district surveyor, and that from the fees the latter should be paid a salary, and men to exercise proper supervision be also provided. He had recently heard and believed the principle of allowing boards of guardians to act as sanitary authorities was altogether unsound, as they practically neglected the business. If, as Mr. Chadwick had suggested, the sanitary areas were enlarged, many difficulties would be got rid of, and more efficient officers would in many instances be employed. He also condemned the practice of paying heavy compensation for old ruinous property, and endorsed the suggestion that the landlord should not be allowed to receive rent for property that was in such an unsanitary condition.

Mr. Pritchard, Westminster and Birmingham, said the consensus of opinion, both on the part of the readers of the papers and those who had joined in the discussion, was that local government is in some respects defective. He believed the questions of the qualifications and the protection of officers would be settled by increasing the area of districts, and the formation of county boards, as had been shadowed forth. Having spoken of the satisfactory way in which the rural sanitary authorities of Solihul and Aston discharged their duties, Mr. Pritchard briefly referred to the epidemic of typhoid at Kidderminster, and the slums which exist there; and concluded by again expressing his preference for enlarged sanitary areas and county boards, both of which he considered would be advantageous.

Mr. Jerram, Walthamstow, suggested that larger boards would be beneficial, because then a dominant man would not be able to exercise so much personal influence.

Mr. Gamble, Grantham, protested against the action of the Sanitary Institute with respect to the examination of surveyors. He had passed the examination, but the way in which the Institute had sent round the names of those who had done so to local authorities he considered very objectionable.

Mr. Fowler, Manchester, condemned the false economy of men who got elected on public bodies on the plea of saving the pockets of the ratepayers. Such men were always thinking, what can I do to make my constituents believe that I am saving them money? He suggested that the duties of the surveyor should always be clearly and distinctly defined, and that only for neglect of these should he be called to account. At present a surveyor's duties were so numerous and varied that it was very easy for anyone to find fault. With respect to examinations, the difficulty he felt was that experienced by practical George Stephenson, when it was suggested that he should join the Institute of Civil Engineers—who is to examine me?

Mr. Chadwick, C.B., expressed an opinion that a public inquiry into the reason why a surveyor had been dismissed would enable an officer to justify himself before the ratepayers if he had suffered injustice. If, after such an inquiry, he found the public did not support him, it certainly would not be desirable that he should continue to hold the office. In Ireland the improved administration and greater efficiency of the surveyors employed had resulted in improved roads that one horse's labour out of five could be dispensed with, which would alone represent in this country eight millions per annum.

The readers of the papers having replied, the President said he looked with great distrust upon the suggestion to call in any other local authority to protect surveyors. He thought it might be merely exchanging King Frog for King Stork. Anyone who did his work fearlessly and well would have adequate support from his own board.

A vote of thanks was accorded to Sir Charles Dilke—who had been obliged to leave—for having taken the chair, and a like compliment to the President and to the readers of the three papers terminated the proceedings.

LETTERS TO THE EDITOR.

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

CURVES OF STABILITY FOR SHIPS.

Sir,—In the "Transactions" of the Institution of Naval Architects for this year, we have a very brilliant series of papers on the calculation of curves of stability, and the subject appears to be almost exhausted from a purely scientific point of view. It will, however, occur to many of the readers of these papers that, while it is most desirable that such data, curves, &c., should be calculated for the greater number of merchant ships, yet the methods given—accurate and complete as they are—lack to some extent the simplicity that is necessary to place the work within the reach of unskilled persons. It is desirable, therefore, to have some method of producing curves of stability which will give sufficiently accurate results, while being of such a nature as to be within the range of persons who have neither time nor inclination to study abstruse mathematics; if this can be obtained satisfactorily, such curves can be made for a much larger number of vessels than is now possible, its more elaborate methods being used for new types, or where great accuracy is required. In leisure time the approximate curves can be checked by the more exact methods, and the results will check future calculations.

In a letter to the *Times* last year, Mr. Barnaby described an approximate mode of getting curves of stability, stated to have been used successfully by a large shipbuilding firm—name not given. This process was simply to transfer the sections of the body plan for each angle of heel to a sheet of paper and cut them out; gum them all together, and obtain the centre of buoyancy by suspending the body successively from two points in the well-known manner. This, while easily done, is hardly accurate enough for the purpose, even if the process would bear mathematical inspection, as the common centre of gravity of a series of isolated planes is not, strictly speaking, the centre of a solid body of which these planes are sections; moreover, it would be very difficult to get the centre lines to exactly coincide, and to spread the gum so evenly that it would not affect the result. Part of the method can, however, be used, and much more accurate results obtained by proceeding in the following manner, the calculator being supposed to be supplied with a planimeter, an instrument now to be found in nearly every drawing-office, either as part of the office furniture, or as private property; the only instrument required besides this, and not found in an ordinary draughtsman's outfit, being a pair of scissors.

Body plans, showing whole sections, are required, as in Mr. Denny's first method; the number of draughts, and the angular intervals, have also to be determined, as in the same method. Having decided upon these, we proceed to operate upon the deepest draught, and take, for example, the first angular interval, say, 15 deg. A line is drawn across the body plan in the usual manner at this angle, and planimeter readings taken for each section up to this line; these readings are then to be set up as ordinates—scale as large as convenient—of a curve, the abscissæ being the distances which the sections are apart to a scale, not necessarily the same as the vertical scale. All the sections up to the 15 deg. line are then transferred to a sheet of stiff paper, and cut out, as in the method described by Mr. Barnaby, but the centre of gravity for each must be got separately.

On the centre line of each section an assumed centre of gravity for the ship is marked, the same centre of gravity being used for all draughts, and a correction of a simple nature made afterwards for differences in the centre of gravity. Having suspended each section from two points and got its centre of gravity, a line at right angles to the water-line is drawn through this point; the distance at right angles from this line to the centre of gravity assumed for the vessel is what we may call the lever for the section. Multiplying each planimeter reading by its respective lever, we get ordinates for a curve of moments, which are set up from the same base line as the first curve. The area of the curve of moments—which may be got either by the planimeter or by Simpson's rule—divided by the area of the curve of planimeter readings, gives the righting or upsetting lever for the displacement, assumed position of centre of gravity, and angle of heel. The area of the curve of planimeter readings multiplied by the constant for the planimeter gives the displacement in cubic feet. The same operation having been gone through for each angle and draught, we have the same data for producing cross curves of stability as Mr. Denny's staff got from the use of the integrator. These curves are to the upper deck, and between the extreme displacement sections only, but outlying appendages, such as the counter, &c., can be calculated both for area and moment in a similar manner, and added to the main curves; it is both useful and interesting to show how much the stability is affected by such appendages.

It should be noted that the work is similar for all draughts except in one particular, the paper sections—if not kept for reference—for the deepest draught will do for the corresponding angles of all other draughts by cutting off the required parallel layer, and finding the new centre of gravity, thus saving some time.

The advantages of the above method are as follows:—(1) No expensive instrument is required. (2) Nothing beyond ordinary arithmetic, a knowledge of Simpson's rule, and the nature of a righting or upsetting lever, need be known to the calculator. (3) Different steps in the process can be carried on at the same time by different persons, only one of whom need know anything about the nature of stability. (4) The successive steps are to a great extent independent of each other, and errors in one do not pass on to the next, so that the curves are pretty sure to detect them; differing in this respect from the ordinary calculation, where errors of great magnitude may—and frequently do—creep in, and will give a perfectly fair curve, passing unnoticed unless carefully and laboriously checked. (5) The amount of time required is very small, but of course this latter depends largely upon the calculator, as one man may be able to read off all the areas for an inclination while another is thinking where the decimal point of the first reading ought to go. (6) The curves provide some interesting information in a handy shape besides their primary object, such as the change in fore and aft distribution of displacement produced by inclining the vessel, and the consequent change of trim.

The various steps in the process are not new, and I hope most of them are well-known, but I have not seen a description of them in print combined as above, nor do I know of the method having ever been generally used. I, therefore, think that perhaps it may be interesting and useful to some of your readers, who do not see their way to either purchasing or learning the use of the integrator, however useful and accurate it may be, and the recent papers and discussions leave little doubt on the subject.

In conclusion, I may suggest that the method, besides being used for whole curves, can also be used to complete curves got by other methods, as, for example, for carrying curves beyond 90 deg., which is done for purely ornamental purposes. A. E. Long.

Jarrow-on-Tyne, September 29th.

THE CABLE AND ANCHOR TRADE.

Sir,—We notice a paragraph in your issue of October 10th, *re* "Trades of Birmingham, Wolverhampton, and Other Districts," referring to the cable and anchor trade. We wish you to make a little correction in your next issue.

We do not wish to appear invidious, or to prefer a charge of this description against our opponents in the trade, but in justice to ourselves we feel bound to call your attention to the fact that we supplied the Umbria with her outfit of ground tackle as far back as June 6th, and we may mention that two samples taken out of the cable by the superintendent of the Cambrian Testing Works gave respectively a breaking strain of 213 tons 6 cwt. and 211 tons 18 cwt., being 77 and 76 per cent. above the Admiralty strain, which is 120 tons 9 cwt.; the anchors selected for these ships being Wood's improved Trotman's supplied with box stocks.

Edward Shore,
For Henry Wood and Co.

Dee Ironworks, Saltney, near Chester, October 14th.

Sir,—Wasteneys Smith's patent stockless anchor, which has been many years before the public, and, I believe, stood more tests and trials with perfect success than any other, was selected by Captain Lynch for the Chilian armed cruiser Esmeralda, which was described in your last impression, she having six of them on board, and no other anchors. Many of her Majesty's ships, including the Collingwood and Agamemnon, have been fitted with these anchors, even up to 6¼ tons weight each. The latest splendid additions to the Cunard fleet, the Umbria and Etruria, are fitted with some of 3¼ tons each, and this company have had anchors as heavy as 6 tons each for mooring purposes in the river Mersey, where they have proved themselves unequalled after five and a-half years' experience.

The great strength and soundness—all the material being utilised for strength and holding power—its immense holding power, immediate grip in the ground, impossibility of fouling, requiring shortest scope of cable, ease in stowing—can be drawn within the hause pipe if required, having no stock to prevent it—makes it the safest and handiest anchor extant, and seeing nearly 700 of them are now in use is good proof of its efficiency and favour, particularly when it is remembered the first cost must necessarily be much greater than ordinary anchors.

These anchors are now being made by Messrs. Spencer and Sons Newburn Steel Works, Newcastle-on-Tyne, in high-class annealed steel, and are most rigidly tested by Lloyds' surveyors during process of manufacture, invariably with highest results. At present moment, eight large anchors of the naval type are being made of this material for the two cruisers now being built by Sir W. G. Armstrong, Mitchell, and Co., for the Japanese Navy.

Newcastle-on-Tyne, October, 14th. Fluke.

THE ROCKET LOCOMOTIVE.

Sir,—I have read with much interest the article in your impression of the 12th ult. and the letters it has called forth respecting the Rocket locomotive. I venture to send you this letter on the subject, as I am able from personal knowledge to give information which will clear up most of the points which appear doubtful. To account for my knowledge of the details, I may say that my father was the contractor for the great cutting between Chat Moss and Salford, and I was in close attendance on him while the work was in progress. I was present at the locomotive trials at Rainhill in October, 1829, and at the opening of the railway in September, 1830; and I think I rode at one time or another on every engine that was worked on the line between those dates.

As to the Rocket, your illustration on page 191 correctly represents the engine as she appeared on the day of the Rainhill trials, even to the trailing wheels, about which I may mention a circumstance not perhaps generally known. The Rocket was put together in the Rainhill engine sheds only just before the day of trial—the parts having been made elsewhere, and the pair of trailing wheels under the fire-box—which were similar in character to the driving wheels, but smaller in size—only arrived on the day before. When these wheels were placed under the frame it was found, to the great annoyance of the erectors, that the journals were too large to fit the bearings. It was impossible to get them altered in time for the trial; but the difficulty was overcome by substituting a pair of cast iron wheels, with a square-ended axle as shown, taken from a tip wagon at the last moment; and on these she ran at the Rainhill trials.

I can corroborate every statement made by Mr. James Boulton in the letter from him which you print in your impression of the 10th inst., both as to the identity of the Rocket and as to the procedure on the day of the opening of the railway. I have no doubt whatever that the sketch made by Mr. Nasmyth represents *not* the Rocket, but the Northumbrian—except that it does not show an awkward projecting step attached to the leading end of the latter engine's tender, against which my father one day tore his knee and was slightly lamed for life, and that there were, I think, no funnel stays on the Northumbrian. At any rate, the sketch is nothing like what the Rocket was in 1830.

The Rocket which ran on the day of the opening, and subsequently, was the identical Rocket that ran in the Rainhill trials in 1829. She was completed only just in time for the competition, and never ran a single trip before then. In the evening after the first day's trial, Mr. Stephenson said to my father, "Now, Stannard, let us have a trip to ourselves;" whereupon he got up, followed by Wakefield, the driver, my father, Mr. Booth, Mr. Moss, and myself. There was not much room, and Mr. Stephenson remarked, "Put your boy up on the tub, Stannard; he'll be more out of harm's way there;" and there indeed I sat during my first ride on the Rocket. As the butt had been newly painted only the day before, I stuck on very literally while we ran some four miles out and back.

When the trials were over the extemporised trailing wheels were removed and her own fitted to the Rocket, and she was sent before the end of October to my father's cutting, where she worked regularly without any alteration being made until the following spring. Her enormous funnel made her rather end-heavy, and at last brought her to grief. It happened in this way. One evening Wakefield was taking an extra run to give a ride to a gentleman named Hunter, who came on the works very frequently for that purpose. When on the bank, and probably going at a good speed, she jumped at a bad joint and tipped up, head downward, in the track, killing the unfortunate gentleman, and considerably damaging her funnel and front framing. She was then taken to the shops and fitted with a smoke-box and a shorter funnel, and after about a fortnight she was sent back to my father again, who worked her up to a very short time before the opening day.

I believe no other alteration was made in her till after the 15th of September, 1830. The same water-butt was on her tender on that day as she carried in the previous October, and it was used for a while afterwards, but was eventually replaced by a wrought iron box tank, carried on the same tender. The Rocket worked regularly on the line after it was opened, but was displaced as soon as a sufficient number of heavier engines were provided to deal with the traffic. I understood that she was bought from the railway company by a colliery proprietor, named Thompson, I think, and that he worked her until about 1845; but I am not able to speak positively as to this.

From the facts I have given—and for which I can vouch from my own knowledge—it is clear that the Rocket of 1830 was the same engine as the Rocket of 1829 with an altered funnel; that she worked nearly all the time between her recorded public appearances, and that she did run in the regular service on the Liverpool and Manchester Railway. ROB. STANNARD.

The Hull and Barnsley Railway Contractors' Office,
Howden, October 14th.

LOCOMOTIVE CRANK AXLES.

SIR,—I cannot give your "North-country Correspondent" the statistics he asks for as to the relative merits of plain *versus* crank axles, but I can supplement the returns given in my last from the Board of Trade report for 1883. With the report for the half-year ending June, 1884, therein I find it stated that fifty-eight broken iron crank axles gave an average mileage of 206,124 miles per axle, against twenty-seven steel crank axles with a mileage of only 166,687 miles, being 39,437 miles per axle in favour of iron. At the recent Iron and Steel meeting the papers read and the discussions that followed would lead an ordinary reader to infer that steel for all purposes was now practically settled to be the best. But is it? Mr. Adamson, at that meeting, spoke of iron as "that more treacherous material." I would like to ask him to explain how it happens, in spite of better tensile strengths, reduction of areas, elongation, permanent set, &c. &c., all in favour of steel, and of which steel makers make so much capital at all meetings where the subject can be introduced, that actual results of practical working are so much against them.

I think we have had deductions advanced upon the results of these tests sufficiently before us now. Of their value let Board of Trade returns show. In my humble opinion, it would be well, or perhaps better, if attention was now directed into a channel that has been much overlooked or avoided by scientists, viz., the effects of expansion, contraction, and vibration. W. P.

Darlington, October 7th.

BRAKE FAILURES.

SIR,—The correspondence in your columns, and especially the letter by Mr. Brooke, should direct the attention of railway companies to the danger of "leak-off two minute" brakes.

On Friday last, 10th inst., the second portion of the up-night Scotch express was worked from Leicester to London with the "leak-off vacuum" brake. One of the passengers from Glasgow informs me that approaching Bedford he felt the action of the brake and quite expected the train would stop; when the brake blocks ceased to grind on the wheels and the train ran the full length past the station and foul of the junction. In this case no accident resulted; the driver will, no doubt, be fined, and probably the case will never appear in the Board of Trade returns. I have frequently pointed out in your columns that the Midland Company does not report the failures, and the resolution passed at the Bath Congress last week now leaves no doubt upon the question. CLEMENT E. STRETTON.

40, Saxe-Coburg-street, Leicester,
October 14th.

UNITED STATES' ROLLING STOCK.

SIR,—In the fourteenth article on "The Chicago Railway Exposition," which appeared in a recent impression, I observe you describe the car illustrated on page 164 as a "palace car." It is not a palace car in the American acceptation of that term, but was specially intended by the makers, Messrs. Jackson and Sharp, of Wilmington, Delaware, to show that an exceedingly handsome and comfortable car could be built at a moderate cost to carry sixty passengers at ordinary fares. Palace cars generally carry little over twenty passengers at extra fares, and are both costly to build and heavy to haul. The car in question costs less for the number of seats than a good English first-class carriage, and is not excessively heavy.

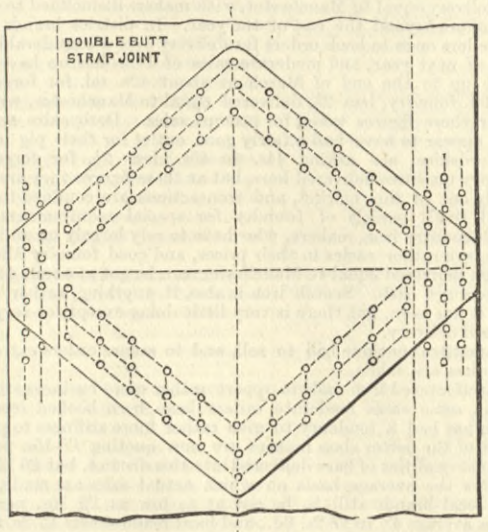
In the description of the suspended car truck on page 165, you state that the equalising or spring beam of the truck or bogie is suspended beneath the axle-box. The drawing of the car, on the contrary, shows the spring beam resting on the top of the axle-box as usual. The suspension truck is made in both ways, but the discrepancy has doubtless puzzled some of your readers.

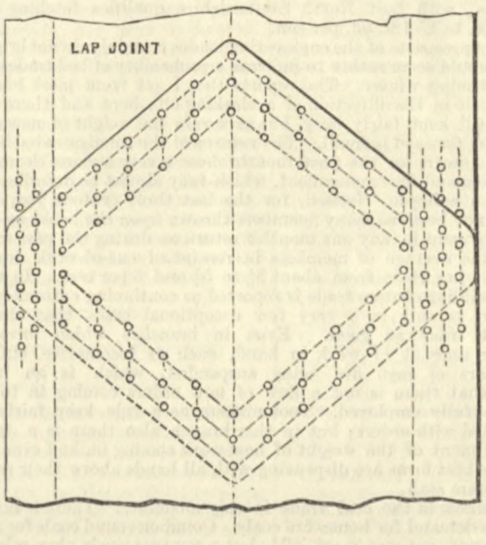
I notice in your issue of September 19th a long article on "Small Engines," describing some well-known locomotive works at Pittsburgh, which, like two or three English firms, make a speciality of locomotives of diminutive size and unusual gauge. The article has been copied without the slightest acknowledgment by the *Mechanical World* and other papers, and though you bestow quotation marks, you omit to state that the article originally appeared in the *Railroad Gazette* published in New York. The natural interest which a writer feels in his own productions must be my excuse for troubling you in this matter.

New York, September 30th. D. H. NEALE.

BOILER SEAMS.

SIR,—I send you herewith a sketch of a novel joint for boiler shells. The formula is very simple. If P be an ordinary pitch





and D the diameter of rivets, the diagonal pitch must be = P + D. This joint is likely to be of some use in boilers for very high pressures. A. T. ORR.

Barrow-in-Furness, Lancashire, October 7th.

THE TRACTION ENGINE TRIALS AT THE STOCKPORT SHOW.

SIR,—I read with great interest your excellent leader in your journal of the 19th ult. on the recent trials at the Stockport Show, and as one of the public who likes fair play, admire the straightforward manner in which you have opened the question out. As your remarks have not been challenged up to the present, I conclude they have been beyond dispute, or they have given satisfaction to all; but I am sorry that I cannot agree with your statement that Mr. Foden's engine was the most economical engine on the show ground, as in your reasoning you do not take into account the different weights of the respective engines, which, in my humble opinion, ought to be considered in arriving at the results of a traction engine test for economy of fuel. What we want to get at is the amount of coal used in each case to haul a uniform weight a uniform distance; and for convenience let us find the amount of coal used to haul one ton one lap.

W = total weight of engine and truck in tons.
N = total number of laps run.
P = quantity of coal allowed in pounds.
L = pounds of coal used per ton per lap.

$$\text{So } L = \frac{P}{W \times N}$$

Which gives the following results:—

First Series of Trials.

Maker's names.	W			N	P	L
	Tons	cwt.	qrs.	Laps.	lb.	lb.
McLaren, 8-H.P., single cylinder ..	16	18	0	13	160	·72
Foden, 6-H.P., double cylinder	13	16	0	$10\frac{3}{4}$	120	·81
Fowler's compound	16	12	2	$12\frac{1}{4}$	160	·78
Aveling, 8-H.P., single cylinder	16	16	0	$9\frac{1}{2}$	160	1·05

Second Trials.

Maker's names.	W			N	P	L
McLaren, 6-H.P., single cylinder ..	14	11	0	8	60	·51
Foden, 6-H.P., double cylinder	13	16	0	$8\frac{5}{8}$	60	·50
Fowler's compound	16	2	2	$8\frac{5}{8}$	80	·56
Aveling, 8-H.P., single cylinder	16	16	0	$9\frac{5}{8}$	80	·49

Now, let us take the average results of the two trials, which makes McLaren's engine the most economical, using only ·615 lb. of coal per ton per lap, Foden next with ·655 lb. of coal, Fowler third with ·67 lb. of coal, and Aveling last using ·77 lb. of coal. The above results are selected from the best performances of the four different makers who have any pretensions to the medal. I have confined my remarks to the economy of fuel alone, as I have seen nothing stated concerning the merits of the respective engines.

Leeds, October 8th. W. M.

SIR,—I did think that some one better qualified for the task than I am would have written before now to call attention to the Stockport trials. Sir, I was a bystander, and I saw more, I think, than the judges. I have been at a great many trials—trials that took place several years ago—and I know how things are done. I remember in one competition the portable engine of an eminent maker had grease crammed into one of the tubes, about 10 lb. of it. The tube was stopped up with clay, and the clay at the right time had a small hole made in it, and the grease ran into the fire—you may guess with what effect. Then they used to run gallons of oil down the side of the fire-box, spilt in filling lubricators! and this got into the ashpan and made the ashes as good or better than coal. Now, Sir, I have not a word to say against the heads of firms competing, for they were all square and above board—but were their men? Ask any one of the drivers whether the other drivers had more coal than was weighed to them, and see what he will say? There was no proper care taken to see that the men had no more coal on their engines than was weighed out to them, because there was not enough assistance for the judges. The trial is not worth anything so far as fuel is concerned.

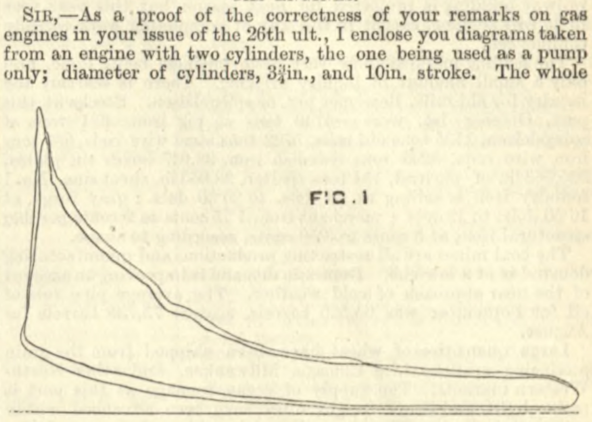
Again, look at the weights. Why four tons behind a big traction engine was like a tin kettle at a dog's tail; and none of the competitors knew what were the points on which the medal would be given till after the trial began.

I do hope we may have a real trial next time.

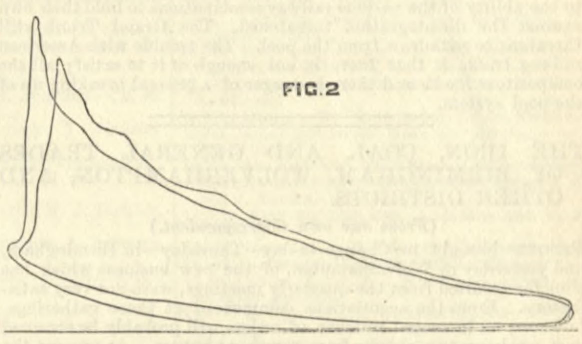
Lincoln, October 13th. W. J. H.

GAS ENGINES.

SIR,—As a proof of the correctness of your remarks on gas engines in your issue of the 26th ult., I enclose you diagrams taken from an engine with two cylinders, the one being used as a pump only; diameter of cylinders, $3\frac{3}{4}$in., and 10in. stroke. The whole



charge is a combustible mixture of gas and air, the whole products of combustion being practically discharged during the first two-thirds of the in-stroke, and the fresh charge compressed during the last third of the stroke, the two pistons being on one crank. The



one diagram was taken with 3in. and the other with 4in. of the stroke for compression. The middle line is caused by the expansion of air only, the governor having risen and prevented the gas valve from operating. Diagram scale 110 lb. per inch.

Wickham Works, Wickham-street, ROBERT SKENE.
Tyres-street, Lambeth, October 11th.

EXHIBITED INVENTIONS.

SIR,—Having in the practice of my profession observed that exhibitors of unpatented inventions at international and industrial exhibitions are not generally aware that their position is affected by certain provisions of the "Patents, Designs, and Trade Marks' Act, 1883," I beg to point out through the medium of your paper that the six months' protection of unpatented inventions so exhibited is no longer accorded unconditionally, such protection being now obtainable only by compliance with the requirements stated in section 39 of the above-mentioned Act, and rule 17 of the Patents Rules. Details of the mode of procedure may be obtained from the proper official sources of information, or I will supply information without charge on application.

W. T. WHITEMAN,
Fellow of the Institute of Patent Agents.

7, Staple-inn, London, W.C.
October 14th.

BELL HANGING.

SIR,—You were good enough to publish some letters of mine on bell-hanging in the early part of 1879. Since then the plan of suspending clappers by a bolt through the crown has become common. I highly approve of hanging clappers by a single bolt through the crown, but not in the way I have just seen it done. The clapper swings in a clumsy crosshead, through which is passed a square 1in. bolt, this goes through a $1\frac{1}{2}$in. round hole in the bell and through the stock, where it is secured by a single nut. A leather washer is placed between the crown of the bell and the shoulder of the crosshead.

To say the least, this nut is apt to get loose; and if it does so, the oscillation of the clapper will tend to bend the inch rod backwards and forwards in the $1\frac{1}{2}$in. round hole at the great risk of breaking it. I say let the jaws or crosshead be of wrought iron, and a nice tidy $1\frac{1}{2}$in. round bolt be passed through a 2in. hole in the crown; then let a shoulder be turned on the bolt reducing it to 1in., then upon this place a 3in. or 4in. washer between the bell and stock. Let the part of the bolt passing through the stock be square, and secure it on the top with two good lock nuts. The leather washers now in use on the under side of the crown are only a delusion and a snare. As I propose, the clapper would be entirely clear of the bell, and no vibration possible. Allow me to beg of bell-hangers to make their nuts fit tighter than they do at present. They very often come off the bolts altogether. My remarks refer to a bell of about a ton weight; larger or smaller bells would require, of course, different sized clapper bolts. G. T.

Leiston, October 6th.

STEAM FIRE ENGINE RAFTS.

SIR,—In your notice of the contract now open for steam fire engine rafts, you do not mention the terms of payment offered by the Metropolitan Board of Works, which are as follows:—66 per cent. of the contract price to be paid upon delivery, and the balance at the expiration of three months from the date of delivery. The same terms are also offered for the construction of two screw tugs for the service of the Board. Of course such terms as these effectually shut out many builders from the competition, and are not at all in accordance with the custom usually observed in the shipbuilding trade.

Upon application at the offices of the Board I find that these terms are, like the laws of the Medes and Persians, unalterable.

Longden-yard, Millwall, GEO. SKELTON.
October 4th.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Oct. 11th, 1884:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 13,947; mercantile marine, Indian section, and other collections, 4438. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 4 p.m., Museum, 1654; mercantile marine, Indian section, and other collections, 215. Total, 20,254. Average of corresponding week in former years, 16,995. Total from the opening of the Museum, 23,437,259.

AMERICAN NOTES.

(*From our own Correspondent.*)

NEW YORK, October 8th.

THERE is no decided improvement in the industrial conditions throughout the States, particularly on account of the excitement incident to the Presidential campaign. Prices of all kinds of products are still declining. Manufacturers of all kinds of goods are still endeavouring to restrict, but the restriction effected thus far is not sufficient to answer the requirements. Iron and steel were never so low as at present. The only exception to this is steel rails, which have advanced 2 dols. per ton within three weeks. But it is to be noted that no very heavy orders are being placed at the new figures. The advance was from 26·50 dols. to 28·50 dols., the latter being now claimed as inside figures. A large amount of railway building is projected for next season, but this year very little will be done, except in the way of completing work already commenced.

The leading markets show very little business being done, and only a small amount of inquiry arriving. There is scarcely any inquiry for old rails, Bessemer pig, or spiegeleisen. Stocks at this port, October 1st, were:—1740 tons of pig iron, 634 tons of spiegeleisen, 1135 tons old rails, 5722 tons steel wire rods, 689 tons iron wire rods, 3203 tons Swedish iron, 38,047 boxes tin plates, 325,563 lb. of pig lead, 154 tons spelter, 28,053 lb. sheet zinc. No. 1 foundry iron is selling at 20 dols. to 20·50 dols.; gray forge, at 16·50 dols. to 18 dols.; merchant iron, 1·75 cents to 2 cents per lb.; structural iron, at 3 cents to 3·50 cents, according to shape.

The coal mines are all restricting production, and manufacturing demand is at a low ebb. Domestic demand is improving on account of the near approach of cold weather. The average pipe run of oil for September was 65,525 barrels, against 75,738 barrels for August.

Large quantities of wheat have been shipped from the grain producing sections into Chicago, Milwaukee, and other North-Western markets. The supply of ocean tonnage at this port is rather light, and hence freight rates have been advanced within two or three days. There is an improving demand for vessels for petroleum and cotton, and there is a probability that a slight advance in rates will soon be announced in this direction, not only here, but at other Atlantic and Gulf ports.

Speculation in railway securities has been checked by doubts as to the ability of the various railway combinations to hold their own against the disintegration threatened. The Grand Trunk still threatens to withdraw from the pool. The trouble with American railway traffic is that there is not enough of it to satisfy all the competitors for it, and there is danger of a general breaking up of the pool system.

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

(*From our own Correspondent.*)

REPORTS brought to 'Change to-day—Thursday—in Birmingham, and yesterday in Wolverhampton, of the new business which has thus far resulted from the quarterly meetings, were not very satisfactory. From the negotiations commenced at those gatherings, however, an increased number of orders will probably be received in a week or two chiefly from merchant buyers. At present the sheet makers have benefitted most, and their books show an accession of orders. Prices in this department keep up, though on the week they are slightly easier, since quarter-day quotations are always excessive. We no longer hear of such miserable prices as £8 5s. per ton and under for lattens; but instead, these gauges are quoted an average of about £8 10s. per ton. Woodford ordinary sheets are £9 5s. Thin sheet makers report continued numerous inquiries, and satisfactory business doing with Australia, Canada, the United States, and other export markets, as also on home account.

Messrs. John Knight and Co., Cookley Ironworks, Kidderminster, reported to-day that they are seriously considering the advisability of removing to Middlesbrough. One reason is the increasing demand for sheets of steel, which makes it desirable to get nearer the great centres of the production of steel blooms, billets, and ingots. The other main reason is afforded in the excessive railway charges. The firm estimate that if they should remove they would save £1 per ton in carriage upon the manufactures leaving their works. The firm are experiencing a good call for stamping and working-up sheets and tin-plates. They are also meeting with an encouraging demand for large tinned sheets, which they make up to 96in. by 48in., for use at home and abroad for gas meter construction, working up purposes, and for the manufacture of milk and cheese vats. The United States demand is especially for the last-named purpose. The firm quote working-up sheets £10 10s. per ton for singles; soft steel singles, £12; charcoal sheets, £20; Knight's Crown bars, £7 10s.; plough bars, £9 10s.; charcoal bars, £16 10s.; all at works. Tin-plates they quote: Cookley K. charcoal, 25s. per box; C.S.S. charcoal, 22s.; and Cookley cokes, 20s. per box.

The plate trade remains quiet, and the mills are only partially employed. The prices of tank sorts range from £7 upwards, and of boiler sorts from £8 to £8 10s. and £9, according to quality. The reduction in the price of Lowmoor plates of between £1 and £3 per ton will not much influence plate prices in this district.

The starting of the new works of the Birkenhead Galvanising Company, which has just taken place, causes local galvanised sheet makers to be increasingly active in the solicitation of orders. Prices are moderately firm, the Sun and Blackwall brands remaining at £14 10s. per ton for 24 b.g. packed in cases, and £16 for 26 g.

The makers of bars and other merchant sections of iron are continually finding that they have to contend not only with competition from the North of England, but likewise from both Lancashire and North Staffordshire. These latter districts are running South Staffordshire hard in the matter of shipping orders for bars and hoops, their nearer location to the ports giving them their main advantage.

The country trade in blacksmiths' bars of good quality is improving, the individual orders being of rather larger bulk. Marked bars remain at £7 10s. to £7; medium quality, £6 10s.; and common, £6 to £5 15s. Hoops, £6 5s. to £6 10s.; and gas strip, £5 15s. upwards.

Pig iron was quieter than for some weeks past; native makers were, however, occasionally able to announce that in the past two or or three weeks they have booked larger contracts than a quarter ago. Prices of brands made outside this district are easier, but vendors were not desirous of selling. Derbyshire sorts 42s. to 42s. 6d. nominal; and Northamptons, 41s. to 41s. 6d.

Messrs. A. Hickman and Sons, Spring Vale furnaces, quote their rates as: Hydrates, £2 17s. 6d.; all-mines, £2 10s.; common iron, £2. This firm are now turning out some 1400 tons of pigs per week, and, what is more, they are finding a market for them.

Minerals were not active to-day, although prices were favourable. Northampton stone was 5s. 10d. to 6s. per ton delivered; Leicestershire calcined ore, 9s. For good native stone vendors were asking 12s., but consumers would not generally give more than 11s. South Yorkshire cokes were 14s. 9d. to 15s., and best best 16s.; Welsh cokes, 15s.; and Durham foundry sorts, 23s.

Coal prices are scarcely so firm, consequent upon the end of the colliers' strike. On Cannock Chase common forge coal is 5s. to 5s. 6d. per ton of 23 or 24 cwt., and 6s. to 6s. 6d. for best forge sorts; fine engine slack, 4s.; rough slack, 5s. 6d.; superior, 6s. 6d.; best deep slack, 7s. House coal is quoted by the best collieries 8s. for shallow one way, 9s. best shallow, 9s. deep one way, and 10s. best deep. Second-class owners quote—shallow, 7s. 6d.; deep, 8s. 6d. to 9s.

The demand for wrought iron tubes is best in the gas department. Here orders are arriving in good average numbers for this season; and galvanised water tubes are also called for.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Here and there moderately good orders have been got since the quarterly meetings, but in the general iron trade of the district there has been no accession of any weight of new business to bring about any improved condition of the market. Where makers have got orders there is a tendency to a little more firmness in prices, but the minimum rates continue the basis of actual transactions, and any attempted advance only operates as a check upon further sales.

The Manchester iron market on Tuesday brought together a good attendance on 'Change, but business was very quiet. Lancashire pig iron makers report only a very small weight of business coming forward, but quotations for local brands are unchanged, and are firm at 41s. for forge and 42s. for foundry, less 2½ as the minimum for delivery equal to Manchester, with makers disinclined to entertain offers beyond the end of the year. In district brands there are sellers open to book orders for delivery over a considerable portion of next year, and moderate sales of Lincolnshire have been made up to the end of March at about 42s. 6d. for forge, and 43s. 6d. foundry, less 2½, delivered equal to Manchester, with 6d. under these figures taken for prompt sales. Derbyshire makers, who appear to have had a fairly good outlet for their pig iron in Staffordshire, are asking 44s. to 45s., less 2½, for forge and foundry qualities delivered here, but at these figures they are practically out of this market, and transactions are confined to occasional small parcels of foundry for special requirements. In North-country iron, makers, who have to rely largely on an inland trade, are rather easier in their prices, and good foundry Middlesbrough delivered equal to Manchester can be got at about 44s. 4d. per ton net cash. Scotch iron is also, if anything, rather easier than it has been, but there is very little doing except for very long forward delivery.

Hematites continue bad to sell, and to secure orders extremely low prices are taken.

Manufactured iron makers report rather more business stirring, and in some cases moderate orders have been booked recently, which has had a tendency to give rather more stiffness to prices. A few of the better class makers are now quoting £5 15s. per ton for good qualities of bars delivered into this district, but £5 12s. 6d. remains the average basis on which actual sales are made, with some local brands still to be got at as low as £5 10s. per ton. Hoops average £6 to £6 2s. 6d., and local made sheets £7 2s. 6d. to £7 5s., with best North Staffordshire qualities fetching about £5 10s. to £5 12s. 6d. per ton.

The prospects of the engineering trades certainly do not brighten, but would seem rather to indicate a probability of bad trade during the ensuing winter. The reports that I get from most branches continue in the direction of a slacking off; here and there works are still kept fairly busy, but as a rule the weight of new orders coming forward is small. The returns of the Amalgamated Society of Engineers for the past month show a very serious decrease in the demand for employment, which may almost be described as a sudden collapse. Indeed, for the last three or four years there have not been so many members thrown upon the books as out of employment in any one month's return as during the past month, and the average of members in receipt of out-of-work donation benefit has risen from about 3½ to 5½ and 6 per cent. In all the shipbuilding centres trade is reported as continuing extremely bad, and it is only in a very few exceptional cases that districts report trade as good. Even in branches which have still a fair amount of work in hand, such as locomotive building, numbers of men are being suspended, which is an indication that there is not a flow of new orders coming in to keep works fully employed. Tool makers, as a rule, keep fairly well supplied with orders; but in this branch also there is a decided curtailment of the weight of new work coming in, and even some of the best firms are dispensing with all hands above their regular minimum staff.

Business in the coal trade is only moderate. There is no push in the demand for house-fire coals. Common round coals for steam and forge purposes meet with but a comparatively slow sale, and supplies of engine fuel continue in excess of requirements. In the Manchester district the leading colliery proprietors are firm at the full October advance for all classes, but in other districts there appears to be some difficulty in maintaining the modified advance of 6d. per ton in all cases, and for common round coals low prices are being taken in some instances. In engine classes of fuel, although the Manchester firms are holding on to their advanced rates, prices generally are as low as ever. At the pit mouth best coal averages 9s. 6d.; seconds, 7s. 6d.; common house coal, 6s. 6d.; steam and forge coal, 5s. 6d. to 6s.; burgy, 4s. 6d. to 5s.; and slack, 3s. to 4s. per ton, according to quality.

There is a quieter tone in the shipping trade, with prices, if anything, rather easier, 7s. 3d. to 7s. 6d. being taken for steam coal delivered at the high level, Liverpool, or the Garston Docks.

As the natural result of the upward movement in prices at the commencement of the month, the men are now agitating for an advance of wages, but no definite action has yet been decided upon.

Barrow.—I have to report only a limited business doing in the pig iron trade of the North Lancashire district. The spurt which occurred a few weeks ago in the trade has completely died away, and left business in an even quieter state than before. There was but a poor attendance at this week's market, and the sales have not been beyond recent averages. Both home and foreign demand has dropped off considerably, and the orders now being booked are inextensive. It is impossible to keep works steadily employed, and makers find a difficulty in obtaining orders for forward delivery. The stocks on hand are considerable and are not being reduced, as the deliveries do not by any means represent the amount of the output. I can hear of no probability of there being a further restriction of the output. Quotations are practically unchanged, No. 1 Bessemer samples being offered at about 44s. per ton net at works, prompt delivery, No. 2 at 43s., and No. 3 at 42s. per ton. Steelmakers are rather busier, and it is probable that their mills will be better employed during the winter than has seemed likely lately. No new orders of any weight are being received for rails, and prices remain at about £4 10s. to £5 for ordinary sections. Hoops and wire show a fair average demand. Founders are but indifferently employed, and the engineering works are very inactive. Shipbuilders are expecting new orders. Iron ore is selling slowly at last week's rates. Stocks are heavy at mines. Coal and coke quiet. Shipping discouraging.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*

COAL continues fairly brisk, owing to the general stocking which is now going on, both in the metropolis and the provinces. The advance made in October will probably be followed by another in November, should there be a return of the cold snap of last week. While I write, however, there is milder weather, with some prospect of its continuance. It is noticeable that during the month of September there were 133,808 tons sent to Hull from the Yorkshire collieries, as compared with 118,064 tons forwarded during the corresponding month of last year, thus showing an increase of 15,744 tons; this increase, however, is not sufficiently great to counterbalance the falling off in previous months, as the returns for the nine months of the present year show only 968,352, as compared with 1,003,932 tons of the nine months of 1883. From Denaby Main there have been sent 11,384 tons; Shireoak, 7248 tons; Manvers Main, 6776 tons; Houghton Main, 5032 tons; Elsecar, 4480 tons; Monk Bretton, 4192 tons; Thrybergh Hall, 4128 tons; Edmunds Main, 3776 tons; Roundwood, 3432 tons; Wharncliffe Silkstone, 3368 tons; Cortonwood, 2680 tons; Oaks, 2544 tons; Wharncliffe Carlton, 2456 tons; and Carlton Main, 2352 tons. The West Yorkshire collieries are somewhat favoured n the way of railway rates, and have consequently made a considerable increase on their tonnage. Allerton Main sent no less than 10,624 tons last month; Tryston, 9560 tons; Whitwood, 6680 tons; and Wheldale, 4104 tons. The quantity of coal exported during September has been 65,142 tons, as compared with 61,967 tons during September, 1883.

A London correspondent to a leading provincial paper holds out hope of activity in the steel trade, on the ground of heavy orders having been received there from various foreign markets. Up to the time of writing none of these orders have come Sheffield way, so far as I can hear. The Board of Trade returns for September, which are before me as I write, show how much this activity is needed. The total value of steel—unwrought—exported during September last was £93,444, as compared with £116,110 for September, 1883, the respective values for 1884 and 1883 being £856,959 and £1,072,858. France took a value in steel last month of £9011, and the United States of £23,414, the respective values for the corresponding month of 1883 being, to France, £11,497; and to the United States £26,980. In this connection I note a letter in a local paper signed "Steel." This writer has taken a prominent part in the steel controversy. He states, with reference to Mr. Seebohm's paper read before the Iron and Steel Institute, and the remarks made thereon by Mr. F. J. Hall, that he has instituted very careful inquiries as to the number of crucible steel furnaces there are at work in Sheffield at the present day. He finds there are at least 30, if not 35 per cent., fewer at work now than there were ten or twelve years ago. "Steel" adds that as these gentlemen stated that the output of crucible steel in Sheffield was larger than ever, it would be rather interesting to know how it is made, "as the productive power of each furnace is the same now as it was then." He invites Mr. Seebohm or Mr. Hall to answer the question.

Hardware and cutlery, during the month of September, have been exported to the value of £264,301, as compared with £355,509 for September, 1883. The decrease on the nine expired months of the year is not less than £465,793. The only increasing markets are Russia, Holland, Spain, and Canaries, Argentine Republic, and these to a trifling extent; while Germany, France, the United States, Foreign West Indies, Brazil, British North America, British Possessions in South Africa, East Indies, and Australasia, all show large decreases. The chief falling off is in Brazil, British North America, and Australasia.

Steel rails are again unsatisfactory, the weight exported last month being only 34,242 tons, as against 63,242 tons in September, 1883. The United States took 6508 tons in September of last year; last month not a rail has been sent to that market. Mexico has fallen from 1147 tons to 19 tons; Sweden and Norway from 3619 to 669 tons; Egypt, 1255 to 301 tons; British North America from 10,927 to 3348 tons; and Australasia from 13,436 to 4429 tons. Russia, which took nothing in September, 1883, was a customer last month for 1173 tons; Germany has also resumed business, but only to the extent of 25 tons; Chili and Peru show slight increases, and the British East Indies has advanced from 3997 to 6038 tons. Not a single rail order, so far as I can learn, has been received in Sheffield this month.

A leading Sheffield manufacturer informs me that an excessive drought in Queensland is unfavourably affecting the demand for Sheffield hardware. Advices recently received give a deplorable account of affairs there. One wool-grower who had 27,000 sheep has only 5000 left, and others are ruined. Of course, as there are no sheep, no sheep-shears will be needed; and the other articles, such as spoons, cutlery, &c., used by the workmen, will similarly be in vastly diminished demand.

Much complaint has been made locally of the non-productive character of the Calcutta Exhibition. Several manufacturers informed me that the world's show there has not brought them a single order. This is in marked contrast to the Melbourne Exhibition, which was followed by good business.

The Cutlers' Feast this year, in spite of the postponement, promises to be a brilliant gathering, the Master Cutler—Mr. J. E. Bingham—having secured a goodly array of distinguished guests. The whole of the splendid display of plate decorating the tables is supplied by Messrs. Walker and Hall, of which firm the Master Cutler is the principal. Usually the various electro-plate establishments are laid under contribution for the feast; but the extensive works of Messrs. Walker and Hall are quite equal to supplying the whole of the articles required.

Messrs. John Horton and Co., of the Oxford Brass Works, Bailey-street, have just completed several very handsome chandeliers, which have been manufactured by them for the Newcastle and Gateshead Gas Light Company's new offices. The chandeliers are of novel design, and give evidence of excellent workmanship.

Mr. T. W. Jeffcock, J.P., has been elected president of the Midland Institute of Mining, Civil, and Mechanical Engineers. In his introductory address he strongly counsels the adoption of the sliding scale for the regulation of miners' wages in Yorkshire.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE business done at the Cleveland iron market, held at Middlesbrough on Tuesday last, was but moderate in extent, and prices were not quite so firm as a week previously. This is to be accounted for to some extent by the circumstance that exports are very rapidly diminishing, as the shipping season draws to a close. Makers continue to ask 37s. per ton for No. 3 g.m.b., and it is said that some foreign consumers are giving even more than that figure for special brands and immediate delivery. Merchants, however, and makers not connected with the combination, are again offering No. 3 at 36s. 6d. per ton. Quotations for forge quality range from 33s. 6d. to 34s., and some sales have been made at the lower figure.

The Cleveland ironmasters, at a meeting held at Middlesbrough on Monday last, discussed the general condition of the pig iron trade, and the practicability of a further restriction of output. A proposal was made to appoint an official salesman to act for the combination firms throughout the whole district, but nothing definite was settled.

Messrs. Connal's stock of pig iron amounted, on Monday last, to 54,148 tons, being a reduction of 471 tons for the week. At Glasgow their stock decreased 595 tons.

During the first thirteen days of this month, 30,744 tons of pig iron were exported from the Tees. This is 9000 tons less than during an equal number of days last month.

The few finished ironworks which are still in operation are running somewhat more regularly. Specifications, however, come to hand slowly, and the competition for new work is as keen as ever. Makers continue to offer plates at £5, angles at £4 15s., and common bars at £5 2s. 6d., all on trucks at works less 2½ per cent. Favourable specifications can be placed at slightly less.

Owing to scarcity of orders, the Grange Iron Company, Durham, has given notice of a reduction of wages of 1s. per week to the whole of its workmen.

The North-Eastern Railway Company is about to reduce its staff of platelayers. This is due to dulness of trade, but is facilitated by the substitution of steel for iron rails. It is said it is able to dispense with one man for every two miles of railway.

The directors of the Scarborough and Whitby Railway Company have made an arrangement with the North-Eastern Railway Company to be provided with engine power, rolling stock, station-masters, &c., for the working of their line as soon as completed. For these services they are to allow the North-Eastern Railway Company 50 per cent. of their gross receipts.

The prices at which the Staffordshire Steel and Ingot Company are selling finished steel, in competition with what is made in the North, is the subject of much comment at present. It is said, for instance, they are offering basic steel plates at £6 10s., less 2½ per cent. discount, delivered locally, equal to, say, £6 5s. cash at makers' works. At the latter price a considerable quantity of steel sleeper plates have been recently made by northern plate makers. But after executing their trial orders, none of them are now willing to take more at the price. Some, indeed, assert that they lost from 10s. to 12s. 6d. per ton on these orders. If, therefore, the Staffordshire Company can make steel plates at, say, 15s. per ton cheaper than their northern competitors, we may soon see their plates sent for consumption on the north-east coast, instead of as heretofore, and at the present time east coast plates—iron—are being sent into Staffordshire at below the price at which they can be produced there. But possibly the Staffordshire Company, being very young, is at present, metaphorically speaking, only "sowing its wild oats."

Messrs. J. M. Lennard and Son, shipowners, of Middlesbrough, having lost a vessel recently, are about to replace her with one made of steel, and fitted with triple compound engines. They have made a contract with Messrs. Dixon and Co., and the steel plates are to be supplied by Messrs. Bolckow, Vaughan, and Co. from their new Siemens steel department at Eston. The price has not yet transpired. It is said, however, that the additional advantages of steel over iron, and triple over double engines, will be gained without any extra cost over what was incurred in building her predecessor when higher prices were ruling.

Rumour says that the Cleveland smelters' ring has at last broken down. It appears certain that one firm at all events, after giving due warning to the rest, sold a quantity of No. 3 iron at more than a shilling below the ring price of 37s. per ton. It was scarcely to be expected that any other end could be in store for this combination of competitors. The spectacle of 3s. 3d. difference between the artificial price of No. 3 and the natural price of No. 4 forge, as compared with the usual difference of 1s. per ton, was not likely to be lost on consumers. Naturally they would conclude that such a difference could not last, and they would hold back orders, and so drag down the higher figure. Nor could sellers under such circumstances say a word in defence of a level so obviously artificial. Concurrently with the rumour referred to another has been current to the effect that further restriction was about to be adopted, and more furnaces to be blown out. This, however, is scarcely likely. The combination has so far manifestly proved a failure, and relief must clearly now be sought in some new direction, and not in the old one.

Some sensation was created in the North a few months since by a statement made by Sir Jno. Brown, chairman of Earle's Shipbuilding Company, to the effect that German steel was now being used in large quantities by northern shipbuilders and marine engineers, as they found it cheaper than English steel. The impression created at the time was that the steel he referred to was imported in the form of ship plates and angles; but a very little inquiry resulted in the ascertainment that this could not be the case. Very few ships were built of steel at all last year on the north-east coast, and the plates and angles used in them were almost entirely from English sources. More recent information points to the probability that Sir Jno. Brown must have been referring to German steel castings, which really have been largely used by marine engine builders.

A steel-making firm at Dortmund, in particular, has been pushing the sale of its castings in England with great pertinacity and success. The castings are all made of crucible steel. They are very sound and well finished, and are delivered at the Northern ports, by way of Rotterdam or Antwerp, at about the same price as English steel castings made by the Bessemer or Siemens' processes are obtainable. But it is said that the German castings, being made by the crucible process, are freer from blowholes, and generally sounder and more satisfactory. There is no doubt that marine engineers are now using steel castings more and more largely in place of iron ones. Although the cost per ton is about three-fold, a portion of the weight can be saved; and even then they are infinitely stronger and more reliable. Indeed, it would seem that the time is rapidly approaching when all the castings in a marine engine will be of steel, except valve casings and such details of an intricate form, and without liability to heavy strain; and these will be made separate, and bolted on.

Besides castings, German steel-making firms are also offering to deliver slabs or blooms made by the basic process for rolling into plates or angles, at about English prices. But it is not likely they will do a large business in these, as finished steel-makers can purchase English ingots at much less than the price of slabs; and in ingots it does not appear the Germans can compete at all.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Glasgow iron market, which was quiet at the end of last week, became much firmer a few days ago, in consequence of better shipments and of the breakdown of the ironmasters' combination for restriction in the North of England. Those who are acquainted with the trade do not, however, attach much importance to this latter occurrence, seeing that all through the term of its existence the agreement was in a great measure practically ignored. The ultimate effect on our market is likely to be a slight depression of prices. During the past week the shipments of Scotch pigs amounted to 11,661 tons, as compared with 9655 in the preceding week, and 11,787 in the corresponding week of 1883. A much larger quantity of iron than usual was sent to Russia, but less to Germany. Two additional furnaces have been put in blast, one at Summerlee and the other at Dalmellington, and there are now ninety-four in operation, against the same number at the corresponding date last year. The stock of Scotch pigs in Messrs. Connal and Co.'s Glasgow stores has been reduced by 490 tons since last report.

Business was done in the warrant market on Friday at 41s. 7½d. per ton for cash. On Monday transactions occurred at 41s. 7½d. to 41s. 8½d. cash, and 41s. 9d. to 41s. 10½d. one month. Business was done on Tuesday at 41s. 9d. to 41s. 9½d. cash, and 41s. 10d. to 41s. 11d. one month. The quotations on Wednesday were 41s. 8d. to 41s. 10d., and back to 41s. 9d. cash. Transactions occurred to-day—Thursday—from 41s. 8½d. to 41s. 9½d. cash.

The market quotations of makers' iron are well maintained, as follows:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 56s.; No. 3, 50s. 6d.; Coltness, 60s. and 52s.; Langloan, 58s. and 52s. 6d.; Summerlee, 54s. and 47s. 3d.; Calder, 53s. 6d. and 47s. 6d.; Carnbroe, 50s. 6d. and 47s.; Clyde, 48s. 6d. and 45s.; Monkland, 43s. 9d. and 40s. 9d.; Quarter, 42s. and 40s. 6d.; Govan, at Broomielaw, 43s. and 40s. 9d.; Shotts, at Leith, 54s. 6d. and 52s.; Carron, at Grangemouth, 49s. (specially selected, 53s. 6d.) and 48s.; Kinneil, at Bo'ness, 44s. and 43s.; Glengarnock, at Ardrossan, 50s. 6d. and 43s.; Eglinton, 44s. 6d. and 41s.; Dalmellington, 47s. 6d. and 43s. 6d.

The demand for Cleveland pig iron in Scotland, on the part of founders and others, has been good all through the present year, and still continues so. The total arrivals to date are 197,575 tons, being nearly 7825 tons less than at this time last year.

The past week's foreign shipments of manufactured articles from Glasgow included three locomotives, valued at £6600, for Calcutta, £8100 worth of machinery, £4900 sewing machines, £3740 steel goods, and £26,100 general iron manufactures.

In the coal trade a fair business is passing in the West of Scotland, the demand for household kinds steadily increasing as the season advances. The shipping trade in the Glasgow district is moderately active, and the week's despatches included 3000 tons for Odessa, 2240 for San Francisco, 1420 for Gothenburg, 1400 to Rangoon, 1130 to Malaga, 1085 to Christiania, and smaller quantities elsewhere. At Troon, 7694 tons were shipped; Ayr, 7838 tons; Grangemouth, 7011; Leith, 6000; Irvine, 2614; and Greenock, 620 tons. Prices in the west exhibit little or no alteration. The quietness of the shipping trade in the Leith district induced the coalmasters to reconsider prices there a few days ago, but so far no general reduction has been intimated. Trade is reported dull in Fifeshire, and shipments are not quite satisfactory, but quotations are without change.

Some months ago Nos. 3 and 4 pits at Netherton Colliery, belonging to the Glasgow Iron Company, were stopped owing to fire and water. In course of time the fire was subdued, but it was found that water was accumulating to the extent of about 18in. a day. To cope with the inundation machinery was employed which raised about 3000 tons of water daily, and the pits are now sufficiently dry to admit of the resumption of the digging of coal by upwards of one hundred men.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*

The question of firing in collieries has been revived in rather an unexpected manner; and there is every expectation of a ferment amongst coalowners and colliers. The announcement was made by circular from the Home-office, pointing out the necessity that, when shots were fired in a mine, only the firing parties should be present. Immediately upon receipt of this, a meeting of the Coalowners' Association of South Wales and Monmouthshire was convened, when the matter was deliberated upon, and its urgency was deemed so great that a further meeting was arranged to take place in the course of a day or two. The coalowners are strongly antagonistic to the measure, as one calculated to interfere considerably with the output of coal; and they maintain that, with existing arrangements, ventilation in good order, and ordinary care, there is no fear of the present custom being attended with danger. What, perhaps, will weigh with the authorities most, is the action of the men in this matter. The men are, of course, the most interested in any regulation for their own safety; yet they, too, object to their being withdrawn during firing. At a meeting held by them this week they were resolved upon opposing, and of urging the Home-office instead, to increase the number of assistant inspectors.

The coal trade maintains a fair condition, and, as shown by exports, is steadily regaining its old average. Last week the total export from Cardiff alone to foreign destinations was over 14,000 tons, and the totals of other ports were well up to late figures. Newport is showing a good deal more activity, consequent upon the increase of coal from the Rhondda Valley. It is remarkable how steadily the Rhondda coal traffic to Newport has progressed since the starting of the new line, and a natural eagerness is shown by all connected with the new railway from Rhondda to Swansea to see similar results brought about for the good of that port. The coal market remains firm, but small steam is still a drug.

The iron and steel trades remain in the same semi-stagnant condition that I have so long recorded. In fact, things in some districts are fast becoming gloomier. At Dowlais there is an almost certain expectation of a complete stop. The men are subject to short time wages, and as their time becomes more and more reduced, the men say that they will not be able to get sufficient to find food for their families. This week the feeling is strong at Dowlais for a radical change in arrangements; but as the merest tyro in political economy knows, so long as the demand for steel rails is of so slight a character, no improvement can be expected. The works at Treforest, which have been so long kept going under the difficulty of getting any orders of account, are now to be closed, so far as the make of new material is concerned. Notice has been given to the men, and at the end of the month the works will stop until all the stock has been cleared away. Judging from indications at other works, I shall not be at all surprised at the same course being pursued elsewhere.

The tin-plate trade at Swansea is firm, and makers of best brands are fairly employed, and some even find it difficult to keep pace with requirements. I see, too, another improvement, shown by the re-starting of an old works at Caerleon. Prices are moderately firm.

I regret to record the death of Mr. G. F. Adams, mining engineer, of Cardiff, and son of Mr. Adams, of Aberdare.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

*** *It has come to our notice that some applicants of the Patent-office Sales Department, for Patent Specifications, have caused much unnecessary trouble and annoyance, both to themselves and to the Patent-office Officials, by giving the number of the page of* The Engineer *at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at* The Engineer *Index, and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.*

Applications for Letters Patent.

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

7th October, 1884.

13,259. Bicycle Saddles, S. Davis, Brighton.
13,260. Brick Kilns, H. J. Allison.—(*S. W. Underhill and G. E. Fisher, U.S.*)
13,261. Manufacturing Felt Hats, E. Tweedy, London.
13,262. Cast Iron Door Frames, G. Rockliffe, Sunderland.
13,263. Register for Ranges, W. Shaw and W. Shaw, jun., Birmingham.
13,264. Iron, J. Gilligan, Abertillery.
13,265. Suspending Lawn Tennis Rackets, &c., A. E. Trimmings and C. G. Knighton, London.
13,266. Printing Telegraphs, W. P. Thompson.—(*C. G. Burke, U.S.*)
13,267. Hand Grenades, W. P. Thompson.—(*H. D. Harden, U.S.*)
13,268. Bottle-stoppers, W. P. Thompson.—(*H. Spriegel, Dantzig.*)
13,269. Pincers for Fastening Frost Cogs, H. Wooldridge, Stourbridge.
13,270. Water Tap, R. Entwistle, London.
13,271. Detonation Machine, J. B. Denis, London.
13,272. Steam Winches, J. Tweedy, London.
13,273. Making Pile Fabrics, E. and E. Scheppers, London.
13,274. Making Textile Fabrics, E. and E. Scheppers, London.
13,275. Spinning Machines, A. M. Clark.—(*O. Hanna, H. W. T. and J. Earnshaw, C. F. Corben, and J. W. Wormelsdorf, U.S.*)
13,276. Closing Casks, H. Forman, London.
13,277. Electric Railway, J. H. Johnson.—(*E. M. Bentley and W. H. Knight, U.S.*)
13,278. Consuming Smoke in Boilers, T. Hudson, Glasgow.
13,279. Locks, J. C. Hudson and T. Bayley, London.
13,280. Drying Bottoms of Ships, A. H. and A. W. Fell and R. Turnbull, London.
13,281. Electro-magnetic Apparatus, H. J. Haddan.—(*C. Cummings, U.S.*)
13,282. Material for Filtering Sewage, A. T. Smith, Barkingside.
13,283. Gas Engines, G. F. Redfern.—(*T. McDonough, U.S.*)
13,284. Pipes, F. George, London.
13,285. Gearing Apparatus for Velocipedes, &c., E. Burstow.
13,286. Fasteners for Boots, &c., A. J. Boult.—(*G. Valiant, Canada.*)
13,287. Belting Machinery, R. F. M. Chase, U.S.
13,288. Collineameter, T. Bolton, London.
13,289. Dust pans, G. E. Smart, London.
13,290. Car Couplings, R. H. Dowling, W. Baker, and C. H. Follett, London.
13,291. Bicycles, E. C. F. Otto, London.
13,292. Alarm Apparatus for Automatic Fire-extinguishers, H. E. Newton.—(*C. C. Worthington, United States.*)
13,293. Leaf Springs, T. Midelton, London.
13,294. Tricycle Horses, J. Bate, London.
13,295. Railway Signals, W. Buck, London.
13,296. Separating Tin from Tin-plate, N. E. Maltass. (*P. G. P. Tibaldi, Milan.*)
13,297. Cartridges, R. Morris, London.
13,298. Injecting Fluids into Boilers for Preventing Incrustation, C. J. and W. T. Arnell, London.
13,299. Writing Slate, A. M. Clark.—(*P. Wenzel, Mainz.*)
13,300. Galleries of Gas, &c., W. Nunn, London.
13,301. Loom Harness, W. R. Lake.—(*J. and F. Sladdin, and P. J. Desmond, United States.*)
13,302. Wood Screw Machines, W. R. Lake.—(*H. A. Harvey, United States.*)
13,303. Inserting Filter Bags into Sheaths or Casings, W. R. Lake.—(*J. H. Webster, U.S.*)
13,304. Car Starters, W. C. Trussell, Massachusetts.
13,305. Metal Packing for Joints, W. R. Lake.—(*J. Tennant and J. Hattersley, U.S.*)
13,306. Horseshoes, F. R. Aikman, London.

8th October, 1884.

13,307. Fish-hooks, H. Terry, Redditch.
13,308. Bicycles, &c., B. Oldfield, Coventry.
13,309. Yarn for Oil Press Wrapper Bags, &c., H. Portway and H. Woodhead, Halifax.
13,310. Rails, &c., for Tramways, M. H. Smith, Halifax.
13,311. Forced Combustion in Steam Boilers, A. MacLaine, Belfast.
13,312. Compositions to act as Non-conductors of Heat, E. C. C. Stanford, Glasgow.
13,313. Rulers, R. F. Mackay, Dundee.
13,314. Glazing Bars for Windows, W. and W. R. Lester, Glasgow.
13,315. Compound Action Springs for Packings of Pistons, R. Wagstaff, Hyde.
13,316. Repeating Attachment for Watches, W. P. Thompson.—(*F. Terspegen, U.S.*)
13,317. Photographic Cameras, J. Thomson, Liverpool.
13,318. Photographic Cameras, J. Thomson, Liverpool.
13,319. Carrying Awnings on Tram-cars, &c., W. Jones, Liverpool.
13,320. Shoe-blacking Machine, H. Haworth and J. Hartley, Haslingden.
13,321. Bottle Stands, A. W. Cooper and R. Grœme, London.
13,322. Motive Power Engines, T. Bromley, London.
13,323. Table Cutlery, C. Ibbotson, Sheffield.
13,324. Electrical Signalling Apparatus, J. W. Fletcher, London.
13,325. Combined Self-acting and Hand Actions for Water-closets, &c., G. Moore, Lewisham.
13,326. Ratchet Locking Nuts, S. T. Croasdell, Lewisham.
13,327. Treatment of Sewage, W. D. Curzon and G. Jones, London.
13,328. Trousers, J. C. W. Masterman, London.
13,329. Elevators or Lifts, P. M. Justice.—(*Otis Brothers and Co., U.S.*)
13,330. Valve Apparatus, P. M. Justice.—(*Otis Brothers and Co., U.S.*)
13,331. Tandem Quadricycle, F. J. Gibbons, London.
13,332. Latching Mechanism for Locks, J. T. and J. Green, London.
13,333. Hoes, A. J. Boult.—(*A. G. Hubbard, D. Humphrey, and J. C. Street, United States.*)
13,334. Aerating Liquids, C. W. Harrison, London.
13,335. Grinding Knives, G. Richards, London.
13,336. Mechanism for Indicating when Watches are Wound Up, S. E. Nielsen, London.
13,337. Preparing Silicates with Neutral Materials, J. Robbins, London.
13,338. Stamping Stone Paving, &c., M. Sugar and L. Hidveghy, London.
13,339. Opening Ventilators, J. S. Bruce, Birmingham.
13,340. Apparatus for Registering Money Received by Shopkeepers, J. N. Maskelyne, London.
13,341. Wire Fencing, J. Young, London.
13,342. Spring Saddle Bars, W. J. Langdon, London.
13,343. Medicated Paper, W. R. Lake.—(*S. Wheeler, United States.*)
13,344. Umbrellas, H. J. Haddan.—(*E. A. R. Geisler, Voekler and Roh, Leipzig.*)
13,345. Filters, P. A. Maignen, London.
13,346. Portable Filters, P. A. Maignen, London.
13,347. Valve Gear for Steam Engines, A. Hill, London.

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13,348. Relieving Shuttles in the Boxes of Looms, J. Mottram and J. Willis, Ashton-under-Lyne.
13,349. Fixing Window Curtains, E. P. Purkis, Birmingham.
13,350. Kilns and Stoves, J. W. C. Webb, Worcester.
13,351. Rest or Holder for Fishing Rods, S. Skerritt, Sheffield.
13,352. Stretching Upholsterer's Webbing, R. Kelly, Liverpool.
13,353. Picking Sticks, &c., for Looms, A. P. Bird, Glasgow.
13,354. Velocipedes, W. B. Smith, London.
13,355. Waterproof Cement, W. Smith, Dublin.
13,356. Railway Wheels, G. Thomas, Liverpool.
13,357. Toilet Instrument for Paring the Nails, F. Allen.—(*J. J. Thompson, U.S.*)
13,358. Preventing the Decomposition and Putrefaction of Animal and Vegetable Matters, W. Hibbert, Manchester.
13,359. Hat Holders, C. J. Marsland, London.
13,360. Wringing Machine Rollers, T. Birbeck and E. Miller, Sunderland.
13,361. Spring Knives, W. Singleton and E. Priestman, Sheffield.
13,362. Threading Needles, J. Darling, Glasgow.
13,363. Tailoring Systeme or Distre-ungre, A. Mezzadri, London.
13,364. Sash Fasteners, A. A. Joy, London.
13,365. Motive-power Engines, J. Dodd and H. Kay, Manchester, and J. Revell, Dukinfield.
13,366. Ship Logs, J. E. Massey, London.
13,367. Automatic Lubricator, R. James.—(*T. H. James, U.S.*)
13,368. Treatment of Town Refuse Matters, J. Hanson, London.
13,369. Adjustable Chin Holder for Violins, F. Upton, Margate.
13,370. Pessary, J. Brown, London.
13,371. Lantern Front for Magic Lanterns, W. C. Hughes, London.
13,372. Mechanical Frame for the Change of Pictures in the Lantern, W. C. Hughes, London.
13,373. Hydrostatic Weighing Machines, F. Wheatley, Lewisham.
13,374. Bobbins, W. Dixon and J. Dixon, Steeton.
13,375. Iron and other Metallic Roofs, J. A. R. Main, Glasgow.
13,376. Apparatus whereby Special Matter may be Rapidly Inserted in Stereotype Plates, J. Petch and J. Marshall, London.
13,377. Pipe Connections, J. Kemp and F. Fissi, London.
13,378. Mole Traps, A. Lane and J. Chester, London.
13,379. Balconies, A. St. G. Cuff, London.
13,380. Brick Kilns, J. J. Barclay, R. Allison, and J. Barclay, London.
13,381. Mounting, &c., Window Sashes, W. Wright, London.
13,382. Bassinette Perambulators, J. Preston, London.
13,383. Knitting Machinery, A. Brewin, London.
13,384. Blocks or Shoes for Brakes, B. J. B. Mills.—(*La Société Lachaud et Compagnie, Nevers.*)
13,385. Holders of Electric Lamps, C. H. Gimingham and J. F. Albright, London.

10th October, 1884.

13,386. Tangent Wheel for Velocipedes, H. J. Pausey, London.
13,387. Steam Boilers, J. Lewis, Belfast.
13,388. Window Fasteners, H. Smith, near Coventry, and D. Smith, near Birmingham.
13,389. Zephyr Silk Hat Body, W. H. Taylor, Failsworth.
13,390. Automatic Bolt or Fastener, W. W. Crowder, Birmingham.
13,391. Bell Levers and Bell Pulls, J. Waller and B. Farringdon, London.
13,392. Electric Arc Lamp, A. M. Richardson, Manchester.
13,393. Eye for Stair Rods, G. P. Lemprière, Birmingham.
13,394. Wheel Tires, S. Rideal, Manchester.
13,395. Apparatus used in the Manufacture of Metal Castings, S. Rideal, Manchester.
13,396. Looms for Weaving, D. Greenhalgh, Halifax.
13,397. Ventilators, R. A. Goodman, Halifax.
13,398. Hammerless Guns and Rifles, J. W. Smallman, Nuneaton.
13,399. Scales and Weighing Machines, J. G. Hopkinson, Harrogate.
13,400. Hydraulic Elevators, N. Selfe, London.
13,401. Paddle for Washing Purposes, H. H. Cobbett, London.
13,402. Steam Generators, W. R. McKaig and J. C. Stitt, London.
13,403. Steam Generators, W. R. McKaig and J. C. Stitt, London.
13,404. Indicating, &c., Fares, J. Hope, London.
13,405. Raising Sunken Ships, &c., G. S. Dodman, London.
13,406. Hardening Steel Bands, J. Thornton and H. Ellison, Cleckheaton.
13,407. Musical Instruments, H. E. Hildred, T. H. Scott, and G. J. Hildred, London.
13,408. Producing the Tremolo Effect in Harmoniums, H. E. Hildred, T. H. Scott, and G. J. Hildred, London.
13,409. Measuring Tapes, G. H. Smith, London.
13,410. Railway and other Wheels, J. R. Hill and J. Clark, Birmingham.
13,411. Concrete Elevator, F. West, Lewisham.—13*th June*, 1884.
13,412. Adjustable Crane, F. West, Lewisham.—13*th June*, 1884.
13,413. Breech-loading Cannon, W. Brown, Birmingham.
13,414. Adjustable Sanitary Spring Mattress, J. Hubbert, London.
13,415. Soles of Boots and Shoes, E. A. Herbert, London.
13,416. Dies, J. Hamblet, London.
13,417. Check Action, C. G. Gill, London.
13,418. Enabling Deaf People to Hear, R. Jagger, London.
13,419. Bottle Stoppers, T. Rule, London.
13,420. Steam Engines, W. Bury, London.
13,421. Distributing Oil upon Water to Protect Ships, H. H. Lake.—(*H. W. Gregory, U.S.*)
13,422. Plug for Stopping-up Pipes, &c., F. Botting, London.
13,423. Time Indicators for the Blind, J. Kendal and and M. Laval, London.
13,424. Cover for Keyholes, C. D. Abel.—(*J. Thomer, Vienna.*)
13,425. Producing Articles of Metal, Glass, &c., C. D. Abel.—(*Dr. G. Gehring, Landshut.*)
13,426. Furnaces, T. Nordenfelt.—(*C. G. Wittenström, Motala, and E. Faustman and P. Ostberg, Stockholm.*)
13,427. Tobacco pipes, &c., J. Rose, London.
13,428. Apparatus for Driving Horses in Vehicles, E. J. Murray, London.
13,429. Hanging Carriages, P. Ness, London.
13,430. Ceilings, &c., P. A. Ames, London.

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13,431. Tips for Heels of Boots or Shoes, F. Parker, Leicester.
13,432. Slide Valves for Steam Engines, J H. Smiles, Glasgow.
13,433. Algin and other Products from Seaweeds, E. C. C. Stanford, Dalmuir.

13,434. Draw Tin for Fire Ranges, J. Walker, Yorkshire.
13,435. Sanitary Urinals and Disinfectants, J. Peachey, Worcester.
13,436. Cutlery, C. H. Wood, Sheffield.
13,437. Cart Brakes, G. Gaskell, Pemberton, and J. Higham, Wigan.
13,438. Vacuum Lubricator for Condensing Steam Engines, W. Richards and J. Chamberlain, Bristol.
13,439. Shifting the Switch Points of Railways, J. Riddick, Pollokshaws.
13,440. Woven Labels, T. G. Lomas, Manchester.
13,441. Transferring Heat, C. L. Braithwaite, jun., and I. Braithwaite, Liverpool.
13,442, Imitating Glass Ornaments, A. M. F. Caspar, London.
14,443. Washing Coal with Hydrocarbon Vapours, R. W. Thom, Liverpool.
13,444. Curtain and Cornice Rings, G. W. Herbert, Birmingham.
13,445. Drugget Pins, G. W. Herbert, Birmingham.
13,446. Purifying Paraffin Oils, G. T. Beilby, Glasgow.
13,447. Letter Boxes, T. W. Angell, London.
13,448. Automatic Gaiter Fastener, T. W. Hill, Middlesex.
13,449. Ventilating Ships' Holds, G. S. Dodman, London.
13,450. Extinguishing Fires in Warehouses, J. B. Adams, London.
13,451. Curling Hair, T. Singleton and G. Townsend, Halifax.
13,452. Grates and Kitcheners, B. Hawerkamp, London.
13,453. Ring Cylinder Steam Engine, A. J. Cooper and E. E. Wigzell, London.
13,454. Deep-sea Sounding Instrument, A. J. Cooper and E. E. Wigzell, London.
13,455. Producing Watermarks on Paper, E. G. Colton.—(*C. M. Schmidt, Berlin.*)
13,456. Bicycles, H. W. Lambert, London.
13,457. Door Mats, J. Whiteley, London.
13,458. Apparatus for Disinfecting Water in Cisterns, J. Harsant, London.
13,459. Adjustable Dip for Cullies, S. S. Phillips and J. Millier, London.
13,460. Washing Metallic Ores, &c., T. Vosper and J. Eastcott, London.
14,461. Handy Jam Pot Holder and Cover, A. G. Klugh, London.
13,462. Rout Seat, A. G. Klugh, London.
13,463. Cooking and Heating Stoves, E. F. Jones, London.
13,464. Furnaces, A. W. L. Reddie.—(*R. Marsa, Motril.*)
13,465. Cartridge Cases, F. V. Oppen.—(*W. B. Franklin, United States.*)
13,466. Arranging, &c., Disappearing Targets or Dummies, E. C. Plant, London.
13,467. Gas Producers, R. Howson, London.
13,468. Combustion of Gas for Heating Purposes, A. Deas, London.
13,469. Printing Tramcar and Railway Tickets, M. Bebro, London.
13,470. Shears, W. Clark, London.
13,471. Feathering Paddles and Floats, J. and E. Evans, London.
13,472. Stoves and Grates, H. Thompson, London.
13,473. Pianos, &c., H. Morris, London.
13,474. Bakers' Ovens, H. H. Lake.—(*J. L. W. Olsen, Copenhagen.*)
13,475. Explosive Compounds, G. G. André, London.
13,476. Explosive Compounds, G. G. André, London.
13,477. Dividing Timber, J. R. Jex-Long, London.
13,478. Barrels, N. R. Fienemann, Hamburg.
13,479. Weeding Machine, T. Knowles, London.
13,480. Holding Neckties in Position, C. Smith, London.
13,481. Tandem Sociable Tricycles, C. W. R. Duerre, London.
13,482. Making Grooves in the Rings of Glass Bottles, S. Hartley, London.
13,483. Double Driving Gear for Velocipedes, W. B. Downey, Hendon.
13,484. Life-saving Oil Ship, T. W. Q. Honeywill, London.
13,485. Bottle Stoppers, W. Shepherd, London.
13,486. Draught Vehicles, A. M. Clark.—(*T. Hill, U.S.*)
13,487. Permanent Way of Railways, W. H. Willett and T. C. Wakeling, London.
13,488. Bottle Stoppers, W. H. Hall, London.
13,489. Testing Apparatus for Liquids Boiling in Vacuo, R. Bartlett, London.
13,490. Heating Rooms and Buildings, W. H. Tooth, London.

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13,491. Ballooning Wires or Rings, E. Tweedale and S. Tweedale, Halifax.
13,492. Making White and other Lead Pigments, A. French and J. B. Hannay, Glasgow.
13,493. Manhole Covers for Drains, H. M'Colley, Chelsea.
13,494. Gas, H. J. Rogers, Watford.
13,495. Spring Link, J. B. Cousins, London.
13,496. Testing Cement, J. L. Spoor, Gateshead-on-Tyne.
13,497. Exhaust Ventilators, S. J. Chinn, Edgbaston.
13,498. Sewing Machines, M. Booth, Hooley-hill, near Manchester.
13,499. Spiral Springs for Buffers, &c., B. F. Cocker and J. Bishop, London.
13,500. Bakers' Ovens, J. T. Pearson, London.
13,501. Counter Check-books or Slips, C. and J. S. Baker, London.
13,502. Separating Dust from Air, H. H. Lake.—(*H. Seck, Dresden.*)
13,503. Felt Hats, J. Plant, London.
13,504. Treating Fibres for Extracting Resinous, &c., Matters, J. Smith, London.
13,505. Printing Presses, J. Maynes, Lee.
13,506. Advertising Tablets, T. Hughes, London.
13,507. Tobacco-pipes, &c., J. Preston, Glasgow.
13,508. Velocipedes, W. H. White, London.
13,509. Pneumatic Pump, &c., J. W. Gordon, Lower Clapton.
13,510. Lamp Burners, W. Sandbrook, Dalston.
13,511. Elastic Tires, J. K. Starley, London.
13,512. Lubricating Oils, J. Seeger, London.
13,513. Arc Electric Lamps, J. H. Johnson.—(*La Compagnie des Fonderies et Forges de l'Horme, Lyons.*)
13,514. Steam Engine Lubricators, J. C. Mewburn.—(*H. Carrière, Wizernes.*)
13,515. Hot-water Cistern Regulator, A. E. Hubert and W. W. Fyfe, London.
13,516. Bearing for Carrying the Hub Lamps of Velocipedes, J. R. Henson, London.
13,517. Regulating the Motion or Feed of Carbons in Electric Arc Lamps, &c., C. Brown, Dalston.
13,518. Drying Apparatus, R. S. Jennings, London.
13,519. Boilers, W. Hayes, London.
13,520. Stanchions, G. Hughes, London.
13,521. Galvanic Batteries, C. W. Harrison, London.
13,522. Blasting Powder, W. E. Gedge.—(*W. F. Wolff, Walsrode, and M. von Förster, Berlin.*)
13,523. Buff or Polishing Device, A. M. Clark.—(*The Zucker and Levett Chemical Company, U.S.*)
13,524. Ships' Rudders, W. Whyte, London.
13,525. Electric Burglar Alarms, H. H. Lake.—(*H. C. Roome, U.S.*)
13,526. Portable or Table Fountains, J. Gilbert, London.
13,527. Dough Cake Mixing Machine, G. E. Chapman, London.
13,528. Ventilating Rooms, W. Paulson, Mountsorrel, near Loughborough.
13,529. Filtering Water, W. Paulson, Mountsorrel, near Loughborough.
13,530. Registering Passengers in Public Conveyances, W. J. Hawkins, London.
13,531. Bread, Pastry, &c., R. Herron and R. E. Donovan, Lonovan.
13,532. Stenographic Machines, M. M. Bartholomew London.
13,533. Circular or Rotary Loom, G. Wassermann, London.
13,534. Dressing or Moulding Blocks or Plates of Wood, &c., H J. Haddan.—(*A. Fischer, Leipzig.*)
13,535. Wire Rope, H. Cheesman, London.
13,536. Ploughs, W. H. Sleep, London.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

303,344. Operating the Pistons of Rock Drills, *Richard Uren, Houghton, Mich.—Filed October 12th*, 1883.

Claim.—(1) The combination, with a reciprocating main piston, of a movable valve cylinder within which said piston may work, and an outer casing within which said cylinder may slide, said casing and cylinder being provided with delivery and escape ports for steam or compressed air, substantially as described. (2) The combination, with the drill or tool carrier and the main piston, of the movable valve cylinder and the outer casing, said cylinder and casing being provided with delivery and escape ports, and being arranged relatively to each other, substantially as described. (3) The combination, with the piston, of a valve cylinder having closed ends, and an outer casing having steam or compressed air ports above and below said cylinder, whereby a short stroke of the piston may be secured, substantially as described. (4) The combination, with a piston, of a valve cylinder within which said piston may work, and an outer casing within which said cylinder may slide, said casing and cylinder being provided with delivery and escape ports for admitting steam or compressed air for directly operating the piston when full strokes are to be made, and said casing being provided with supplemental ports for admitting steam or compressed air above and below the valve cylinder when short strokes are to be made, substantially as described. (5) The combination, with the drill or tool carrier and the piston, of a valve cylinder within which said piston may work, and an

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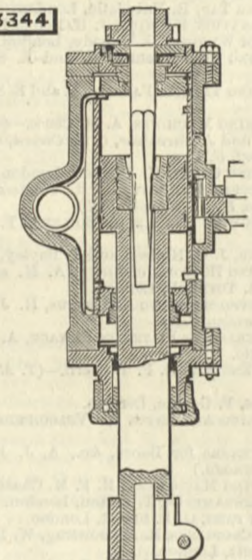

outer casing within which said cylinder may slide, said casing and cylinder being provided with delivery and escape ports for admitting steam for directly operating said piston when full strokes are to be made, and said casing being provided with supplemental ports for admitting steam or compressed air above and below the valve cylinder when short strokes are to be made, substantially as described. (6) The combination, with the piston and the casing and the valve cylinder arranged to slide therein, said valve cylinder and casing being provided with delivery and escape ports and channels, situated substantially as shown, of the cock F and suitable means for operating said cock, substantially as described. (7) The combination, with the piston, of a valve cylinder and casing having delivery and escape ports adapted to be brought into coincidence, and mechanism adapted to vary with respect to the piston stroke the point at which the escape ports of the cylinder and casing shall coincide, substantially as set forth. (8) The combination, with the piston, of a valve cylinder and casing having obliquely-inclined escape ports, and means for turning said valve cylinder, substantially as described. (9) The combination, with the piston, of a valve cylinder within which said piston works, and a casing within which said valve cylinder slides, said valve cylinder and casing being provided with delivery and escape ports adapted to be brought coincident, and the interior of said casing being connected from end to end by channels, and a perforated valve or cock, substantially as described. (10) The combination, with the piston, of the cylinder within which said piston moves, having its discharge ports located at a slight distance above the end of the cylinder, and adapted to be closed by the piston before the end of the stroke, thereby forming an air cushion to break the force of the piston, substantially as described.

303,706. Valve Gear for Steam Engines, *Leon B. Carricaburu, New York.—Filed March 10th*, 1884.

Claim.—(1) The combination, with the valve, the stem, rocker lever, and collar or tappet, of cams

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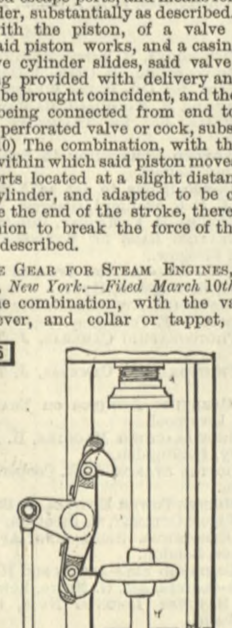

movably connected with the rocker lever, and acting with the collar to complete the movement of the rocker and valve after the stroke of the engine has been completed and the piston commences to move in the other direction, substantially as set forth. (2) In an engine valve motion, the combination, with the rocker lever, of two cams pivotted to the rocker lever near its ends and swinging freely by pressure from the collar or tappet when approaching the end of the stroke, and falling behind the collar so as to complete the movement of the valve after the piston commences to move in the reverse direction, substantially as specified. (3) The combination, with the valve and rocker lever, of two cams introduced into mortises in the rocker lever, and pivots and springs for said cams, substantially as set forth. (4) The combination, with the steam piston, piston rod, and direct-acting mechanism for moving the valve, of a valve having one or more small ports that coincide with similar ports passing into the steam cylinder at the time that the valve covers both the ordinary steam ports, substantially as and for the purposes set forth.

303,558. Bottle and Jar Stopper, *Mark Campbell, Chicago, Ill.—Filed November 27th*, 1883.

Claim.—The combination of the cap B, having central threaded recess, the washer D, having a central opening, a concavity on its lower side, and a bevelled

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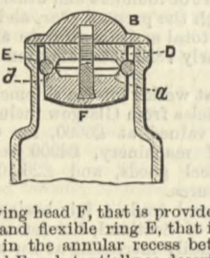

edge, screw *a*, having head F, that is provided with an annular recess *b*, and flexible ring E, that is adapted to be compresssd in the annular recess between the washer D and head F, substantially as described.

303,758. Harrow, *Charles P. Snow, Lanark, Ill.—Filed February 8th*, 1884.

Claim.—(1) In a harrow, the combination, with the main frame A, the sliding frame B, the swinging teeth C, having the upper laterally-bent ends, and the bearings D, secured to the sliding frame, of the bearings E, having apertures $a\,a^1$, with upper and lower flared surfaces, and means for adjusting the sliding frame, substantially as shown and described, and for

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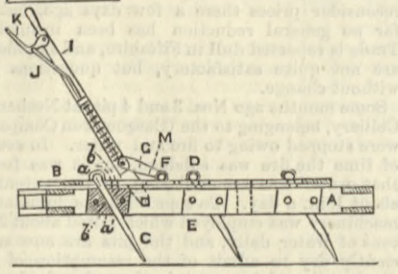

the purpose set forth. (2) In a harrow, the combination, with the main frame A, the sliding frame B, the swinging teeth C, bent at their upper ends to form pivots, and the bearings D, secured to the sliding frame, of the bearings E, having upper and lower apertures $a\,a^1$, meeting at their smaller ends and opposite parts *b b*, bearing F, hinged bar G, lever I, spring-pressed pawl J, lever K, and catch-plate M, substantially as shown and described.

303,891. System for Transmitting and Distributing Electrical Energy, *William Anthony Shaw, Brooklyn.—Filed April 21st*, 1882.

Brief.—A battery consisting of a continuous line of pipe—lead—having another pipe inclosed and suitable separating material between. The electrolyte is

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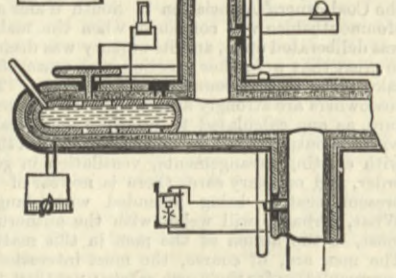

pumped through the line from a central reservoir. It is proposed to tap the line wherever a current is needed by bringing the interior and exterior electrodes into the desired circuit, whether to be used for lighting, power, or other well-known purpose.

303,968. Rivetting Machine, *John F. Allen, Brooklyn, N.Y.—Filed July 2nd*, 1883.

Claim.—The combination, of a portable U-shaped frame A, the elastic anvil consisting of cylinder G, piston H, and piston-rod H^1, attached to the end of one of its arms, and the rivetting device R, consisting of the cylinder B, piston C, piston-rod D, and foot or nozzle F, having projecting prongs *a* attached to the

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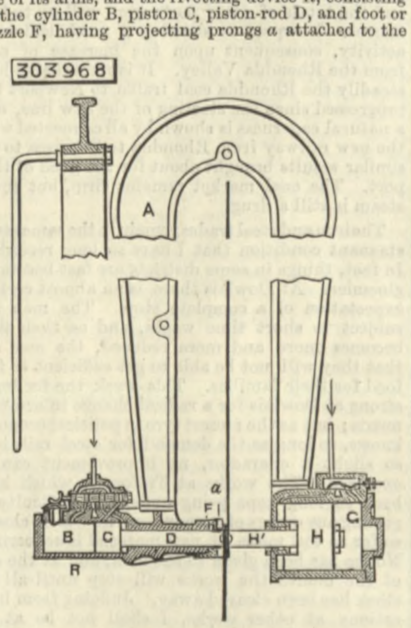

ends of the cylinder B, said rivetting device being attached to the end of the other arm of the U-shaped frame, the whole being constructed and arranged to operate in the manner and for the purpose herein described.

303,979. Steam Engine Governor, *Gilman Weld Brown, West Newbury, Mass.—Filed February 18th*, 1884.

Claim.—(1) The steam engine governor, substantially as described, consisting of the wheel, spring, slotted arm, and a vibratory weighted lever, adapted and arranged essentially and to operate as set forth. (2) The combination of the spring and the vibratory lever, having the two arms and their weights, and pivotted to the wheel, with such wheel and the slotted

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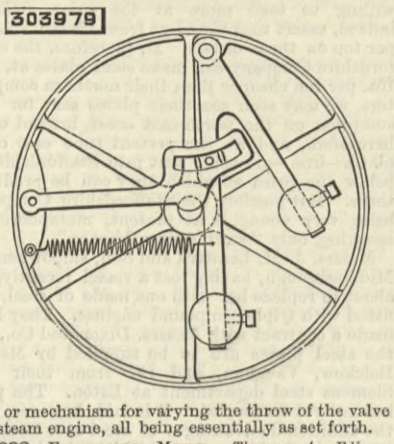

arms or mechanism for varying the throw of the valve of a steam engine, all being essentially as set forth.

304,082. Electrical Meter, *Thomas A. Edison, Menlo Park, N.J.—Filed August 14th*, 1882.

Claim.—(1) An electrical meter having in combination two electro-depositing cells, and means for passing current through the cells alternately, substantially as set forth. (2) In an electrical meter, the combination of two electro-depositing cells, a pivotted beam from which one electrode of each cell is suspended, means for completing the circuit through the cells alternately, and a registering mechanism, substantially as set forth. (3) In an electrical meter, the combination of two electro-depositing cells, a pivotted beam from which one electrode of each cell is suspended, means for completing the circuit through the cells alternately, and reversers for periodically changing the relation of the electrodes of the cells, substantially as set forth. (4) In an electrical meter, the combination, with a pivotted beam, means operated by the current for oscillating said beam, and a registering apparatus moved by said oscillations, of a dash pot for retarding the movement of the beam, substantially as set forth. (5) In an electrical meter, the combination, with two electro-depositing cells, of a pivotted beam from which one electrode of each cell is suspended, means for completing circuit through the cells alternately, a registering mechanism, and a movement-retarding device, substantially as set forth. (6) In an electrical meter, the combination, with the oscillating beam, of means operated by the current for oscillating such beam, a dash-pot for retarding the

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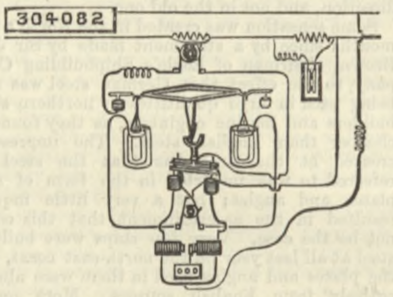

movement of the beam, and a mercury cup for maintaining electrical connection with said beam, substantially as set forth. (7) In an electrical meter, the combination, with two electro-depositing cells, of a pivotted beam carrying an electrode of each cell, a pivotted circuit controller worked by the movement of the beam, and making and breaking circuits at mercury contacts, and having connections for completing circuit through the cells alternately, and a registering mechanism, substantially as set forth. (8) In an electrical meter, the combination, with two electro-depositing cells, of a working beam from which one electrode of each cell is suspended, a circuit-controlling device for completing circuit through the cells alternately, and two current reversers, one for reversing the connections of the meter with the main circuit, and the other for reversing the connections within the meter between the circuit controller and the cells, substantially as set forth.

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The Engineer, October 17th, 1884.