MISCELLANEOUS EXHIBITS AT THE ROYAL AGRICULTURAL SOCIETY'S SHOW, DERBY.

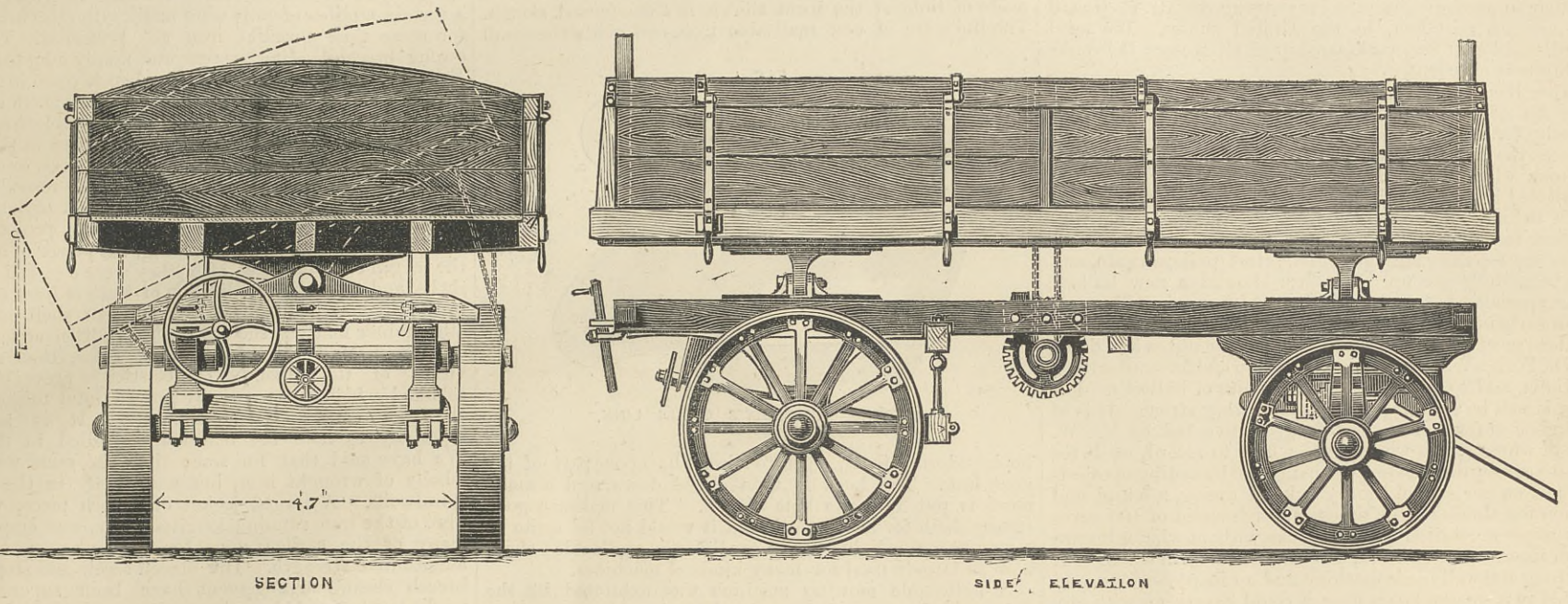
WE believe that little or nothing is to be gained by describing year after year exhibits which are perfectly well known to all those who have any occasion to use them, and our notice of miscellaneous exhibits at the Derby Show must therefore be brief.

Probably the greatest novelty was a curious little steam engine exhibited by Messrs. Willdegg Bros., of Burges, Coventry. The cylinder is of D section, and the straight line opening is covered by a slide, in which is a slot, in which works the crank pin, which pin is set on a disc. In the disc are ports, so that the disc acts as a valve. The machine is very ingenious. What it is capable of we have had no means of knowing as yet. Another curiosity is the exhaust injector shown by the Exhaust Injector Company, of Manchester. This feeds a boiler by the exhaust steam from the engine. We shall have more to say concerning it. It is a modification of the ordinary injector, and inasmuch as with an exhaust pressure of a couple of pounds it will feed a boiler carrying 80 lb., it is evident that there are some questions connected with the theory of its action which require more elaborate treatment than we can give them here.

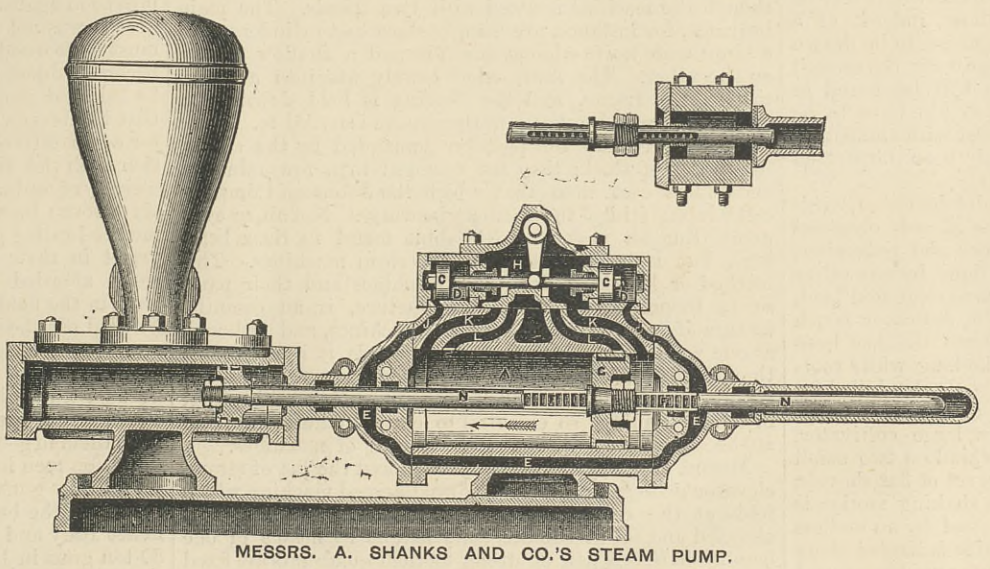
Messrs. J. Evans and Sons, of Wolverhampton, showed Tonkin's patent pump at work. This pump is another of the multitudinous class of steam pumps with steam moved valves, first invented about twenty years since. It is very silent and quiet in its action. They also exhibited some good rotary donkey pumps, coarse and strong, and well fitted for rough work.

Messrs. Thwaites Bros., of Bradford, showed steam and air hammers and blowers of various kinds, all good. The greater portion of their stand was, however, taken up by an air compressor, which forced air into a tank whence some blower engines were supplied. This compressor is named as an air cooler in the catalogue, but it is nothing of the kind by itself, and we presume that it is only assumed to be a cooler when worked with one or more of the blowers, in the cylinders of which expansion would take place. The existing compressor has india-rubber valves, which we need hardly say do not answer. The best makers of cold air machines use steel valves, but Messrs. Thwaites are going to try white metal. While on the subject of pumps, we may mention that Messrs. Shanks, of Arbroath, exhibited several. That which is most noteworthy we illustrate in the accompanying engraving. The following description of the working parts of this steam pump, taken in connection with the sectional drawing given above, will make its arrangement sufficiently understood :—A is the steam cylinder; B the slide valve; C and C two small pistons on the same piston rod and connected to the slide valve; and D and D the cylinders in which these pistons work. E is a steam passage in communication with the steam chest H. J and J are steam ports for the cylinders D and D; and K and K for the main cylinder A; L and L being the exhaust passages for the latter. N is the piston rod which works through both ends of the cylinder; and F and F are steam ports through this rod. On referring to the illustration, it will be seen that the piston G has just completed its stroke from left to right. The ports F have been brought into communication with the passage E and steam port J, allowing steam to pass through into the right-hand cylinder D, which has forced the piston C—and along with it the slide valve B—from right to left; thus steam is allowed to pass from the steam-chest H, through the port K, into the main cylinder A. This operation is repeated at the end of each stroke of the piston. The exhaust steam passes through the port L, and immediately the piston G has passed this port, communication with the atmosphere is cut off, the steam remaining in the cylinder thus forming a cushion for the piston, and rendering it impossible for it to strike the end of the cylinder. The port L is feathered, to prevent the piston ring from striking the edge.

The Victoria Foundry Company, of Newark, show Robson and Herdman's apparatus for laying drain pipes. The machine has never yet been tried in even the smallest way. It is a large heavy affair, intended to be hauled over a field by steam plough tackle. It consists of a long narrow platform of iron mounted on four wheels, and it carries two dredging ladders, each fitted with a chain of buckets. The two ladders are in the same plane one over the other. As it is drawn forwards, the leading ladder takes the top soil of the field for a depth of about 7in. or more, and for a width of about 9in., and carrying backwards, deposits it on the drain pipe laid on the bottom of the channel which has been opened to the proper depth by the second or lowermost chain of buckets; these deposit the soil they raise on the top of that dropped by the first one; the object had in view is the inversion of the natural order of the soils on the field, the subsoil being thus brought to the top. Under the machine is a wrought iron pipe, so bent that if left to itself it could hardly remain quiet in any position; one end of this trails in the drain, and down it the tiles are dropped, arranging themselves in the drain. It would be unfair to condemn this device until it has been tested and found wanting.



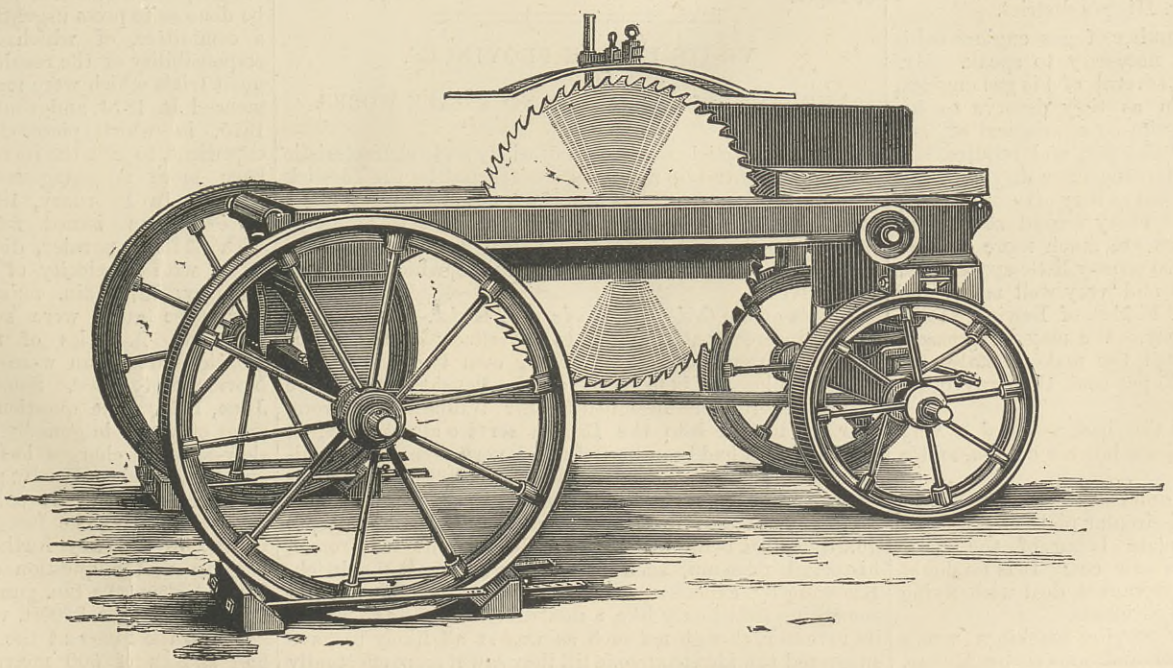
MESSRS. AVELING AND PORTER'S TRACTION COAL WAGON.



MESSRS. A. SHANKS AND CO.'S STEAM PUMP.

The use of fixed hauling drums on traction engines is being abandoned by most makers, because of the difficulty met with in paying out the rope. The engine has to go to the top of the hill, let us say. The road wheels have to be disconnected and the engine run in back gear, while a man walks back with the rope as it is paid out. When the winding drum is left detachable, the engine can advance, paying out the rope the whole way. Messrs. Fowler show two arrangements for working the drum. In one it is driven by a pawl or clutch, which can be thrown in or out of gear; in the other, a kind of leg is attached to the road axle at the upper end; the lower sticks in the road, and when the strain comes on the drum, the engine tends to ride up on the inclined spur or leg, and so the road wheel is lifted clear off the ground and allowed to revolve freely, and with it the winding drum.

Messrs. Aveling and Porter, of Rochester, exhibited a new tipping wagon, which we illustrate. By lining the body with sheet iron it is found that coals can be discharged at a less angle by 10 degrees than will do when wood is used, and the whole wagon can as a result be kept lower. Links are used to keep the body from tilting when on the road; these are cast loose when the load is to be discharged. Two chains worked very simply by a hand-wheel and axle suffice to effect all the requisite movements. This is one of the very best and simplest wagons of the kind made, and worth the attention of contractors.



MESSRS. RICHARD GARRETT AND SON'S SAW BENCH.

Messrs. Priestman Brothers' stand was as usual a great centre of attraction, one of the well-known cranes of the firm being shown constantly at work grubbing up stones, or clay, or gravel, and dropping them in other places. At their stand was shown a pretty model of Brown's disengaging gear. By the use of a tail-chain and an open hook

loads can be tipped with wonderful facility by this device.

Messrs. Howard, of Bedford, exhibited what we have never before seen in England, namely, ploughs with poles and seats for the drivers. One of them had three mould-boards. The whole is mounted on two wheels : in fact, a modification of the American Sulky plough. In order to bout the plough out of the ground at the end of each point, a handle is provided, to the side of which is fixed a projecting stud. This stud can be forced down on the top of one of the carrying wheels, and as this wheel revolves it causes the handle to rotate about a centre, and so lifts the whole machine. The arrangement is very similar to one brought out some years ago by Mr. Rollins, if we are not mistaken, in the United States. We need hardly add that the workmanship of all Messrs. Howard's exhibits is excellent.

The Reading Ironworks Company had an unusually fine lot of exhibits, their stand being especially noteworthy for a fine display of the "Universal" split pulley, which the firm have made for some time. The good opinion which we expressed of them when they were first exhibited has been fully borne out by the results obtained with them. They are now used by the thousand, very perfect machinery being employed in turning them out. They are for their strength the lightest pulleys made, and are beautifully got up. The firm showed a new bullock gear, specially designed for India, which we shall illustrate in an early impression. It was in the first instance especially made to meet the instructions and requirements, as laid down by Dr. Forbes Watson, for ginning cotton and for similar work in India, and to be worked by four pairs of bullocks. For this, it will be seen, the gear must be very strong. It is of the general form of the safety gear invented by Mr. W. Exall, whose death we have elsewhere to record, made for many years by the Reading Company, but by casting a projecting box on one side of the cylindrical casing, a wheel and pinion for obtaining the necessary high speed of 100 revolutions per revolution of the bullocks, without what is known as an intermediate motion, has been included in the gear. It is strong and well-made machine, and for its power is encompassed in a smaller space than it could have been with any other arrangement yet devised.

Messrs. Western and Co., of Derby, had a very good exhibition of wood-working machines. The most noteworthy feature was a four-sided planer, which was driven by a dynamo machine the current being obtained from another and similar machine driven by a portable engine.

Messrs. Richard Garrett and Sons showed a new portable saw bench, which we illustrate. Saw benches have often been mounted on trolley wheels, but this bench, it will be seen, is mounted on large wheels, those, indeed, of a thrashing machine, and consequently can easily be drawn from place to place by a horse. This is a very convenient arrangement, the advantage of which will be found in forests, where railway sleepers and such like have to be produced on the spot. The saw is fitted with the patent gear made by the firm, which has already been illustrated in our pages.

Mr. John Higgs, of Coven, near Wolverhampton, exhibited an implement with which he has already obtained very good results. This is a land cleaner and pulveriser, and is intended to do work not now done by any other machine or implement. Its purpose is to clear foul land, especially stubble infested with twitch, or scutch, or couch grass, as it is variously called. Hitherto this has been only effectively done by hand labour, the long white roots possessing great vitality. They can only be killed by leaving them lying loose on the surface of the field. Mr. Higgs's machine is something like a large cultivator, mounted in front on a steerage, and behind on two small traction engine wheels. Beneath are a set of flat shovels, behind which is a grating to which a shaking motion is communicated, and a set of rakes worked by an endless chain move over the grate as the machine is hauled along by steam plough tackle. The shovels pare up the ground to any reasonable depth required, and it falls on the grating, where, by the combined action of the rakes and the grate, the loose soil is shaken through the latter, while the weeds are left on top scattered behind the machine. This appears to us to be full of promise, and it is well worth the attention of all tillage farmers. We understand that it is becoming highly popular in Mr. Higgs's district.

There was a considerable number of gas engines exhibited. Of the Otto it is not necessary to speak. Mr. Turner, of St. Albans, showed several of his gas engines, which are not so well known as they deserve to be. These engines, although not quite so economical of gas as the Otto engine, are much cheaper, and require less fittings and arrangements for putting them down. They are also practically quite silent, and as they give an impulse every revolution instead of one every second revolution, as in the Crossley engine, they are much more regular drivers of machinery. They also occupy little space. The engines shown are very simple and very well made. Of the gas engine shown by Mr. Fiddes, of Lewin's Mead, Bristol, we may have more to say. We may be excused, however, if we hesitate to adopt the maker's statement that it costs less to work it by 75 per cent. than any other gas engine.

Messrs. Hayward Tyler and Co. had, as usual, a very fine show of steam pumps, Rider's hot air engine, and a Linford gas engine.

Mr. Tayler, of Bury St. Edmunds, showed a new saw guard, which consists of a semi-circular plate of steel suspended over the saw. This plate being of the same thickness as the saw, enters the saw cut. It is no doubt to a large extent effectual, but it cannot deal with flying splinters, which often cause bad accidents.

Amongst the sheaf delivery reaping machines was a newly arranged combined reaper and mower by Messrs. Hornsby and Sons. The machine is so arranged that when used as a mower the cutter bar is in front of the wheel, but when as a reaper it is to the rear of the wheel. By this arrangement the combined machine is well balanced, and the objections which belong to a rear knife for a combined machine when used as a mower are avoided. It is held by some makers that when a machine with the forward knife is suddenly stopped by an obstruction, and the driver thrown, he usually falls on the knife side of the machine, but with the rear knife his fall would take place to the other side. Whether this is generally the case or not we are not in a position to say, but if true it is a curious fact needing explanation. The rake head for this reaper is of simple construction, and the alteration necessary to cause all or none, or every third, fifth, or sixth rake to deliver, is very rapidly effected by a very simple form of compound cam, stops and switch. The machine is provided with two speeds, the one for mowing and the other for reaping. The rake mechanism is driven by a pitch chain made of links of the form shown in the annexed sketch. The links are of cast malleable iron, cast with the small

FIG. 1

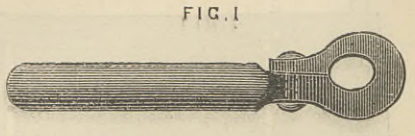
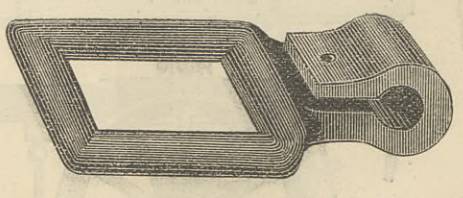


FIG. 2



MESSRS. HORNSBY'S CHAIN LINK.

hook-end sufficiently open to admit the open part of the next link. The hook is then closed down, and a small rivet is put into the hole shown. This makes a good strong chain for heavy work, but it would not be quite so convenient for light work as Ewart's malleable chain now so largely used for many kinds of machines.

A noticeable mowing machine was exhibited by the Johnston Harvester Company. This is what the makers term the "new continental mower," and it is an illustration of how a good machine may be so made that the foundry and smith shop charges shall be nearly all, and these, especially those of the smith shop, very small. Most of the parts are so made that they will go together from the foundry, the boring of those parts which fit on turned spindles is of the simplest character, and the mechanism is reduced to the lowest number of parts, though the machine is fitted with two speeds. The main bearings, for instance, are simply short cast cylinders with a blunt scale knife edge at one side and a shallow groove on the other. The knife edge loosely fits into a recess cast in the frame, and the bearing is held down by a staple bolt, which takes into the groove referred to. These bearings swivel to the position demanded by the shafts, which are of steel; they are renewed in a few minutes, and at less cost than that which the Johnston Company call "rebabbiting" the ordinary bearings. Not all, or even many English makers use Babbit metal in these bearings, but it is used in most American machines. This method or knack of designing machines and their parts so as to permit of cheap manufacture, is an essential feature of most of the American machines, and although as one walks through these show grounds it is noticeable that English machinery makers are moving out of the old grooves in scheming, they are in many matters still behind in the little things so essential to cheap manufacture, and at the same time to the efficient working of machines.

Messrs. Hornsby and Sons have entered the list of straw-elevator makers, and have produced a good machine which folds at the centre for travelling, and packs up or is elevated and set at the necessary height by means of one handle shaft. A pair of strong toothed quadrants are fixed on the two sills of the machine at the end opposite to that at which the trough is jointed; at the centre of these quadrants are pivotted a pair of jointed arms, to which at the radius of the quadrants is fixed a hand shaft with pinions gearing into the quadrants. By these means the trough is raised or lowered and held in position without any chains or ropes.

VISITS IN THE PROVINCES.

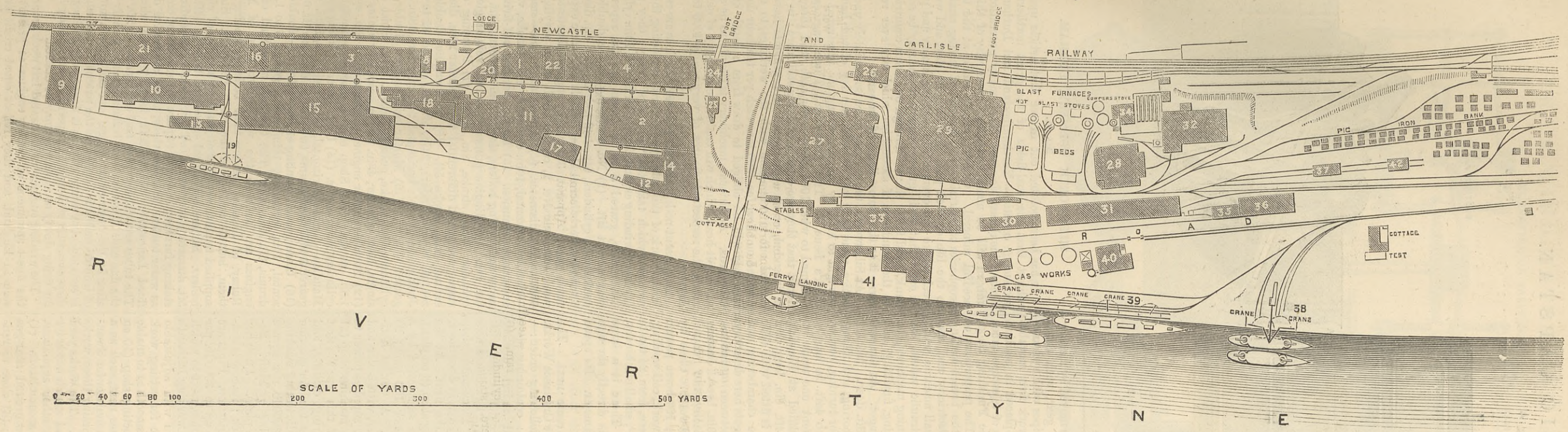
THE ELSWICK ORDNANCE AND ENGINE WORKS.

No. II.

In our last article we described briefly some characteristic designs of hydraulic machines constructed by the Elswick Engine Works; among these was a hydraulic capstan made on a bed-plate mounted on trunnions, so as to admit of being turned over when it is desired to have access to the engines. This is shown in Figs. 3, 4, and 5, which speak for themselves.

Origin of the Ordnance Works at Elswick.—Among the results indirectly attributable to the effects of the fire of the Russian guns and those of our own two 18-pounder guns at Inkerman is to be traced the development of the system of ordnance designed by Sir William Armstrong and introduced into the British service about 1858, at which time it had been brought to a very complete condition. Rifling, breech-loading, and the application of coils shrunk on over each other systematically, were all new features in modern ordnance. We say modern ordnance, to guard against being met by some design exhumed from a historical museum, such as the Rotunda at Woolwich. Knowing by experience that it is often possible to find something sufficiently like a new design to serve to annoy its inventor, though not such as was at all likely to have suggested the idea to anyone till they saw it more effectually carried out. Briefly, Sir William Armstrong made, and at last proposed, a gun made of a steel barrel on which were shrunk coils of wrought iron with sufficient tension to throw on them a due proportion of the strain of discharge, basing his conclusions on Barlow's calculation, that the circumferential tension on every concentric layer of metal in a gun is inversely as the square of its distance from the centre. The main features embodied in the Armstrong gun were—(1) the system of the building up the gun by concentric layers of metal shrunk with a certain calculated tension; (2) the polygrooved system of rifling in connection with lead coated projectiles; (3) what may be termed the screw and stopper breech-loading arrangement. Sir W. Armstrong thought of using steel both for barrel and rings at first; but dismissed the idea owing to its unreliable character at the time. He had some correspondence with Brunel on the desirability of constructing a steel wire gun, an idea which it appeared had already occurred to Mr. Longridge. Eventually this was abandoned, and although a certain number of guns were made with steel inner tubes, for some time wrought iron was preferred. The Armstrong breech-loading system was finally adopted for the British service in January, 1859, when it came in in a very complete shape with its equipment of segment shell and time and percussion fuses. It is not desirable here to discuss the various ingenious designs embodied in this equipment. We may note the following features, however :—The absence of windage, of ignition of time fuses by means of detonating composition, the application of inertia and momentum to the action of fuses on the projectile first moving in the bore and on striking, the power of adjusting the length of time fuses after they were screwed into the shells, and a peculiar application of lines of least resistance to the thick arched walls of the segment shell, as well as other minor matters, such as the application of lead for a cushion behind the hammers of fuses, that metal in virtue of its absence of elasticity preventing the rebound which has generally proved fatal to the success of fuses of a similar character. It is important especially to note the features embodied in the guns. We have said that for some time the guns were made wholly of wrought iron, but not wholly in the form of spiral coils. A forged jacket or breech piece, with the fibre of the iron running longitudinally, was employed in many of the earlier guns for the sake of obtaining longitudinal strength. The breech screw and stopper and breech closing arrangement have been superseded, as might be expected, by others. We can now see faults in it. The closing of the joint depended too much upon the mechanical perfection of the surfaces of the copper rings which were brought in contact to close the joint. The lever and tappet ring was undoubtedly a powerful means of closing a joint, and lives to this day, being, in fact, adopted by Sir W. Palliser in his new breech-loader. The lifting of the vent piece has been found inconvenient in any but very light guns, and there was not sufficient provision against accident from firing the piece when the breech was not screwed home. These are matters which must be learned in the school of actual service when guns become subject to usage more barbarous than is likely to be believed generally. It is, however, to be borne in mind that the breech screw and stopper were only introduced for comparatively light guns; the Admiralty, in consultation with the War-office, having at that time limited the weight of ordnance that could be carried by the navy to six or seven tons. About 1864 public opinion went over to muzzle-loading guns. For field guns there is much to be urged in their favour. Experiment has shown that the cover afforded to a gun detachment by breech-loading guns in the field is very inconsiderable unless steel shields be used on the axletree arms, and in that case the disadvantage of a screen which opens and causes shells with percussion fuzes to act with terribly increased effect, has to be weighed against the advantage of cover against bullets. Then, again, breech-loaders require continual attention to keep them in good working order, which may entail harassing duties on men in a severe campaign. For a long time with very heavy guns, either great difficulties were experienced in closing the breech, or in the manufacture of steel guns; hence Italy and England took the lead with 100-ton and 80-ton guns in 1875, the former being made at Elswick on the original coil system as it had been applied to muzzle-loaders. About this time, however, the attention of the English Government had been drawn to the possibility of obtaining greatly increased results from the action of large charges of powder made to burn slowly in long bores by Capt. Andrew Noble, of Elswick, who had long worked at the subject, and had so far satisfied himself as to what could be done as to press urgently for trials to be undertaken by a committee, of which he was a member, taking the responsibility of the results on himself. The first Government trials which were made in this direction were commenced in 1874, and continued with the 80-ton gun in 1875, in which piece chambering was adopted as an expedient, to give the increase in space which would have been more advantageously provided by adding to the length. In February, 1878, a new type 6in. gun of 78 cwt. was issued from Elswick, which was fired with 33 lb. of powder, discharging a projectile weighing 70 lb. with a velocity of nearly 2200ft. per second. In January, 1878, 8in. muzzle-loading and breech-loading new type guns were submitted to the Government for trial. A series of results obtained with the 8in. muzzle-loading gun were published in The Engineer of November 5, 1880. Some of these trials took place in June, 1879. The question as to priority in the development of power in guns by means of increased length and slow-burning charges has been raised between Elswick and Krupp. It is hardly possible to avoid touching this question, but we desire as far as possible to confine ourselves to stating the facts as far as we know them, being willing to add any further facts that may be given us bearing on the question either way. In July, 1878, an Elswick new type 8in. gun of 11½ tons fired a 180 lb. projectile with over 2200ft. velocity. This result was published in the *Times* at the time. Previous to this Krupp had spoken of 500 metres velocity as an achievement which he compared with the results of our old type English guns. Some time after this we find high velocities obtained by him. In August, 1879, indeed, Krupp obtained very high velocities from several guns; with a 5⅞in. gun he got, we believe, 2135ft. per second, being 561 foot-tons work per ton weight of gun—see pamphlet, "Armstrong and Krupp," translated from the

GENERAL PLAN OF THE ELSWICK WORKS, NEWCASTLE-ON-TYNE.



	ft. in.		ft. in.
21. Fitting and turning shop	480 0	,,	80 0
16. Engine and boilers	70 0	,,	60 0
3. Smiths and boilerwork	360 0	,,	70 0
23. Brass foundry	380 0	,,	25 0
5. Pattern stores	310 0	,,	20 0
6. Chainmakers' shop	390 0	,,	20 0
7. Painters' shop	40 0	,,	20 0
8. Stables	60 0	,,	20 0
9. Pattern shop	100 0	,,	70 0

	ft. in.		ft. in.
10. Erecting shop	390 0	,,	65 0
15. Bridge and girder yard	405 0	,,	120 0
19. Jetty with two hydraulic cranes	—		—
13. Joiners' shop	120 0	,,	40 0
18. Offices	—		—
*11. Gun boring and turning shop	307 0	,,	140 0
* 2. Gun boring and turning shop	220 0	,,	110 0
17. Gas producers	80 0	,,	40 0
*14. Gun finishing shop	145 0	,,	55 0

	ft. in.		ft. in.
12. Fuze factory	110 0	,,	45 0
20. Engine and boilers	60 0	,,	60 0
* 1. Gun boring and turning shop	90 0 by		80 0
22. Boilers	—		—
* 4. Forge and steam hammers	320 0	,,	80 0
24. Boilers	80 0	,,	40 0
25. Engines	—		—
*27. Foundry	260 0	,,	200 0
26. Boilers	75 0	,,	35 0

	ft. in.		in.
*29. Gun carriage shop	206 0	,,	200 0
*33. Projectile shop and stores	355 0	,,	70 0
30. Joiners' shop	140 0	,,	38 0
31. Smiths' shop	330 0	,,	60 0
28. 35-ton steam hammer	125 0	,,	110 0
34. Blowing and hydraulic pumping engines	—		—
*32. Coiling shop	50 0	,,	70 0
35. Locomotive shed	—		—

	ft. in.		ft. in
36. Gas producers	125 0	,,	45 0
37. Pit for building up heavy guns	—		—
38. Jetty with 120-ton shears and two hydraulic cranes	—		—
39. Jetty with five movable hydraulic cranes	—		—
40. Hydraulic pumping engines	—		—
41. Pattern stores	—		—
42. Special rifling and boring shop	50 0	,,	20 0

* These numbers are actually borne by the shops in large figures. The numbers are arranged above in the order in which visitors pass through the works.

Spanish, and printed at Essen in 1879. In fact the guns experimented on at Meppin in August, 1879, were unquestionably Krupp new type guns. The earliest of such high results we have noticed in Krupp's records, is December, 1878. The Elswick new type 8in. gun, mentioned above, was fired, as we have said, in July, 1878, and the article giving full results and particulars was then published in the *Times*. This would argue a priority sufficiently great to have enabled lessons to have been learned from it. If, then, we are right in believing that Krupp put forward a 6in. gun, giving its projectile a velocity of only 1640ft. in June, 1878, it appears probable that he made a great stride in the development of length about the autumn of 1878; for in December he had guns giving really high velocities, and in the following August the proportion of the guns and the results obtained by them were admirable, the proportions in many, though not in all, cases being very closely similar to those of the Elswick new type guns. The increase in length in ordnance was favourable to breech-loading, and in certain cases it became obvious that breech-loading would enable guns of greater power to be employed than was possible with muzzle-loaders. The case of broadside guns of ships is a case in point. The breech-closing arrangement employed at Elswick is that now adopted in the British service, which is described, as applied to the 13-pounder, in THE ENGINEER of October 29th, 1880.

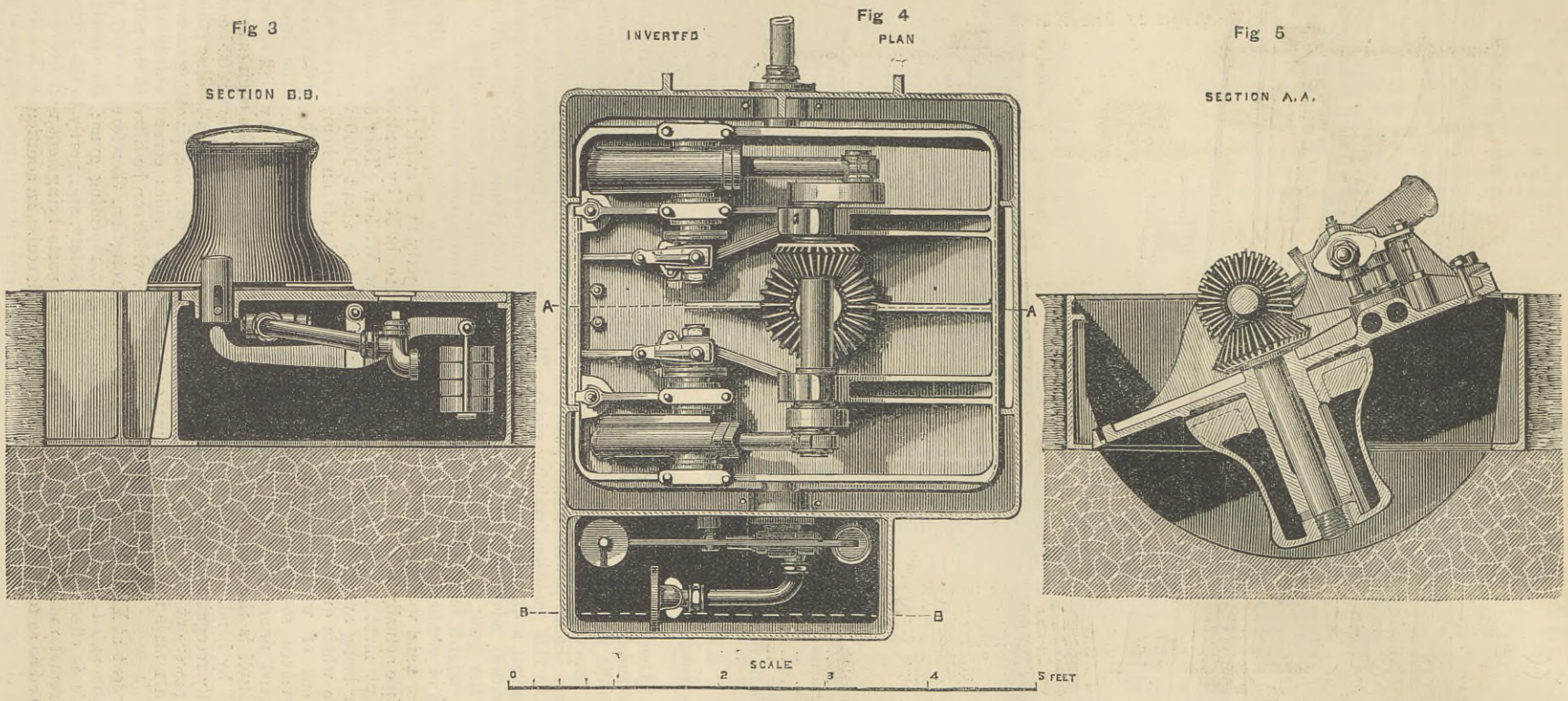
We have now to come to the newest and most interesting gun constructed at Elswick, which is made almost wholly of steel, consisting of an inner steel tube, on which are wound coils of steel riband, with the tension on each concentric layer adjusted to agree with the results obtained by calculation. This is done by means of a machine designed for this purpose. The idea of a wire gun, as we have said already, is an old one; it has not hitherto, however, been successfully carried out. The advantage of the riband gun is threefold—(1) that steel in small section may be obtained with greater strength than is possible in any other form; (2) that each layer can be brought more truly to its correct tension; (3) that the danger due to the existence of flaws becomes reduced to a minimum, because a flaw would be easily detected, and if not detected, would be confined to the riband in which it existed. It is obvious that the opinion we expressed in favour of a gun built up of successive cylinders of soft steel—*vide* ENGINEER of July 30th, 1880, commits us to expect great results from this gun—unless some special evil accompanies the application of steel riband wound on cold, which there seems no reason to suppose. Obviously, the tension can be given to a degree of accuracy not to be attained by shrinking. To give longitudinal strength, a certain number of layers are formed by short lengths of steel riband placed longitudinally like the staves of a barrel, and secured by doubling or hooking in the ends. The whole is cased with thin steel; one or two wrought iron coils only are used on the entire gun. A 6in. gun has been made on this system and fired, and it has given results considerably better than could be expected from a gun built up in the ordinary way; a 10in. gun is nearly complete, and we hope next week to give a drawing of a much larger design. Of course, a question of actual strength of structure can only be completely tried by testing to destruction.

Carriages.—For some time after the introduction of rifled ordnance very little improvement was attempted in carriages. Wood carriages did not offer much scope for improvement, and there was a prejudice against iron as likely to splinter. In 1865, however, when it had been proved by experience that this was a mistake, iron carriages came in. The Elswick Works turned out some early patterns, which were inspected by the Ordnance Select Committee, who visited Newcastle for this purpose. Compressors of different kinds were devised at Elswick and introduced into the service, fulfilling the conditions of self-action without setting, and of becoming disengaged by the ordinary operations necessary for running up, these conditions being specially demanded by sea service. One pattern of disappearing carriage—differing from that of Moncrieff, who had first dealt with this question—acting by hydraulic power, was designed at Elswick, and supplied to H.M.S. Téméraire. The application of hydraulic machinery to replace hand power has been specially advocated at Elswick. On this question the Carriage Department in the Arsenal has taken a different position. The Carriage Department authorities advocated the employment of such gear as enables the gun to be worked by hand, considering that matters might have to come to this on active service. Any application of steam power then on this principle acts on the gear supplied for hand working. In short, the steam power may on this principle actually take the place of the hands of the detachment, but must not be applied in any way that prevents hand power being available if necessary. The Elswick argument is that the whole question is simply one of the probability of getting out of working order; that gear suited to hand power involves so many cogs and complicated parts, which are rendered unnecessary by hydraulic machinery, that the hand gear itself is the less reliable of the two, even when actually used by hand. The Carriage Department authorities, we believe, fully recognise that guns may attain a magnitude that puts hand power out of the question. We believe this limit occurs sooner in muzzle than in breech-loading guns.

This brings us, however, to a special arrangement at Elswick, namely, that by which muzzle-loading guns, mounted to fire *en barbette*, may be loaded under cover. This is effected by running the gun on its traversing platform round until it is parallel to the parapet, when its muzzle is dipped so as to bring it in line with a rammer in a fixed position with charge and projectile presented ready for loading. The gun, then, thus depressed, forms an incline, up which they are easily pushed home. The training of the traversing platform for loading may at first appear heavy work. This, however, is reduced much more than we should have expected by two things—one, that the gun is at the time just over the centre of the training circle, and the other that the platform rests on three points, not four namely, the two trucks and a cap pivotting on the centre of the training circle. The gain is very great, for while a bearing on four points is constantly disturbed by the want of truth in the planes which contain the four points, a bearing on three points is always true. Unquestionably, then, this method of working is very easy and well suited to certain positions.

Vessels Designed and Supplied Complete.—Just now there are two cruisers lying off the jetty at Elswick supplied by this firm. The vessels themselves are built by contract for them by C. Mitchell and Son, of Low Walker. They are made entirely of steel. Their displacement is about 1400 tons. They possess very high speed, namely, 16 knots an hour, a speed which they attained over a measured distance to the satisfaction of the inspecting officer during the last few days. The lines forward are fine, but this speed is, nevertheless, very high for so short a vessel weighted with such heavy guns. The engines are supplied by R. and W. Hawthorne, Newcastle; they are 2400-horse power. The vessels each carry two long 10in. breech-loading guns, weighing 25 tons each, moving on a hydraulic, pivotting on racers, in a fixed turret or tower, whose sides consist chiefly of hinged shutters of ⅜in. steel plate, which can be lifted at the point where it is desired to fire. Protection, therefore, is only provided against small arms or light repeating guns; the vessel trusting partly to its small size for safety, and partly to the circumstance of its engines and vital parts being kept well below the water line and covered over with coal. In addition to her two heavy guns thus carried in fore and after turrets, each vessel has four 40-pounder breech-loading guns—12 centimetres, 4·7in. calibre—mounted on Albini carriages and two 9-pounder breech-loading guns on naval slides, with alternative field carriages provided, as

TURNOVER HYDRAULIC CAPSTAN.



well as Nordenfelt, Hodgkiss, or Gatling guns. The ships draw about 15ft. of water. These vessels are made for ramming, and ought to be very formidable if well handled. Their guns possess the power of penetrating any armour, except that of the Inflexible, and Duilio, and Dandolo.

Present Condition.—We give herewith a plan recently made of the Elswick Works. It will be seen that they cover an area of ground lying between the river Tyne and the railroad; alongside the latter runs also the high road and tramway from Newcastle to Scotswood. The facilities for transport are therefore unusually great. We do not attempt to give any sketch of the works, because, as may be surmised from the plan, they are too extensive to admit of any satisfactory general view being taken. The east end is devoted chiefly to ordnance work, the west end being the so-called engine works, where the engineering structures we have described, such as bridges, iron lighthouses, dock machinery, and hydraulic machinery are made. The offices are between these two departments, and the principal road and jetty near the middle point. We do not propose to attempt to give a description of the works in any general sense, but merely to notice a few features such as characterise the works or should be noticed by visitors to Elswick, especially engineers who may have a special opportunity this summer of visiting these works. We suppose the works to be traversed in the order adopted, as far as we understand, on the last public day.

Commencing at the point forming the right hand top corner, or N.E. corner of plan, the first objects of interest are the 6in. and 40-ton breech-loading gun mounted *en barbette*. The method of mounting and working is shortly noticed above. It is well to observe the system in action, and the cover afforded to the detachment. Close to these guns is a shrinking pit, 37, for ordnance from the 100-ton gun downwards, also nineteen gas producers for furnaces. The shops then may be taken in the following order:—No. 32*, Coiling: The largest section of bar has been 12in. × 10in.; length of coiling furnace, 180ft.; gas furnace for heating barrels, also for tempering, with an oil well 50ft. deep, over which stands a hydraulic hoist. Forge, No. 28: The large hammer here, made by Thwaites and Carbutt, Bradford, has a 48in. cylinder and 12ft. stroke; weight of piston and hammer head, 35 tons. Blast Smelting Furnaces, one furnace building, two in work and running from 900 to 1000 tons a-week, chiefly Nos. 1, 2, and 3 pig, made from Spanish and Elba ores, most of it sold for steel making. The blast is at present heated by horseshoe pipes, but Cowper's patent heating stoves are in course of erection; temperature of blast, from 750 to 800—about the melting point of zinc. The engine for the furnaces is made by the firm. Carriage Shed, No. 29*: There are band saws cutting iron which may be noticed, and Albini carriage on short-recoil and self running-up system. Projectile Store, No. 33*, containing finished projectiles: These are chiefly made with bands only up to full diameter, which saves work and leaves to the projectile body the strength of the uninjured skin of the casting. The Palliser chilled projectiles will be generally found with sharp-pointed heads struck with two diameters ogival. Foundry No. 27*, containing ten cupola furnaces, of which four are generally in work: Forty tons is about the maximum weight of casting made in the foundry—a much larger one, such as the bed of the steam hammer, weighing 137 tons, being cast on its own ground. The system of hydraulic cranes should be noticed. They are fixed so as to work in pairs or three together for heavy work. Engines: Near this are the engines for the east works, and also those for the west ordnance works. Horizontal double Corliss engines are employed, with four boilers, three working at a time. Jukes's bars and system of stoking is applied to all. The jetty may probably be conveniently visited next, near which are more horizontal engines, 100-horse power, working on the accumulators; the water-pressure maintained is about 700 lb. per square inch. Five or six locomotives are generally employed in the works. On the east end of the jetty are two fixed hydraulic cranes for lifting 5 tons and 30 cwt., and between them large hydraulic sheers; made by Day and Summers, worked by a direct-acting hydraulic cylinder, 40ft. stroke, lifting 120 tons. The back leg moves so as to bring the lifting cylinder about 30ft. out, 15ft. inboard of a vessel. The foot is moved by a screw 50ft. long with hydraulic engine and gear, with three different powers. Along the jetty run pipes with hydrants from 18ft. to 36ft. apart, on which work five movable cranes, each lifting about 30 cwt., being placed in position to suit the holds of the vessels by means of telescope tubes attached to the nearest hydrants. The Finishing Shop, No. 14*, may be taken next in order. The proportions of new type guns should be noticed also; the breech-loading fittings and apparatus for firing by electricity and also mechanically. No. 12* shop is for small machine work, completing Gatling machine guns, hydraulic valves, &c. No. 26* is a machine shop containing planing machines, &c. No. 2* may come next, chiefly for turning, finishing, and boring work, commencing on the solid ingot. At the east end, guns are bored vertically in a pit 23ft. deep. No. 11* is a large machine shop for turning, boring, and rifling. The finest lathe is one of Whitworth's, for turning, boring, screw-cutting, and rifling, taking a job 44ft. in length, 36in. centres. There is also a convenient one made by Fairbairn, Kennedy, and Naylor, modified at Elswick, taking a chuck job 20ft. in diameter, 4ft. 6in. long, or a job 34ft. long and 8ft. in diameter; it is fitted with slide rests on independent beds. There are chambering and rifling machines. There may be steel ingots here deserving of notice, such as one now waiting between operations, supplied by Vickers, 32ft. long, for a 13in. breech-loading gun inner tube, and a steel tube replacing the "2 A" coil for 100-ton gun supplied by Whitworth. Close by this building is another Corliss engine, 169-horse power. No. 4*, Forge: Crank shaft, and gun work, coil welding, &c., performed. The steam hammers here, from 24 ton to 15 cwt., chiefly Morrison's make. No. 1*, small machinery, turning and boring out short coils. There is a large endless band saw 1¼in. wide, which cuts directly through iron cylindrical work about 16in. in diameter. Its speed is from 76ft. to 129ft. per minute.

Engine Works.—The engine works come next. The shops are not numbered like those of the Ordnance Works. They may be taken, however, in the following order:—Bridge and Boiler-yard (15 on plan): containing plate planing, punching, and multiple and radial drilling machines, &c. The work turned out is chiefly crane work and other structural ironwork, such as a lighthouse now going to Brazil, pedestals of cranes, &c. Blacksmiths' shop (3 on plan): Boiler and rivetting work, &c., is done here. There is a hydraulic rivetter made by the firm. At the back of the building is the chain-making shop (6 on plan), where all chains for the firm are made and tested by a hydraulic machine, either up to 30 tons or 100 tons; 25 cwt. is the lowest test of the machine. A Corliss horizontal engine working to 190-horse power, with boiler and Jukes's grate, &c., is fixed here, which supplies power to the whole engine works. A fitting and machine shop (21 on plan) comes next. The east end of this was the first shop erected at Elswick; planing, boring, drilling, and turning are done here. The west end is used for erecting hydraulic machinery. There is a hydraulic testing machine for testing cylinders and valves up to 3000 lb. per square inch, and a drilling and tapping machine by Muir. Behind this is the brass foundry (23 on plan). Phosphor bronze is employed for gun carriage work; its cost is considerable, but it works well without lubrication. Pipes are tested in a small building (9 on plan) up to 3000 lb. per square inch by a hydraulic testing machine, next to which is a pattern shop, in which may be seen working Richard's planing machine, and also circular saws with adjustable spindles, with guide and graduated arc for setting work at any required angle. The work is so smooth as to enable planing to be dispensed with. An erecting shop (10 on plan) for engines and large work comes next, such as a 45-ton crane for Valparaiso, and an accumulator for Swansea. There is a jetty (19 on plan) adjoining these works with 12-ton and 5-ton hydraulic cranes. The works yard is furnished with hydraulic capstans and snatch heads for hauling wagons about the yard, and other appliances. There are five pumping stations with accumulators. (1) Near the blast engines, 34; (2) on low ground near gas works at 40; (3) behind foundry, 27*; (4) close to railway; (5) at engine works erecting shop, 10.

SILKSWORTH COLLIERY, DURHAM.

No. II.

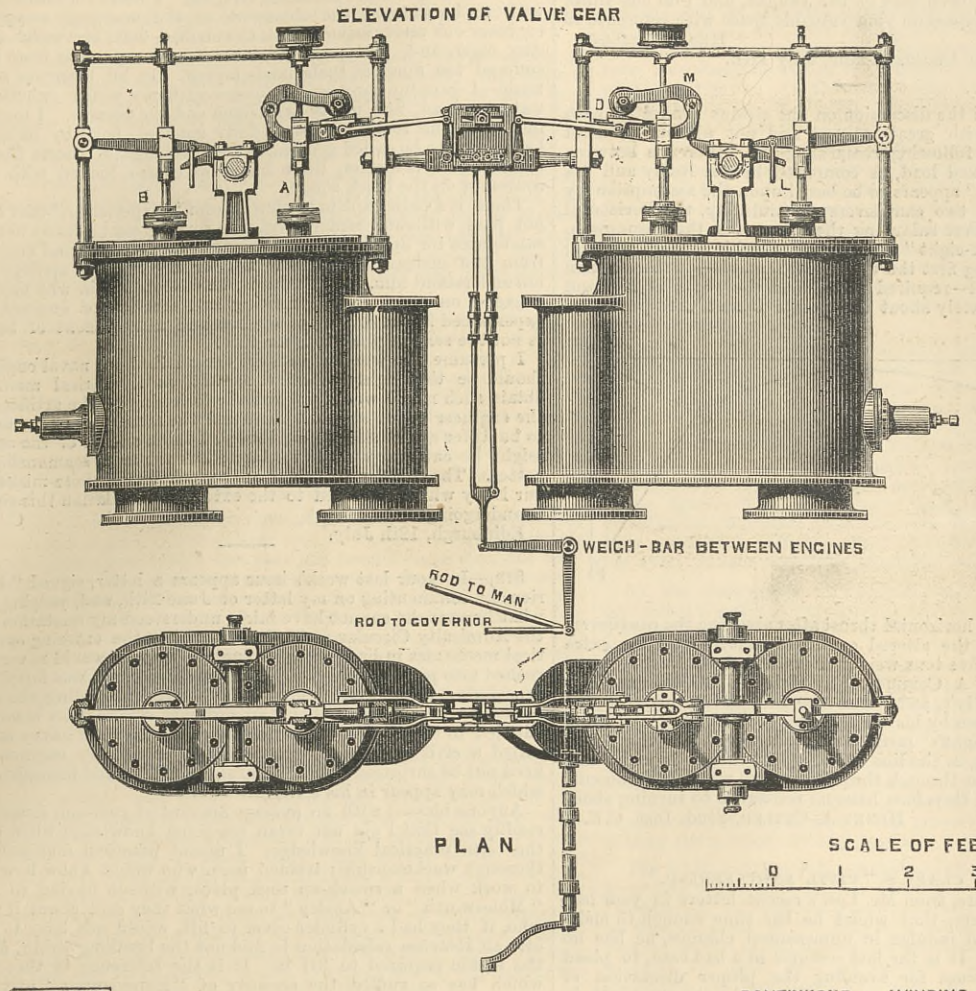
It has been pointed out in our first article upon this subject that the coal-fields of the great northern coal-producing counties—Northumberland and Durham—are almost inexhaustible, and that many generations yet unborn will be unafflicted with any scarcity of this most needful mineral. Colliery owners smile at the terrible prophecies of alarmists, and instead of feeling anxious as to the life of their pits, they day by day, and week by week, make improvements in their machinery and pit gear in order that a still greater supply of coal may be sent "to bank," and from thence through our home countries, and to the hundreds of steamships which are ever ready to carry it to the utmost limits of the earth.

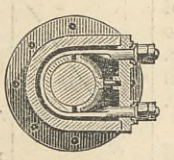
At Silksworth, the colliery more immediately under our notice, some 1800 tons of coal, per day of ten hours, are brought to bank by the pair of engines illustrated in last week's issue of The Engineer. These engines were designed to wind 1000 tons per day each, and there is no doubt that they are capable of doing still more; in fact, it is intended, as soon as certain arrangements have been carried out in connection with the workings, to make a demand on them for 1200 tons each per ten hour day, and this they will be obliged to draw from a depth of some 600 yards. Additional machinery is shortly to be erected at the pit-head, which will enable the quantity of output to attain the respectable figures of very nearly 4000 tons per day.

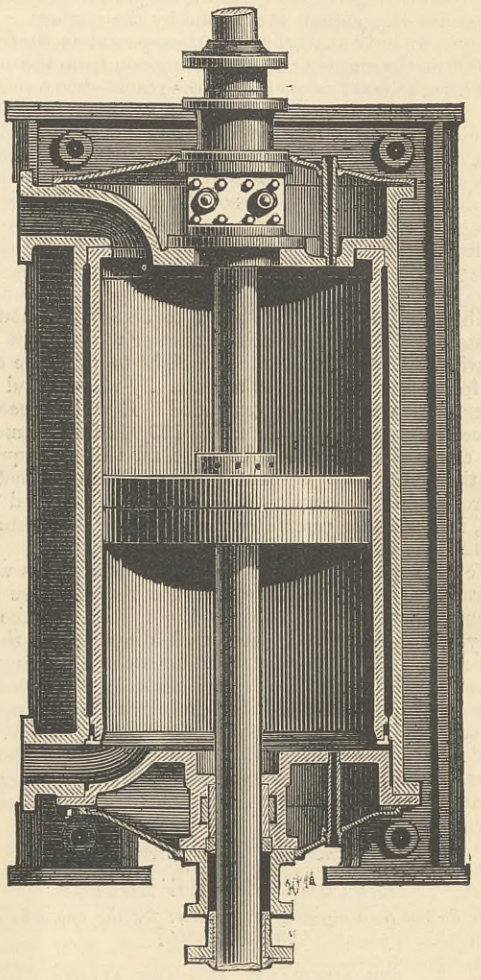
At present no less than sixteen steam engines are engaged in the work of this colliery, of course neglecting the locomotives which take the "winnings" away; they are:—(1) No. 1 winding engine, double horizontal, 20in. cylinders, 3ft. stroke, geared 3 to 1, drums for flat ropes 10ft. diameter at lift. (2) No. 2 winding engine, double horizontal 48in. cylinders, 6ft. stroke, drum 25ft. 4in. diameter, 8 tons counterbalance chains, variable automatic expansion valve gear. (3) No. 3 winding engine—illustrated last week—same as No. 2, conical scroll drum varying from 15ft. to 28ft. diameter. (4) "Apparatus" engine—small coal—double horizontal, 16in. cylinders, 26in. stroke, variable automatic expansion. (5) Engine working self-firing furnaces and feeding boilers, single 15in. cylinder, 30in. stroke, 6in. ram. (6) Engine pumping to reservoir, single, 15in. cylinder, 30in. stroke, 8in. ram. (7) Pumping engine, staple, compound differential first cyllnder 23in. diameter, second 42in., stroke 5ft. (8) Crab engine, double horizontal, 10in. cylinders, 24in. stroke, geared 32 to 1. (9) Jack engine, double horizontal, 9in. cylinders, 18in. stroke, geared 6 to 1. (10) Mortar mill engine, double, 6¾in. cylinders, 9in. stroke, geared 10 to 1. (11) Hoist engine, single, 15in. cylinder, 48in. stroke, geared by chains 8 to 1. (12) Portable shaker engine, single, vertical 8in. cylinder, 12in. stroke. (13) Shop engine, single horizontal, 12in. cylinders, 24in. stroke. (14) Underground hauling engine—Maudlin—double horizontal, 18in. cylinders, 24in. stroke, geared 3 to 1, three drums, two 6ft. 6in. dia., one 7ft. 6in. dia. (16) Underground hauling engine—Hutton—double horizontal, 11in. cylinders, 16in. stroke, geared 6 to 1, three drums, 6ft. diameter. The two last mentioned of these engines are built on the well-known type of Messrs. Robey, of Lincoln, having their boilers standing above them, but all resting on the same bed-plate. Steam is supplied to all the engines at bank by a group of eighteen boilers. Six are cylindrical egg-ended boilers, 44ft. long, 5ft. diameter; they are fired by Vicar's self-feeding and stoking furnaces, and only require the services of one man, as water tender. Besides these, there are twelve double-flued Lancashire boilers, 30ft. long, 7ft. 6in. diameter. The tubes are 3ft. diameter, and are tapered to 2ft. 6in. at the flue end. This series of boilers is very carefully looked after by the engineer in charge, and has given a minimum of trouble, and it is found that the patent furnace employed is economical in every way, as it fires neatly and regularly, dispenses with stokers, and is perfectly easy of adjustment for firing slowly or rapidly as may be desired.

The winding engines we illustrated last week are amongst the finest specimens of colliery engines at present to be seen in England, and they reflect equal credit on their designers, Messrs. Daglish and Lawrence; on their builders, the Grange Ironworks Company; and on Mr. G. W. Ross, a

No. 3 WINDING ENGINE, SILKSWORTH COLLIERY—DETAILS.



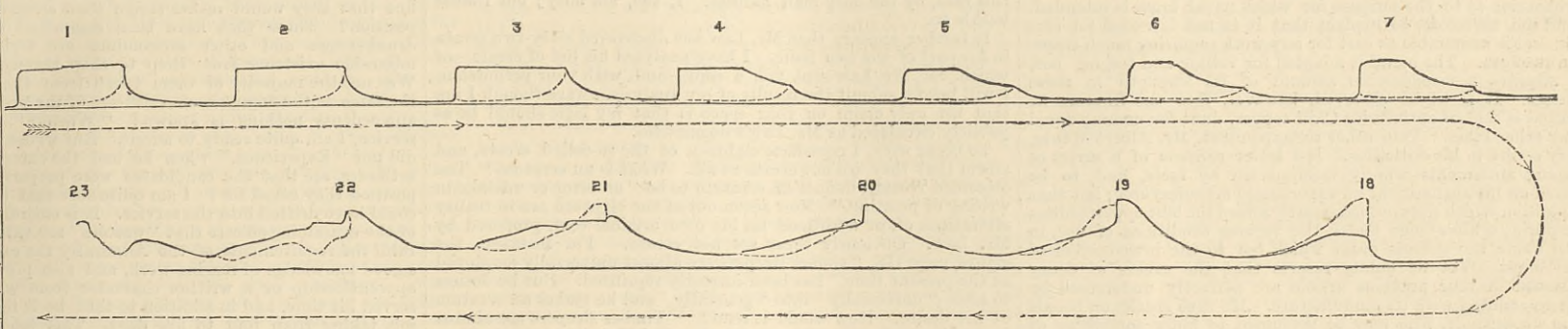




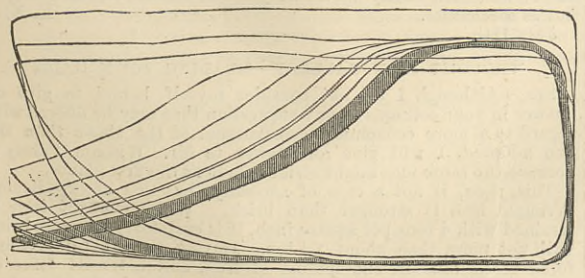
No. OF REVS	TIME
1	5
2	7½
3	10
4	12
5	13¾
6	15¼
7	17
18	36
19	38
20	40½
21	43
22	46½
23	52

SECONDS

CONTINUOUS WINDING DIAGRAM

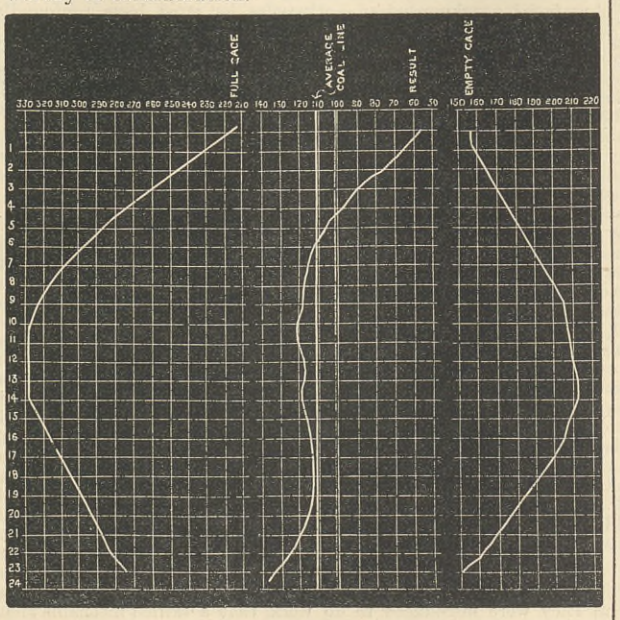


well-known north-country engineer, and president of the Institution of Colliery Engineers for the year 1879, under whose watchful eye, as mechanical engineer to Silksworth Colliery, they have worked since their erection. During this year Mr. Ross has obtained a still larger field for his energies than Silksworth offered, and the best wish we can express to this colliery is that its machinery may be now as efficiently cared for, and as closely watched, as it was during the time of his service. The cylinders of these engines are, as stated above, of 48in. diameter, with a stroke of 6ft., and they are steam jacketted. The inner linings of the cylinders have internal flanges jointed to the front ends of the jackets or casings, and at the back ends these form expansion joints, to allow for the unequal expansion of the inner linings and the jackets. Experience has proved that the wear in the bottom of the cylinders of long-stroked, heavy pistoned, horizontal engines may be very great, and it



6 FULL TUBS ASCENDING
6 EMPTY " DESCENDING
TIME —— 48 SECONDS

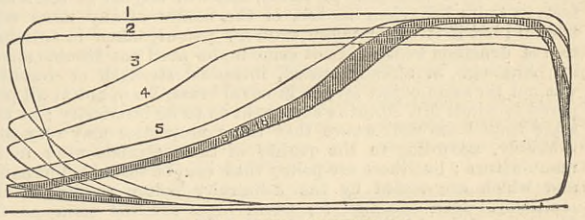
was deemed desirable, in addition to fitting the pistons of these engines with double piston rods, so that the weight could be supported on guide bars at the back ends of the cylinder as well as the front, to have stuffing-boxes of an unusually large surface. Notwithstanding these precautions, however, it was found, on taking the cylinder cover off and putting the piston—of No. 2 engine, not so with No. 3—at the far end of the cylinder, that the rod was down ⅜in. In order to provide against this in future, an ingenious and simple method of adjustment was designed by Mr. Lawrence, manager of the Grange Ironworks, which we illustrate above. The neck bushes at each end are in halves, and are hung ¾in wrought iron slings, the ends of which are screwed with a very fine thread, and are fitted with nuts. Doors are provided in the false covers at either end of the cylinders, through which these nuts may be readily got at and adjustment easily effected, the brass being lifted as it wears. This plan is quite novel, and up to the present has worked admirably. This sagging of the piston in horizontal engines is a very serious matter, and if this plan of Mr. Lawrence's will cure it, it will prove of great importance to all heavy horizontal engines. It is a curious thing, and, perhaps, somewhat savours of mechanical conservatism, that horizontal engines are retained at all for colliery use, and it seems difficult to understand this on any other ground. A larger engine-house would not be required for vertical engines, for though obliged to build it somewhat higher, we should gain in all other dimensions save height; and the advantages of a more equal wear and tear, and of a straighter lead for the rope from the drum to the pit pulley, are worthy of consideration.



The steam and exhaust valves are of the double beat type, of ample area to prevent back pressure, and the expansion gear is beautifully simple and efficient. It is almost the first application to a winding engine of automatic governor gear in England. The engine-man has always the full power of his engines to start his load; but as the speed increases the governor puts on the expansion or cut-off without his control, and when the speed decreases takes it off. Above we give elevations of the valve chests attached to the steam cylinders. A are the steam valve spindles; B are the exhaust valve spindles; C are the steam valve levers; D are the sliding wedges or movable blocks, which are connected by rods and levers and adjusting screws to an arm which is keyed fast on the weigh bar; on this same weigh bar is keyed at any convenient part the double arm or lever H fitted at each end with swivel guide pieces; through these at one end works the rod I leading to the governor, and at the other end the rod leading to the engine attendant; L are wipers, and M are the lifters or tripping portion of the steam valve levers, at the end of each of which is attached an adjustable roller cased with india-rubber.

When the gearing is in the position shown in the drawing the engine can be started with full steam. Motion is then given by the engine attendant to his rod, by which the sliding wedges or movable blocks D are worked in and out, and give the necessary amount of expansion independently of the governor; but as soon as the engine arrives at its fixed full speed the governor gives motion to its rod, and thus regulates the position of the sliding wedges or movable blocks D D, and thereby the amount of expansion independent of the engine attendant.

The power of the engines is exerted in turning the large



8 FULL TUBS ASCENDING
8 EMPTY " DESCENDING
38 LBS. STEAM PRESS.
TIME —— 50½ SECONDS

wrought iron conical drum, round which at either end runs a scroll, on which the steel ropes bearing the weight of the cages, wagons, and coal are wound. The rope at one side is engaged in hauling up a cage with a number of laden wagons, while that at the other is lowering an unloaded one, the engines being called upon to exert power to the extent of the difference between the weights. In the middle column we give a diagram of the moments of load in foot-pounds on the engine with the conical or spiral drum. In this diagram the top and bottom figures represent the load on the engines in foot-pounds per revolution, and for this purpose it is merely necessary to read them as thousands; thus, where ten is read, it will be understood that 10,000 foot-pounds is meant; and where 370 is marked, 370,000 foot-pounds will be understood. The figures to the left represent the number of revolutions of one winding. The left-hand line of the diagram is the ascending full load, and the one to the right-hand side represents the empty tubs descending. The variation of both of these lines is caused by the increase or decrease of the weight of the rope as it coils or

uncoils round the drum. The one of these lines deducted from the other gives, as a result, the middle line, and this represents the actual work done by the engines. As, for example, we have at start 215,000 foot-pounds on the full cage, 157,000 on the empty one ; deducting one from the other we shall have 58,000 foot-pounds as the result—see top of result line. Again, say at the twelfth revolution, 329,000 foot-pounds for the full cage and 210,000 foot-pounds for the empty one, we see at once that at that particular moment the work of the engines is represented by 119,000 foot-pounds. The double line in the centre of the diagram represents the average load, taking the average diameter of the drum. On looking closely at this line it will be seen that the average load on the drum is 100,000 foot-pounds, but for the sake of getting the engines into speed as quickly as possible, that has been reduced to 58,967 foot-pounds at the start, and the proportions answer well at the end of the winding, for it takes much weight to pull the engines up, for the drum acts as a huge fly-wheel, and stores power which has to be expended. It will be seen at a glance that we have at the finish 133,942 foot-pounds, and it is established by practice that all this is required to pull the engines up without putting steam against them. The rope used for hauling is of the most improved plough steel, it is $5\frac{1}{2}$in. in circumference, and weighs from 26 lb. to 29 lb. per fathom according to maker.

We also give a reduced copy of a continuous winding diagram. The dotted lines are the reproduction of the exhaust lines, which owing to the motion of the paper always in one direction, link each diagram to the next succeeding. We give also a similar set of diagrams taken on one card. It will be seen that in the continuous diagram we have omitted all from seven to twenty-three, the omitted diagrams being all precisely alike. The terminal drawings show the action in the cylinder while the engine is being stopped. The gradual cutting off as the inertia of the load is overcome is very beautifully shown by these diagrams.

LETTERS TO THE EDITOR.

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

THE ADMIRALTY AND NEW ALLOYS.

SIR,—I fear your correspondent, Mr. Barry, is under some misapprehension as to the purpose for which naval brass is intended. Permit me, therefore, to explain that it is not intended for cast work, and is unsuitable as cast for any work requiring much transverse strength. The metal is adapted for rolling and forging hot, and acquires a considerable amount of its strength in these processes. It is to be observed, however, that the fracture he describes is that of an inferior Chili copper, unfit for making naval or any other brass. Your other correspondent, Mr. Albert Muntz, is very severe in his criticisms. His letter consists of a series of sweeping statements wholly unsupported by facts, and to be received on his authority as an experienced manufacturer; but that is a position which does not necessarily afford the best opportunities of acquiring a knowledge under the various conditions of use, in which alone the defects occur which led to the introduction of naval brass. Yet he boldly asserts that the causes of decay mentioned in your previous article are perfectly understood by those acquainted with its manufacture. He thus speaks on behalf of the whole trade, who may be presumed to know something of their business. During the time the matter was under consideration I had opportunities of consulting several manufacturers with large practical experience, none of whom suggested that the cause lay in the manufacture ; moreover, any error in the proportions of the composition are readily discovered, and in none of the cases examined have the unaffected parts differed much from Mr. Muntz's specification, and I am satisfied that it is not due in any material degree to any of the causes suggested by Mr. Muntz, whose theory is that of very young students of the question, and which is always given up on becoming familiar with actual facts. It places the whole responsibility of failure on the manufacturer, and gives no hint to the user how he may ascertain beforehand whether the manufacturer is dealing honestly with him or not. He appears to have misapprehended the object sought in introducing naval brass. It was not on account of any supposed superiority in strength or ductility, and the discovery made was not, as he seems to suppose, viz., the means of making the metal. I claim to have suggested before any tests were made, that the introduction of a small percentage of tin would render the metal free from the peculiar and insidious change which had in many cases occurred, and my anticipations have been justified by all the tests yet made, but it yet has to receive the better confirmation of actual experience under the numerous trying conditions to which it may be put in actual use. I was not aware, and am still doubtful, about the previous application of the alloy to which Mr. Muntz refers in vague and general terms, and will be glad to learn any facts as to its behaviour in use, or the names of any users who tried it ; but if it was a manufacturer's patent, taken in anticipation of demands which did not come in, he need not trouble about it. Although, as already stated, increased strength or ductility was not the main object sought in naval brass, I am not at all prepared to admit Mr. Muntz's statement as to its inferiority ; at the same time I am well aware that these properties may vary considerably, according to the quality of the materials used in its manufacture ; but these are points that can be tested beforehand, and which are tested by the Admiralty before receipt. The mechanical tests specified for naval brass are the same as for Muntz's metal. If, therefore, the naval brass made by Mr. Muntz for Admiralty use was inferior, as he states, he must have been agreeably surprised to find it was not rejected. I am able to furnish your readers with the facts, and ask them to judge his statements by them—the only naval brass made by Mr. Muntz for the Admiralty was rods for making bolts, and these when tested after being finished, stood a tensile of 26 tons per square inch, which is four tons above the Muntz metal standard. They bent cold in the screwed parts on their own radius without fracture to an angle of 60 deg. or so above the test required.

Pomona House, King's-road, Fulham. J. FARQUHARSON.

THE PROPOSED BRIDGE OVER THE DOURO.

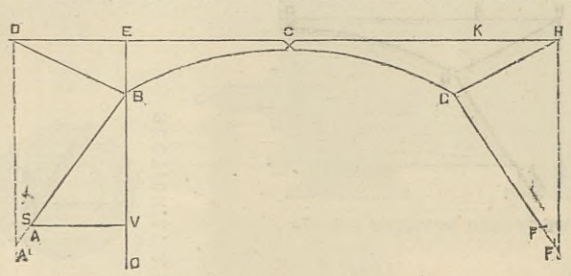
SIR,—The geometrical construction by which your correspondent, "A Common Five-eight," seeks to justify his calculated results is equally fallacious with the calculations by which those results were previously obtained. The resolution of a vertical force supposed to act at B into oblique and horizontal components at that point would only be correct if the two points B G were directly connected by means of a horizontal compression member replacing the actual superstructure, or if the point C at the crown of the bridge lay in the horizontal line joining B and G.

The determination of the primary forces which are in question, whether carried out by geometrical construction as described in the original article, and in my letter published June 10th, or by direct calculation as explained in my succeeding letter published July 1st, rests equally upon elementary principles of statics which are well known, and which should be familiar to any one claiming to criticise the working out of a comparatively simple problem in structural mechanics.

It does not, therefore, appear either necessary or useful to add to what has already been said on the subject, and I do not think that I need again trespass on your valuable space with reference to this matter. HENRY REILLY.

Lonsdale-chambers, Chancery-lane, July 11th.

SIR,—Having read the discussion on the strains connected with the above bridge with great interest and not without profit, I venture to offer the following remarks. The difference between the strains for the fixed load, as computed by Mr. Reilly and "A Common Five-eight," appears to be based upon the assumption by Mr. Reilly that the two cantilevers act mutually, the horizontal thrust of one cantilever balancing the other, and the assumption of "A Common Five-eight" that they first act independently and then together, finding first the weights at D and H—in the diagram given in your journal—required to balance the parts D B C and H G C acting separately about the points B and G respectively,



then calculating the horizontal thrust after abutting the cantilevers at the centre with the altered centre of gravity and the extra weights. The fifty-five tons weight or holding down force required at D and H by "A Common Five-eight's" method are not required by Mr. Reilly's, as he uses the horizontal thrust at the outset, which is shown by his calculations to be sufficient. I think "A Common Five-eight's" method would be correct if the points B and G were acting in the line of horizontal thrust, in which case the thrust would pass through the points round which the moments would be taken, and therefore have no resistance to turning about those points. HENRY A. CUTLER, Stud. Inst. C.E.

Upton, July 11th.

LAW AND CLARK'S "CIVIL ENGINEERING."

SIR,—So it appears, from Mr. Law's recent letters in your last and previous numbers, that whilst he has time enough to make broad assertions, and indulge in unmeasured charges, he has no time for discussion. It is the last resource in a bad case, to plead busy-ness as an excuse for avoiding the proper discussion of improper charges—a discussion opened, and the charges made, in this case, by the busy man himself. I, too, am busy ; but I must buckle to.

It further appears that Mr. Law has discovered sixty-two errata in *his* part of the new issue. I have analysed his list of errata—of which, Sir, Mr. Law sent you a copy—and, with your permission, I will briefly submit the results of my analysis, aware though I am that my only claim on your space is that my logic should be as publicly circulated as Mr. Law's dogmatism.

To begin with, I repudiate eighteen of the so-called errata, and affirm that they are not errata at all. What is an erratum? The esteemed Nuttall defines an erratum to be "an error or mistake in writing or printing." Now seven out of the eighteen are in reality alterations of, or additions to, his own original text, proposed by Mr. Law. Obviously these are not errata. For instance, the clause, page 116, "timber sleepers are almost universally employed at the present time," has been correctly reprinted. But he desires to alter "universally" into "generally," and he makes an erratum of his desire. How would it read? "Timber sleepers are almost generally employed at the present time." I like the syntax ! Here is another attempt : I wrote, page 35, "so that shrinkage of the truss may not incur settlement." He says that "incur" should be read "produce." Be that as it may, "incur" was rightly printed from the MS., and is not an erratum at all.

Again, three more errata are specified, which are really Mr. Law's own mistakes corrected by himself. Then there are forty-one errata, the net balance, most of which are but trifling and obvious. Knee-strap, for instance, is printed "knee-trap." Of these, I accept the responsibility of nine ; the remaining thirty-two are chargeable to the printers' readers.

Clearly, this is not the place to sport one's individuality, and if Mr. Law believes he has gained some degree of notoriety, he should be content. Otherwise, we must settle the matter elsewhere. He was only five-and-twenty or six-and-twenty when he wrote his book, and it brought him *kudos*. Obviously he could not, at that age, have accumulated the experience detailed in that book—though he has contradicted my assertion that he appropriated much of the material unacknowledged—otherwise he must have profoundly studied the theory of the arch, likewise that of retaining walls ; he must have contracted many a mile of road ; in the theory and practice of locomotive engines he must have been an adept ; in railways, docks, bridges, canals, &c., he must have been an Admirable Crichton of science. The fact is, truth is stranger than fiction.

8, Buckingham-street, Adelphi, D. K. CLARK.
London, July 12th.

[We can publish no more letters on this subject.—ED. E.]

ENGINE-ROOM ARTIFICERS, R.N.

SIR,—It is with such great interest that I have read the correspondence which has appeared in your columns on this subject, that I am led to make a few remarks regarding, not only my own, but the opinion of most with whom I have spoken. To begin with, I would ask, "What is the difference in position between the engineer and artificer?" I must plead ignorance, as far as actual personal experience goes, but from what I have learnt from men who should know, the one directs and the other uses his hands. This explanation, though short, to my mind expresses all that is required. Your correspondent, "Experience"—by-the-bye, that is a big name—states that artificers were introduced to do work which was formerly done by scientific men holding the position of officers. Now surely the true reason for their introduction—and again, as far as I can find out, I have a heavy weight of general opinion with me—is that given by "R. N." in your issue of 17th June. I will quote his words : "They were introduced with the double object of bringing men of more direct 'mechanical skill' into the engine room, and to reduce the number of commissioned officers in the steam department." Myself, I would state the chief reason thus : They were introduced to do work that a skilled mechanic alone could do properly. My sea experience convinced me entirely that the man to take charge of engines, &c., is that one who has commenced at the bottom of the ladder—*i.e.*, entered in the lowest position—who, with hammer, chisel, file, and spanner in his hand, has served the stated periods, and risen, if endowed with brain capacity for a decent amount of theory, by means of examinations, from blow-off and scum cocks to main bearings, slide valves, &c., to the top, when he will be fitted to control the whole steam department. This is the only system that can teach a man numberless small particulars in connection with the working of engines, which must be known before a sweet working engine can be obtained. Moreover, having been through it himself, he will know by the turn of the subordinate's hand whether the proper adjustment, &c., be given. Let the engineer commence as the artificer—in other words, let the lowest grade in the engine room be the door of admittance, and with proper pay, accommodation, &c., there will be quite enough of intelligent men to fill the higher positions. No doubt the gentleman would not enter. Well, to my mind, the engine room is not the place for him—unless, indeed, he will first stoop to the hammer, dirt, &c. I don't for one moment wish to be thought the champion of the boasting, swaggering engineer one meets ashore, with the civilian suit, big watch chain, ring, cigar, and, to top the lot, brass-bound cap. Far from it. I suffered too much at their hands myself. In all branches of the trade—I gave up the term profession with my youth—whether on water or land, one meets gentlemen and the reverse. I met men in the engine room who were fully entitled, both by birth and behaviour, to be called gentlemen ; and among the officers the very reverse. Nevertheless, these latter, of course, looked with utter contempt on the black squad.

There is a paragraph in the letter from "Experience" that I cannot pass without a remark, viz., the comparison he draws between candidates for appointment as engine-room artificers and engineers from the mercantile marine. I offer my humble apology if I misunderstand him. As I take it, he expects a man who has been engaged on shore in the making and erection of engines to be experienced in the driving of engines and management of boilers. Is not the sea the place to learn this?

I presume the whole nation are agreed that our naval engineers should be thoroughly practical as well as theoretical men. To obtain such men I would suggest the following :—The artificer and the engineer cadet should be one and the same, the examinations to be stiffer as the stages rise, though I think a little of the science might be cut out with advantage ; but the more seamanship the better. The country will then hear much less of those mishaps in our Navy which have led to the extensive ventilation this subject is undergoing. C. C.

Edinburgh, 12th July.

SIR,—In your last week's issue appears a letter, signed "Experience," commenting on my letter of June 24th, and, judging from what he says, he cannot have fairly understood my quotation from the Admiralty Circular of 1868, authorising the entering of practical mechanics in lieu of junior engineers, or he would never have rushed into print and have said that my statement was false. But considering that "Experience" is evidently misleading the whole question when he says that "an ordinary engine fitter is no more entitled to be called a practical engineer" than a "navvy is to be called a civil engineer," or a scavenger a sanitary engineer, one need not be surprised at other glaring anomalies and inconsistencies which may appear in his letter.

Anyone blessed with an average amount of common sense could readily see that I did not mean sea-going knowledge when I used the term practical knowledge. I meant practical manipulation, thorough workmanship; trained men, who would know how to go to work when a smash-up took place, without having to go to "Molesworth" or "Ansley" to see what they said about it; men who, if they had a cylinder cover to lift, would not have to enter into an abstruse calculation to find out the breaking strain, &c., of the tackle required to lift it. It is the reference to these men which has so ruffled the serenity of "Experience's" existence. Who were the engineers of thirteen years ago who became so mighty fine that they would rather resign than serve on in a subordinate position? Those that have been compelled to resign through drunkenness and other misconduct are trying to drag out a miserable existence from shop to shop throughout the country. Was not the majority of them taken from the private factories, the same as the engine-room artificers of the present day, of whose antecedents nothing is known? "Wasters" there are in the service, I am quite ready to admit. But whose fault is it? Why did not "Experience," when he had the entering of engine-room artificers, see that the candidates were properly qualified for the position they asked for? I am quite sure that then no "wasters" could have drifted into the service. It is entirely due to the laxity of the examining officers that "wasters" are entered. To properly fulfil the requirements of the Admiralty the candidate must have a good knowledge of marine work, and also produce indentures of apprenticeship or a written character from where he may have served his time, and in addition to that, he is required to do a test job, taking from four to five days. This job varies at different ports. At Devonport, a knuckle joint rough from the forge ; at Portsmouth, a connecting-rod end, with strap, gib, and cotter ; at Chatham, a set of Whitworth stocks and dies.

Now, Sir, candidly, could a "waster" execute any of these pieces of work to the satisfaction of the foreman of an average London shop? No, he could not. It is only because the examining officer fails in his duty that so many misfits, with influence behind them, slip into the service. To say that the engineers are inclined to listen favourably to the claims of the engine-room artificers is simply nonsense. Where is the evidence of their friendship? Did the engineers lend a helping hand to remove the obnoxious badge from their arms? Have they ever asked for better washing and messing accommodation for the men they rely upon to relieve them in their duties? But as "Experience" makes no distinction between the engine-fitter and the navvy, scavenger, &c., there cannot be the slightest doubt about the fostering care that the engineer officer evinces for the engine-room artificers.

If the engineers are so eager to see some system constituted which would supply the Navy with trained, good, practical men, why do they not assist in removing some of the grievances from which the engine-room artificers are now suffering? Let the engineers treat the engine-room artificers as helpers, and not as slaves, and then better men will join the service, not as drudges, but as mechanics. E. X.

July 11th.

WROUGHT IRON GALLERY—READING TOWN HALL.

SIR,—Although I do not consider myself bound to give an answer in your columns to any suggestion that may be offered with regard to a more economical construction of the above than the one adopted, I will give an answer to Mr. William Parsey's, because the same idea might strike others at the first glance.

This, then, is not a case of necessity, but one of expediency. Wrought iron is stronger than brick. While wrought iron is strained with 4 tons per square inch, it is customary to strain brick with not more than about ·04 ton. Having, then, a compressive force of 33 tons in one lamina of iron, and a tensile force of 23 tons in another lamina, it is not expedient to transfer these two forces independently of each other to the brickwork, which consequently would have to offer a total bearing area sufficient to resist $33 + 23 = 56$ tons, but it is expedient to arrange so that the brickwork may have to resist altogether only $33 - 23 = 10$ tons

M. AM ENDE.

3, Westminster-chambers, July 12th.

HIGH-SPEED LOCOMOTIVES.

SIR,—Can "Running Board, of Swindon," explain why their narrow-gauge locomotives are allowed ten minutes longer on the journey to Swindon than the broad-gauge locomotives. This required explanation would be of service to some of your readers interested in the gauge question. A loss of ten minutes in every seventy-eight miles would be a serious item with some of our enterprising railway men. E. J. W.

THE BUENOS AYRES EXHIBITION.

SIR,—Will you kindly insert in your journal the following information referring to the South American Exhibition, to be held at Buenos Ayres? The exhibition will be opened on the 15th February, of 1882. "La Plaza del 11 de Setiembre" has been reserved for machinery, and the new and improved machines will be specially welcome. I am authorised to receive applications for places until the 15th of December next, and the despatch of machines must be done before or on the first days of January.

A. ALDANA.

Southampton, 8th July. Consul of the Argentine Republic

RAILWAY MATTERS.

THE directors of the Birmingham Tramways and Omnibus Company, Limited, have declared an interim dividend for the past six months at the rate of 10 per cent. per annum.

MESSRS. JOHN KING AND WILLIAM KEYSER, vice-presidents of the Baltimore and Ohio Railroad, have resigned. Mr. Robert Garrett and Mr. Samuel Spencer have been elected as their successors. In connection with this railway a new steamship line begins, sailing between Baltimore and Barrow-in-Furness, in October, designed especially for cattle shipment.

UNUSUALLY rapid progress is being made with the Hull and Barnsley Railway. Less than six months ago the first sod of the new railway and dock was cut, and work commenced by Messrs. Lucas and Aird, the contractors. The progress has been rapid beyond expectation, half a-dozen miles of temporary line for the carrying of material along the permanent way being already laid.

A SERIOUS accident recently happened to a tramway carriage on its way to Roslyn, a suburb of Dunedin, New Zealand, injuring eleven persons and causing the death of one. *India and the Colonies* says, "The tramway is worked by an endless wire rope, to which the carriages are attached by gripper carriages provided with powerful brakes. On the occasion in question the car had gone some 600 yards, when, in a part where the gradient is 1 in 7½, the gear got wrong, and the car rushed down the hill at a fearful speed, tore through the heavy work at the terminus and 3ft. of metal road, and then turned over on its side."

BRIDGES and structural ironwork are still to be bought at the low rates of from £12 to £15 per ton, but the movement downwards to ruinous prices which last year had become so serious, has been retarded by the failure of some of the weaker firms, who competed most recklessly. The orders from the India States railways are not so numerous or extensive as they have been for the last few years, but some more bridges of very large span are projected, and are likely soon to be carried out. Bridges for Canada, South Africa, and Australia, are being ordered, those for the latter colony coming frequently through local contractors, with whom it seems the policy of the authorities to deal, instead of always through the agents of the colonies in England.

ON the 14th ult. a big blast, in the promontory at the upper end of Shell Rock, twelve miles above the Cascades, and in the line of a new railway, was fired. Chambers had been run into the cliff from nearly opposite sides, and charged with 14,000 lb. of powder. The cliff is of basalt, projecting into the river, above which it stood at the height of about 150ft. The extent of its base was about 200ft., and the lateral depth of rock which it was desired to move was 75ft. to 80ft. About 40,000 cubic yards of rock had been blown off into the river, and the work of constructing the railroad at that point will now be a comparatively easy one. Rapid progress, says the *Portland Oregonian*, is now being made all along the line, and there is every reason to expect that by September the rails will be laid from the Cascades to the Dalles.

RAILWAY construction in England is being carried on mainly for short or branch lines, the Hull and Barnsley Railway being the only large undertaking now in progress. There is, however. Messrs. Matheson and Grant remark in their *Engineering Trades Report*, a considerable total of smaller contracts for widening lines and improving station accommodation, the increasing trade of the manufacturing districts stimulating in this direction the rivalry of competing companies. The London and North Western Railway Company still continues to let important contracts of this kind, and the Great Western scheme for a railway into Southampton is also likely to be carried out shortly. Tramways, which were so slow of introduction in this country are now at work in all the principal provincial towns, and the conditions of success are becoming well understood. The problem of working by steam is still an unsettled one, and probably if engine power becomes adopted, considerable alterations in the permanent way will prove necessary. In this country as well as in France, Belgium, and Germany, the makers of all kinds of railway equipment are busier than last year, and though prices are still low, the cheapness of material and the saving which a larger output permits, leave a profit unattainable a year ago. Locomotive builders in America and Europe are well employed.

ON Monday when giving evidence before the Select Committee on Railway Rates, Mr. Tennant, general manager of the North-Eastern Railway Company, was examined. It had been stated, he pointed out, that the rates charged for cattle from Hawes to Kelso, which was 174 miles, and from Leyburn to Kelso, which was 154 miles, were the same. The explanation was that there was a shorter route by the Midland from Hawes to Kelso of only 127 miles, and the North-Eastern Railway Company had simply given the cattle dealers the privilege of sending by the longer route at the cheaper rate. If they had not given facilities of this kind there would have been no ground of complaint. The North-Eastern Railway Company were largely concerned in the conveyance of articles for the manufacture of pig iron. Taking a comparison of the continental rates as charged over similarly short distances to those over which the materials are carried by the North-Eastern Company, he had found that the Cleveland rates were rather less than the foreign rates over the same distances. For instance, in France the charge for 30 miles was 2s. 4½d., while in the Cleveland district of the North-Eastern Railway it was only 1s. 11½d.; while for limestone for the same distance the rate on the Continent was 2s. 3d., while in the North-Eastern Railway district it was 2s. 0¼d. Whereas the owner of a blast furnace in France would have to pay £162 for the week's materials, in the Cleveland district he would have to pay only £143.

THE railway tunnel under the Mersey to connect Liverpool and Birkenhead, by which a railway distance of 30 miles will be saved, and a ten minutes' run substituted, has now so far advanced that successful completion is now only a matter of time and funds. A shaft for access and drainage has been sunk to a depth of 180ft. on either side of the river, two engines and two double sets of pumps provided, and the tunnel headings carried more than 200 yards on the Birkenhead side, and about 100 on the side of Liverpool. The total distance from shaft to shaft is 1600 yards. The engineers, Messrs. Brunlees and Fox, now state that the whole under-river part of the tunnel will be in compact new red sandstone, and that no trouble from water is to be expected in excess of the necessary leakage through occasional fissures, which will be readily kept down by the pumps until the tunnel is lined and completed. Ugly fissures sometimes appear though, such as that which drowned the Severn tunnel. The average thickness of rock above the crown of the tunnel will be 30ft., and the minimum thickness 25ft. From either end of the tunnel the railway will be carried, mostly beneath streets, to effect junctions with the chief lines by which the traffic of Liverpool and Birkenhead is at present conducted; uniting at Tranmere with the Birkenhead Joint Railway of the London and North-Western and Great Western companies, and terminating in Church-street, Liverpool, near to the Central Station of the Midland, Great Northern, and Manchester, Sheffield, and Lincolnshire companies. There are to be stations at Tranmere, and near Hamilton-square, Birkenhead, and in Lord-street and Church-street, Liverpool, and goods stations near Woodside, Birkenhead, and near St. George's Docks, Liverpool. The opening of the tunnel will afford a through route for passengers and goods from the whole of the Great Western Railway to Liverpool, and a much more direct connection than at present exists between Liverpool, Chester, and the Welsh coalfields. The Birkenhead Docks will, moreover, be benefitted. The estimated cost of the whole undertaking, including the tunnel, railway, connections, and stations, is £866,000, and the proprietors now propose to transfer the undertaking to a public company to complete and work the line. The Great Western Railway Company will take a prominent part in the scheme.

NOTES AND MEMORANDA.

THE census returns were not at latest advices complete for New Zealand, but the following approximate figures have been published, viz., Europeans, 489,500; Maoris, from 40,000 to 45,000. If the "natural increase" continues at its present rate during the current year, New Zealand will at the close of 1881 number over 500,000 white inhabitants. Of the chief towns, Dunedin, with its suburbs, has a population of 42,800; Auckland, 40,000; Christchurch, 30,970; and Wellington 22,000.

A MAP of the Transvaal appended to the last Blue Book of South Africa shows the populations of the various provinces. Zoutpansberg is the largest; in it are 364,250 Kaffirs, 654 Boers, 160 Europeans other than Boers; Waterberg comes next with 174,045 Kaffirs, 714 Boers, 50 Europeans; Lydenburg is next in size, with 123,300 Kaffirs, 1286 Boers, 292 Europeans. The largest number of Boers is in Potchefstroom where there are 6517. The largest number of Europeans other than Boers is in Pretoria, where there are 1810, The total in all the Provinces is 774,930 Kaffirs, 33,739 Boers, 5316 Europeans.

FOR the purpose of arriving at a proposal with respect to employers liability and insurance, the Iron Trades Employers' Association, taking all the different departments of the engineering, shipbuilding, iron founding, and machine making trades, found that of 88,290 men who had been under risk in these several trades, during the three years 1878-80, thirty-nine had met with fatal accidents, and 2002 had met with minor accidents; including amongst these minor cases every accident reported, however trivial. These figures, therefore, showed that, taking all risks without classification, the fatal accidents were as 1 for every 2263 men and boys employed, and the minor accidents of all kinds were as 1 for every 44 men and boys employed over the periods named.

AT the observatory of Campidoglio, Prof. Respighi has lately conducted a series of experiments for the determination of gravity. The author has described his method, which consists in the use of a pendulum with a lead ball about 9½ kilo. in weight, and a steel wire 0·6 mm. in diameter; a sharp iron point at the extremity dips in mercury each oscillation, so as to give passage to the current of a chronograph. Five different lengths of pendulum were used, between 7·90 m. and 5·16 m.; and with all these lengths the pendulum, on account of its weight, the fineness of the wire, and the convenient mode of suspension, proved independent of the rotary motion of the earth, presenting Foucault's well-known phenomemon. The number and duration of the oscillations were registered by the chronograph with greater exactness than is attainable by the method of coincidences.

THE white saline substance that appears upon brick walls may—according to the *American Architect*—be remedied. It says: "The 'saltpetring' of brickwork can generally be prevented by adding oil to the mortar, at the rate of a gallon to the cask of lime. If cement is used in the mortar, an additional gallon of oil must be allowed for each cask of cement. Linseed oil is generally employed, but any kind which does not contain salt will answer. The incrustation, once formed, can be removed with hot water, or by the muriatic acid generally used for cleaning down brickwork, but it will reappear to some extent, and usually leaves a permanent black or brown stain." It is not said how the oil is made to mix with the water, &c., of the mortar, nor what is the effect of the use of oil on the brickwork. One would think cure, namely, hot water, better than prevention in this case.

WATER glass is used for a large number of purposes in the arts, but it might find many every-day uses if better known. Mixed with chalk, it forms on drying a compact marble-like stone; bone ash, zinc white, and magnesia with water glass form similar stones. Ransome's artificial stone is prepared by mixing sand with water glass solution to form a plastic mass which is pressed into the required shapes, then placed in solution of calcium chloride; silicate of calcium is formed and cements the grains together, the chloride of sodium formed at the same time being removed by washing with water. With clay, lime, sand, cement, &c., soluble glass enters largely into the composition of many of the patented artificial stones, plastic tiles, slates, &c. The detergent properties of water glass make it an excellent scouring material, and it enters largely into the composition of most of our common soaps.

IT is often desirable to detect in the air of dwellings very small admixture of carbonic oxide. The following test, furnished by Vogel, has long been regarded as the most simple and unfailing: To a flask of water exposed to the air under examination add blood very much deluted. Carbonic acid is shown by the immediate reddening of the mixture. The addition of ammonia sulphide does not banish the absoprtion lines in the spectroscope as with ordinary diluted blood. This test will show the presence of a portion as small as 0·25 of 1 per cent. Experiments show, however, that the oxide may not all be absorbed in this manner. The *Scientific American* attributes to Dr. Walter Hempel a new use for mice. He uses the lungs of living mice to gather the gas from the room. The mouse experimented upon is then drowned, and blood from the region of the heart is tested with fresh, colourless ammonia sulphide. In this way 0·03 of 1 per cent. can easily be detected, and strong symptoms of poisonng are shown with as little as 0·05 of 1 per cent. of the gas.

PROF. S. P. LANGLEY, Director of the Allegheny Observatory, has started on an expedition, one of the objects of which will be to prove by a new class of experiments a curious conclusion which Prof. Langley has arrived at, namely, that the sun is not really a white, or yellow, or even a red object; but that sunlight is in reality "blue." We see sunlight only through an atmosphere. If we had always looked at the electric light in this way—say through yellow glasses—we should have fully believed it yellow. The proof that we have a blue sun is, however, somewhat conclusive at present. This is not merely a subject of curious inquiry. If our atmosphere in reality has played the part of yellow glasses, it follows that an enormous proportion of the sun's heat has never been taken into account in those questions of scientific meteorology which have a special bearing on climate, and hence upon agriculture and other practical affairs. Two adjacent stations will be selected, respectively at heights of 3000ft. and 14,000ft., for purposes of comparison, through their very different thicknesses of atmosphere. Is Professor Langley going to show us that when we speak of a blue moon as a conveniently distantly recurring phenomenon we are nearer the truth than we suspect?

A COMPARATIVE statement of the number and tonnage of vessels which have paid rates to the Mersey Docks and Harbour Board during the year ended on Friday last and in the previous year, has just been issued by Mr. W. H. Livesey, chief accountant, to the Board, and this statement affords a good indication of the state of the trade at the port. The total number of vessels which entered and left the Mersey in the year just closed was 20,249, with an aggregate tonnage of 7,893,948 tons, against 20,070 vessels of 7,524,538 tons in the preceding year, an increase of 179 vessels and 369,415 tons—figures which strikingly indicate the continual development of the trade of the port. Of this great tonnage, dock rates were paid on foreign going sailing vessels of 1,644,989 tons, an increase on the year of 81,337 tons; coasting sailing vessels of 384,765 tons, an increase of 56,004; on foreign going steamers of 3,603,692 tons, an increase of 274,434; and on coasting steamers of 1,529,755 tons, a decrease of 12,342 tons. Harbour rates only were paid on foreign-going sailing ships of 57,412 tons, a decrease of 5373 tons on the year; on sailing coasters of 272,300 tons, a decrease of 30,828 tons; on foreign-going steamers of 162,585 tons, an increase of 5889 tons; and on coasting steamers of 238,450 tons, an increase of 294 tons. There is a total increase of 399,433 tons in the vessels paying dock rates, and a decrease of 30,018 tons in those paying harbour rates only. The aggregate receipts of the board were £1,051,928, against £1,068,212, showing a decrease of £16,284, which is more than explained by a reduction of rates at the beginning of the year.

MISCELLANEA.

THE honour of knighthood has been conferred on Mr. Frederick J. Bramwell, M.I.C.E.

THE old-established Coalbrookdale Company is being turned into a limited liability concern.

A TUNNEL under the Thames between Greenwich and Poplar is under consideration by the Works' Committee of the Metropolitan Board of Works.

THE Société des Acieries de Longwy in France is erecting large new engineering shops, steel works, and foundries. The plant will produce 100,000 tons of steel per annum, and the foundries and shops are to be fitted up to turn out from 80 to 100 tons per day.

A FINE ART AND INDUSTRIAL EXHIBITION is to be opened in Cardiff on the 29th inst. The collection includes (1) paintings and fine arts; (2) statuary, porcelain and curiosities; and (3) machinery. It is intended to make the exhibition of especial local interest, especially in the sections 1 and 2, in which a special feature will be Nantgarw china, and pictures relating to South Wales.

THE new bridge at Battersea, as now sanctioned by both Houses, will be an iron structure erected somewhat to the east of the present bridge, at an estimated cost of £231,000. The width will be increased from 23ft. to 40ft., and the number of spans decreased from seventeen to five, the centre of which will be 173ft. wide. The new bridge will be 6ft. higher than the present one, and will allow 15ft. above Trinity high-water mark.

THE roof of a church at San Mateo fell in during service on the morning of the 5th inst., killing over thirty of the worshippers present, the greater number being women. The church was being partially rebuilt, and while a party of men were working on the roof, one fell through, and the sudden rush of all the others at the some moment in their endeavours to get off caused the remainder of the roof to collapse. Twenty of the workmen were killed, and several were fatally injured.

THERE was recently put in the blooming mill of the Siemens-Anderson Steel Works a new 70-ton vertical shear, made by Cavitt and McKnight, Pittsburgh. It is said to be the largest in the United States. The body of the shear is 9½ft. wide, and its height is 16ft., while the roller table attached to it is 22ft. wide. It is, according to the *American Manufacturer*, designed to cut steel blooms 8in. by 8in., or plates 36in. by 4in. hot. It does the work with the greatest ease and nicety, and one day last week it was in operation cutting blooms 7in. by 11in.

A STATISTICAL atlas of England, Scotland, and Ireland, edited by Mr. G. Phillips Bevan, is being published by Messrs. W. and A. K. Johnston, several of the fifteen parts in which it is to be comprised, being already issued. Each set of three maps in a Part, is accompanied by letterpress, giving in figures the statistics shown graphically and locally in the maps. The third part which we have received gives the statistics of the industrial condition of the United Kingdom. The seventh part is devoted to the agriculture of the United Kingdom. From this it appears that upwards of 346,000 out of the total of 473,638 holdings are of 50 acres each or under. The farms above 1000 acres appear to number 506. In Scotland, out of 80,101 holdings, 52,280 are of 50 acres or under, and 79 only exceed 1000.

THE first stone of the Vyrnwy Waterworks, for the supply of Liverpool, was laid by the Earl of Powis on the 14th inst. The Lake Vyrnwy is to be formed by the construction of a masonry embankment across the south-eastern end of the Upper Vyrnwy Valley; the length of the lake will be 4¾ miles; area of lake, 1115 acres; contents of the lake, above the level at which the water will be drawn for the supply of Liverpool, 11,900,000,000 gallons; available drainage area contributing to the lake, 22,000 acres; the length of masonry embankment from rock to rock will be 1255ft.; its height from lowest part of rock foundation to coping of parapet, 139ft.; and its height from river level to coping, 98ft.; length of contributing tunnel from river Marchant to lake, about 1⅜ miles; length of contributing tunnel from river Cowny to lake, about 1¼ miles. The length of the aqueduct from the Lake Vyrnwy to the reservoirs of the Liverpool Corporation at Prescot will be 67 miles; this aqueduct will consist of a triple line of pipes and of three tunnels, two of seven-eighths of a mile and one of 2¼ miles in extent. On the line of aqueduct there will be several filter-beds and minor reservoirs. It is estimated that the daily water supply to Liverpool from this source will be—including compensation—52,000,000 gallons.

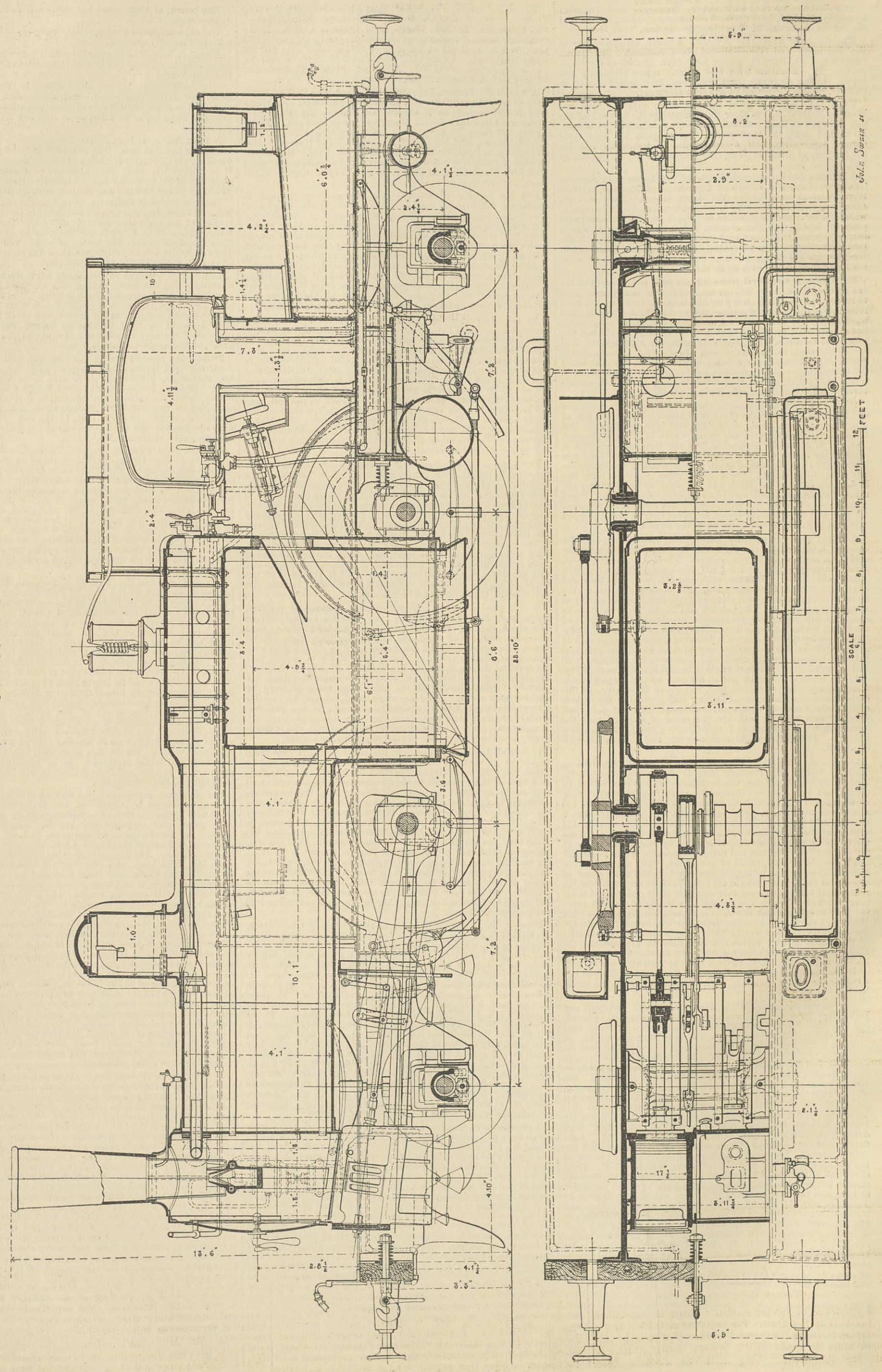
THE Egyptian newspapers just arrived give an account of the trial of a steamer at Alexandria, one of a fleet of vessels being fitted with compound engines to replace ordinary engines which for many years have propelled the vessels. The steamers are the property of the Egyptian Government, and are worked by an administration named the Postal Khedival, under the direction of English officials. The Damanhoor, a boat of 1000 gross tonnage, is 246ft. long, 30ft. beam, and 18ft. depth of hold, has been fitted up for the Red Sea traffic, with large deck and cabin accommodation to carry passengers to and from Jeddah during the pilgrim season, and for generally carrying traffic. The new engines are of 120 nominal horse-power, guaranteed to indicate 610 horses, and have been supplied by Messrs. Day and Summers, of Southampton, and erected on board the vessel at the arsenal, Alexandria. On the trial a speed of 11¾ knots was obtained with an indicated power of 706 horses, being 96-horse beyond what is guaranteed. Consumption of fuel, 9½ tons in 24 hours. The great improvement effected will be better appreciated in comparing the above results with that with the former engines, viz., 6½ knots per hour with a consumption of 20 tons of coal in the 24 hours. Messrs. Day and Summers are now sending out the sixth pair of these engines for vessels for the same service, and have in hand also two pairs of 200 nomina horse-power engines guaranteed to indicate 1000-horse, besides boilers for several other vessels. These contracts were arranged through the agency of Messrs. J. Matthewson and Co., of Leadenhall-street, who for many years have supplied through their Alexandria House, machinery and engineering materials to the several Egyptian Administrations.

A NEW Marine Parade Fence at Brighton commenced at the end of July, 1880, has been completed during the past week. It commences at the entrance to the aquarium, and terminates at the junction of the Madeira-road with the Marine Parade, not far from the Eastern Boundary of the town. The straight portion of the fence, which is fixed at the edge of the cliffs, is 5400ft. long, consists of massive cast iron standards placed 8ft. centre to centre, each weighing 3¾ cwt., between which are bolted panels weighing 4¼ cwt. and a top rail of teak 4 in. diameter is fixed above, forming a very comfortable rest for visitors to lean over. At intervals there are ten balconies which form recesses for seats, from which an uninterrupted view of the sea, the beach, and the Madeira-road below can be had. There are four flights of stone steps nearly 50ft. high, down which similar iron fencing has been fixed; this added to the straight part gives a total length of 6160ft. of ironwork. The standards are placed on a bed of Portland cement concrete, and a wall of the same material is formed round and between them forming a facia and coping about 2ft. 6in. high on the front. The stone steps and footpath have also been relaid throughout. Altogether there are about 350 tons of iron and 750 cubic yards of Portland cement concrete. The fence was designed by Mr. P. C. Lockwood, M.I.C.E., the borough surveyor, and the works have been set out and superintended by Mr. W. Parsey, A.M. Inst. C.E.; Messrs. C. Reed and Son, of Brighton, supplied and fixed the ironwork, and Mr. J. G. B. Marshall was contractor for the concrete and other work. The fence has been very carefully ranged to straight and curved lines on the top of the old wall, which is not quite regular on plan, and the gradients of the fence have been arranged to give as near as possible a uniform fall for the water to the kerb. Altogether the work has a very good appearance, and is a great improvement to the east end of the town.

TANK LOCOMOTIVE, DUTCH RHENISH RAILWAY.

MESSRS. SHARP, STEWART, AND CO., MANCHESTER, ENGINEERS.

(For description see page 66.)



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PUBLISHER'S NOTICE.

*** *Next week a Double Number of* THE ENGINEER *will be published containing the Index to the Fifty-first Volume. The Index will include a Complete Classified List of Applications for and Grants of Patents during the past six months. Price of the Double Number,* 1*s.*

TO CORRESPONDENTS.

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

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

*** *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.*

AN ERECTOR.—*For a single-cylinder engine divide the result by two.*

C. W.—*An ordinary Cornish, that is, single-flued, boiler, will evaporate about* 6 *lb. of water for every pound of common engine coal burned on the grate.*

W. R.—*It is almost impossible to sell a patented invention. We believe it to be quite impossible to sell an invention which has not been tried. If you have tried yours, and found it successful, then write to us, and we will endeavour to advise you.*

J. C. (Bradford).—*There is no simpler form of brake than that which you show in your sketch. The weight of the lever must be balanced by carrying it out at the opposite side of the shaft, or else it must be allowed for in making your calculations.*

THE EUPHRATES VALLEY RAILWAY.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers supply me with the names and addresses of the engineers of the Euphrates Valley Railway now in projection?

Higham, July 19th. A. S. E.

SAINTÉ'S COUNTERS.

(*To the Editor of The Engineer.*)

SIR,—Can any reader favour me with the address of Mr. Applegarth late of Abchurch-lane, City? He used to advertise a speed counter made by a French house—A. Sainté, Paris. G. W. S.

London, July 15th.

BRONZE CASTINGS.

(*To the Editor of The Engineer.*)

SIR,—Will any of your correspondents state the most reliable method of getting bronze or gun-metal for heavy castings into the mould perfectly clean, when run direct from the reverberatory furnace in channels across the foundry floor? The metal tank over the mould as used in statue casting cannot be applied in the case in point. T. T.

July 16th.

SUBSCRIPTIONS.

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

MARRIAGES.

On the 13th inst,. at Platt Church, Rusholme, Manchester, HARRY CHARLES GRIMWOOD, M.R.C.S. Eng., of Pontefract, Yorkshire, to HARRIETTE, eldest daughter of FREDERICK APPLEBY, C.E., of Rusholme, Manchester.

On the 7th inst., at St. Thomas's Church, Portsmouth, ARCHIBALD COURT, Paymaster R.N., H.M.S. Victory, second son of the late Stephen C. Court, C.E., M.I.C.E., to ELIZABETH JANE WILLIS (BESSIE), younger daughter of the Rev. W. MEYMOTT FARLEY, Vicar of Cretingham, Suffolk.

DEATHS.

On the 14th inst., at Holy Brook House, Reading, WILLIAM EXALL, C.E., aged 72.

On the 10th inst., at High Elms, Hackney, ANNIE, the beloved wife of JOHN TOPHAM, C.E., aged 49 years.

THE ENGINEER.

JULY 22, 1881.

COOPER'S HILL COLLEGE.

THE existence of Cooper's Hill College is imperilled. Its vitality as an institution was never remarkable; and it has long been known in certain circles that considerable changes must be made in the system under which its affairs are conducted. Very little has, however, been said on the subject. Until a new scheme was proposed it would have been impolitic to announce that unless a new scheme was adopted the college must be closed. On Friday last the Duke of Argyll, in reply to Lord Belper, gave some explanations. The college, he explained, was founded during his administration at the India-office, and he had always taken a great interest in it. The reason why it was brought into existence was to be sought in the fact that a proper supply of trained engineers could not be got for service in India, and the civil engineers who were there were incompetent. To use his own words, "The Indian Government lost annually enormous sums of money by the carelessness and incompetence of many of the civil engineers in India, and when holding the office of Secretary of State for India he found that it was hardly possible to obtain in the open market a sufficient number of competent men to conduct the public works in India on a scale such as that on which they were then being undertaken. Some of the civil engineers in India at the time to which he referred were very distinguished persons, but there were also a number of inferior men who might have been called 'hard bargains.' On one occasion some millions were spent under the direction of the engineers of India in the construction of new barracks. It turned out, however, that these buildings had been erected in accordance with entirely erroneous principles, and that they were mere 'sun traps.' They were tremendously hot, and in consequence the health of the troops quartered in them suffered severely. Many of them were so insufficiently built that it was found they would not last for more than a few years, and in some cases even the lime that had been used was pronounced to be bad. In this way the Indian Government were annually losing hundreds of thousands of pounds in bad engineering. The insufficiency of the engineering service having been brought prominently before the notice of the India-office, the authorities formed the idea of the erection of Cooper's Hill College. The project was opposed by a number of persons, including many members of Parliament, but eventually it was successfully carried out." Furthermore he explained that as economy and retrenchment are called for in India, the construction of public works was discontinued to a very large extent, and it would not be worth while to maintain Cooper's Hill for the sake of educating ten or a dozen pupils a year. What the details of the new scheme are remains to be seen. The papers will be produced in the House of Lords in a day or two it is to be hoped. Broadly stated, the idea is that Cooper's Hill College is to be made self-supporting. As many pupils over, say, 100 as can be got are to be taught within its walls, and of the best of these ten or a dozen are to receive appointments each year for service in India. The success or failure of the scheme will depend on the action taken by parents and guardians.

The formation of a training college at Cooper's Hill was not perhaps in itself a mistake; but the reasons assigned by the Duke of Argyll for its establishment manifest a considerable want of appreciation of the facts. In the first place, the mistakes made in India and on which the Duke dwelt with such emphasis, were not made by civil engineers, but by military engineers, who were called upon to discharge duties for which they were unfitted. We do not mean to assert that all civil engineers serving in India have been highly competent men, but they have, on the whole, done their work fairly well. The military engineers were placed in false positions. *Esprit de corps*, not to use a harsh term, kept them from seeking counsel from their civilian brethren. Unfortunate dissensions arose, and want of harmony between the two departments was followed by the usual results. The Duke of Argyle is quite in error when he asserts that good men could not be got in England when he wanted them. They could not be got for the wretched remuneration offered by the Indian Government. This statement admits of illustration. Some years since an effort was made to obtain about fifty engineers for service in India. The candidates had to pass a very simple examination, intended not so much to test their attainments as to ascertain the facts of their previous career. Business was not very flourishing in England at the time, and we know that many engineers went in for the examination, were accepted, and then declined point blank to serve, unless the rate of pay was raised from £400 a year or thereabouts, to a minimum of £600. We believe that at the time we speak of plenty of excellent men could have been had for a five years covenanted service for £600 to £800 a year and a free passage out. The Government would not give these salaries, and driven to their wits' end, started Cooper's Hill, and a very expensive—for parents and guardians—education was given. A good many young men joined the college. After a time, as they began to find their way to India, it was discovered that they were practically useless. Book learning they had in plenty, and nothing else. To get over this difficulty arrangements were made with some leading engineers in good practice for the admission of pupils for six months to their offices, so that a little practical insight into the routine of office work, and the way in which engineering operations are really carried on, might be obtained by them. Far be it from us to attempt to disparage the education given at Cooper's Hill. Of its kind it is, and always has been, the best possible. If it were but practicable for a young man to spend four years at Cooper's Hill, and then four years under some large contractor, or in carrying out works under the eye of such men as Sir John Hawkshaw, Mr. Hawksley, or many others whose names will at once suggest themselves, then, indeed, there would be a prospect of obtaining all but perfect engineers. But no young man can afford to spend eight or nine years of his life in thus learning his profession, and the Indian Government certainly held out no inducements in pay or position to tempt the budding engineer to undergo such a woefully long apprenticeship. Consequently, the Cooper's Hill men always have been, and always will be men of theory. Unfortunately, the men of pure theory have never yet done any engineering work of importance. They have always needed dry nursing either by contractors or practical men. But in India there are no contractors in the sense in which we use the word, and the practical men of ability are either equally scarce, or so absorbed in work themselves that they cannot teach theorists. For this reason we fear we must say that Cooper's Hill has been a failure. We have taken much pains to arrive at the truth; we have made inquiries in India from time to time ever since Cooper's Hill men began to work there, and the replies we have received all harp on the same string. Cooper's Hill turns out educated gentlemen, trained mathematicians, good linguists, admirable draughtsmen, but it does not turn out engineers in the full sense of the term. When they reach India they have to learn their business and to unlearn some things taught at Cooper's Hill.

It may be said that we write harshly of able young men. We do nothing of the kind. The fault does not lie with them, but with their teaching. College training is not only good, but invaluable up to a certain point; yet we cannot too strongly insist on the truth that it will not make engineers. No amount of book learning will qualify a man to put up a bridge, although it will enable him to determine what are the proper proportions of all its parts. It is the essential characteristic of such a training as that given at Cooper's Hill that it is accurate and precise. But in actual engineering there is nothing accurate and precise in the same sense. There is always some difference found between what a material or a man ought to do according to books, and what it or he does in practice. To the theoretical man called upon to discharge practical functions the unforeseen is always occurring. To the practical man of experience it is not too much to say that the unforeseen never occurs. In India some years ago a great dam had to be erected; a bed was cut for it in what the engineer believed to be the solid rock. His reading had taught him that rock such as this was always solid. The dam was made, and an attempt was made to fill the tank, and without success, for the water escaped through fissures below the dam, of the existence of which the engineer, a military man, had no suspicion. It is to the last degree unlikely that a practical engineer would have made such a mistake; his training would have taught him caution, consequently he would have explored before he proceeded, and his explorations would have supplied information. In writing thus we are not upholding the so-called "practical man," the rule-of-thumb man, who knows nothing save how to hide his ignorance. We speak of men who have had large experience in dealing with materials and forces under all sorts of circumstances and conditions. These men possess at once a definite knowledge and a means of communicating it to others, which cannot possibly be paralleled in any way by college life. To use a homely illustration, the most careful study of a cookery book will not enable a man to cook a good dinner. It is quite possible to have admirable dinners cooked by persons who never looked into the pages of Francatelli, or Mrs. Glasse of respected memory. But the true *chef*, the master of his art, combines a knowledge of all that has been written—in modern days at least—on the subject, with consummate practical skill. In the combination of practice with theory lies the way to the highest excellence. Cooper's Hill can only teach theory.

The truth ought to be carefully put before the public by those who prepare the new scheme to which we have referred. It ought to be made quite clear to parents and guardians that 95 per cent. at least of the students will get nothing in India, and that the college can only give a theoretical training. Under the circumstances we suggest that the duration of that training be shortened. Taking five years as the term of pupilage, then, let two of them be spent at the college, the remaining three with some competent engineer. It may be urged that two years is too short a period to teach all that is wanted. This, we submit, depends on the way in which the teaching is done. No time must be wasted. In the first place, no one should be admitted unless he could pass an examination intended to show that the pupil could understand what he would be taught. Again, the year's instruction should not consist of three terms of two months each, or thereabouts; and no subjects should be taught which were not certain to prove useful. A diligent student, who had a course carefully marked out for him, could acquire an enormous quantity of information in a couple of years at Cooper's Hill. Undertaking to turn out trained and competent engineers, it will deceive the public. It will outstep its own province, and, attempting all things, will achieve nothing. If, on the contrary, it honestly professes to give a sound theoretical preparatory engineering education, it will come honestly before the public, and we see no reason why it should not be a success. There is plenty of room for work of the kind; and the results obtained in the past supply a guarantee that the work of the College will be thoroughly well done in future. Only, let it be clearly understood that the College will not pretend to train engineers. It will half train them. Is it not possible for the Institution of Civil engineers to lend some assistance in completing the education of the rising generation? It would appear at times that the Institution does not realise its own importance, or know of what it is capable. It certainly does not as yet do all that it may be legitimately expected to do.

THE BOARD OF TRADE AND LAND BOILERS.

ONE of the most important chapters in the annual report of Mr. McDougall, the chief engineer of the Boiler Insurance and Steam Power Company, upon one section of which we commented last week, refers to the strength of boilers which have been subjected to wear. After pointing out the untrustworthiness of the system of inspection at present pursued by the Board of Trade, as compared to the Admiralty practice, quoting as an instance the well-known case of the Humboldt, the superheater of which exploded immediately after its inspection, in July, 1878, under circumstances fully described in these columns at the time, Mr. McDougall refers to the extraordinary difference between the general land-boiler practice and the Board of Trade rules and ideas. It appears from statistics he has collected from the mass of information in possession

of his company, "that certainly one-third, and probably one-half, of the land boilers at present at work in the United Kingdom would be put out of use if those rules and the ideas of the Board of Trade officers, as exhibited in recently-published reports, were put in force." He further remarks:—"No doubt in many instances the margin of strength allowed at present is lower than is advisable, and possibly competition among boiler inspection and insurance societies, as suggested in some quarters, has tended to prevent a higher margin being generally provided. Probably the practice of the Steam Users' Association—a body which, although very limited in its operations, is the oldest of the boiler inspection societies—has had most to do with the low factors of safety prevalent among the older boilers in the Lancashire district. It appears to be still the practice of the Association to sanction the working of boilers at 60 lb. pressure, even if of extreme age, with single-rivetted shells 7ft. diameter, made of $\frac{3}{8}$in. plates, and with the rivets in the longitudinal seams spaced less than 2in. apart. Assuming, as in one of the calculations made by the Board of Trade officers for the Walsall Rastrick boiler, that the efficiency of the joint is here ·39, and that the tensile strength of the iron, impaired by use, at the seams, is 19 tons per square inch, the factor of safety becomes 2·46. Or, taking the strength of the iron at 20 tons, and the efficiency of the joint at ·44, the factor will be raised to 2·93. The latter calculation gives a much higher result than would apparently be considered by the Board of Trade officers as representing the true strength of a boiler of extreme age; but even assuming it to be admitted by them as approximately correct, the margin of strength allowed would not at all meet their requirements. In a recently-published report one officer lays it down that the ratio of the bursting pressure to the working pressure should never be less than 4 to 1; and another states that the 'best authorities' recommend that in steam boilers 'the working pressure shall, according to circumstances, be from one-sixth to one-fourth of the bursting pressure.' From a communication I have had from the Board of Trade on this subject, it appears that, in the first of these cases, at all events, the officer had expressed his own opinion, without official sanction or direction." According to this, it appears that the opinions expressed by Board of Trade officers during coroners' inquiries are not always to be regarded as "official utterances." Referring to the Board of Trade rules for marine boilers, however, we find that the highest working pressure which would be allowed for a new boiler, of the dimensions given above, would be 43 lb. This pressure would only be allowed where the boiler had been open to inspection during the whole period of construction, and the iron used was known to be of the best quality. Where the quality of the iron is doubtful, and the boiler has not been open to inspection during construction—which is the case with most old boilers required to be passed by boiler inspection societies—the working pressure allowed for a new boiler by the rules would only be 30 lb., or just one-half that allowed by the Manchester Steam Users' Association for an old boiler of the same dimensions and construction.

A communication recently addressed to a contemporary by Mr. Fletcher, the chief engineer of that Association, throws some light upon the extraordinary difference between his practice and the Board of Trade rules and estimates. Mr. Fletcher states that in an experiment made some years ago by his Association, a single rivetted joint was shown to have a strength of 57·11 per cent. of the solid plate when burst by hydraulic pressure in the actual boiler; and he points out that the bursting by hydraulic pressure of a Rastrick boiler at Walsall, full particulars of which we published at the time, showed the inaccuracy of a calculation made by Mr. Richards, a Board of Trade officer, who assumed the strength of a single rivetted joint to be only 39 per cent. of the solid plate. As will be observed, the same calculation is referred to in the above quotation from Mr. McDougall's report, and its proved incorrectness is pointed out in another part of his report. There is therefore a concurrence of opinion, and in fact positive proof that the strength of a single rivetted joint in a boiler is considerably higher than laid down by the Board of Trade officers in the case of the Walsall boiler; but, on the other hand, is it at all certain that it is so high as it is assumed to be by Mr. Fletcher from a single experiment made by his Association? Mr. Fletcher states further in the communication to which we have referred, that the strength of the double rivetted joint was shown to be 64·72 per cent. of the solid plate, and we certainly should not ourselves expect that the single rivetted joint would so nearly approach the strength of this as to give 57·11 per cent. We should also be exceedingly chary of basing our calculations for the strength of so ticklish a structure as a boiler on the results of one experiment, more especially where the factor of safety would be a low one, even assuming so high an efficiency of joint to be correct. Thus even taking the strength of the joint at 57·11 per cent. of the solid plate, and the tensile strength of the material at 19 tons—quite high enough for the iron at the joints in a boiler of extreme age—the factor of safety in a boiler of the dimensions quoted above by Mr. McDougall would be only 3·6 with the working pressure sanctioned by the Steam Users' Association. In the event of accident to a boiler of this kind, say from over pressure, to what standard could the Association appeal in support of this practice, in order to show that a sufficient margin had been allowed to provide against accidental increase of pressure or carelessness?

Under the Employers' Liability Act, the only rules whose correctness is recognised for all purposes connected with the Act are those framed by the Board of Trade, and the only rules available at present in regard to boilers are those issued by that body for marine boilers. According to these, as we have already shown, only one-half the pressure sanctioned by the Association we have named should be allowed, and if the bursting pressure of the boiler were attempted to be calculated, it would be found that the efficiency of the joint assumed by this Association would be nearly 50 per cent. higher than allowed by the Board of Trade officers in their calculations. Such differences in the practice of two public bodies, both professing to be authorities on boilers generally, are utterly discreditable to us as an engineering nation; and we entirely concur with Mr. McDougall as to the importance of fixing some reasonable standard for the strength of land boilers. On the Continent the difficulty has been practically solved by the enforcement of a test pressure bearing a defined and reasonable relation to the working pressure; and the maker or owner of a boiler there takes good care that the joints, of whatever character they may be, are sufficiently strong to bear the stipulated test pressure without giving way. We are afraid that a measure of this kind would be altogether too simple for the Marine Department of the Board, whose rules and fondness for fancy calculations have so frequently driven the marine engineers and shipowners of this country to the verge of desperation.

THE METALLIFEROUS MINES BILL.

A BILL has been brought in by Messrs. Joseph Pease, A. Macdonald, C. M. Palmer, and Thomas Burt, which is entitled "A Bill to amend the Law relating to the use of Gunpowder in certain Stratified Ironstone Mines." It proposes briefly to exempt or give powers of exemption to certain mines from the eighth general rule under the Mines Act of 1872, by which the use of cartridges is enforced. The question is one of considerable interest to iron mining districts. When the Mines Act was passed it was not expected by the owners of ironstone mines that these mines would be included in its operations as they have been, and hence little attention was paid by them to its provisions. One of these, in working, has been productive of great inconvenience, and it is believed has added in ironstone mines to the danger it was intended to remove. It is that general rule which provides for the use of gunpowder in cartridges only for blasting and other like purposes. In mines such as the large ironstone mines of Cleveland, the drills used in preparing for the blasting agent drill a roughly triangular hole, and at the recent investigation as to the complaints that the Cleveland mine owners and miners make as to the restriction, it was proved that the use of cartridges in such holes added often to the danger that attends the use of gunpowder loose. Hence the giving of power to remove that restriction is not only a convenience, but it is believed that it will reduce risk. Mr. Pease proposes in his Bill that one of the principal Secretaries of State should have the power to grant exemption of a mine from such rule on the application of the owner, agent, or manager of the mine in question. There will remain to the Secretary of State the power to revoke that exemption after giving twenty-four hours' notice of the revocation at the mine; whilst it is also provided that a list of the mines exempted under the Act shall appear in the annual report of the Inspector of Mines for each district. It is clear that in the case of Cleveland this Act will supply a want that is felt, and that has been long felt. It is not alone the mine owners that have complained of the provisions of the eighth general rule in their case, the miners have also shown their disapproval, and the reports of the inspectors of mines, as well as the investigation of the chief inspector, have conclusively shown that the change is needed in the interests of the safety of the mines. How far the need for the Act—should it become such—will be lessened by the adoption of drilling by machine, cannot be said, though at the present time there is an increasing quantity of ironstone in Cleveland being won after the drilling by compressed air machines. But as the great bulk of the ironstone is won after hand drilling, and as it seems clearly proved that the allowance of the use of loose powder for blasting purposes would add to the safety of the mines, it is to be hoped that the measure of Mr. Pease will pass—the more especially because the names of the members that support it may be fairly said to represent both mine owners and miners in more than one of the different mining districts of the country, so that it may be regarded as a measure for the benefit alike of employers and employed.

RAILWAY RATES ON IRON AND IRONMAKING MATERIALS.

THE British Iron Trade Association has been doing a most opportune and useful work. Through its officers it has just compiled a list of rates charged by railways upon iron and ironmaking materials in every affected district in the United Kingdom. These rates have then been grouped together into averages per ton per mile, and the averages placed in a table for comparison. At a glance those interested are now able to see how they are being served in comparison with their competitors. Hitherto this has been practically impossible, for no individual could be expected to find time or energy to do such dry, tedious, and difficult work, in addition to fulfilling the claims of his own business or profession. The following table shows clearly the result, reduced to nutshell dimensions:—

Average charge in pence per ton per mile.

District.	Iron ore.	Pig iron.	Manufactured iron.
Cleveland	0·9	1·19	1·44
North Staffordshire	0·93	1·17	1·62
West Cumberland	1·88	0·96	1·46
Northamptonshire	0·55	1·00	
Lincolnshire		1·02	
Lancashire	3·03	1·18	1·87
South Wales	0·88	1·22	1·57
Scotland			
Average	1·36	1·06	1·59

The above statistics are exceedingly opportune, in view of the Parliamentary Commission upon railway charges now sitting. The results are curious in many respects; we might have said curious and startling; so much so that their publication is likely to lead to alteration even before they come to be dealt with by the Commission. Let us glance at the first column. What possible excuse can there be for charging for the conveyance of iron ore in Cumberland double what is charged for similar work in Cleveland, North Staffordshire, and South Wales, and nearly four times what is charged in Northamptonshire? On what authority do the railway directors in Lancashire—we presume in Furness—charge more than three times what is charged in the three competing districts we name, and about six times what is charged in Northamptonshire? Surely these things should not be. We suspect the solution to our questions will be found in the higher intrinsic value of the Cumberland and Lancashire ores. Until recent years these ores could alone be used for making hematite pigs. Their purity and their richness made them from two to three times the value at the mines of the poorer carbonates elsewhere obtained. This enabled the railway companies to impose rates for conveyance higher in proportion to value; even though the work they did in conveying cost no more than for poor ores. This principle, which we may call the *ad valorem*, in contradistinction to the "specific" rate principle, we see everywhere cropping up as the guiding star of railway companies. They say in effect to freights:—"We will not be guided by the cost of the work we do in conveying. Like other men of business, we will increase our profit where we see a chance. In proportion as the article we convey is of higher intrinsic value, and can therefore bear a higher rate, so we will charge. If we did not, it would be so much more in the pockets of the owners of royalties, who are only too well off as it is." It will be for the Royal Commission to decide whether such a policy is justifiable or not. Turning to the column under the head of "Pig Iron," we find very little difference as regards the several districts. The highest is South Wales, which pays an average of 1·22 pence per ton; and the lowest is West Cumberland, which pays 0·96 pence, or about one farthing per ton less. We must point out that this favourable average for West Cumberland no doubt results mainly from the charges of other than the local railway companies, who are alone responsible for the high charges for the conveyance of ore. Referring now to the last column, we find very little difference between the districts except as regards Lancashire, where the charges are 1·87d. per ton, or nearly $\frac{1}{2}$d. more than in Cleveland, where they are 1·44d. If we now add the three averages together and take the mean between them, we shall find it about 1·3d. per ton per mile. An inspection of any of the reports of our leading railway companies having a traffic in iron and iron-making materials will reveal the fact that the actual cost of conveying such traffic in quantity is only about ·4 of a penny per ton per mile, or about 30 per cent. of the charge to the public. But a far more important question for the whole country is a comparison between the cost of transit as between this and foreign countries. In Belgium, the nearest competing country, and the only one which largely sends manufactured iron into England, the average rates are about ·6 of a penny per ton per mile. Presuming that the cost of transit is the same in both countries, it would appear that the Belgian railway administration are satisfied with a charge of 50 per cent. more than the working cost, while in England 150 per cent. is demanded and enforced! Surely, then, these are two questions for the British public, and for their representatives, the Railway Commission, to deal with. The first and minor one is the re-adjustment of rates as between one district, one town, or one freighter and another. The other, and by far the more important one, is the lowering of the rates altogether, so as to relieve the heavily burdened trade of the country from one of the forms of oppression to which it is now subject. If the railway companies can show that dividends which are now small would undergo some reduction if a change were made, it is quite legitimate that they should do so, but we have not heard this point urged; and it is possible that the increased traffic which would follow on the reduction in rates would compensate for the loss. At all events, we trust that the valuable statistics we have been considering will lead to some considerable alterations in those railway charges which at present are neither creditable nor justifiable.

LITERATURE.

Aid-Book to Engineering Enterprise Abroad. By EWING MATHESON M.I.C.E. Part II. London, E. and F. N. Spon. 1881.

THE original character of this aid-book removes all opportunity for criticism by comparison. It is unique in conception, and remarkable for the completeness with which that conception has been worked out. Chiefly it is written for the advantage of intending investors in engineering enterprises abroad; but it is equally of interest to those engaged in similar enterprises at home. It in reality takes the place of a consulting engineer to those wanting preliminary information and advice in making a proper selection of the character and design of machinery and material required in public works, factories, and elsewhere. It does much more than this; for the information given upon the various questions relating to contract and purchase in the engineering trades is of the sound character that comes from experience of the ill that follows improperly defined conditions of purchase, indefinite specifications, and insufficiently ascertained requirements, previous to commencement of negotiations. This volume is the sequel and conclusion to the volume published in 1878, which dealt more especially with the conditions which determine, technically and commercially, the success or failure of engineering works of various kinds. This second part may be said to be a general guide to the selection of the plant and material employed in those works. It gives a concise and sufficient description of all these, with the reasons which determine selection under various circumstances, the whole representing an enormous amount of work, combining the knowledge of the engineer with that of the commercial man. It is divided into sixteen chapters, and the titles of these may be usefully given. They are:—Contract and Purchase in the Engineering Trades; Purchase for Export; The Establishment of Factories; The Transmission of Power; Commerce in Coal, Iron, and Steel; The Purchase of Steam Engines and Boilers; Pumping Engines, Fire Engines, Tanks, Pipes, and Tubes; Railway Equipment; Railway Locomotive and Rolling Stock; Machine Tools; Smithy Tools and Steam Hammers; Cranes; Excavating Machines, Boring Tools, Rock Drills, Dredgers, Pile Drivers, Diving Apparatus; Portland Cement; Iron Roofs and Buildings; and Lighthouses. Under all these various heads the author anticipates and answers the questions which would occur to anyone in considering a scheme of enterprise, namely, what class of things are required? which are the best for the special object in view? and what the approximate cost? No fault can be found with the arguments employed, for in almost all parts of the book, and especially in that part on contracts and purchase, the author gives instances in illustration of the question under consideration, which serve the same purpose as examples of the working of a rule in arithmetic, or of the application of algebraic formulæ. We have endeavoured thus far to give a general idea of the contents and objects of Mr. Matheson's book, having commenced reading it with some intention of speaking in detail of the way in which the different subjects are treated, but the subjects are so numerous that to do this would be like reviewing a dictionary word by word. It should be mentioned that the chapter entitled Commerce in Coal, Iron, and Steel, is not wholly statistical as might be inferred; but is chiefly occupied with questions which should determine the selec-

tion of one or other of the materials under consideration, the relative value of different kinds of coal in distant markets, the quality and sections of iron and steel which may be most economically or advisedly used in structures in different countries, and the effect of these considerations on design.

The first Part of the work we noticed at greater length, but it would be useless to extend this notice, for we can only repeat what we said of the first volume, namely, that it is a book which will be sure to find a place amongst those of the consulting engineer, the capitalist, contractor engaged on foreign works, young engineers likely to be employed on such works, and of promoters and investors in engineering enterprise. Like the first volume it is profusely provided with marginal index notes, and where useful, with small type illustrations, and the index to the whole, a very important part of such a work, is complete, as may be gathered from the fact that it occupies twenty-six pages of double columns.

NEW WATERWORKS FOR LIVERPOOL.

On Thursday, the 14th inst., the first stone of the embankment for the Vyrnwy Reservoir was laid by Lord Powis, in the presence of the Mayor of Liverpool and of a large number of members of the Corporation of that city, representatives of the several towns and districts which will be supplied with water from the new works, and other officials. The day was fine and very hot. The party left Liverpool at 8.30 a.m., and travelled by special train to Llanfyllin, the nearest station to the works, where carriages were in readiness to convey them to the scene of the day's ceremony, a distance of about ten miles. On reaching the site of the embankment the first stone was laid by Lord Powis, who is the lord of the manor and a considerable landowner in the district, and has rendered great assistance to the Corporation in obtaining the necessary powers authorising the construction of the works. The stone, a massive block of granite, with a bronze plate let into it, inscribed with the names of the mayor, engineers, and other officials, is in no sense a foundation stone, and, in fact, will not form any part of the embankment, being placed above the level of the top of the bank on one side of the valley, and facing the road which will eventually cross the valley on the top of the embankment.

After the ceremony about two hundred guests sat down to luncheon in the hall erected for the use of the workmen, and which will be fitted up as a cocoa, refreshment, and reading-room.

Earl Powis, in responding to the toast of his health, proposed by the mayor, alluded to the contrast between the aqueducts of the Romans and the subterranean water pipes of the present day, and compared the waters of the Vyrnwy to the nymph Arethusa, who changed into a stream, disappeared from the middle of the Peloponnesus, and, passing under a portion of the Mediterranean, bubbled up again in Sicily.

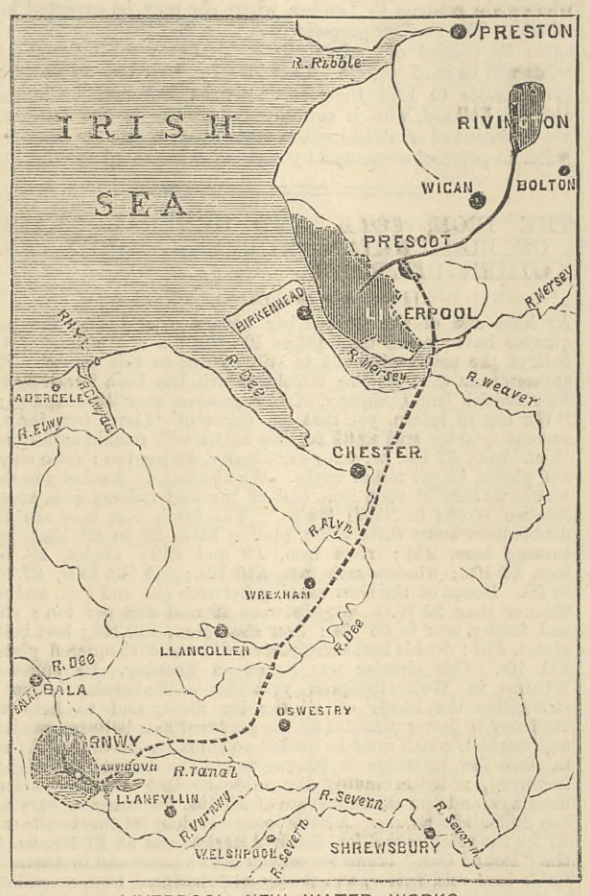
For many years the question of providing an additional source of water supply for the city and district of Liverpool has occupied the attention of the Corporation. At present the supply is derived from two sources, viz., Rivington, situated in Lancashire, about seven miles from Bolton and twenty-five miles from Liverpool, and from wells sunk in the red sandstone in the immediate vicinity of Liverpool. At Rivington the water is collected from about 10,000 acres of moorland, and stored in eight reservoirs containing 4268 million gallons.

The quantity of water delivered from Rivington is about 10¾ million gallons daily, and the quantity obtained from the wells is about 5 million gallons per day, making a total supply of 15¾ million gallons per day. The area supplied with water by the Corporation of Liverpool is about 60 square miles, and contains by the last census 720,000 inhabitants, the supply being at the rate of 15½ gallons per head after deducting the water used for manufacturing and other purposes. In 1865, after a period of great drought, there was only ten days' supply in the reservoirs, although the water was only turned on for a short period in each day. This alarmed the Corporation, who instructed their engineer, the late Mr. Duncan, to report upon the best means of obtaining an increased supply. This he did by recommending that the waters of Bala Lake should be conveyed to Liverpool, thus supporting the opinion of Mr. Robert Rawlinson, C.B., who suggested Bala Lake in preference to Rivington, before the works were commenced at the latter place. The season of drought having passed away, Mr. Duncan's advice was not followed, but various efforts have been made to improve the existing sources of supply, by constructing an additional reservoir at Rivington, sinking new wells and adopting energetic measures to prevent the waste of water.

In the meantime the Corporation have investigated many schemes for bringing water from the Cumberland lakes, either alone or in conjunction with Manchester, and nearly adopted a plan for utilising the waters of the Brock and Calder, and constructing a reservoir at Bleasdale, near Lancaster. This scheme was abandoned, owing to the unfavourable nature of the site of the embankment, and the objectionable character of some of the water. Eventually the Vyrnwy has been adopted, upon the recommendation of Mr. Bateman and Mr. Hawksley, and powers for the construction of the works were obtained on August 6th, 1880, the opposition of the Severn Commissioners and many other public bodies interested in the river Severn, of which the Vyrnwy is a tributary, having been successfully overcome, and the Bill was practically unopposed, although some members of the committee were of opinion that Liverpool was abstracting water which belonged naturally to the midland towns. Their objections were overruled, and the powers sought for granted to Liverpool, provision being made that water should be supplied to Warrington, Widnes, St. Helens, Oswestry, and other places near the proposed pipe line upon certain conditions. The watershed from which it is proposed to collect the water is situated round the small village of Llanwddyn, in Montgomeryshire, at an elevation of 780ft. above the sea, and is about forty-six miles in a direct line south-west of Liverpool.

The area of the watershed from which water would naturally flow into the proposed reservoir is 17,583 acres, and it is from this area only that it is proposed to collect and impound water in the first instance, but, as the demands in Liverpool increase, additional water will be brought into the lake from two streams, called the Cowny and Marchnant, which now fall into the Vyrnwy below the proposed embankment. These streams will be brought into the lake by tunnels respectively 1¼ and 1⅝ mile in length. The Cowny and Marchnant will give an additional contributing area of 4417 acres, making the total watershed of the lake, when all the works contemplated by the Act have been carried out, 22,300 acres. The water to be thus collected will be of the usual excellent quality derived from the Welsh hills. Previous to the application to Parliament for the Water Act of last session the water was analysed under various conditions of flood and drought by Dr. Frankland, Dr. Tidy, and Dr. Brown. Their reports were of the most favourable character, though chemical evidence is scarcely necessary where, as in this case, the watershed is so admirably adapted for the collection of water in the purest and best possible condition for potable purposes. There is probably no district in Great Britain of equal area that is so thinly populated. There are no mines or mineral workings, and the only dwellings remaining will be a few scattered sheep farms. The hills are precipitous and sterile, and the slate rocks of which they are composed throw off the rainfall with great facility.

The village of Llanwddyn will be submerged in the reservoir, and some roads which now traverse the valley will have to be reconstructed at a higher level. At Llanwyddn the valley attains a width of over half a mile, and then following the course of the river, becomes narrower, until at a distance of two and a-half miles below the village its width, at the narrowest part, is not more than about 300 yards. Across this gorge, through which the Vyrnwy runs, the Corporation intend to construct an embankment, the total length of which will be 418 yards, and the top, measured to the water-line, will be about 84ft. above the present valley bottom. The effect of erecting this short embankment will be to dam back the river so as, without any further enclosure than the natural valley sides, to form a lake which will be four and three-quarter miles long, with a water area at the surface of about 1115 acres. The surface area of Bala Lake is 1100 acres. The contents of Lake Vyrnwy, above the level at which water will be drawn off for Liverpool, will be about 12,000,000,000 gallons, which is one-third more than the storage capacity of the Loch Katrine works of the Glasgow Corporation. The Vyrnwy will thus be the largest artificial reservoir in the United Kingdom, the next in size being the Vartry reservoir, for the supply of Dublin, which has an area of 410 acres, and contains 2,400,000,000 gallons, as compared with 1115 acres and 11,900,000,000 gallons at the Vyrnwy.



LIVERPOOL NEW WATER WORKS.

The embankment is to be built of masonry, and will be the first specimen of this class of work on a large scale in England, although many masonry dams have been constructed on the Continent, some of much greater height than the one now being proceeded with, notably that at St. Etienne, which has a height of 183ft., a base of 110ft., and contains only 52,000 cube yards of masonry, but the length of this bank is only 329ft., or about one-third the length of the Vyrnwy bank. The excavation of a trench for the foundation has been commenced, and it has been ascertained by trial holes that a solid rock bottom will be obtained at a depth which, in the centre of the valley, does not exceed 41ft. below the natural surface. The total height from the bottom of the foundation to the top water-line of the embankment will therefore be about 121ft. This will be spanned by arches carrying a road and footways, having a total width of 17ft. between the parapet walls, the height from the water-line of the dam to the top of the parapet walls being 14ft.

The embankment will contain 214,000 cube yards of masonry, all of which will be set in Portland cement. Suitable stone can be obtained close to the site of the embankment; but the 20,000 tons of cement which will be required will have to be carted for ten miles over a very hilly road from Llanfyllin, the nearest railway station, and it is unfortunate that the Corporation have not been able to arrange for the construction of a tramway or light railway, as the carriage of materials will form a very heavy item in their expenditure. Any overflow from the lake will pass through the central series of arches, and down the outer face of the wall. Thus the costly and troublesome weirs and bywashes of ordinary earth embankments will be dispensed with. The greatest width of the embankment at the base will be over 100ft. For the discharge of the compensation water which the Corporation are bound to supply to the river, there will be two tunnel outlets, with necessary sluices and appliances through the embankment.

The quantity of water to be supplied for compensation is thirteen million gallons. The aqueduct for conveying the water from Lake Vyrnwy to Liverpool will be formed partly by tunnelling and partly by cast iron pipes. Where the aqueduct is in tunnel it will be made of sufficient capacity to convey as much water to Liverpool as the lake will be capable of yielding, but where pipes are to be used it is intended to lay, in the first instance, only one pipe, which will be large enough to deliver about one-third of the calculated total yield available for Liverpool from the watershed. The aqueduct will commence at the lake by a tunnel about 7ft. in diameter, and two and a-quarter miles in length, starting from the north side of the Vyrnwy Valley, and terminating in the Hirnant Valley. From the outlet of the tunnel a cast iron pipe of about 42in. internal diameter will be laid through the Hirnant Valley across the river Tanat, and to the north of the village of Llanrhaidr-yn-Mochnant, near which place the first section of the pipe line will terminate in a small reservoir or relieving tank to be constructed at Parc Uchaf Some of these pipes will have to be carried a distance of nearly 18 miles. Thence it will be laid through the parish of Llansilin to the valley of Cynynion, on the borders of Denbigh and Salop counties, whence a tunnel of about one mile in length will be driven to the west side of the Morda Valley. There will be a raised aqueduct over the Morda River, and from the east side a second tunnel of one mile long, terminating in a small reservoir to be formed on elevated ground, about a mile to the west of Oswestry. At this point filter beds are to be made, if filtration should be required. From Oswestry the cast iron main proceeds in a north-easterly direction, through the parishes of Whittington and Ellesmere, Hanmer and Malpas. In Malpas there will be another relieving tank on Oat-hill. Thence the pipe will be continued through Bunbury and Beeston, passing at about a mile to the east of Tarporley, to a relieving tank on Luddington-hill; thence through Delamere Forest, and under the river Weaver, near Kingsley Ford, through Aston, to a tower to be erected at Norton. From the Norton water-tower the main takes a northerly direction to the Mersey, which it crosses at a point two and three-quarter miles to the east of the Runcorn Viaduct. After crossing the Mersey the pipe follows an almost straight line through Farnworth and Rainhill to the existing reservoirs of the corporation at Prescot, near Liverpool. The total length of the aqueduct from the Vyrnwy to Prescot is sixty-seven miles. The Corporation have already entered into contracts with Messrs. Cochrane, Grove, and Co., Dudley, and Messrs. D. Y. Stewart and Co., Glasgow, for the supply of about twenty-seven miles of pipes, and pipe-laying has been commenced at Hirnant by the Corporation workmen. The river Vyrnwy is at present subject to great fluctuations in flow. During heavy floods the discharge at the point of proposed interception exceeds 700 million gallons per day, while in seasons of drought the discharge falls below two million gallons per day. After the lake has been made the Corporation will have to send down the river the statutory supply of compensation water, which, being delivered in a steady, regular, and constant stream, instead of the present irregular flow, will be a great improvement to the river, and a great advantage to the residents on its banks. The total estimated yield of Lake Vyrnwy watershed, including the compensation water, is estimated at 52 million gallons per day. The estimated cost of the first section of the works is about a million and a-quarter. With regard to the time of completion, it is, of course, impossible to foresee all the difficulties that may arise in the execution of such an undertaking, but it is confidently anticipated that the whole of the operations connected with the first instalment will be so far completed as to enable the water to be delivered into Liverpool in the year 1885.

The engineers for the works are Mr. Thomas Hawksley, of London, and Mr. George F. Deacon, of Liverpool, under whose superintendence the drawings and specifications are to be made and the works to be carried out, Mr. Deacon having been relieved of all responsibility for the existing Rivington and Liverpool works in order that he may devote the whole of his time to this large undertaking.

TRIAL TRIP OF THE STEAMSHIP ARMATHWAITE.

On Tuesday a large number of engineers and shipowners assembled to witness the trial trip of a fine new cargo steamer, the Armathwaite. This vessel has been fitted by Messrs. John Jones and Sons, St. George's Engine Works, Liverpool, with a pair of compound engines with cylinders 30in. and 60in. by 36in. stroke. These engines have Turton's patent built up crank shaft, and steam is supplied by a pair of Turner's patent boilers. We shall in an early impression illustrate these boilers and the crank shaft. It must now suffice to say that the trip was in all respects a success. The engines gave no trouble whatever, although they had never been under steam before, save for a few hours at the dock side. They indicated 630-horse power with a pressure of 70 lb., and 67 revolutions. The boilers are intended to carry 80 lb., but they were fired very easily, as it was not deemed necessary to push the engines in any way.

Mr. Turner's boiler is one of those to which we alluded last week. It is of the locomotive type, with a fire brick furnace instead of one with water legs. Although very little is known about this boiler outside of Liverpool circles, it has been gradually gaining in favour since it was patented in 1878. The number of boilers made and being made is now forty-five. The first of these boilers was made for the screw cargo launch Bagieda, built at the Canada Works, Birkenhead, to the order of Messrs. Herscheli, African merchants, and under the superintendence of Messrs. Ashlin and Asbridge, consulting engineers of Liverpool. The vessel is 81ft. long on the water line, 9ft. 6in. beam, 5ft. deep moulded, and 3ft. 2in. draught of water loaded, the guaranteed speed being ten knots per hour. The engines are on the high-pressure non-condensing principle and of 13½ nominal horse-power, and are supplied with steam of 80 lb. pressure per square inch from a Turner's patent boiler, having 2172 square feet of heating surface, and a grate with 10½ square feet area. This vessel has now been constantly at work on the river Volta for more than two years with very satisfactory results, having steamed the distance of 90 miles in a little less than six hours, no current or tide at the time. The owners are now on the point of ordering a second vessel of larger size than the Bagieda, the machinery, and especially the boiler, to be on the same design.

The second vessel fitted with these patent boilers was the twin screw tug and tender steamer Gamecock, built at the Canada Works to the order of Mr. Beckett Hill. This vessel is 155ft. long by 25ft. beam, and is fitted with two pairs of compound surface condensing engines of 180 nominal horse-power, which indicated on trial 1164-horse power. This vessel has now been above sixteen months at work, giving very satisfactory results upon a very small consumption of coal. The yacht Mizpah is now under steam on her second yachting season, since she has been fitted with a pair of compound surface condensing engines, and a Turner's patent boiler of 12 nominal horse-power, the working steam pressure being 110 lb. per square inch. The engines indicated 75-horse power on the trial trip. The Nottinghill, now on her voyage to Calcutta, is fitted with ten boilers, which are calculated to bear a working steam pressure of 125 lb. per square inch. The engines are of 570 nominal horse-power, and are to indicate above 3000-horse power. Two other and similar vessels are now being built for the same company. The tug steamer Storm King is fitted with two patent boilers. The engines are on the low pressure jet condensing principle, the boilers have been above six months at work, the results being very satisfactory, and the consumption of coal is said to be very much less than with the former boilers.

Messrs. James Cartland and Sons, of Birmingham, have carried off at the Melbourne Exhibition the gold medal for general brass foundry, in addition to the first class award of merit for superior quality, artistic design, and general excellence of their exhibits.

TANK LOCOMOTIVE, DUTCH RHENISH RAILWAY.

WE illustrate on page 62 a tank engine for passenger service, built by Messrs. Sharp, Stewart, and Company, Limited, of Manchester, for the Dutch Rhenish Railway Company. The engine is, as will be seen, of the "double-ender" type with inside cylinders, four coupled wheels, and a pair of running wheels at either end. These are fitted with radial axle-boxes, on an arrangement designed by the makers, which ensures the perfect contact of the sliding surfaces in all positions of the wheels, allowance being made for the vertical inequalities of the rails, as well as for the lateral curvature, all risk of the jamming of the slides when one wheel is raised higher than the other being thus avoided. The lateral movement of these boxes when on a curve is controlled by means of spiral springs set in their places with considerable initial compression, so that the wheels are held much more stiffly in the central position when the engine is running on a straight road than is usually the case; and the oscillation when running on the straight which has been objected to in engines with radial boxes is thus done away with.

The water is carried partly in side tanks and partly at the back of the footplate, under the coal bunker, a very even distribution of the weight being thus secured. The advantages of this type of engine, especially for local and branch line traffic, are obvious, the radial axle boxes being at either end. The engine runs with equal facility in either direction, passing the curves with ease, while the long wheel base renders it very steady vertically, and much lighter on the permanent way than an engine of the ordinary description, which would pass curves of the same radius. These engines have now been running for some months, during which time they have given very satisfactory results, and the makers have supplied engines of the same type to the Dutch South-Eastern Railway Company, where they are giving equal satisfaction. We append a list of the principal dimensions, and weights :—

Cylinders and Motion.

	ft.	in.
Diameter of cylinders	1	5½
Stroke of cylinders	1	10
Distance apart between centres of cylinders	2	0¾
Width of steam ports	0	1½
Width of exhaust ports	0	3
Length of ports	1	0
Diameter of piston rods	0	2¾
Length of connecting rod between centres	5	10
Length of excentric rods	5	4

Wheels and Frames.

Diameter of leading and trailing wheels	3	6½
Diameter of coupled wheels	5	6½
Distance between centres of leading and driving wheels	7	2
Distance between centres of coupled wheels	8	6
Distance between centres of hind-coupled and trailing wheels	7	2
Total wheel base	22	10
Width of tires	0	5¼
Total side play of leading wheels	0	1½
Total side play of trailing wheels	0	1½
Distance apart of frames	3	11¾
Thickness of frames	0	1⅛

Boiler.

Length of barrel	10	1
Thickness of barrel plates	0	0 9/16
Thickness of smoke-box tube plate	0	0¾
Diameter of barrel plates inside	4	1
Length of fire-box shell outside	6	1
Width of fire-box shell at bottom	3	11
Depth of fire-box below centre line of boiler	4	9¾
Length of fire-box inside	5	4
Width of fire-box inside	3	2⅝
Height of fire-box inside	5	8¼
Thickness of fire-box shell plates, front and back	0	0⅝
Thickness of fire-box shell plates, sides	0	0 5/16
Thickness of fire-box shell plates, top	0	0 7/16
Thickness of fire-box copper plates	0	0⅜
Thickness of fire-box tube plate	0	1
Length of tubes between tube plates	10	4¾
Diameter of tubes outside	0	2
Number of tubes (iron)	189	
Diameter of chimney at bottom	1	3½
	sq. ft.	
Heating surface, tubes	1028	
Heating surface, fire-box	102	
Total	1130	
Fire-grate area	17·15	
Ratio of grate area to total heating surface	1 : 65·8	
Ratio of chimney area to grate area	1 : 13·0	

Tanks.

Capacity	1400 gallons.

Weight in Working Order.

	tons	cwt.	qrs.
On leading wheels	11	0	0
On front coupled wheels	14	0	0
On hind coupled wheels	14	0	0
On trailing wheels	10	0	0
Total	49	0	0

TRIAL TRIP OF THE DE BAY.

No doubt it will interest many engineers and shipowners to know that a series of close, crucial, comparative, and in every way trustworthy trials of the elative merits of the patent De Bay propeller and the ordinary screw is being carried out under the supervision of engineers appointed by the De Bay Patent Direct-acting Propeller Company. Messrs Capper, Alexander, and Co. have recently added to their fleet a new vessel, which has been named the De Bay, and it is their desire, having carefully gone into the matter, to have this vessel fitted with a propeller, or rather pair of propellers, on the De Bay principle. The De Bay is a first-class cargo steamer, and reflects great credit on her builders, Messrs. Palmer, and Co., of the Jarrow Shipbuilding and Engineering Works. She is an exceptionally strongly built, commodious, highly-finished cargo steamer. Her length is 250ft.; beam, 35ft. 4in.; depth of hold, 23ft.; and with a mean draught of 21ft. she will carry some 2500 tons of cargo. Her engines are compound surface condensing, with cylinders of 30in. and 55in. diameter, respectively, having a stroke of 42in., and are capable of indicating upwards of 900-horse power; they are fitted with all the latest improvements in engineering, and in every part indicate the care they have received at the hands of Mr. Gibb, of the Jarrow Works, under whose direction they have been constructed. In the engine-room is to be found Durham's patent marine governor on a new pattern, in which he has abandoned the gearing to which some shipowners had objected. In this his latest design the water cylinder revolves, and its position on the main shaft or spindle—at right angles to its position in the original design—obviates of course the necessity for gearing to drive the internal fans. On deck the steel hawsers, on neat rollers, fore and aft, attract notice, and are for mooring a ship, a vast improvement upon the untidy, uncouth, and unwieldy cables, which for too long a time have retained their places on the decks of our steamers.

The wheel-house is fitted with a steam steering gear, from the patented design of Mr. Nelson, and is worked from the upper bridge by means of a very small wheel. Should an accident occur to the little engine which works the steam steering apparatus, a lever may instantly throw the apparatus into gear for steering by hand, for which purpose a large hand wheel is attached to the machine. We have said that Messrs. Capper, Alexander, and Co., had determined to have this ship fitted with the De Bay propeller, but in order that an absolute comparison might be made as to its behaviour, it was arranged that a common propeller should first be fitted to the ship, that trials under certain known conditions should be made, and that the De Bay should make her first voyage with it. At the conclusion of the first voyage the De Bay propeller will be attached and trials will then be run under exactly similar conditions. On the 30th of June the first of the series of trials was made in the presence of several shipowners and engineers. On this occasion the steamship was unladen, having only water ballast on board. Several runs were made over the measured mile a little to the north of the river Tyne, runs at "full speed," "half speed" and "slow," the best speed obtained being at the rate of 10·97, or in round numbers 11 knots per hour. At the luncheon, after the success of the steamship De Bay had been proposed by Mr. Gibb, duly honoured and responded to, Mr. Capper in felicitous terms proposed success to the De Bay Propeller, which toast was acknowledged by Mr. De Bay, who expressed himself confident, that good as was the performance of that day, he would beat it very considerably under the same conditions, when the time came for trial with his propeller.

On the 11th of July the second of the series of trials was carried out, the ship having then on board a cargo upwards of 2400 tons. Several runs were made over the mile at the same engine speeds as at the first trial. The highest average of the full speed runs was 9·50 knots, as nearly as may be, and this may be regarded as an excellent result. At the conclusion of the trials the De Bay sailed for Cronstadt, from whence she returns to London, where she may be expected in a month. The De Bay propeller will then be fitted, and trials will again be carried out, when all the figures resulting from the trials will be made public. That Mr. De Bay has an excellent performance to beat there is no doubt, but both he himself and Mr. Folkard, who is consulting engineer to the company, are confident of establishing the superiority of the De Bay propeller in point of economy of power, with increased speed.

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

(From our own Correspondent.)

AT least one of the marked bar houses who during the past quarter have quoted their prices 10s. per ton above those of the bulk of the makers intends to still adhere to this course. This appears from the following circular which has been issued by the New British Iron Company, of Corngreaves, near Birmingham :—"We beg to inform you that our prices of 'Lion' iron for the current quarter and until further notice will remain as follows : 'Lion' bars, £7 10s. per ton; ditto hoops, £8 per ton; ditto sheets and plates, £9 per ton at works. We also beg to remind you that we are makers of strip iron, and of bar and railway iron, at our Ruabon Works in North Wales." The firm's best bars are £9; double best scrap ditto, £10; plating bars, £8 to £9 10s.; best turning bars, £11; rivet iron, £9 and £10; angles, £8 5s.; tees, £8 10s.; window sash iron, £10 10s.; and slit rods, £7 10s. to £9. Hoops of the sizes ranging between ⅜in. and ⅝in., and not thinner than 20 W.G., vary between £9 and £16 per ton; strip and fender iron is £8 10s.; best sheet iron, £10 10s.; best boiler plates, £10; double best scrap plates, £11; and chequered plates, £11 10s. This circular was issued on Tuesday. Its effect on 'Change in Wolverhampton yesterday — Wednesday — was to strengthen the hands of all the bar firms, and to help the tendency to firmer rates for all the grades of bars between common and marked, which must be quoted up from 1s. 3d. to 2s. 6d., and in some few instances 3s. 9d. per ton. The demand was slightly improved, notwithstanding the sales at last week's quarterly meetings, and the minimum rate of £5 15s. for common bars was less difficult to secure. A little more was done in marked bars at £7 for the colonies and for South America, and at £7 12s. 6d. for the "Round Oak" brand for smithy use at home and in Australia. Cable bars sold better, and partly manufactured iron, as puddled bars, was in great demand, but small supply, even at better prices than have ruled for four months past.

The Australian mail, delivered on Tuesday, brought a good number of additional orders for galvanised corrugated sheets, and the advices speak of quotations at Melbourne being on the whole exceedingly well supported. At the time the mail left ordinary brands of 26 W.G. were selling at £20 10s.; best brands were offered at £21 10s. to £22; 200 cases of "Gospel Oak" and Walker's had been placed on private terms; "Orb" was still going off at £21 15s.; and 100 cases of "Stork" were sold to arrive. Black sheets were moving quietly. Assortments of Nos. 8 to 18 were selling at £11, while for Nos. 20 to 26, £13 10s. was obtained. Plate iron was firm at from £10 to £11; bars and rod irons were moving off at £9 to £11; and hoop iron for trade purposes was offered at £10. Tin-plates were offered at 15 per cent. on invoice for good assortments, say 19s. 6d. per box for I.C. Drawn fencing wire, when the mail left, was rather quiet. Nos. 6, 7, 8 were quoted respectively £12 5s., £13, and £15. Pig iron was in moderate request at £4 10s. for small lots, and £4 5s. in quantity.

The last previous mail from Australia was so very bulky that this week's, though a good average mail, was yet unequal to it. But the orders were enough to sensibly augment the inquiries in Wolverhampton on Wednesday and in Birmingham yesterday. Offers were made by buyers to take sheets for galvanising at present prices right into the middle of next year at the rate of 50 tons a week. The offers were rejected, makers declining to commit themselves beyond the two months' work which they have mostly upon hand. Occasionally £8 10s. was secured for small lots of doubles, but buyers hesitated to give the £10 which was asked for latens, though they would some of them give £9 15s. For singles the quotation remained at £7 15s, but it was not universally secured.

Messrs. James Russell and Sons, Limited, of the Crown Tube Works, Wednesbury, have just secured another extensive continental order. It is for 3in. lap-welded oil-well tubes, extending thirty miles in length. In their construction upwards of 600 tons of iron will be used; and before they leave the works each tube will be subjected to hydraulic pressure of 2000 lb. to the square inch. The whole order will be executed in seven or eight weeks, notwithstanding that it will involve some thousands of feet of screwing. The knowledge to-day that this order had been received strengthened makers' quotations for heavy strip. Ordinary strip and baling hoop were still inquired for, and £6 5s. upwards was demanded for coopers' hoops.

Plates varied from £7 to £9, according to quality. A slightly better business was done at the latter figure for boiler-making purposes.

Firmness characterised the quotations for pigs, yet orders were mostly sought after. Staffordshire all-mine qualities well sustained the quotation of £3 2s. 6d. to £3 5s., but Shropshires were easy to buy at £3. Consumers of hematites asserted they could buy at £3 5s. easy, and they held off from giving makers full rates; yet most hematite firms declined to give way. Blast furnace firms hereabouts are advocating a concerted reduction in make, not by Cleveland and Glasgow alone, but by Northampton also. In that event, some Staffordshire houses would be prepared to take part in the movement.

Constructive engineers and ironfounders are receiving more valuable inquiries, chiefly on colonial account. An effort will be made to secure for this district the order for the 1760 tons of cast pipes for the Bhundarwa Waterworks, Bombay; also that for the 100 iron-covered goods wagons needed by the Madras Railway. Railway carriage and wagon work generally is looking up for export, though the home demand is less active. The new inquiries are conspicuous for underframes and body underwork for wagons and carriages. Steel coach springs are going in fair quantities to India and South America, and the spring and axle makers of Wednesbury are doing an increasing business with, more especially, the Australian colonies, the Cape, and other parts of South Africa.

There are indications of improved prices being obtained in the hardware trades. Resulting from the higher prices of sheets, the firmness of the tin market, and the continued active demand, the frying-pan makers have advanced prices between 10 and 15 per cent., and the buyers are not withholding their orders.

Merchants still report that orders from various Australian markets for American hardwares continue to be received. The indents comprise shovels, scales, nails, carriage bolts, saws, lemon squeezers, cooking and heating stoves, and the like.

The Birmingham gun-makers are doing a very good business on best and cheap sporting guns, in most part for the United States. But in the military department there is little doing, and wanting sufficient employment in rifles, both the local small-arm companies are now manufacturing bicycles and tricycles, for which there is a large and increasing demand.

In the hope of improving the style and design of the local manufactures, an opportunity is to be afforded to the artisans of Birmingham for the inspection of the finest extant examples of industrial art. The memorial stone was laid there on Tuesday of a new fine art gallery and industrial museum. The building is to be erected by the gas department of the Corporation, at the cost of £100,000. The proposal originated with Councillor Tangye, of Messrs. Tangye Bros., who has given a donation of £10,000.

In North Staffordshire orders for iron are arriving rather more freely. The home demand, which has been stagnant for some time, is showing more signs of life, and a steady trade is doing with the colonies and a few European markets.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—In the iron trade of this district a steady tone is maintained, with a moderate business doing; but higher prices are still very difficult to obtain, and although there is no doubt that business, taking it all through, is better, it would be premature at present to conclude that a really permanent material improvement has been established. The most that can be said is that a considerable business has been done during the last few weeks, which has left a more hopeful tone generally throughout the market, and that, to a limited extent, better prices are being realised; but the figures which sellers can command are still too low to leave anything like a profitable margin.

Lancashire makers of pig iron have been doing tolerably well. As I stated in a previous report, they have recently secured new orders for a considerable weight of iron, and these have been followed by further large sales of local iron made at the Birmingham quarterly meeting last week, where Lancashire makers were able to obtain a slight advance upon late rates. The result is that local makers, in some cases, are now fully sold for the next three months, and they are very firm at 44s. for No. 4 forge, and 45s. for No. 3 foundry less 2½ delivered equal to Manchester, which represents an advance of about 2s. per ton upon the lowest prices which have recently been taken.

In outside brands there is no material change to report. Lincolnshire irons are still being sold in this district at about 44s. to 45s. per ton less 2½ delivered equal to Manchester, but Derbyshire and Middlesbrough irons cannot realise in this market, unless under special circumstances, the prices now asked by makers.

In hematites a moderate business has been doing at about 67s. per ton for foundry qualities delivered equal to Manchester.

In the finished iron trade there is a stiffer tone. Manufacturers are gradually getting better employed, and in some cases, as I mentioned last week are holding out for an advance upon late rates, but it is exceptional where this is being actually realised. For bars, hoops, and sheets, there is a fair demand both for home consumption and shipment, and the average quoted prices for these delivered equal to Manchester are about as under: Bars, £5 17s. 6d. to £6; hoops, £6 7s. 6d. to £6 10s.; and sheets, £7 10s. up to £7 15s. and £7 17s. 6d. per ton.

During the week I have been through several of the large engineering establishments in the district, and I find generally a very fair amount in hand. Locomotive builders are tolerably busy both with home and colonial orders, but there is still a very keen competition to contend with, and so far as the continental trade is concerned English makers have really no chance against the low prices which the German and other firms are able to quote. In other classes of work, such as steam hammers of the ordinary size, a good many are now being made for shipment; manufacturers of cranes also report a tolerably good business doing, and wheelwrights, tool makers, and machinists are, in many cases, very fairly occupied. There is, however, still one general complaint, and this is that work has to be taken at such low prices that it results in little or no profit to the employers.

Amongst other establishments to which I paid a visit was Messrs. Ashbury and Co.'s well-known carriage and wagon works, and here I found a very marked improvement as compared with the state of things existing when last I had an opportunity of going over them. Numerous orders were on hand for railway carriages, wagons, and tram-cars, both for English and foreign companies. Amongst these I noticed several carriage underfames, 54ft. long, constructed on two six-wheeled bogies, and plated the entire length with angle iron in one continuous bar; there were also a number of railway vans for abroad, specially constructed for carrying sugar, with an inside framework of wood coated outside entirely with iron plates and bound with iron ribs. Of turntables and other railway fixed plant the firm had also a considerable quantity in hand.

Mr. Bernard Samuelson, M.P., has contributed an article to the current number of the *Fortnightly Review* which has attracted considerable attention amongst ironmasters and engineers here, and as some of the facts upon which it is based were not only collected in this district, but furnish very suggestive material for consideration, a brief reference to one or two points will not be out place. The subject specially dealt with by Mr. Samuelson is technical education in Saxony, but in an indirect manner reference is made to the mechanical engineering trades. After showing how, at the town of Chemnitz, in Saxony, English manufacturers of woven fabrics generally are finding an ever-increasing band of rivals, the writer proceeds, "The demand for railway locomotive engines, and for power looms and frames, had led to the creation of a prosperous establishment for the manufacture of these various machines—that of M. Hartmann—which gives employment to 2800 mechanics. Its central position and the cheapness of fuel have caused the workshops of the Saxon Government Railways to be placed there. These employ 5000 hands, and there are also works in which stationary steam engines, jute spinning frames, brewing machinery, engineering tools, and, in fact, all kinds of mechanical appliances are produced." Further on the writer, after pointing out that English inventions and contrivances are copied in these shops from English models, proceeds to deal with cost of labour, and in comparing the wages of skilled mechanical engineers at Chemnitz with those in Lancashire and Yorkshire, facts of a rather startling character are set forth. Mr. Samuelson takes as a basis of comparison a locomotive-making shop, and says :—"It appears that in the loco-

motive factory at Chemnitz the average weekly wages of the mechanics and labourers in 1866-70 were as low as 13s. But they rose to 18s. in 1873-4, and have declined again to 16s. 4d. at the present time. I have ascertained that the average weekly wages at a similar factory in this country are more than 23s., or 40 per cent. above the Chemnitz rates; and that the lowest wages of its unskilled labourers are higher than the average of the skilled and unskilled in the Chemnitz shops." To this Mr. Samuelson adds another equally important factor for an accurate estimate of the entire case, viz., that the skilled artisans at Chemnitz not only work for 40 per cent. less than their English rivals, but also for twelve or fourteen hours more each week than is worked by the mechanics in the shops of this country.

Singularly enough, almost simultaneously with the appearance of Mr. Samuelson's article a curious commentary has been furnished by Mr. Guile, the secretary of the Ironfounders' Friendly Society, who in his last report says: "When we view the present state of trade in all the centres of our staple industries, it really appears as if we had lost our lead in cotton, worsted, silk, lace, and general articles of utility in iron. Take, for instance, Manchester and its surroundings, Bradford, Nottingham, Macclesfield, and Birmingham, and view their state for the past two or three years, and we are compelled to ask—Where has the trade gone?" Mr. Guile adds that the subject is too large to enter into in the brief space of his report, or no doubt good reasons might be found for present appearances; it might be suggested that Mr. Samuelson has furnished some tolerably good reasons, which deserve a little study both on the part of employer and employed.

The coal trade is without material change from last week. Allthough business continues extremely dull, and although colliery proprietors do not care to contract very far forward at present rates, stocks under bond are pressed upon the market for prompt delivery at excessively low figures. The average prices at the pit mouth are about as under: Best coal, 8s. to 8s. 6d.; seconds, 6s. to 7s.; common coal, 4s. 6d. to 5s. 3d.; burgy, 4s. 3d. to 4s. 9d.; good slack, 3s. 9d. to 4s. 3d.; and common, 3s. to 3s. 6d. per ton.

Barrow.—The demand for all qualities of hematite iron is steady. The output of the furnaces is maintained, and there is reason to believe that deliveries which have increased during the past few weeks will further increase during the season. A large number of steamers has arrived here lately to take in cargoes of iron and steel for other countries, and it is expected by this means that stocks of metal in this district will be reduced considerably. The yield of the district is very heavy, notwithstanding the fact that several furnaces have been put out of blast. Blooms are beginning to form a conspicuous part of the cargoes of metal shipped from local ports. The price of iron is unchanged, 55s. per ton being the average value of all-round parcels of Bessemer pig iron, and 54s. the value of forge iron of No. 3 quality, inferior qualities realising about 52s. per ton and upwards.

One of the features of the week has been the launch of the steamer Navarre from the yard of the Barrow Shipbuilding Company, on Saturday last. This vessel, which is the first of two, has been built to the order of the Société Générale de Transport Maritime, Marseilles. The launch was most successful. The vessel is of 4000 tons gross register, and measures 400ft. in length, 40ft. in beam, and 33ft. depth of hold. She will carry a dead weight of 4200 tons. Accommodation will be furnished for forty first-class, forty second-class passengers, and about 1000 emigrants. The Navarre, along with the Bearn, building in the same yard, and expected to be launched in a couple of months, is intended for the Brazil trade. Her engines are of the compound, inverted, direct-acting surface condensing type, the cylinders having a diameter of 49in. high-pressure, and 90in. low-pressure, the stroke being 3ft. 11in. These engines are expected to indicate 2500-horse power, and to drive the vessel at a speed of 12½ knots at sea.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THERE was but a small attendance at the iron market held in Middlesbrough Exchange on Tuesday, none but the usual attenders being present. The strike of blast furnacemen against the 2½ per cent. reduction awarded under the sliding scale was the principal topic of discussion. It commenced on Saturday last without a moment's notice, and affected twenty-four furnaces belonging to Messrs. Bolckow, Vaughan, and Co., and Downey and Co. The initiators of the strike were the mine fillers, who are all Irishmen. There is little doubt but that the recent extremely hot weather had been very oppressive to these men, and had put them out of temper. The reduction happening to come just when they were in this state of mind and body, proved to be the last straw, and they threw down their tools despite of reason or fear of consequences. Their leaders and the cheap press were against them, but as is usual their protests were provokingly mild, almost savouring of timidity. One of their own union officials who made a feeble attempt to stem the tide of their anger was hooted out of the Eston Works, and had to fly to save himself from injury. The strike lasted from Saturday till Tuesday afternoon. The men were, however, far from unanimous as to the wisdom of the course they were pursuing, but for a time the malcontents prevailed. On Monday gangs of them went round among the other works in the district, and endeavoured to induce the men to come out and make the strike general. In this, however, they were unsuccessful. Disheartened thereby, they were eventually willing to listen to the now stronger arguments of their officials, and returned to work on Tuesday. The damage done in the meantime to the firms affected was very great, indeed it cannot be said how great.

The danger of suddenly stopping furnaces without adding coke arises from loss of heat, leading to "scaffolding" of the materials, inside damage to the lining, and deteriorarion of the product for some time to come. As a bye consequence several mines and coke ovens had to be temporarily laid off. The associated masters complain bitterly that the difficulty would perhaps not have arisen had there been complete unanimity among the employers. Certain outside firms had delayed enforcing the reduction till they saw it safely accepted at their neighbours' works; and one firm within the association did the same. The omission was attributed to the oversight of a clerk; but this explanation is generally regarded as unsatisfactory, similar mistakes having previously occurred in a manner singularly opportune for the interests of the firm in question.

The general effect of the strike—still current—upon the market was to cause a rise of about 3d. per ton in the value of pig iron. No. 3 changed hands at 37s. 6d. f.o.b., warrants being sold at 38s. 6d., and forge quality at 36s. 6d. The quantity of iron in Connal's Middlesbrough store is now 182,312 tons, being an increase of 1337 tons during the week.

The manufactured iron trade continues about the same as when last reported. Ship plates are £6 to £6 5s. per ton; bars, angles, and iron rails, £5 10s., all free in trucks Middlesbrough; cash less 2½ per cent. discount.

The coal trade is nominally unchanged, but several transactions have recently taken place at a little less than previous prices.

The joint meeting of the Stockton and Middlesbrough Corporation called by the Water Board to consider the question of an increased water supply was brought to a conclusion, after two adjournments, on Thursday last. A resolution was passed by a considerable majority "That in the opinion of this meeting the Water Board must, in the exercise of its responsibility, decide upon the proper course to adopt at the present juncture." Immediately after a meeting of the Water Board was held, and the law clerks were instructed at once to give the requisite notices to treat for purchase of the land. This action will lead to an immediate expenditure of nearly £60,000, and three times that amount within the next two or three years. The money will be spent in the purchase of land, pipes, pumping engines, and in general labour and contingent expenses.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

A HEAVY order for steel rails for Australia was competed for by English manufacturers a few days ago. The Sheffield, Welsh, Barrow, and other rail-makers have all been beat by Messrs. Bolckow, Vaughan, and Co., of Middlesbrough. The price has not transpired. The quantity, I am told, is 20,000 tons. The local papers announce that Messrs. Wilson, Cammell, and Co., Limited, Dronfield Steelworks, have secured a similar order for the States. This firm are at present making heavy deliveries on American account. Home companies are now placing contracts rather less freely, owing to their having given out a great deal of work during the earlier months of the year. Railway extensions, which have not been unimportant this year so far, have assisted to make the demand brisk for railway material, particularly permanent way and rolling stock.

In the coal trade there is continued dulness. At several of the pits the coal put to stock has on some days exceeded the quantity sold, and though there is little complaint as yet heard among the miners themselves, the reduced employment must soon tell upon their condition. Their wages have not been high for two years, but up to this spring they have had pretty full work, and adversity has no doubt taught them to husband their resources. At present the state of the coal trade is causing great anxiety to the lessees of collieries, especially where house coal is worked.

Negotiations are at present proceeding with the Italian Government for compound armour-plates for a new war-ship that Power proposes to build. It is expected that the order will be divided between the two firms who produce the new armour—the Atlas and the Cyclops works. Italy was expected to leave off the building of monster vessels after her experience with the Duilio and the Dandolo, and the resolution to build another maritime giant has come as a surprise. The Duilio and Dandolo have 24in. of iron armour. The new ship will not need compound—iron and steel—so thick, 18in., or even 16in., of the new armour being considered equal in defensive power to 24in. of iron, while the weight is much less.

A speciality which is rapidly rising in importance are steel rims for gear wheels. At the Show at Derby solid steel wheels were shown. Messrs. W. Jessop and Sons, Limited, Brightside, and Mr. R. Hadfield, Attercliffe, are showing great energy in this department, which is destined to prove a profitable one.

In the cutlery trade, the orders for the United States are lighter, owing to the advent of the hot summer, when the Americans do not take kindly to "trade." July and August are noted for the dullest months of the year in the American trade. Fortunately the manufacturers are fairly well off for orders to last them till the cooler weather sets in. A singular feature of American trade is the demand for razors, which has been exceptionally brisk for two years, and continues heavy. The American water is said to be unfitted for the proper "tempering" of razors. This idea is scoffed at by the Americans; but the continued demand for Sheffield-made razors would seem to show that there is something which militates against the successful production of razors in America.

Disused collieries have other dangers besides the difficulty of securing thorough ventilation. In Pinderfield's-road, Wakefield, is a colliery which has been laid down for some time, the mouth of the pit being covered with sleepers of wood, and soil, and fenced round with wooden rails. On Monday a loud report was heard, and flames were afterwards observed to come out of the shaft, the woodwork over and around which was on fire. The colliery had caught fire, probably from the extreme heat igniting the old tarry sleepers. One of the barge fire-engines had to be called in to extinguish the flames.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

OWING to the annual fair holidays, business in the public works of Glasgow and the surrounding manufacturing and mining communities has been suspended during the greater part of the week. The iron market was closed from Thursday last until Tuesday, and the shipping trade has likewise been to some extent interrupted. The shipments of pig iron have, nevertheless, amounted to 11,150 tons, being 672 over those for the corresponding week of last year, and the trade, as far as it can be judged of in present circumstances, is in a fairly satisfactory condition. Upwards of 1000 tons of pigs have been added to the stock in Messrs. Connal and Co.'s Glasgow stores. A number of furnaces have been damped down, but only temporarily for repairs, and there does not appear to be any immediate intention on the part of the ironmasters to curtail the production.

The warrant market opened with a firm feeling on Tuesday, when business was done at 47s. 4d. to 47s. 6d. cash, and 47s. 5d. to 47s. 7½d. one month. On Wednesday the market became flat, and business was done down to 47s. 1½d. The tone was firmer again to-day—Thursday—with transactions up to 47s. 6d. cash, and 47s. 7½d. one month.

Makers' prices are also a shade firmer in tone, the quotations being as follows:—Gartsherrie, No. 1, at 55s.; No. 3, 49s.; Coltness, 57s. and 49s.; Langloan, 57s. and 49s.; Summerlee, 55s. and 47s.; Calder, 55s. and 48s. 6d.; Carnbroe, 51s. 6d. and 47s.; Clyde, 50s. and 46s.; Monkland, 47s. 6d. and 45s. 6d.; Quarter, do., do.; Govan, at Broomielaw, 47s. 6d. and 45s. 6d.; Shotts, at Leith, 56s. and 49s.; Carron, at Grangemouth, 52s. 6d. (specially selected, 56s.) and 51s. 6d.; Kinneil, at Bo'ness, 47s. 6d. and 45s. 6d.; Glengarnock, at Ardrossan, 52s. and 47s. 6d.; Eglinton, 48s. and 44s. 6d.; Dalmellington, 48s. and 45s.

There is nothing new to report with reference to the miners. In Lanarkshire their holidays are, as a rule, shorter than usual, and they are fairly well employed at low but comparatively steady wages.

The monthly meeting of the Mining Institute of Scotland was held a few days ago at Hamilton, Mr. Ralph Moore, inspector of mines, in the chair. Mr. M'Beth read a paper descriptive of the coal measures of Stirlingshire, demonstrating their similarity to those of Lanark. Mr. Henry Mungall, of Cowdenheath Collieries, Fife; Mr. John Drinnan, Arden Colliery, Airdrie; and R. T. Moore, C.E., B.Sc., son of the president, afterwards submitted an elaborate report of a visit they paid to various collieries in Scotland, England, and Wales, at the request of the Institute, with the object of inquiring as to the methods in operation in these mines for supporting the roofs and sides. Upon the whole, they gave it as their opinion that the methods adopted in the North of England of having their work done by deputies, each representing ten or twelve men, is not to be recommended, but rather that the other and almost universal system of the men doing their own propping should be continued and improved in a fashion such as is adopted at Cannock Chase, *i.e.*, that each seam or working should have prescribed by the manager a rule stipulating the extreme distance between the props and sprags. It was resolved to discuss the report at a future meeting.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

THE old ironworks of the past are destined to become obsolete. There was one endeavour made last week to sell Melingriffith and Pentyrch Works, but not a bid was forthcoming. The remark made by the auctioneer, as a stimulus, that they had been in operation 150 years, had rather a repelling effect than otherwise. The iron trade has entered upon a new life, and the less of the antique about it the better. There are mills at Plymouth which are amongst the very first of the old kind in the country for the make of bars, but capitalists will not look at them. Steel, and not iron, is likely to be the one thing needed.

In the neighbourhood of Swansea there will be in a short time an addition of seven Siemens furnaces to various works. Bessemer is the best for cheap steel rails, but a Siemens furnace is required to utilise the scrap ends. The future ironworks will not only have its Bessemer and Siemens, but its tin-plate mills, and the tendency of things at present in Wales points strongly to that end. I hear a whisper of important iron and steel works in Monmouthshire being on the eve of starting tin-plate works. Managers say, "we are making tin bar, and there is a fair demand, but tin-plate manufacturers are in many cases in a doubtful position, and returned bills and bad debts are becoming frequent incidents. Query if we had not better utilise our scrap, and make our own tin-plate."

At Treforest the modification of another furnace is going on. Unlike the plan at Dowlais and Landore, where the Whitwell stove or the Cowper stove is preferred, the iron pipe method is adopted, and the able manager is able to obtain a yield of one ton of iron per ton of coke. This has slightly been exceeded by the Blast Furnace Company, Swansea.

The Siemens-Landore Co. is turning out a fine steel plate, equal to anything produced for her Majesty's shipbuilding yards, at Milford. I have heard, but cannot positively verify the statement in the absence of Mr. Crawshay, that the lease is settled, and all matters in good trim for a start into the steel line. It is not yet known who will have the engineering orders. For Swansea Docks the selection has been of the most complete order, and Messss. Armstrong and Co. will supply the hydraulic machinery.

The quantities of iron and steel shipped from the Welsh ports last week amounted to 9000 tons. The quantity of coals was close upon 140,000 tons, and of patent fuel 7000 tons.

The most prosperous industry in Wales at present is unquestionably that of coal, for though Baltimore, San Francisco, New York, and New Orleans continue tolerably good customers for rails, the prices are not of much account, and the margin of profit is very small. In coal, on the contrary, the pressure for cargoes is such, that for best samples coal owners are able to obtain improved prices, at Cardiff especially. The state of the trade is well shown by the monthly statistics, which indicate, as compared with the corresponding month of last year, that we have had at Cardiff an increase of 160,000 tons, or 50 per cent.

The facilities at the Bute Docks, Cardiff, the improved discipline, and special advantages afforded by the changes in management, or administration, have already told well. None are quicker in learning and appreciating this than the captains of our coaling sailers and steamers. The whisper of a difficulty with men is always sufficient to send a fleet of vessels elsewhere.

The French trade is slow, and for shippers unremunerative. Coasting also, as a rule, can be had at lowest rates, there being such an influx of new men into the business. A screw steamer, 2400 tons burden, was launched at Wallsend last week for Stallybrass, of Cardiff. Speculations are again beginning to suggest the feasibility of shipbuilding on Cardiff shores. Since Scott Russell's era little has been done in that line, though the opening is a good one. Most of the works have appliances for turning out plates.

The patent lift invented by Mr. Thomas, of Merthyr and Cardiff, and which was exhibited at the Royal Agricultural Show, has proved a great success with the improvement that was lately added.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending July 16th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m to 10 p.m., Museum, 9879; mercantile marine, building materials, and other collections, 4208. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2243; mercantile marine, building materials, and other collections, 545. Total, 16,875. Average of corresponding week in former years, 18,584. Total from the opening of the Museum, 20,144,681.

THE NEW CUNARD LINER SERVIA.—While this splendid new vessel, built by Messrs. Thomson, of Clydebank, was proceeding down the Clyde a few days ago, with the object of having her experimental trials made, it was unfortunately observed that a crack was opening out in the main crank shaft. Although it might have been possible to work the vessel for some time with the shaft, yet it has been deemed advisable to have it taken out and either thoroughly repaired or a new one substituted. The work will, it is expected, occupy about two months. The shaft was made at the Lancefield Forge, Glasgow, and is probably the largest hitherto placed in any Clyde-built steamer. The Servia is a vessel of 8500 tons, 530ft. in length, and the largest merchant vessel yet built, with the exception of the City of Rome, recently launched at Barrow-in-Furness, excluding the Great Eastern.

PATENT OFFICE FEES.—From a return just issued showing a classification of the whole receipts from the Patent-office for the year 1880-81, including stamps, under five heads, viz.: Initial stages; third year fees; seventh year fees; other fees, certificates, sales, &c.; designs and trade marks, we obtain the following information: The amounts made on petitions for letters patent was £28,060; on applications with complete specifications, £1105; notices to proceed, £20,230; warrants, £18,300; letters patent, £18,275; final specifications, £16,625; notices of objection to grant, £82; notices of objection to sealing, £20; on oppositions, £122; giving a total of £102,819. Third year fees came to £50,300 seventh year fees to £26,100; other fees, certificates, sales, &c., to £3544; and designs and trade marks, £4982 and £3784 respectively, or in all £8766. The total receipts have, therefore, been £191,529.

SANITARY INSTITUTE OF GREAT BRITAIN.—At the anniversary meeting of the Sanitary Institute of Great Britain, held at the Royal Institution, Albemarle-street, on Thursday, July 14th, Right Hon. Earl Fortescue in the chair, an address was delivered by Prof. F. S. B. F. De Chaumont, M.D., F.R.S., chairman of the council, entitled "Modern Sanitary Science," and the medals and certificates were awarded to the successful exhibitors at the exhibition held at Exeter, in October, 1880. At the close of the address the chairman, the Right Hon. Earl Fortescue, called upon Dr. A. Carpenter to propose a vote of thanks to Prof. F. S. B. F. De Chaumont, M.D., F.R.S., which was seconded by G. J. Symons, F.R.S. Earl Fortescue, in putting the motion, spoke of the pleasure with which he had listened to the address, and fully endorsed the wisdom of the paper, and spoke of the interest he had formerly taken in the sanitary condition of the army. A vote of thanks to Earl Fortescue was moved by Mr. W. H. Michael, Q.C., and seconded by E. Chadwick, C.B. Dr. A. Carpenter, Dr. H. C. Bartlett, E. Chadwick, C.B., Dr. B. W. Richardson, F.R.S., Earl Bathurst and Earl Fortescue were among those present.

DEATH OF MR. WILLIAM EXALL.—We announce with regret the death of Mr. Exall, one of the founders of the Katesgrove Ironworks, now the Reading Ironworks. Mr. Exall was a man of great ingenuity. He took out several patents, the first of which was granted in 1846 for wheel-making machinery and for rolling endless tires and band saws. A patent of 1848 has reference to a method of constructing concaves of thrashing machines, and regulating the distance between the concave and drum, and it also includes improvements in steam engines and boilers, horse gears, and in wheels with wooden teeth. In 1851 he had a patent for chaff-cutting machines, thrashing machines, mowing machines, and agricultural engines. In the following year the subject of bread and biscuit making was attracting his attention, and he took out a patent for improvements in machinery for kneading and treating dough. His name also appears in the patents in use for the years 1854, 1855, 1856, 1858, 1863, and 1867, in connection with chaff-cutters, thrashing machines, sawing machinery, valve motions for steam engines, and boilers for portable steam engines. In Reading Mr. Exall was much liked and highly respected. He died at Holy Brook House, Reading, on the 14th instant, aged seventy-two, and was buried on Wednesday, in Reading Cemetery.

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 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.

12th July, 1881.

3042. BAND SAW MACHINES, A. Dodman, King's Lynn, and N. G. Kimberley, London.
3043. BICYCLES, G. J. T. Barrett, London.
3044. ENVELOPES, W. McKenzie.—(*S. Grant, Boston, U.S.*)
3045. SHUTTLES, J. Broadhead, Huddersfield.
3046. SPINNING COTTON, T. Coulthard, Preston.
3047. MOUNTING for BOOTS, L. Bensel, Iserlohn.
3048. COMBING MACHINES, C. A. Barlow.—(*M. P. P. Baudouin, Paris.*)
3049. LAMPS, F. Haddan.—(*L. Woolley, Mendon, U.S.*)
3050. FURNACES, J. A. King and J. Little, Dublin.
3051. FORCING APPARATUS, G. Wilson, Westminster.
3052. HAULING ENGINES, D. Greig and R. Shaw, Leeds.
3053. BATTERY TELEPHONES, L. Jacobson, Berlin.
3054. BROOMS, A. Denjoy, Auch.
3055. DISINFECTING APPARATUS, C. M. Scott, Dalkey.
3056. TREATING FLUID SLAG, A. M. Clark.—(*A. D. Elbers, Hoboken, U.S.*)
3057. BOOTS and SHOES, C. Lion, London.
3058. BEARINGS, W. Lake.—(*J. R. Baker, Jersey, U.S.*)

13th July, 1881.

3059. CONVEYING GOODS, J. Ingleby.—(*J. Pechar, Teplitz, Germany.*)
3060. TRUEING UP ROUND BARS, W. Brown, Sheffield.
3061. PENCIL CASES, W. E. Wiley, Birmingham.
3062. TREATING WOOD, C. D. Ekman, London.
3063. YEAST and VINEGAR, J. Jensen, Newcastle-on-Tyne.—(*N. Rasmussen, Copenhagen.*)
3064. DRYING SUGAR, A. Scott, jun., J. D. Scott, and T. R. Ogilvie, Greenock.
3065. PROPELLING SHIPS, E. A. Brydges.—(*J. B. Merkl, Berlin.*)
3066. MULES, H. Robinson, Bolton.
3067. INDUCING DRAUGHT from CHIMNEYS, J. Gilmore, Lower Norwood, and W. R. Clark, Peckham.
3068. STAYS, &c., R. Auerbach, London.
3069. GAS, W. R. Lake.—(*A Wittamer, Antwerp.*)

14th July, 1881.

3070. BOOTS and SHOES, J. Robertson, London.
3071. PAPER-CUTTING MACHINES, H. P. Trueman, Birmingham.
3072. PYROXILINE, &c., C. F. Claus, London.
3073. LAMP CASINGS, &c., D. Graham, Glasgow.
3074. TURBINES, F. W. Haddan.—(*J. J. Delori, Belgium.*)
3075. LOCKING, &c., LEVERS, M. C. Denne, Sussex, and T. J. Denne, Surrey.
3076. ALCOHOL, W. R. Lake.—(*L. Selzer, Vienna.*)
3077. SPEED INDICATORS, H. S. and E. Shaw, Bristol.
3078. CAKES, &c., W. R. Lake.—(*J. H. Mitchell, U.S.*)
3079. FIRE-GRATES, J. Cornforth and E. T. Burton, Birmingham.
3080. LOOMS, J. Clayton and T. Richmond, Burnley.
3081. URINALS, W. Dawes, W. & D. Thompson, Leeds.
3082. FOOD for HORSES, J. Long, Reading.
3083. FOOD for HORSES, J. Long, Reading.
3084. FASTENING, &c., R. J. S. Joyce, London.
3085. ALARMS, &c., R. Roger, Stockton-on-Tees.
3086. HAMMOCKS, A. M. Clark.—(*V. P. Travers, U.S.*)
3087. METALLIC TUBES, &c., J. V. Jones, Saltley.
3088. STEEL, W. T. Whiteman.—(*C. Martin, Belgium.*)

15th July, 1881.

3089. HEATING WATER, J. Fraser & E. Welch, London.
3090. SADDLES, W. F. D. Schreiber, Roundwood.
3091. METERS, T. R. and T. W. Harding, Leeds.
3092. TENTERING MACHINES, F. Craven, Brighouse.
3093. DRYING MACHINERY, W. and D. Gibbs, Chingford.
3094. PROPELLING SHIPS, H. J. Allison.—(*T. G. Widmer, Boston, U.S.*)
3095. MINING MACHINES, W. Mather, Manchester, and F. M. Lechner, Richmond.
3096. ORNAMENTING COVERS of BOOKS, L. Dee, London.
3097. SORTING WOOL, E. de Pass.—(*M. H. Blank and Garnier, Aix la Chapelle, Germany.*)
3098. PENCIL CASE, S. Guiterman.—(*L. L. Tower, New York, U.S.*)
3099. CUTTING SCREW THREADS, W. R. Lake.—(*F. Armstrong, Bridgeport, U.S.*)
3100. UTILISING GAS, W. R. Lake.—(*E. W. Kellogg, Hartford, U.S.*)
3101. RAILWAY BRAKES, W. Parsey, Brighton.

16th July, 1881.

3102. BOTTLE STOPPERS, A. T. King, Nottingham.
3103. STEAM SHIPS, R. F. Farlie, London.
3104. BREAD, G. W. Simmons, London.
3105. METALLIC PLATES, R. Jones, Abercarn.
3106. HORSESHOES, T. Grason, Emley.
3107. HEATING, H. Haddan.—(*J. F. Lebreton, France.*)
3108. SCOURING, H. J. Haddan.—(*L. Poitrey, France.*)
3109. FIRE-ARMS, L. de la Bastide, France.
3110. TRICYCLES, W. H. Howarth, Cleckheaton.
3111. EXHIBITING APPARATUS, C. & J. Elstob, London.
3112. PACKING TEA, E. Ormerod & J. Higson, Atherton.
3113. ENGINES, E. Eteve and C. G. Lallement, Paris.
3114. ROOFS, W. Lake.—(*J. Schieder & C. Polzer, Vienna.*)
3115. SERVICE BOXES, F. Wirth.—(*G. Mack, Germany.*)

18th July, 1881.

3116. RAISING BLINDS, G. Furness and J. Robertshaw, Manchester.
3117. BOOTS, &c., A. Christophe, Liège.
3118. LAMPS, &c., C. Saunderson, Kilburn.
3119. SLIDING, &c., INDICATOR, J. Wood, Newport.
3120. KIERS, H. Brandes.—(*T. Harbeck and A. Haspery, Elmshorn.*)
3121. RANGE-FINDER, G. W. Hart, Portsea.
3122. ELECTRIC BRIDGES, St. G. L. Fox, London.
3123. ICE, E. Edwards, London.
3124. BOOTS and SHOES, J. Robertson, London.
2125. DRILLING MACHINE, W. Allan, Sunderland.
3126. BOILER TUBES, F. H. F. Engel.—(*J. Empson and Co., Germany.*)
3127. SILK-DRESSING MACHINERY, A. Greenwood.—(*A. Schüle, Switzerland.*)
3128. LOOMS for WEAVING, T. Singleton, Darwen.
3129. REPRODUCTION of SOUND, J. J. Walker, London.
3130. EVAPORATING APPARATUS, W. R. Lake.—(*J. A. Morrell, U.S.*)
3131. HORSESHOES, W. R. Lake.—(*J. A. Burden, U.S.*)

Inventions Protected for Six Months on deposit of Complete Specifications.

3041. TUBING, &c., A. S. Murphy, Philadelphia, U.S.—11*th July*, 1881.
3058. AXLES of RAILWAY VEHICLES, W. R. Lake, Southampton-buildings, London.—Com. from J. R. Baker, Jersey, U.S.—12*th July*, 1881.
3086. HAMMOCKS, &c., A. M. Clark, Chancery-lane, London.—A communication from V. P. Travers, New York, U.S.—14*th July*, 1881.

Patents on which the Stamp Duty of £50 has been paid.

2775. DRESSING MIDDLINGS, &c., A. Crabtree, Bacup.—11*th July*, 1878.
2776. SODA, &c., W. Weldon, Rede Hall, Burstow.—11*th July*, 1878.
2792. PAPER, &c., BOXES, J. P. Lawrence, St. Mary Axe, London.—12*th July*, 1878.
2800. PHOTO-CHEMICAL PRINTING, W. Willis, jun., Bromley.—12*th July*, 1878.
2809. WOVEN FABRICS, R. Orchar and J. Graham, Dundee.—13*th July*, 1878.
2815. HARVESTING MACHINES, W. McIntyre Cranston, and T. Culpin, Worship-street, London.—13*th July*, 1878.
2846. COATING SHIPS' BOTTOMS, H. A. Harvey, Plymouth.—17*th July*, 1878.
2863. SAFETY HYDRAULIC LIFTS, C. Baldwin, Strand, London.—18*th July*, 1878.
2916. SPINNING, &c., FABRICS, E. and S. Tweedale, Accrington.—22*nd July*, 1878.
2938. CORDS, &c., J. and J. E. Newton, Saddleworth.—24*th July*, 1878.
3004. SPINNING, &c., FIBRES, E. and S. Tweedale, Accrington.—20*th July*, 1878.
2829. CHOPPING SUGAR, F. B. McCrea, Carlton Lodge, Ealing, and E. A. Cowper, Great George-street, London.—16*th July*, 1878.
2844. TOBACCO PIPES, &c., G. Castleden, Canterbury.—17*th July*, 1878.
2854. VEGETABLE, &c., PULP, E. C. Vickers and E. W. Knowles, Compton-street, London.—17*th July*, 1878.
2856. SEWING MACHINES, E. Hunt, Glasgow.—17*th July*, 1878.
2869. CRANK AXLES, Sir J. Whitworth, Manchester.—18*th July*, 1878.
2870. METALLIC SPRING LATHS, C. S. P. Wood, Birmingham.—18*th July*, 1878.
2881. TRACTION, &c., ENGINES, C. Burrell and R. Edwards, Thetford.—19*th July*, 1878.
2990. FIXING, &c., ENCAUSTIC TILES, W. Godwin, Lugwardine.—27*th July*, 1878.
3018. PAPER BAGS, C. B. Stilwell, Worcester, U.S.—30*th July*, 1878.
3231. ROTARY, &c., ENGINES, J. E. A. Gwynne, Essex-street Works, London.—15*th August*, 1878.
2871. PROPELLING, &c., VESSELS, A. M. Clark, Chancery-lane, London.—18*th July*, 1878.
2874. PREPARING, &c., WOOL, H. B. Barlow, Manchester.—18*th July*, 1878.
2908. FORCING FLUIDS, A. M. Clark, Chancery-lane, London.—20*th July*, 1878.
3134. ELECTRICITY, C. H. Siemens, Queen Anne's Gate, London.—8*th August*, 1878.

Patents on which the Stamp Duty of £100 has been paid.

2308. CIGARETTES, J. Schloss, Cannon-street, London.—2*nd July*, 1874.
2638. CUTTING WOOD, M. Glover, Wortley, near Leeds.—28*th July*, 1874.
2516. STEAM GENERATORS, C. D. Abel, Southampton-buildings, London.—18*th July*, 1874.
2524. FIREPROOF STRUCTURES, F. S. Brereton, Lincoln's-inn-fields, London.—18*th July*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 5th August, 1881.

948. MINCING MACHINE, W. A. Barlow, St. Paul's-churchyard, London.—Com. from Wilhelm v. Krause.—5*th March*, 1881.
1005. WASH BOILERS, A. Specht, Hamburg.—Com. from T. Harbeck and A. Hasperg.—9*th March*, 1881.
1033. CONSUMING SMOKE, G. Hunter, Leeds.—10*th March*, 1881.
1035. CLEANING, &c., KNIVES, H. Courteen, Clapham-road, London.—10*th March*, 1881.
1036. METALLURGICAL FURNACES, J. H. Johnson, Lincoln's-inn-fields, London.—Com. from C. Pernot, Paris.—10*th March*, 1881.
1038. WATER-CLOSET APPARATUS, W. R. Lake, Southampton-buildings, London.—Com. from A. Edwards.—10*th March*, 1881.
1052. BOOTS, &c., K. Proctor, Burnley.—11*th March*, 1881.
1065. TEMPERED STEEL WIRE, W. F. Bateman, Low Moor.—11*th March*, 1881.
1066. STRAINING PULP, G. Tidcombe, jun., Watford.—11*th March*, 1881.
1069. DATE POWDER, F. Pool, Charleston, U.S.—12*th March*, 1881.
1072. RAILWAY SWITCHES, A. E. McDonald, New York, U.S.—12*th March*, 1881.
1076. REGULATING APPARATUS, H. Charlton, Gateshead-on-Tyne, and J. W. Wailes, Wednesbury.—12*th March*, 1881.
1077. LOOMS for WEAVING, J. Slimon, Kirkintillock, and J. Whyte, Glasgow.—12*th March*, 1881.
1079. GYMP, &c., O. L. Deschamps, Paris.—12*th March*, 1881.
1104. BALING HAY, J. H. Ladd, Queen Victoria-street, London.—Com. from P. K. Dederick.—14*th March*, 1881.
1163. DESICCATING EGGS, E. P. Alexander, Southampton-buildings, London.—Com. from L. J. Cadwell.—17*th March*, 1881.
1196. NON-CONDUCTING COMPOSITIONS, D. H. Dade, Bermondsey.—18*th March*, 1881.
1215. MARINE VEGETABLES, J. Imray, Southampton-buildings, London.—Com. from Monsieur le Marquis Alexandre de Saint-Yves.—19*th March*, 1881.
1257. LAYING TELEGRAPH WIRES, S. Pitt, Sutton.—Com. from W. B. Espeut.—22*nd March*, 1881.
1258. PACKING BOTTLES, S. C. Davidson, Belfast.—22*nd March*, 1881.
1282. STEAM BOILERS, C. W. King, Manchester.—23*rd March*, 1881.
1283. MULTICHARGE GUNS, F. J. Cheesbrough, Water-street, Liverpool.—Com. from J. R. Haskell.—23*rd March*, 1881.
1300. HEELS, &c., of BOOTS, A. Sumner, City-road, London.—23*rd March*, 1881.
1353. SUPPLYING STEAM, &c., T. Ritson, Greenock, N.B.—Com. from T. A. Ritson.—26*th March*, 1881.
1380. ORNAMENTAL SCREENS, W. E. Crowther, Manchester.—29*th March*, 1881.
1510. HEELS, &c., of BOOTS, F. Hocking, Quality-court, Chancery-lane, London.—6*th April*, 1881.
1815. WATER-CLOSET CISTERNS, H. and W. Sutcliffe, Halifax.—27*th April*, 1881.
2017. SODA, E. Solvay, Brussels.—9*th May*, 1881.
2113. SODA, E. Solvay, Brussels.—14*th May*, 1881.
2268. ROADWAYS, W. R. Lake, Southampton-buildings, London.—Com. from P. Kiss.—24*th May*, 1881.
2347. PERMANENT WAY, A. J. H. Smythe, Athlone, Ireland.—28*th May*, 1881.
2354. PUMPS and PISTONS, B. B. Schneider, Orange, U.S.—Com. from W. Dette.—28*th May*, 1881.
2391. PHOSPHATE of LIME, E. Solvay, Brussels.—31*st May*, 1881.
2424. SEWING MACHINES, G. F. Elder, Lochee, N.B.—2*nd June*, 1881.
2446. SPIKES, &c., S. E. Mossberg, Elfkarleö.—3*rd June*, 1881.
2472. CHECKING APPARATUS, W. M. Llewellen, Bristol.—7*th June*, 1881.
2504. GAS MOTORS, C. W. Siemens, Queen Anne's-gate, Westminster.—9*th June*, 1881.
2528. GAS, J. Dixon, Water-street, Liverpool.—10*th June*, 1881.
2543. SOAP, A. J. Boult, High Holborn, London.—A communication from C. S. Higgins.—11*th June*, 1881.
2548. TEAPOT, J. A. Gilbert, Mount Pleasant, London.—11*th June*, 1881.
2572. ELECTRIC LAMPS, H. E. Newton, Chancery-lane, London.—A communication from C. A. Hussey and S. Dodd.—14*th June*, 1881.
2636. GAS COOKING APPARATUS, G. J. Cox, Lower Fant-road, Maidstone, Kent.—16*th June*, 1881.
2793. VENETIAN BLINDS, J. L. Seymour, Malpas-road, New Cross, Kent.—25*th June*, 1881.
2807. TELEGRAPH CABLES, A. C. Ranyard, Old-square, Lincoln's-inn, and J. A. Fleming, St. John's College, Cambridge.—27*th June*, 1881.
2813. PRODUCING DESIGNS, E. Lee, Leeds.—27*th June*, 1881.
3041. TUBING, &c., A. S. Murphy, Philadelphia, U.S.—11*th July*, 1881.

Last day for filing opposition, 10th August, 1881.

529. PRESSING MACHINERY, B. C. D. Greenhill, Manor House, Somerset.—8*th February*, 1881.
1030. MUSICAL INSTRUMENTS, T. Paterson, Queen's-square-place, London.—10*th March*, 1881.
1107. ELECTRICAL BATH APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from B. Barda.—14*th March*, 1881.
1116. MEASURING APPARATUS, A. Légé, Clerkenwell.—15*th March*, 1881.
1118. DITCHING, &c., MACHINERY, C. Binney, Ilford, and S. W. Blyth, Ongar.—15*th March*, 1881.
1121. CAST IRON POTS, J. V. Hope, Wednesbury.—15*th March*, 1881.
1137. SHEETS, &c., of TIN, F. H. F. Engel, Hamburg.—A communication from the New York Hamburger Gummiwaaren Compagnie.—16*th March*, 1881.
1146. WATER HEATERS, A. Sweet, Hampstead-road, London.—16*th March*, 1881.
1155. FIRE-BRICKS, &c., S. J. Payne, Charlton.—16*th March*, 1881.
1178. TAB CONNECTORS, T. Walker, Birmingham.—17*th March*, 1881.
1190. CUTTING TEETH of COMBS, F. H. F. Engel, Hamburg.—Com. from the New York Hamburger Gummiwaaren Compagnie.—18*th March*, 1881.
1222. BREECH-LOADING SMALL-ARMS, W. H. Monks, Chester.—19*th March*, 1881.
1230. UNBREAKABLE COMPOSITION, A. C. Henderson, Southampton-buildings, London.—A communication from J. W. Platonoff.—21*st March*, 1881.
1243. CUSHIONS, S. Newington, Ridgeway.—21*st March*, 1881.
1260. REVERSIBLE GARMENTS, W. E. Gedge, Wellington-street, Strand, London.—A communication from S. Rosenthal.—22*nd March*, 1881.
1305. SAWING MACHINES, O. C. P. and R. A. E. Fleck, Berlin.—24*th March*, 1881.
1323. CARTRIDGES, W. R. Lake, Southampton-buildings, London.—Com. from L. Létrange.—24*th March*, 1881.
1331. ENRICHING GAS, J. Livesey, Victoria-chambers, Westminster.—25*th March*, 1881.
1373. COLOURING MATTERS, O. N. Witt and H. Koechlin, Mülhausen, Germany.—28*th March*, 1881.
1375. REGULATING APPARATUS, F. W. Eames, Watertown, U.S., and J. McIntosh, Liverpool.—28*th March*, 1881.
1387. SIFTING CINDERS, T. Bradford, High Holborn, London.—29*th March*, 1881.
1402. STANDS, J. Kettle, Stepney Green, London.—30*th March*, 1881.
1406. COATING PLATES of METAL, J. Lysaght, Bristol.—30*th March*, 1881.
1439. VALVES, W. H. Westwood and E. T. Wright, Dudley.—1*st April*, 1881.
1455. LOOMS, J. Wood, Bingley.—2*nd April*, 1881.
1631. PERMANENT WAY, A. J. Acaster, Sheffield.—14*th April*, 1881.
1698. MOTIVE POWER, G. W. von Nawrocki, Leipziger-strasse, Berlin.—A communication from R. Schultz.—19*th April*, 1881.
1897. STORING, &c., GAS, W. A. Barlow, St. Paul's-churchyard, London.—2*nd May*, 1881.
2377. PRESERVING ALES, E. J. T. Digby, Hammersmith.—31*st May*, 1881.
2494. WHITE COMPOUNDS of LEAD, A. French, Morriston.—8*th June*, 1881.
2525. GLAZING PAPER, T. R. Johnston, Edinburgh.—10*th June*, 1881.
2580. PRODUCING ALUMINA, J. Webster, Solihull.—14*th June*, 1881.
2592. TELEPHONIC CONDUCTORS, W. R. Lake, Southampton-buildings, London.—A communication from H. A. Clark.—14*th June*, 1881.
2626. CLOCKS, A. W. L. Reddie, Chancery-lane, London.—Com. from H. J. Davies.—16*th June*, 1881.
2660. FEEDING APPARATUS, A. M. Clark, Chancery-lane, London.—Com. from E. Gessner.—17*th June*, 1881.
2757. WINDING, &c., YARN, J. and T. A. Boyd, Shettleston.—24*th June*, 1881.
2825. SEPARATING STEEL, E. Hunt, Glasgow.—Com. from J. King.—28*th June*, 1881.
2851. ELECTRIC LIGHTING APPARATUS, W. R. Lake, Southampton-buildings, London.—Com. from J. J. Wood.—29*th June*, 1881.
2871. BREECH-LOADING SMALL-ARMS, W. Tranter, Birmingham.—1*st July*, 1881.
2879. RAILWAY SIGNALLING, E. Tyer, Ashwin-street, Dalston.—1*st July*, 1881.
2917. THREAD BOBBINS, G. W. von Nawrocki, Leipziger-strasse, Berlin.—Com. from A. Englisch.—4*th July*, 1881.
2947. CLEANING FIBROUS MATERIALS, W. R. Lake, Southampton-buildings, London.—Com. from C. A. Dresser.—5*th July*, 1881.
2959. STEEL, &c., J. C. Ramsden, Gristhorpe Hall, near Filey.—6*th July*, 1881.
3007. BINDING BOOKS, H. G. Thompson, New Haven.—Com. from S. E. Mower.—8*th July*, 1881.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 15th July, 1881.)

216. TRACTION ENGINES, J. F. Dyson, Stainland.—17*th January*, 1881.
217. SEPARATING CINDERS, T. H. Williams, Long Acre, London.—17*th January*, 1881.
224. POWER HAMMERS, J. F. M. Pollock, Leeds, and T. Beeley, Manchester.—18*th January*, 1881.
226. SHOES, &c., of ANIMALS, H. Bland, Luton.—18*th January*, 1881.
230. FOOT-COVERINGS, P. Martin and T. H. Sneyd, Sheffield.—19*th January*, 1881.
234. PREPARING FIBROUS SUBSTANCES, T. C. Fawcett, Leeds.—19*th January*, 1881.
235. SAMPLING LIQUIDS, J. O'N. Mackle, Liverpool.—20*th January*, 1881.
247. ORNAMENTAL ENAMELLING of IRON, F. Winterhoff and H. C. Webb, Worcester.—20*th January*, 1881.
253. PRODUCING ELECTRIC CURRENTS, C. G. Gumpel, Leicester-square, London.—20*th January*, 1881.
260. TRICYCLE SEATS, J. Turner, Coventry, and J. A. Lamplugh and G. F. Brown, Birmingham.—20*th January*, 1881.
271. SYPHON TAP, H. J. Allison, Southampton-buildings, London.—21*st January*, 1881.
277. ORE SEPARATORS, R. H. Brandon, Rue Laffitte, Paris.—21*st January*, 1881.
283. SHAPING PLATES, T. Turton and R. Roberts, Liverpool.—22*nd January*, 1881.
285. SIZEING MACHINES, H. Livesey, jun., Greenbank, Blackburn.—22*nd January*, 1881.
288. CONTROLLING SPEED of ENGINES, J. Richardson, Lincoln.—22*nd January*, 1881.
311. ORNAMENTING SURFACES, H. E. Newton, Chancery-lane, London.—24*th January*, 1881.
326. SEWING MACHINES, R. H. Brandon, Rue Laffitte, Paris.—25*th January*, 1881.
366. AERATED LIQUIDS, F. Wirth, Frankfort-on-the-Maine, Germany.—27*th January*, 1881.
372. RAISING SUNKEN SHIPS, O. Wolff, Schloss-strasse, Dresden.—27*th January*, 1881.
397. BREECH-LOADING FIRE-ARMS, J. T. and J. Rogers, Birmingham.—29*th January*, 1881.
436. TRANSFERRING DESIGNS, C. Poirson, Stamford-street, London.—2*nd February*, 1881.
473. CONVEYING APPARATUS, E. P. Alexander, Southampton-buildings, London.—4*th February*, 1881.
592. COMBS, &c., T. R. Harding, Leeds.—10*th February*, 1881.
728. MAGNESIA, &c., C. Pieper, Gneisenau-strasse, Berlin.—19*th February*, 1881.
757. PUMPING WATER, &c., W. Anderson, Whitehall-place, and W. Airy, Queen Anne's-gate, Westminster.—22*nd February*, 1881.
796. APPLIANCE to BOOTS, H. Bland, Luton.—24*th February*, 1881.
1095. WHITELEAD, H. J. B. Condy, Battersea.—14*th March*, 1881.
1186. CHAIN GEARING, N. K. Husberg, Stockholm.—18*th March*, 1881.
1268. STOPPERS, N. Thompson, Southampton-buildings, London.—22*nd March*, 1881.
1272. COTTON-COVERED WIRE, W. R. Lake, Southampton-buildings, London.—22*nd March*, 1881.
1639. NITRO-BENZOLE, J. Deucker, Manchester.—14*th April*, 1881.
1726. ELECTRICAL CALL, W. R. Lake, Southampton-buildings, London.—20*th April*, 1881.
1734. CENTRIFUGAL MACHINES, B. H. Remmers, Glasgow.—22*nd April*, 1881.
1824. TRICYCLES, T. Banister and S. Lees, Rochdale.—27*th April*, 1881.
1862. SUGAR, W. R. Lake, Southampton-buildings, London.—29*th April*, 1881.
1912. BURNISHING APPARATUS, W. R. Lake, Southampton-buildings, London.—3*rd May*, 1881.
1914. EXHIBITING CARDS, W. R. Lake, Southampton-buildings, London.—3*rd May*, 1881.
1944. REFRIGERATING MACHINES, M. J. Klein, New York, U.S.—4*th May*, 1881.
1962. ELONGATING NAIL BLANKS, H. J. Haddan, Strand, London.—5*th May*, 1881.
1977. TILLING LAND, F. H. P. P. Oram, St. Paul's-road Tottenham.—6*th May*, 1881.
2042. ROOT-CUTTING MACHINES, J. Hornsby and J. Money, Grantham.—10*th May*, 1881.
2134. CUTTING CYLINDRICAL CORES, J. Gazeley, Watervleit, New York.—16*th May*, 1881.
2206. MAKING CIGARS, A. M. Clark, Chancery-lane, London.—20*th May*, 1881.
2226. NITRO-GLYCERINE COMPOUNDS, G. S. Dean, San Francisco.—21*st May*, 1881.
2234. AXLE-BOXES, W. G. Raoul, Macou, U.S.—21*st May*, 1881.

(*List of Letters Patent which passed the Great Seal on the 19th July*, 1881.)

248. HEATING APPARATUS, E. de Pass, Fleet-street, London.—26*th January*, 1881.
249. HEAT REGULATORS, E. de Pass, Fleet-street, London.—20*th January*, 1881.
264. PRODUCING LIGHT, A. Apps, Strand, London.—21*st January*, 1881.
268. VELVETS, &c., H. Lister, Huddersfield.—21*st January*, 1881.
286. TELEPHONES, F. H. F. Engel, Hamburg.—22*nd January*, 1881.
297. STAIR ROD EYES, M. and M. M. Lenzberg, Southplace, London.—22*nd January*, 1881.
302. SELVAGES, H. H. Lake, Southampton-buildings, London.—22*nd January*, 1881.
304. CARBON, &c., R. Werdermann, Princess-street, Surrey.—22*nd January*, 1881.
305. GAS STOVES, A. C. Henderson, Southampton-buildings, London.—24*th January*, 1881.
308. CORDS for BINDING FODDER, J. Wetter, Strand, London.—24*th January*, 1881.
322. SHIPS and VESSELS, C. Cullen, Rosherville.—25*th January*, 1881.
337. FASTENINGS for BELTS, &c., J. Hinks and T. Hooper, Birmingham.—26*th January*, 1881.
352. RAILWAY WHEELS, J. W. Howard, Fenchurch-street, London, and D. H. O'N. Neale, Elm-terrace, Woodford.—26*th January*, 1881.
407. LOOMS, J. Kenyon, Blackburn.—29*th January*, 1881.
432. GRINDING RAZOR BLADES, H. H. Lake, Southampton-buildings, London.—1*st February*, 1881.
437. DECORATING SOAP CAKES, P. Chapelain, Paris.—2*nd February*, 1881.
453. HURDLES, J. Sheldon, Birmingham.—3*rd February*, 1881.
492. SAFETY, &c., LAMPS, V. Ragosine, Moscow.—5*th February*, 1881.
504. TREATING MAIZE, &c., J. Boydell, Portland-street, West Dublin.—5*th February*, 1881.
506. FIXING RAILS, F. C. Glaser, Berlin.—5*th February*, 1881.
571. VENTILATING, &c., H. Mestern, Berlin.—10*th February*, 1881.
673. SAFETY VALVES, J. D. Adams, Marshall-street, London.—16*th February*, 1881.
693. SUBMARINE BOATS, T. Nordenfelt, St. Swithin's-lane, London.—17*th February*, 1881.
759. PREVENTING INCRUSTATION in BOILERS, W. P. Thompson, Holborn, London.—23*rd February*, 1881.
775. OPERA GLASSES, C. D. Abel, Southampton-buildings, London.—23*rd February*, 1881.
1350. PICKLING IRON, J. Williams and G. L. Morris, Landore.—26*th March*, 1881.
1384. ELECTRIC LIGHTING APPARATUS, W. R. Lake, Southampton-buildings, London.—29*th March*, 1881.
1548. SEWING MACHINES, J. W. Ramsden, Leeds.—8*th April*, 1881.
1624. ELECTRIC TELEGRAPHS, A. Muirhead, Regency-street, and H. A. C. Saunders, Old Broad-street, London.—13*th April*, 1881.
1795. GLASS, C. A. Schon, Hamburg.—26*th April*, 1881.
1796. RAILWAY SIGNALLING, H. Morris, Manchester.—26*th April*, 1881.
2115. CURLING, &c., HAIR, J. Careless, Birmingham.—14*th May*, 1881.
2179. PRODUCING METAOXYBENZALDEHYDE, J. A. Dixon, West George-street, Glasgow.—18*th May*, 1881.
2217. ELECTRICAL CABLES, W. R. Lake, Southampton-buildings, London.—20*th May*, 1881.
2283. WIRE FABRICS, A. M. Clark, Chancery-lane, London.—24*th May*, 1881.
2303. FLUID METERS, A. M. Clark, Chancery-lane, London.—25*th May*, 1881.

List of Specifications published during the week ending July 16th, 1881.

2909* 6d.; 4359, 4d.; 4548, 2d.; 4652, 2d.; 4675, 6d.; 4686, 6d.; 4754, 6d.; 4768, 2d.; 4777, 6d.; 4786, 2d.; 4788, 4d.; 4809, 8d.; 4938, 6d.; 4964, 8d.; 5062, 6d.; 5064, 4d.; 5079, 6d.; 5113, 6d.; 5119, 6d.; 5120, 6d.; 5121, 6d.; 5123, 6d.; 5135, 6d.; 5136, 6d.; 5137, 2s. 8d.; 5142, 6d.; 5147, 6d.; 5149, 6d.; 5151, 6d.; 5154, 6d.; 5158, 8d.; 5159, 6d.; 5161, 4d.; 5162, 1s. 2d.; 5163, 6d.; 5164, 4d.; 5166, 6d.; 5169, 6d.; 5171, 10d.; 5175, 6d.; 5176, 4d.; 5177, 6d.; 5187, 4d.; 5192, 6d.; 5194, 6d.; 5195, 6d.; 5196, 6d.; 5202, 6d.; 5204, 2d.; 5205, 2d.; 5207, 2d.; 5208, 2d.; 5212, 6d.; 5213, 6d.; 5214, 6d.; 5215, 6d.; 5216, 2d.; 5218, 6d.; 5219, 6d.; 5220, 6d.; 5221, 6d.; 5222, 2d.; 5224, 8d.; 5225, 2d.; 5227, 6d.; 5228, 6d.; 5230, 2d.; 5231, 6d.; 5233, 4d.; 5234, 6d.; 5235, 2d.; 5237, 6d.; 5238, 2d.; 5239, 2d.; 5241, 6d.; 5242, 6d.; 5244, 6d.; 5245, 6d.; 5246, 6d.; 5247, 6d.; 5248, 6d.; 5249, 2d.; 5250, 2d.; 5251, 6d.; 5252, 6d.; 5253, 4d.; 5255, 4d.; 5256, 2d.; 5257, 6d.; 5258, 6d.; 5259, 2d.; 5260, 2d.; 5262, 2d.; 5263, 4d.; 5264, 6d.; 5265, 4d.; 5266, 6d.; 5267, 6d.; 5269, 2d.; 5271, 6d.; 5273, 2d.; 5274, 2d.; 5275, 2d.; 5278, 6d.; 5279, 6d.; 5280, 6d.; 5283, 6d.; 5284, 4d.; 5285, 8d.; 5286, 2d.; 5288, 4d.; 5289, 6d.; 5290, 8d.; 5292, 6d.; 5297, 2d.; 5298, 2d.; 5300, 4d.; 5301, 2d.; 5305, 6d.; 5307, 4d.; 5309, 2d.; 5310, 2d.; 5312, 6d.; 5314, 2d.; 5316, 2d.; 5317, 2d.; 5319, 8d.; 5320, 4d.; 5321, 6d.; 5322, 2d.; 5323, 2d.; 5324, 2d.; 5325, 2d.; 5326, 2d.; 5328, 6d.; 5332, 4d.; 5334, 6d.; 5339, 4d.; 5340, 8d.; 5349, 6d.; 5357, 6d.; 5361, 6d.; 5437, 6d.; 5467, 6d.; 5512, 6d.; 938, 2d.; 939, 4d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.

ABSTRACTS OF SPECIFICATIONS.

Prepared by ourselves expressly for THE ENGINEER *at the office of Her Majesty's Commissioners of Patents.*

4359. CLEANING IRON WIRE, &c., *W. Hewitt.*—26*th October*, 1880.—(*Void.*) 4*d.*

This relates to collecting and utilising the hydrogen gas generated in cleaning wire, &c. The wire, &c., is treated in a suitable vessel, the vessel being provided with a movable air-tight cover, and connected with a gas reservoir.

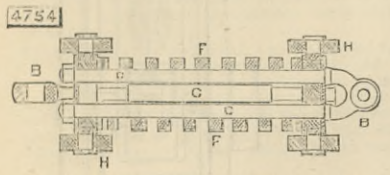
4548. SEPARATING IRON FROM CHARCOAL, SUGAR, &c., *D. MacEachran.*—*6th November*, 1880.—(*Void.*) 2*d*.
Consists in an arrangement of magnets (either permanent or electro-magnets), the matter to be treated being passed slowly across.

4652. CONSUMING SMOKE, *J. Teale.*—*11th November*, 1880.—(*Void.*) 2*d*.
Two bridges are constructed inside the flue with air passage between regulated by a valve. The smoke passes through passages in a fire-brick lining, which being hot causes the smoke to be consumed.

4675. FOLDING COUCH, *A. and E. Lloyd.*—*13th November*, 1880. 6*d*.
Relates to an arrangement by which the couch can be used either as a sofa or bed. Consists in the manner of hinging side and top frames to the bottom frame, so as not to be inconvenient to anyone lying down.

4754. STEERING GEAR, &c., *R. Wotherspoon.*—*18th November*, 1880. 6*d*.
This relates to a buffer to be linked up in the steering chains so as to take up sudden shocks, and it consists of two shackles composed of eyes B and bolts C, which pass through disc plates, and are held by

4754



nuts. A spring F is compressed between the discs. A piece of square iron fits between the bolts, so as to form a solid filling to the spring, and also acts as a guard to take off the strain from the spring when it becomes excessive. The whole apparatus rests on wheels H which run on the deck.

4768. ORNAMENTATION OF GLASS, &c., *J. Couper.*—*19th November*, 1880.—(*Void.*) 2*d*.
Consists in applying to the back surface of the glass a coating of silver, gilt or white or coloured stucco on the blank parts of a pattern already produced. The pattern may be produced by printing, or transferred, being secured to the glass by a backing of stucco, varnish, &c.

4777. SLICING MACHINE, *A. C. Herts.*—*19th November*, 1880.—(*A communication from J. Herts.*) 6*d*.
Consists in an arrangement of a cutting knife in a sliding frame, with a regulating board. The arrangement allows the apparatus to be readily folded up when not in use, and is provided with wedges and grooves for quickly and efficiently fixing same.

4786. TEAPOTS, *W. H. Andrew.*—*19th November*, 1880.—(*Void.*) 2*d*.
Relates, First, to a stirrer connected with the knob of the pot or otherwise; and Secondly, for reheating the tea by introducing hot liquids in suitable vessels rotated on the stirrer.

4788. FOLDING PAPER, &c., *J. Davies.*—*19th November*, 1880.—(*Void.*) 4*d*.
Relates to improvements in folding, securing the parts, and trimming the edges. The action of the folding is as follows: The sheet on passing over the folding cylinders is forced by the knife into a groove cut in the cylinder. It is there gripped at the fold or crease by a series of grippers. It then passes on through gripping rollers to a second fold. At the last fold is an arrangement for supplying wire, which is pressed in the act of folding into the form of the letter U round the last fold. The specification further describes an arrangement of knives for cutting and trimming the edges, actuated by suitable mechanism.

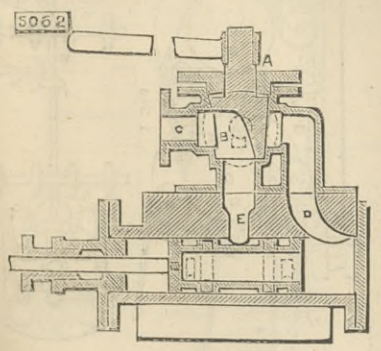
4809. PERMANENT WAY FOR RAILWAYS, *P. Burrell and H. Valpy.*—*20th November*, 1880. 8*d*.
Describes an improved form of sleeper and rails, whereby the bearing surface is increased. The sleepers consist in the use of plates, either square or with curved edges, placed diagonally along the length of the rails, and connected with each other by cross tie bars. The plates may be slightly arched. The improved rail, having a broad base, is formed in two pieces provided with grooves and projection for interlocking.

4938. GAS STOVES, *W. Wyman.*—*27th November*, 1880. 6*d*.
The improved form of stove consists of two metallic shells placed one within the other, and connected at the bottom by a tube; two other shells are placed one within the first two and the other outside, and these are connected at the top by a tube. The top margins of the two inside shells are closed by a top casting, and the top and bottom of the two outside ones are also closed. The bottom of the inside shell is also closed. The outside shell is provided, top and bottom, with two apertures, connected by a tube having a throttle valve. The stove is heated by jets of gas underneath. By this construction a thorough circulation of the heated products is maintained.

4964. VELOCIPEDES, &c., *J. C. Garood.*—*29th November*, 1880. 8*d*.
The objects of this invention are, First, an improved treadle provided with springs or projections to grip the boot; Secondly, improvement in the steering, by employing a friction rack and pinion; Thirdly, employing a second handle placed lower than the original one; Fourthly, mechanism for effecting the working by giving a circular motion to the legs; Fifthly, improvement in roller bearings, and consists in making a groove on the opposite sides of the lever.

5062. STEAM ENGINES, *J. J. Miller and G. J. Tupp.*—*4th December*, 1880. 6*d*.
This relates to a method of reversing steam and other engines by making the inlet and exhaust passages to and from the cylinder mutually inter-

5062



changeable, so that the inlet when running forwards becomes the exhaust when running backwards. The drawing shows the manner of effecting this by means of the four-way cock A, in which, B, C, D, and E are the four orifices.

5064. REGULATING THE FLOW OF GAS TO BURNERS, *T. Thorp and R. Tasker.*—*4th December*, 1880. 4*d*.
A cylinder is open at bottom and closed at top with the exception of a central recess, into each side of which a cross passage communicating with the burner opens. Within the recess moves a tube perforated at top, so as to work over the cross passage, a disc being fitted to the tube, and upon which the gas acts, so as to raise the tube.

5079. CALIPERS, *A. Scott.*—*6th December*, 1880. 6*d*.
One arm A of the calipers carries a fixed gauge point C, and travels on parallel links B, which attach it to the other arm D, the latter carrying a sliding gauge point E which is moved longitudinally with the arm by an inner tube and pin G actuated by the sledge link K, which travels by roller bearings L, one of which embraces the arm like a strap, so as to keep the sledge link in its place on the arm. This sledge

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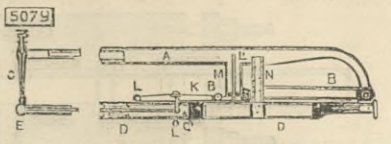

link, and with it point E, is caused to travel simultaneously with the arm A by means of pin L¹ capable of sliding in hole M in arm A. The links B cause arm A to travel outwards from arm D in a parallel manner, the amount of travel corresponding to the distance of the points C and E from one another, and may be ascertained from scale N passing through slots in arms A and D.

5119. SKATES, *H. Bezer.*—*8th December*, 1880. 6*d*.
Relates to skates attached by springs to the boot. Consists principally in a spring bearing plate, which supports the hollow of the foot; and describes the mechanism for forcing the front clips and the heel clip into the boot, by the pressure of the foot, the mechanism being set by a screw.

5120. HOLDING AND REGULATING WINDOW BLIND CORDS, *C. E. Gibson.*—*8th December*, 1880. 6*d*.
The cord passes between two rollers supported by a carrier and pressed towards a back plate by springs, the ends of the cords hanging loosely down beyond the rollers.

5121. GAS BURNERS, *C. Defries.*—*8th December*, 1880. 6*d*.
Relates to a form of burner for obtaining a double current of air. Two chambers are formed in the lower part of the burner, one for draught and the other for gas. The draught chamber is provided with a perforated cover. Round the burner or burners a conical casing is placed, rising to within a short distance of the flame and resting on the air chamber, to convey the air.

5123. TURKISH BATHS, &c., *H. Jones.*—*8th December*, 1880. 6*d*.
This relates to forming the bath above a separate and independent heating chamber, the fumes from which pass up the chimney in the room, or through any suitable outlet.

5135. HOLDERS FOR THE BOTTOMS OF TROUSERS, *A. M. Clark.*—*8th December*, 1880.—(*A communication from F. de Sandoval.*) 6*d*.
A band of leather, metal, cardboard, or other stiff but flexible material, is placed round the bottom of the trouser leg, and retained in position by spring clip of steel, whalebone, or other material, and when turned up retains the turned-up part effectually in position.

5136. SHAFT COUPLINGS, *A. M. Clark.*—*8th December*, 1880.—(*A communication from T. R. Almond.*) 6*d*.
This relates to means for connecting shafts placed at angles to one another. A is one shaft, and B the other;

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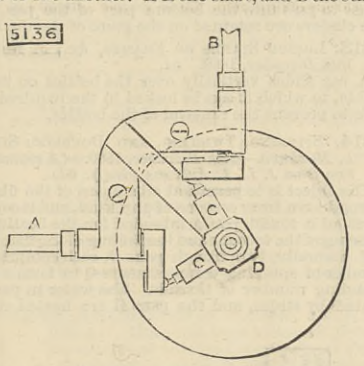

to the end of each a crank is attached and connected by a ball joint to a swivel pin C, which enters a tubular socket projecting from a sliding tube or rod D.

5142. MANUFACTURE OF BOBBINS, *W. and J. Dixon.*—*9th December*, 1880. 6*d*.
This relates to bobbins, tubes, and spools used for spinning, and has for its object to cut out the centre hole accurately true with the circumference. On a frame are mounted two radiating arms connected by rods attached to a double lever secured to a rock shaft. On the upper arm a set of pulleys are mounted, and on the lower arm two sets of revolving pulleys driven by a suitable belt. The bobbins are placed separately between the bottom pulleys, resting upon their peripheries, and are held by bringing the arms towards each other, so that sufficient pressure is put by the pulleys upon the bobbins to cause them to revolve and overcome the resistance of the cutting tool.

5147. LAMPS, *T. Rolfe.*—*9th December*, 1880. 6*d*.
Relates to a form of lamp for oil, &c., which will immediately right itself on overturning. The lamp is weighted at the bottom, or the reservoir may be weighted and supported inside the lamp or case.

5149. HYDRAULIC LIFTS, *E. B. Ellington.*—*9th December*, 1880. 6*d*.
This relates to constructing the lift so that both the permanent weight of the cage and ram and also the variable weight of ram, resulting from its greater or less protrusion from its cylinder, is compensated without the use of chains or pulleys. The drawing shows an arrangement of effecting this, and it consists in connecting the lift cylinder A by pipe B with the lower end of a cylinder C fitted with a trunk piston D. The upper end of C communicates, by pipe E,

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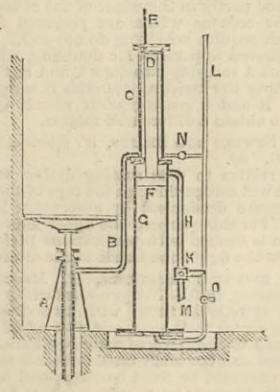

with an accumulator, and the trunk of piston D is connected to a second piston F working in a cylinder G, the upper end of which is connected by pipe H with the working valve K. The latter is connected with pipe L, supplying water under pressure from the accumulator, and with discharge M. By cocks N and O the lift cylinder can be charged when required.

5151. HORSESHOE NAILS, &c., *J. A. Coleman.*—*9th December*, 1880. 6*d*.
This relates to improvements on patent No. 55, A.D. 1880, and it consists of the frame A carried at the upper part of the main shaft to actuate the various parts. In the middle of this shaft is an excentric, which actuates a pair of punches B, shaped so as to punch a pair of blanks of the approximate shape of the nails from a bar C which is fed forward each time the punch ascends, the feed being also effected by a cam on the main shaft. The punched blank is forced between spring arms E which turn on

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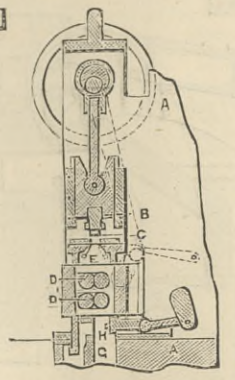

their axes and deliver the blanks to the rolls D, from whence they pass to the rolls D¹, both sets of rolls having depressions to receive the blanks and being partially rotated so as to shape the blanks, after which they are, by the pump H, forced through the finishing die G.

5154. WINDING GEAR OF STEAM CULTIVATING APPARATUS, *R. Hitchcock.*—*9th December*, 1880. 6*d*.
This relates to the manner of mounting the guide rollers used to cause the rope to be wound evenly on the drum upon their lever. A is the lever to which an up-and-down motion is imparted, so as to distribute the coils of the rope evenly along the drum from end to end. The end of the lever is forked, and through it

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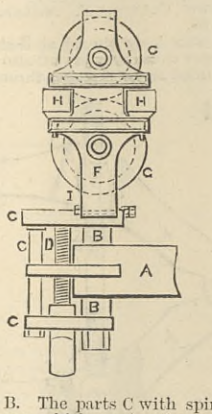

passes a spindle B. The parts C with spindle B form a rectangular frame, which carries the screw D, so as to adjust the frame in relation to the end of the lever A. The guide rollers are mounted on frame F secured to the upper bar C by a hooked bolt I, and small lateral guide rollers H are mounted on vertical axes in front of and behind two rollers G.

5158. FORMING MOULDS FOR LIQUID METALS, &c., *J. T. King.*—*10th December*, 1880.—(*A communication from S. J. Adams.*) 8*d*.
This relates to apparatus whereby cylindrical moulds practically perfect can be more rapidly formed than by ordinary methods, and it consists in causing a revolving pattern C, provided with knives D, to cut its way into a solid body of sand, sleekers or smoothers

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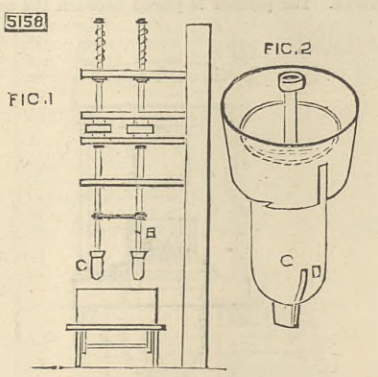

being placed behind the knife to polish the surface of the moulds. The revolving patterns are made hollow to receive the sand removed by the knives. Fig. 1 shows a number of the patterns mounted on shafts B; and Fig. 2 is a detatched view of the pattern. The sand is packed hard by rolling a heavy roller over it.

5159. STRAINING PAPER PULP, *A. Paisley.*—*10th December*, 1880. 6*d*.
This relates to the suction apparatus used in combination with the strainer for straining paper pulp. A is a revolving strainer supported in bearings of the receptacle B for the paper pulp. A tube C extends from the driving end to near the opposite end of the strainer and carries the suction apparatus. At each

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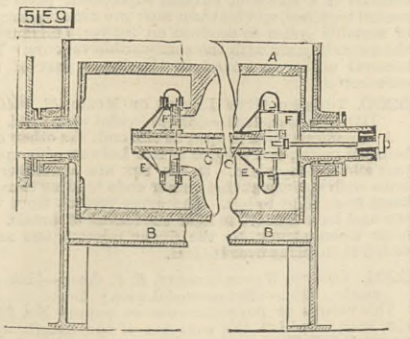

air space of the tube C a cup-like flange or conical disc E is secured, the large end of which fits into a recessed plate F secured to the strainer. When the strainer revolves, a reciprocating motion is imparted to tube C, whereby the cups E are alternately urged forward and drawn back, causing the larger end of E to slide in plates F, thus producing a sucking action, whereby the pulp in receptacle B is drawn through the slits of the plates of the strainer.

5161. MAKING BOTTLES FOR USE WITH INTERNAL STOPPERS, *E. Breffit.*—*10th December*, 1880. 6*d*.
The tools to form a rebate or ledge in the neck of the bottle are formed with the plug fixed at such an angle with the swiller as to enable the workman to produce the groove or ledge without the use of springs.

5163. SETTING-OFF MOTION FOR LOOMS, *J. Williamson and J. and G. Swindells.*—*10th December*, 1880. 6*d*.
The object of the invention is to effect the automatic weighting and letting off the yarn from the warp beam, so that only as much is let off as is taken up, and further to maintain a constant and uniform tension of the warp. A horizontal lever H is employed either at one or both ends of the warp beam, and to it is jointed an arm K, the lever being pivotted to the frame at such an angle to the arm K as to include the neck or collar of the warp beam. The ends of lever H and arm K are hollowed out to embrace the neck, and they are connected by a spring L. The warp beam is nearly balanced by weight G carried by lever H, and is freely suspended by means of the warp which passes over a rounded bar E at the back of the loom. The upper part of comes in proximity to a movable cam D. The warp beam when lifted carries with it the lever and arm, the upper end of which is brought

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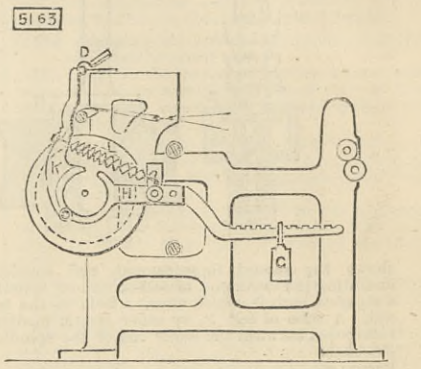

with increasing pressure against cam D, and as soon as such pressure exceeds the tension of spring L, the grip on the neck of the warp beam is released, and the warp beam actuated by that portion of its weight unbalanced by weight G revolves and falls, carrying with it the lever and arm. The top of arm K being thus removed from cam D, the spring again causes the grip on the neck of the warp beam, and prevents its further revolution and descent.

5164. DRAIN PIPES, *E. Brooke.*—*10th December*, 1880. 4*d*.
Relates, First, to forming ribs horizontally along the pipes, or the pipes may be corrugated; Secondly, in forming the joints by cement made in segments of circles which fit into each other and interlock.

5166. STANDS FOR BOTTLES, &c., *J. E. Bingham.*—*10th December*, 1880. 6*d*.
The bottles are pivotted separately each in a separate compartment, so that they may be tilted in order to empty the contents.

5169. WASHING CHINA CLAY, *J. Lovering.*—*10th December*, 1880. 6*d*.
Relates to a method of keeping clean the gauze or straining frame by causing it to revolve or be in constant motion.

5171. RAILWAY VEHICLES, *W. R. Lake.*—*10th December*, 1880.—(*A communication from J. W. Chisholm.*) 10*d*.
This relates, First, to preventing lateral movement between the vehicle body and the truck, and consists in making the lower shaft, which is secured in reverse standards projecting downwardly from the body bolster of the vehicle, and which passes through the lower ends of suspension links, so that its ends just touch the insides of the truck standards carrying the shaft which passes through the upper ends of the link. Secondly, to adapting the suspension link principle to six-wheel trucks by using two sets of suspension links, arranged so that one pair is between each adjacent two pairs of wheels, the set of links with

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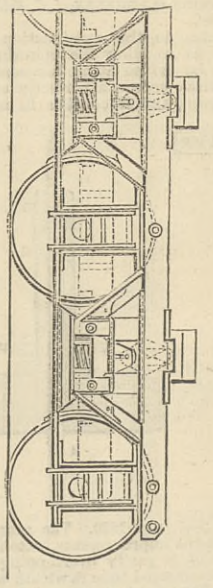

their shafts nearest the end of the vehicle body being made as above described, and the other set having the links similarly formed, but so arranged that their lower ends and the shaft secured to the vehicle body are free to move laterally in relation to the truck, so as to allow the truck and body to swivel relatively to each other. Thirdly, to the framework of the truck; and, Fourthly, to means for holding the brake beam.

5175. PERFORATING, STAMPING, OR MARKING DOCUMENTS, &c., *A. H. Robinson.*—*11th December*, 1880. 6*d*.
This relates to improvements on patents No. 1242, A.D. 1800, and No. 1270 A.D. 1880. According to one arrangement, a set of finger keys are used to operate the perforators, stamps, or markers.

5176. POSING TABLE FOR ARTISTS' MODELS, &c., *J. P. Clarke.*—*10th December*, 1880. 4*d*.
Consists of a revolving turntable provided with friction rollers on which the model is placed. The position of the sitter or model may be changed by the operator by means of a stick or cord, without moving.

5177. LAMPS, *S. Pitt.*—*10th December*, 1880.—(*A communication from W. B. Robins.*) 6*d*.
A candle consisting of a core of bibulous paper coated with a "magma" or "compost" of powdered chalk or other mineral, and a mucilaginous or other bond, insoluble by and impervious to mineral oil, is placed upon a layer of springy fibrous material forming the feed wick, by compressing which the amount of oil rising to the top of the candle (where it is consumed) can be regulated.

5179. SPINNING AND DOUBLING COTTON, &c., *T. Coulthard and J. M. Hetherington.*—*10th December*, 1880. 6*d*.
This relates particularly to ring and traveller spindle apparatus known as "self-contained" spindles, and consists, First, to means for preventing the spindle from being lifted out of the bolster when the bobbin is removed for piecing or doffing, so as to dispense with the use of hooked pins, sliding bars, &c., usually employed, and in affording facilities for

removing the spindle from and replacing it in working position within the bolster, and without the necessity of severing the driving band; and Secondly, in an improved method of mounting the spindle apparatus in the bolster. Fig. 1 shows the first improvement, and consists in forming on the upper edge of the oil reservoir D, with a lip or cover C projecting inwardly, so as to overlap a flange on the lower edge of the metallic sleeve attached to the spindle. On the flange are helically-shaped projections A, which enter helical slots in the inner edge of the lip or cover C. Fig. 2

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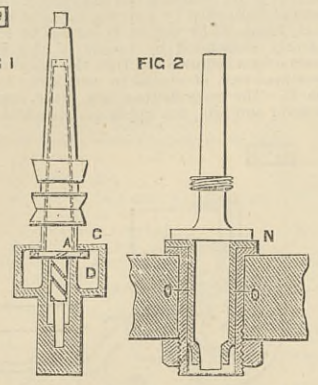
FIG 1 FIG 2



shows the second improvement, and consists in mounting the lower end of self-contained spindles in a separate bush O, which enters a hole in the bolster rail. A tube of felt N, or other elastic medium, is interposed between the lower end of the spindle and the bush.

5186. TRAM-RAILS, *J. Sharp and J. T. Tong.*—11*th December*, 1880.—(*Not proceeded with.*) 2*d.*

The rail is made in two parts, the foot and web being rolled in one piece, and the web having a projection or flange at top to fit into a groove in the head of the rail, which is rolled separately and has a shank on its underside, by which it is bolted to the web.

5187. WASHING AND WRINGING MACHINES, *J. Summerscales.*—11*th December*, 1880. 4*d.*

Arrangement of levers for rocking attached to the bottom of the tub. The tub is fitted with projections for breaking the action of the water. The wringer is worked by a spur wheel from the fly-wheel, and can be thrown out of gear when required.

5188. PAINT, *P. M. Justice.*—11*th December*, 1880.—(*A communication from Major F. I. R. Seaver.*) 4*d.*

The object of the invention is to protect submarine structures from decay, and also to preserve telegraph pole, tops of railway carriages, and similar materials, from the effects of severe weather, and it consists in coating them with a paint manufactured from the sub-oxide of copper and carbolic acid, with which is incorporated a drying oil or other suitable substance.

5189. SAFETY FASTENING FOR ENVELOPES, *J. Fleury and E. Perier.*—11*th December*, 1880.—(*Not proceeded with.*) 2*d.*

The four flaps of the envelope each have a row of small holes, which correspond when the envelope is closed, and three of them have also a larger hole, which also corresponds. A cord is passed through the holes and tied and secured by a small seal.

5191. TREATMENT OF FATS AND OILS FOR MANUFACTURE OF SOAP, *C. A. Burghardt.*—11*th December*, 1880. 6*d.*

The raw material is placed in a jacketted retort heated to from 260 deg. to 360 deg. Fah., and, when the fat begins to volatilise, air is blown in above the liquid oil and into the vapour arising therefrom, which it carries off to be condensed and collected in a suitable apparatus. In manufacturing soap the vapour of the fatty acids and oils is passed directly into the caustic lye.

5192. SPINNING MACHINERY, *J. C. Fell.*—11*th December*, 1880. 6*d.*

This relates to the construction of solid metal carriers so as to allow the spinning and twisting machine to be driven at an increased speed, and at the same time ensure a perfectly even drag on the cotton or yarn, and it consists in improvements on

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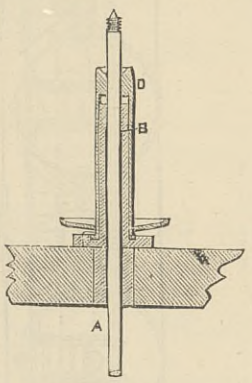

patent No. 2047, A.D. 1880. The saucer carrier D is, according to the improvements, extended upwards, so as to allow of it partly overtopping the upper end of the bolster or fixed tube B, within which the spindle A rotates. The carrier runs loosely on the bolster, and has its bearings at the top and bottom only.

5193. FOOTSTEPS FOR SPINDLES AND SHAFTS, *J. Greenwood, jun, G. A. Hellivell, W. Hammond, and S. Holt.*—11*th December*, 1880. 6*d.*

A footstep A of cast iron, brass, or other metal is bored at the top with a hole at B to fit the foot C of the spindle or shaft. Then with a larger tool it is bored in the reverse direction from the lower side upwards, thus forming an enlarged chamber D, and

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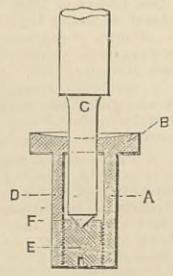

caving a portion only—say about $\frac{1}{8}$in. thick—at the upper side, bored with the smaller sized hole. A plug E of hardened steel or other suitable metal and the required diameter, has a shallow conical hole bored in its upper side at E to receive the pointed end of the spindle C, and it is screwed or driven fast into the lower side of the footstep A.

5194. FURNACES FOR MELTING GLASS, *D. and J. Warren.*—11*th December*, 1880. 6*d.*

The invention is also applicable to other than glass furnaces, and its object is to effect complete combustion of fuel or gases, while the reverberatory flame at an extremely high temperature is directed with great energy on the molten glass or other material, thereby saving time and fuel. The flames pass from the furnace F, over the bridge B, and play on the glass in tank T, where it is met by currents or blasts of heated air, which are forced through openings C in the crown

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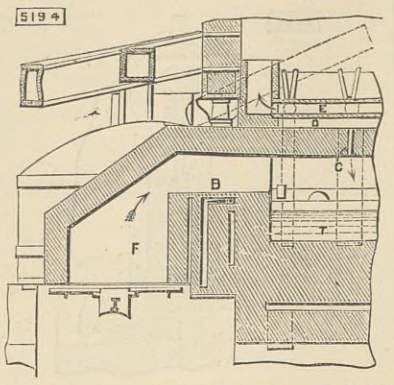

of the furnace, and leading from a common flue D. The air forced into flue D by the blower is heated by waste heat from a hot flue E formed above it, through which the waste products of combustion are led from the furnace.

5195. SMOKE-CONSUMING GRATES OR STOVES, *H. S. Snell.*—11*th December*, 1880. 6*d.*

This relates to stoves in which the grate is caused to revolve on a pivot at the back. The sides of the grate are made cylindrical to occupy a socket in the stove, and the covers at top and bottom are hinged. The cylindrical sides are made solid, and the pivot is mounted in a frame fitted with friction rollers. A spring handle and catch are provided to revolve the grate and hold it in any desired position.

5196. SCREW CLAMPS, *H. Methan.*—11*th December*, 1880. 6*d.*

The two arms A are hinged at their lower end, and at their upper ends carry jaws C also hinged. A right and left-handed screw E passes through eyes near the

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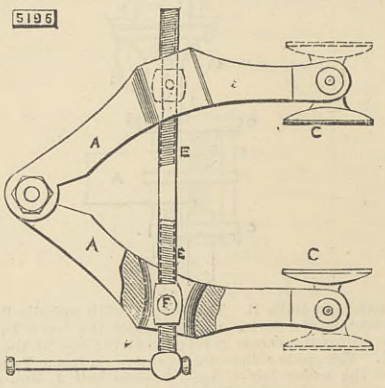

middle of the arms, where it engages with nuts F pivotted in the eyes of the arms. A clamping jaw capable of gripping a joist or timber may be applied to the upper end of each arm in place of the jaw C shown.

5197. DIES FOR METALS, &c., *J. T. Andrews.*—11*th December*, 1880. 6*d.*

This consists in making castings in steel of the dies, and whilst still hot and capable of being moulded by pressure a pattern is taken of the article to be manufactured. The pattern is placed between the acting

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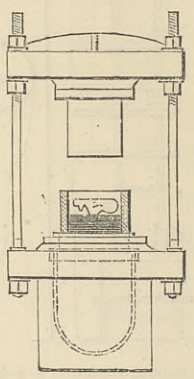

faces of the pair of roughly-shaped dies, and by hydraulic or other pressure they are forced against the acting faces of the pattern, so as to impress upon the roughly formed dies the exact configuration of the pattern. The drawing shows a hydraulic press arranged for making a single die.

5198. CARBURETTING APPARATUS FOR THE MANUFACTURE OR TREATMENT OF LIGHTING GAS, &c., *W. L. Wise.*—11*th December*, 1880.—(*A communication from V. C. Devobz.*)—(*Not proceeded with.*) 2*d.*

Atmospheric air is forced under pressure into a receiver, and passes thence to the carburetter through a rose so as to divide it into fine jets. The carburetter consists of a series of circular superposed parts connected together, and between each two are diaphragms of metallic gauze to produce an intimate mixture of the ascending air with the combustible vapours. The mineral oil is contained in the lower part of the carburetter.

5200. TURNING OVER LEAVES OF MUSIC, *M. Volk.*—11*th December*, 1880.—(*Not proceeded with.*) 2*d.*

A rectangular box is open at one end, the other end being of metal, and a space is left between its upper part and the top plate. In the box are a number of arms with springs at their inner ends tending to move them from right to left. The arms project from the box and have holders to hold the leaves of music. A lever when struck by the finger releases one arm, which then turns over its leaf.

5201. TROUGH WATER-CLOSETS, *B. C. Cross.*—11*th December*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 2324, A.D. 1878, in which the contents of the trough were drawn or let off at regulated intervals, and it consists in conveying the urine to a small tank, which, when nearly full, is arranged to turn downwards a syphon bend in the outlet pipe, so as to discharge the trough.

5204. MAKING PAPER BAGS, &c., *R. Woods.*—13*th December*, 1880.—(*Not proceeded with.*) 2*d.*

Paper is led in a continuous web between two rollers which cut it into suitable strips, after which the paste is applied, and by means of rollers the paper is formed into a bag.

5202. STUFFING-BOXES, *C. E. Hæger.*—13*th December*, 1880. 6*d.*

This relates chiefly to means for connecting by a steam-tight joint the pipe C to the moving cylinder A, and it consists in making the recess D of larger diameter than the collar or head of the pipe C, which works in a prolongation of the recess, whilst a loose ring or false bottom E of the stuffing-box takes all

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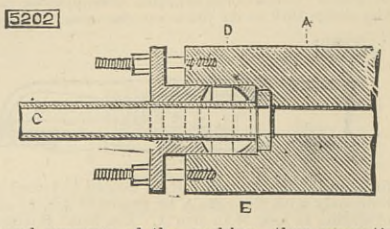


the end pressure of the packing, thus preventing friction between the collar and the bottom of the recess in which it works.

5205. STEAM ENGINES, *D. McPherson.*—13*th December*, 1880. 2*d.*

This relates to means for economising steam by forming a vacuum in the cylinder. By a jet of steam the air is exhausted from the cylinder, and impulse given to the piston by the introduction of a slight jet of steam against the piston head, which is then carried to the opposite end of the cylinder, where a valve admits the steam into a tank, in which it is condensed by a small stream of water.

5207. SPLINTER BAR FOR CARRIAGES. *W. Bowden and J. Garward.*—13*th December*, 1880.—(*Not proceeded with.*) 2*d.*

The rollers to which the traces are attached are fastened by a band and hinge to the splinter bar, the hinges being held by bolts, which when released permit the roller to revolve, thus releasing the traces.

5208. SHAKING STRAW PASSING FROM THRESHING MACHINES, *R. G. Morton.*—13*th December*, 1880.—(*Not proceeded with.*) 2*d.*

A rocking shaft is placed across the frame of the threshing machine under the end of the shakers furthest from the crank shaft, and to its opposite ends wipers or spanners are attached and connected to the oscillating standards or hangers, so as to balance the shakers. The rocking shaft is actuated so that the wipers rise and fall in unison with the throw of the crank shaft.

5209. SHIRTS, *W. and G. Benger.*—13*th December*, 1880. 4*d.*

This consists of a shirt which is furnished with double layers of material in front, is closed at front and back, but is open along the top of the shoulder, and is there furnished with fastenings.

5210. MANUFACTURE OF SHIRTS AND DRAWERS IN ONE PIECE, *W. and G. Benger.*—13*th December*, 1880. 4*d.*

This consists in the combination of a shirt body and drawers or legs, with flaps which overlap each other in front and are fastened by two rows of buttons and button-holes.

5212. ASH PANS FOR FIREPLACES, *B. Banks.*—13*th December*, 1880. 6*d.*

The ash pan is fitted at top with a grated box, which catches the ashes falling from the fire, and allows the ashes to pass into the bottom part of the pan, while the cinders are retained on the grate of the top box.

5213. LIQUOR STANDS OR FRAMES, &c., *J. Burley.*—13*th December*, 1880. 6*d.*

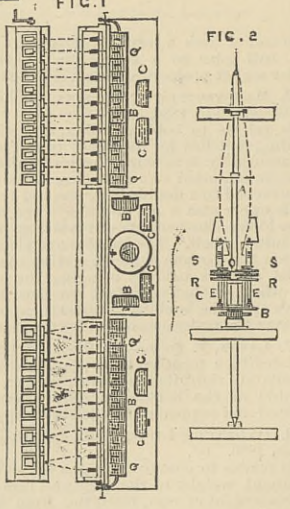
A bar slides vertically over the bottles on two uprights, to which it can be locked in the required position to prevent the removal of the bottles.

5214. SPINNING, TWISTING, AND DOUBLING SILK, *J. L. Mewburn.*—13*th December*, 1880.—(*A communication from J. L. A. Aubenas aîné.*) 6*d.*

The object is to permit at all seasons of the filament being drawn from cocoons of any kind, and it consists, First, of a round pan A intended for the beating and clearing of the cocoons and the finding of the filaments; and Secondly, two trough pans B, each comprising a number of spinning compartments Q to form a corresponding number of threads. The water in pan H is heated by steam, and the pans B are heated at their

5214.

FIG. 1 FIG. 2



ends and for a portion of their length only. A pipe communicates between the pan A and pans B so as to ensure a regular and uniform temperature of the water. The cocoon holders, perforated with holes, are immersed partly in the water of the different pans, so that the cocoons which are prepared for spinning or which require reheating do not cool. Fig. 2 shows the improved apparatus for doubling, which consists of a shaft A carrying two discs C and B, the lower one supporting the twisting spindles E carrying toothed wheels R and S gearing with wheels Q, the object being to obtain a differential motion.

5215. SEWERS AND DRAINS, *W. Edes.*—13*th December*, 1880. 6*d.*

This relates to constructing drains so that gases evolved will escape through the tops of the drain pipes and become deodorised by absorption in the earth above. For this purpose the upper side of the sewer or drain is formed with perforations preferably tapering from the out to the inside of the drain.

5216. SPINNING MACHINES, *A. Munzinger.* — 13*th December*, 1880.—(*Not proceeded with.*) 2*d.*

Each spindle is fitted with two drawing rollers rotating round their axes, and also round an axis perpendicular to the plane of their own axes. One roller is toothed and the other faced with felt or leather, the former mounted in fixed bearings, and against it the latter is pressed by a spring. The toothed roller carries a bevel pinion gearing with an internally screw-threaded ring. By these means a regular twist capable of adjustment and a uniform tension are obtained.

5218. METALLIC ALLOYS, *G. Höper.*—13*th December*, 1880. 6*d.*

Alloys of different hardness are obtained by combining phosphorus, tin, and copper in the following proportions:—$3\frac{1}{2}$ per cent. to 8 per cent. phosphorus, $\frac{1}{2}$ per cent. to 15 per cent. tin, and copper sufficient to make up the 100 parts. The alloy can be cast in moulds made partly of metal and partly of loam.

5219. GAS MOTOR ENGINES, *A. Fiddes.*—13*th December*, 1880. 6*d.*

This consists, First, in constructing a gas engine with a slide valve of peculiar construction working in the cylinder of the engine, by which the length of the cylinder is reduced internally at the time of firing, also fully compressing the charge and maintaining such compression up to the time of firing; Secondly, in admitting water to the charge at the time of firing,

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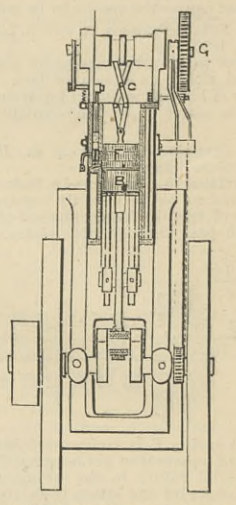

which is converted into steam so as to increase the power, and also clean the internal parts; Thirdly, in the valve arrangement for forcing the flame into the charges; and Fourthly, in the employment of an oscillating cylinder. B is the piston; F is the slide valve worked by cross levers C from cam plates on the back shaft G.

5220. FIRE GRATES, *J. R. Pickard.*—13*th December*, 1880. 6*d.*

The object is to produce an intense heat from the commonest fuel, and also to prevent the discharge of carbonised vapour or smoke from the chimney, or to enter the room. Near the grate one or more chambers are placed which communicate with the grate and have openings to admit air. The smoke passes into the chambers and is consumed.

5221. GRINDING MILL, *C. M. Sombart.*—13*th December*, 1880.—(*A communication from R. Schneider.*) 6*d.*

This relates principally to the peculiar arrangement and shape of the grinding teeth, and in the manner of suspending the runner C. The grinding surfaces are conoidal, and provided at their lower portion with radially ascending rows of teeth shaped like the step of a staircase, there being less teeth on the runner than on the inside of the surrounding shell B. The

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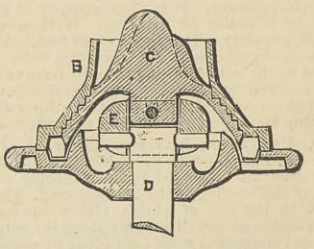

runner has projections round its base, which are bevelled to fit into an annular recess in the shell. The runner is connected to the central shaft D by a balance E, with two grooves at right angles to each other, one at the upper and the other at the lower face. A pin passes across the shaft and through the lower groove, while the upper groove supports another pin attached to the runner.

5222. LOOMS, *E. M. Heatley.*—13*th December*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to means for operating the picker and shuttle, and also to the temples. The picker is actuated by the picking stick or an arm connected therewith. The temples have two or more roughed surfaces having recessed spaces, and are carried by supports, the outer ends having screw adjustment to regulate the grip of the rollers.

5224. PRINTING MACHINERY, *J. Davies.*—13*th December*, 1880. 8*d.*

This relates principally to a mode of operating the movements of the tables of perfecting or single-cylinder printing machines, so as to drive them at a uniform speed during the time the impression is being

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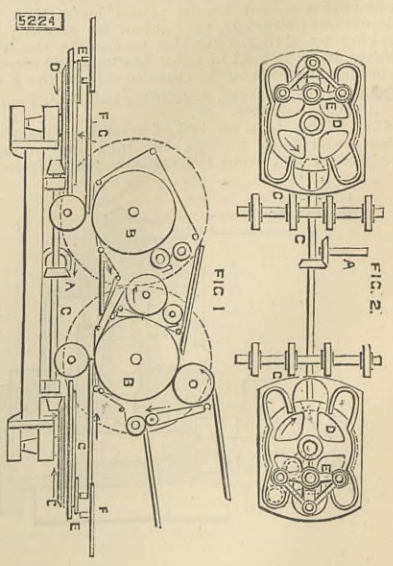

taken. A is the driving shaft by which the printing cylinders B are actuated, and also the shaft C carrying at either end bevel pinions gearing with wheels D keyed to vertical shafts. On each wheel D is a crank pin carrying a T-shaped lever E which underlie their respective tables F carrying the formes of type and the inking slabs, and are so situated that in moving inwards one table overlaps the other. At the end of levers E antifriction bowles are mounted, one of them engaging with a slot in the underside of the table, while the other two work in a frame G.

5225. OBTAINING COLOURED COATING FOR THE PREPARATION OF SKINS, &c., *E. Fernbach.*—13*th December*, 1880.—(*Not proceeded with.*) 2*d.*

Powders or liquid colouring matters of any shade are mixed with any kind of greasy matter, so as to form a coating of any desired colour.

5227. BRAKES FOR VEHICLES, *N. Talard.*—*14th December*, 1880. 6*d*.

The frame is made in two halves, the lower one connected to the vehicle and the upper one bolted to the lower one. In the frame A is a circular seat for the ring B, capable of revolving with slight friction, an

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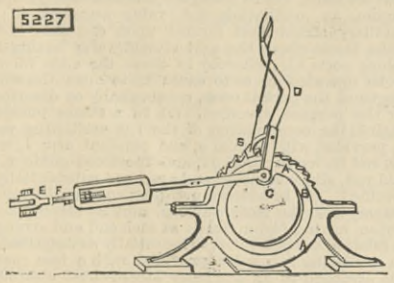

having a boss C through which passes a square pin connected to a forked lever D, and also to the brake rod E. On the frame are ratchet teeth with which gears a pawl S.

5228. STRIKING, SCOURING, AND FLESHING LEATHER, &c., *E. Wilson.*—*14th December*, 1880. 6*d*.

The drawing is a diagram showing the main feature of the invention, which consists in actuating the striking tools Z by attaching them to two slipper plates S, capable of sliding one on the other and actuated by the rod Q, bell crank O, and connecting

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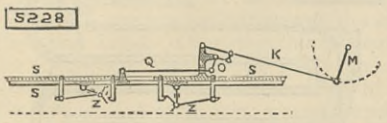

rod K from the crank M; the tools attached to one plate acting in one direction, and those on the other in the opposite direction. The hides or skins are supported either upon a circular table or upon a cylinder which is caused to rotate.

5230. HIDING OR FILLING UP CORNERS OR SKIRTINGS OF ROOMS OR STAIRCASES, &c., *W. P. Thompson.*—*14th December*, 1880.—(*A communication from D. McFee, R. A. Kellond, and D. E. McFee.*)—(*Not proceeded with.*) 2*d*.

This relates to a plate of metal formed to fit the corner and secured in any suitable manner, the object being to prevent the accumulation of dust and dirt, and also presenting an ornamental appearance.

5231. SUGAR, *H. Stokes.*—*14th December*, 1880.—(*A communication from O. A. de Gramont.*) 6*d*.

This relates to the convertion of saccharine solutions and juices into clear crystalline sugar at less cost and in a more simple manner than hitherto. The solutions and juices are submitted to the action of gases and vapours of acetate or sugar of lead, mixed with alcohol and water, ammoniac or ammoniacal crystals or liquid mixed with alcohol and water, and the fumes of sulphur which is passed through water before

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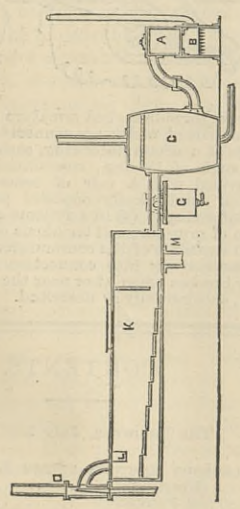

mixing with the first two agents. The drawing shows the apparatus to effect the operation; A is the sulphur retort heated by furnace B, the fumes passing through water in vessel C; G is the retort containing acetate of lead, alcohol, and water; H retort containing ammoniac or ammoniacal crystals or liquid alcohol and water, the retorts being connected by pipes with the chamber K, to which the saccharine solutions are admitted at L and escape at M. The ejector O draws off the gases.

5234. SECTIONAL WARPING AND BEAMING MACHINE, *J. C. Sewell, F. Hilton, and J. Bethel.*—*14th December*, 1880. 6*d*.

The object is to equalise the diameter of all the sections of a warp and the length and tension of the yarn of each section. Two sectors A and B are placed on the presser shaft, the former keyed thereto, and having a graduated scale on its rim, while the latter is free to rotate and carries an index finger moving over the scale on A. The sector B has teeth gearing with a worm E, and the two sectors can be

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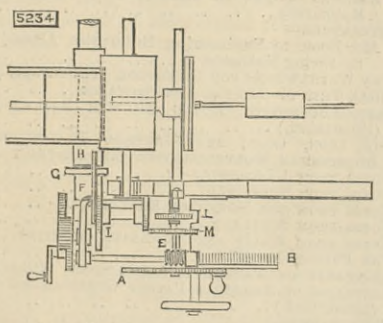

secured together by a bolt and nut. The motion of the second shaft is imparted intermittently to the apparatus by pawl F actuated from the section shaft by excentric and rod G and lever H. Pawl F drives ratchet wheel I fixed on a shaft parallel with the shaft of worm E, the two shafts being geared together by a train of change wheels. On the ratchet shaft is a worm gearing with a wheel L, on the axis of which is an index finger pointing to divisions on a graduated disc M. The drawing is a plan of the apparatus.

5235. BOBBINS OF SHUTTLES FOR SEWING MACHINES, *R. A. Edwards.*—*14th December*, 1880.—(*Not proceeded with.*) 2*d*.

The tension of the thread from the shuttle bobbin is regulated by a helical spring, the bobbin spring being acted upon by the helical spring so as to lengthen or shorten it slightly.

5237. BRAIDING, LAPPING, OR COVERING TELEGRAPH WIRES, CRINOLINE STEEL, ENGINE PACKING, &c., *W. T. Glover and G. F. James.*—*14th December*, 1880. 6*d*.

The wire or other core to be covered is forced through the tube A by means of a pair of squeezing rollers D geared together and caused to revolve at the desired

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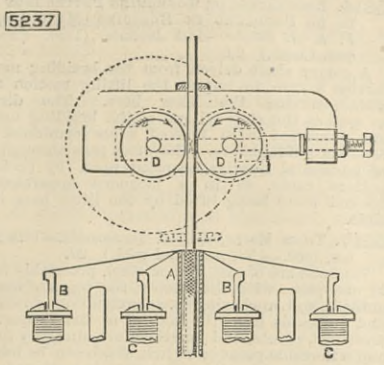

speed, the distance between them being adjustable so as to suit different thickness. B are the tops of the braiding spindles carrying the bobbins C.

5238. CONSUMING SMOKE, &c., *W. Hilton and T. F. Pearson.*—*14th December*, 1880.—(*Not proceeded with.*) 2*d*.

The flues of the boiler are connected at the firing end by a casing, and at the end of each is a revolving damper caused to act automatically. When one flue is fired, the damper at its end is closed, and the smoke and gas are drawn through the other fire and consumed.

5239. LOOMS, *R. Greenwood and W. H. Hayhurst.*—*14th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to stopping the loom on the completion of a given length of fabric, and it consists of a band which is wound from one roller to another, and passes through a slotted lever connected with strap fork. An adjustable stop is secured to the band.

5241. BRUSHES FOR MACHINERY FOR DRESSING AND FINISHING PILE FABRICS, *J. Worrall, J. Lawrence, and J. Lea.*—*14th December*, 1880. 6*d*.

This relates to improvements on patent No. 1910, A.D. 1880, in which rotary brushes and card rollers were caused to act upon cut pile fabrics while in a wet state, and it consists in applying perforated metallic lags to be placed over the roller. Tubes are inserted in the perforations and receive the tufts of bristles which are secured by wire ties or cement. Fine brass wire may be used instead of bristles.

5242. WEIGHING AND MEASURING MACHINES, *W. H. Baxter.*—*14th December*, 1880. 6*d*.

This relates to improvements on patent No. 3137, A.D. 1880, and it consists, First, in means for preventing the wear and tear caused by the return motion of the beam. On an arm of the beam is mounted on an axis a metallic piece so shaped as to remain always against one of two stops, and having a hook capable of engaging with the teeth of a controlling wheel. Secondly, to increase the speed of the machine the cylinder is divided longitudinally, so as to form two compartments; and Thirdly, to adapting semi-automatic weighing or measuring machines to the weighing of fluids.

5244. STOPPERING BOTTLES, JARS, &c., *H. Smith.*—*14th December*, 1880. 6*d*.

To a wire round the neck is swung a U-shaped piece, and through the stopper passes a metallic strip, one end of which is hinged to the U-shaped piece, and the other end is turned down and provided with a tongue which enters a slot in a thumb-piece pivotted to the wire round the neck at the opposite side to the U-shaped piece.

5245. RECTIFICATION OF ALCOHOL, &c., *S. Pitt.*—*14th December*, 1880.—(*A communication from the Compagnie Industrielle des Procedés Raoul Pictet.*) 6*d*.

In the boiler A a coil is placed and supplied with steam to bring the liquor or wash in the boiler to a suitable temperature. Above the boiler is a column B containing shelves alternately round and square, which

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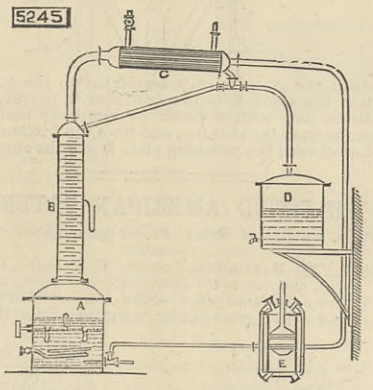

baffle the ascending vapours. From the top of the column the vapours pass to a refrigerating condenser C, similar to a tubular boiler with a cooling medium between the tubes. The liquid condensed flows into receiver D. An exhaust and forcing pump E exhausts the boiler column and refrigerating tubes, so that the operation is carried on in a partial vacuum corresponding to the desired boiling point of the alcoholic liquid.

5246. DISCHARGE AND TRANS-SHIPMENT OF CARGOES, *H. Adams.*—*14th December*, 1880. 6*d*.

A floating pontoon is formed with passages holding sufficient depth of water to float any ordinary barge. The cargo vessels are moored to the outside of the pontoon, and the passages are through the body of the pontoon, leaving a narrow crane deck only between the vessel and barge.

5247. INCREASING THE ILLUMINATING POWER OF COAL GAS, *J. Macdonald.*—*14th December*, 1880. 6*d*.

This consists in apparatus for charging coal with a carburetting material, by causing it to pass through sponges saturated with such material, the gas afterwards being heated so as to convert it into a permanent gas.

5248. BATS FOR LAWN TENNIS, &c., *S. W. Trimmings.*—*14th December*, 1880. 6*d*.

This relates to means for tightening the strings, and consists in making the strings double, and passing them through eyes, by turning which the strings will be tightened by twisting.

5249. STOCKING AND SOCK SUSPENDER CLASP, *L. von Hoven.*—*14th December*, 1880.—(*Not proceeded with.*) 2*d*.

The clasp consists of a parallel slotted tongue, within whose slot the stem of a double-headed button is free to slide. The tongue has jointed near its upper part a metal plate, between which and the stem of the button the top of the sock is held. The clasp has a loop for the attachment of the webbing.

5250. CLASPS FOR SUSPENDING STOCKINGS, &c, *L. von Hoven.*—*14th December*, 1880.—(*Not proceeded with.*) 2*d*.

A clip of metal has a claw at one end and a slot at the other, and it is bent at its centre to form a loop by which it is supported. The top of the sock is nipped between the claw and the slotted end, when they are forced together by a lever plate.

5251. BOWS AND PENDANTS FOR WATCHES, *W. R. Lake.*—*14th December*, 1880.—(*A communication from C. S. Hirst.*) 6*d*.

The pendant is formed in two sections provided on the inner faces with depressions, which, when made to correspond, form cavities to receive spherical or other shaped ends formed on the bow

5252. OVERHEAD SEWING, *A. Storer.*—*14th December*, 1880.—(*A communication from L. and J. Bollmann.*) 6*d*.

This relates to improvements on a patent dated 11th August, 1879, in which a revolving shuttle, reciprocating needle, and a reciprocating hook were employed. The frame carries two shafts, each having cams, one shaft being driven from a suitable motor, and driving the other through an intermediate wheel, which also actuates the shuttle driver through bevel gearing. The shuttle is driven by vertical pins on the driver, and extending down and working in guides. The extensions have notches which gear with a curved rib on the shuttle race, so as to be withdrawn, and allow the thread to pass over the shuttle. The shuttle has an oblong cavity to receive the cop, and is fitted with a spring nipping lever, operated by a cam, so as to release the thread when desired. The motion of the feed is adjustable by means of a sliding bar.

5253. GUN CARRIAGES, *F. C. Glaser.*—*15th December*, 1880.—(*A communication from O. Krell.*) 4*d*.

The rear end of the carriage can be connected to different sized tail pieces, so that a great variation in the angle of elevation can be obtained.

5255. SPINNING AND TWISTING WOOL, &c., *J. B. Farrar and W. Lumb.*—*15th December*, 1880. 4*d*.

This relates to a new arrangement of parts, and consists of a fixed rail A carrying dead spindles B, upon which are mounted tubes C having wharles D,

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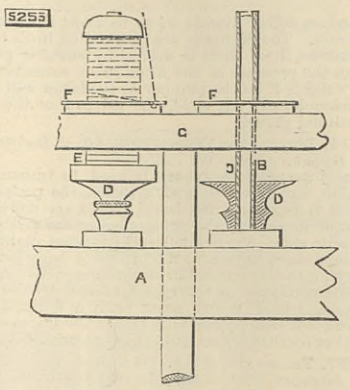

the upper flange of which is larger than the lower one, so as to afford greater frictional surface to the bottom of bobbin E. The rings and travellers F are mounted on a rail G, to which a rising and falling motion is imparted to wind the yarn on the bobbins.

5256. WIRE ROPE TRAMWAYS, *G. Brown.*—*15th December*, 1880.—(*A communication from G. Kilgour.*)—(*Not proceeded with.*) 2*d*.

This relates to the jumper or support for the wire, and consists in mounting it to move or oscillate on a centre, so that the curved rail or part in which the wire rope lies shall be free to accompany the rope in its longitudinal movements.

5257. GAS BURNERS AND REGULATORS, *J. L. Corbett.*—*15th December*, 1880. 6*d*.

The object is to provide means for controlling the supply and pressure of gas, and it consists of a tube of glass fitted in a ring at each end, the lower end terminating in a conical tube to fit in a socket of the gas bracket. The upper ring is fitted with an annular packing, and to it is fitted a gas burner. Into the tube are inserted thin loosely-fitting discs of metal pierced centrally, the holes being smaller in the lower disc than in those above, and are preferably heavier. When gas is admitted through the tube all the discs are slightly raised, and one or more of them bear against a shoulder on the upper ring, or on the under surface of the packing.

5258. CARDING ENGINES, *G. and J. Aimers and D. Wright.*—*15th December*, 1880. 6*d*.

The machine has three carding cylinders A of smaller diameter than usual, and three doffers B arranged alternately, the doffers being driven in the reverse direction to the cylinders, the latter at a high speed, and the former more slowly, so as to take off and carry round the wool from one cylinder to the

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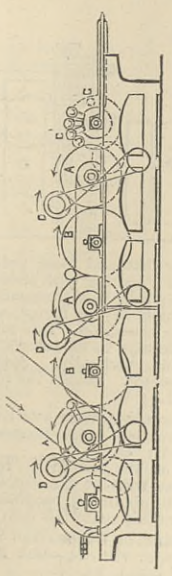

next in succession, and a stripper D being interposed between each cylinder and doffer to carry forward any wool not taken by the succeeding cylinder. A fancy roller is provided for each cylinder. Over the intake Garnett roller G are mounted smaller rollers G1 having inclined discs near the end, by which when they revolve a transverse reciprocating motion is imparted to them.

5259. CUTTERS FOR FORMING BUTTONS, *C. G. Elrick.*—*15th December*, 1880.—(*Not proceeded with.*) 2*d*.

The main feature of the invention consists in forming the cutting blades or edges of the tool separate from and adjustably fitted to the holders, which are constructed so that the blade fitted in each tool acts as a rotating planing iron to cut or "shave" the surface of the material to the desired shape.

5260. COUPLING AND UNCOUPLING PIPES TO WATER AND GAS-METERS, &c., *W. Brett and J. B. Abbey.*—*15th December*, 1880.—(*Not proceeded with.*) 2*d*.

A pipe formed with a thread has two flanges, one fast and the other placed loosely thereon. One end of the pipe is screwed into the meter pipe, and the other into the supply pipe, and the loose flange is then screwed up against the end of the pipe, so as to form a lock nut.

5262. SAFETY APPARATUS FOR MINE CAGES AND LIFTS, *G. B. Richards.*—*15th December*, 1880.—(*Not proceeded with.*) 2*d*.

The raising and lowering rope is fastened to four levers placed on each side of the guide rods, and have their fulcra on pins in the cage frame. A spiral spring is attached to the inner end of each lever, which is prolonged beyond the fulcrum and formed with teeth, which, when the rope breaks, are forced by the spring against the wooden guide rods.

5263. PREPARING COLOURING MATTERS, &c., *J. H. Johnson.*—*15th December*, 1880.—(*A communication from A. Baeyer.*) 4*d*.

This consists in the preparation of colouring matters of the indigo group by the action of reducing or deoxidising agents upon the orange-coloured compound resulting from the action of sulphuric acid upon orthonitrophenylpropiolic acid, also to the employment of sulphurous acid for rendering the blue colouring matters so obtained soluble in water.

5264. BOTTLES FOR GASEOUS LIQUIDS, &c., *F. Trotman.*—*15th December*, 1880. 6*d*.

The neck of the bottle is formed with a conical recess inside, in which a lining of cork is placed, against which an internal ball is forced by the pressure of the gas inside.

5265. COVERING OR SHEATING METAL BUSKS AND SECURING THEM IN STAYS OR CORSETS, *W. R. Lake.*—*15th December*, 1880.—(*A communication from M. H. Fouillet Chevance.*) 4*d*.

The busks are placed in tubes of woven fabrics without seams. The tubes may be formed with lists or edges by which they may be sewn on the stay or corset.

5266. WITHDRAWING OR FORCING AIR FOR VENTILATING, &c., *W. and B. Verity.*—*15th December*, 1880. 6*d*.

This consists in surrounding the central inlet opening of revolving fans with a cylinder projecting outwards from the end of the casing parallel with the axis, to which fan or screw blades are secured and contained within the cylinder. A is the fixed outer casing; B the axis carrying fan blades C and screw

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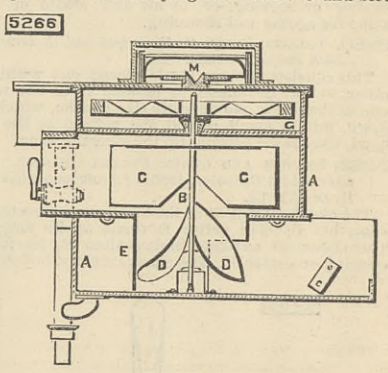

blades D surrounded by cylinder . The drawing represents the fan as being driven by jets of water impinging on the toothed wheel G. The top of the axis ends in a cone point entering a recess in the bottom of the oil vessel M capable of moving vertically in guides.

5267. FASTENINGS FOR NECKTIES, &c., *E. de Pass.*—*15th December*, 1880.—(*A communication from S. Hayem, aîné.*) 6*d*.

The fastening is composed of a baseplate with guides in which the pin slides, such pin having a knob passing through a button-hole in the stiffening piece of the necktie, and serving to move the prong so as to cause it to engage with the end of the band.

5269. LOCOMOTIVE ENGINES FOR TRAMWAYS, *J. R. Wigham.*—*15th December*, 1880.—(*Not proceeded with.*) 2*d*.

The engine may be driven either by gas, steam, or compressed air. The motion of the driving shaft is communicated to wheels by an arrangement of variable speed pulleys.

5271. AUTOMATIC SHEET REGISTERING APPARATUS FOR PRINTING MACHINES, *W. R. Lake.*—*15th December*, 1880.—(*A communication from T. M. Vieillemard.*) 6*d*.

Instead of placing the sheet by hand upon needles or points, a mechanical device is employed to ensure the correct laying of the sheets in the printing machine. The sheet, upon the edge of which triangular notches are first formed, is pushed by hand against

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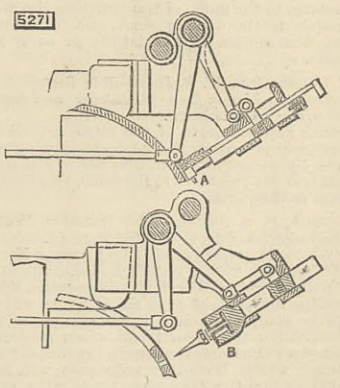

guiding bars A, the position of which corresponds with the notches on the paper. Needles or points B, which, as well as bars A, are operated mechanically, enter holes previously formed in the sheet. When the points enter the holes, the grippers or fingers seize the sheet, and before the cylinder commences its movement the points are lifted.

5273. SCORING PLATE FOR TENNIS RACKETS, *F. Heinrich.*—*16th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in applying sliding pointers moving over suitable plates with figures in the handle of the bat.

5274. JOINING LEATHER STRAPS FOR DRIVING BELTS, &c., *T. Wheelhouse.*—*16th December*, 1880.—(*Not proceeded with.*) 2*d*.

The ends of the strap are connected by a dovetail or tenon connection, which is then stitched or sewn.

5275. ELECTRIC LIGHTING, &c., *D. G. Fitzgerald.*—*16th December*, 1880.—(*Not proceeded with.*) 2*d*.

The carbons used have any degree of hardness imparted to them by treating them with solutions rich in carbon, also with salts of the refractory metals, and with salts such as those of magnesium and cadmium, which, when decomposed, furnish an infusible earth or oxide. To facilitate perfect contact with the carbon, the terminals are coated with any suitable metal. It is preferred to enclose the carbon in a glass vessel filled with acetylene, cyanogen, olefiant gas or vapour of mineral naphtha.

5278. DREDGING APPARATUS, *J. Standfield and J. L. Clark.*—*16th December*, 1880. 6*d*.

This relates to the dredging skip or excavator, and consists of a framework formed of four uprights A

connected by cross bars, and brought together at top, where they are rivetted to a crown plate B. At about the middle of the frame is a pair of beams C, from which hangers D and E are suspended, the former carrying the axis G of the main scoop F, and the

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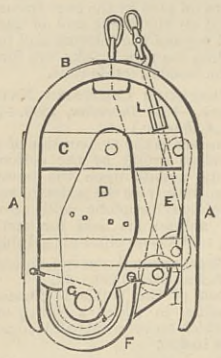

latter an axis of a sheave I, and a loose pair of plates. The sheave carries the main chain. Upon each end of the scoop axis is a pulley, on each of which is wound a chain to cause the scoop to turn over, the other end of which is secured to a spreading beam or butterfly nut L.

5279. DRYING, STOVING, AGEING, OR STEAMING, YARN OR THREAD, *T. P. Millar.*—16*th December*, 1880. 6*d*.

The essential feature consists in treating the yarn or thread in a loose state, free from strain and from liability to breakage of threads. The yarn or thread in a loose form is laid on carriers, which impart to it a progressive motion through chambers or passages in which it is subjected to the action of heated air for drying or stoving, or to air and steam or steam alone for ageing and steaming.

5280. TOBACCO PIPES, *H. E. Gräpel and J. Candelent.*—16*th December*, 1880. 6*d*.

This consists of three bowls placed one within the other, so that the smoke in passing from the middle one to the outer one deposits all nicotine, which runs down into a small cap at the bottom of the outer bowl, the smoke passing up through the stem.

5283. SNATCH AND OTHER PULLEY BLOCKS, *W. R. Lake.*—16*th December*, 1880.—(*A communication from H. Loud.*) 6*d*.

The cheeks B and B¹ of the block are connected by a cross bar C. The pulley D turns on its journal E. The cheek B¹ extends higher than B, leaving the opening or snatch F. The cheeks are cast hollow, with

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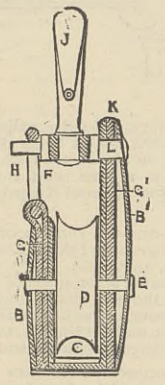

opening at the top and bottom of each for the insertion of the iron straps G and G¹, the former being doubled on itself, so as to form an eye at top to receive a link H, on which it swings. The hook J swivels in a piece K turning on a journal L, the other end passing through link H, and being bent at right angles to prevent displacement.

5284. SUPPLYING PURE AIR TO CITIES, &c., *O. Seydel.*—16*th December*, 1880. 4*d*.

Pure air is conveyed in pipes from the seashore or other convenient locality by means of fans, and delivered to houses or other places through suitable cocks.

5285. TRICYCLES, &c., *J. Stee'e.*—16*th December*, 1880. 8*d*.

This relates to the mode of transmitting the motion of the pedals to the driving shaft, and to means for reversing the motion of the latter, so as to move backwards.

5286. PURSES, &c., *W. R. Lake.*—16*th December*, 1880.—(*A communication from W. Leissler and Sohn.*)—(*Not proceeded with.*) 2*d*.

The cover flap and folds of the purse are all made from one piece of leather shaped by stretching it in a wet state by means of a suitable tool. The middle partition is at the rim sewn to the folds, this being the only seam in the purse.

5288. IRON, *P. S. Justice.*—17*th December*, 1880.—(*A communication from C. M. Dupuy.*) 4*d*.

This relates to improvements on patents No. 1664, A.D. 1877, and No. 3827, A.D. 1880, and consists in combining pulverised iron bearing carbonaceous, fluxing, and binding materials of such character as will allow them to be compressed into moulded masses which will practically retain their forms when subjected to the heat of a reducing furnace until the metal "comes to nature," whilst the other substance will form a substantially non-flowing glazing slag for the purpose of preserving the newly-formed metal from oxidisation. The iron and other materials are moulded into forms which will present the greatest surface to the action of the heat of a furnace.

5289. BRAKE FOR OMNIBUSES, RAILWAY CARRIAGES, &c., *G. M. F. Molesworth.*—17*th December*, 1880. 6*d*.

To the hub of the wheel A is attached the grooved brake pulley H, round which passes a brake band having blocks B to fit the groove, and connected by

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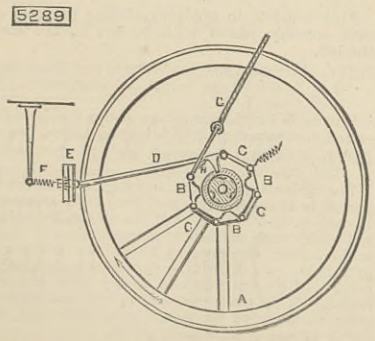

links C. From one end of the band a rod D proceeds, and is secured to a brake block E to bear on the periphery of the wheel, and held back by spring F. The other end of the brake band terminates in a rod or wire G connected to the foot or other lever for applying the brake.

5290. PAVING ROADS, &c., WITH WOOD, &c., *B. J. B. Mills.*—17*th December*, 1880.—(*A communication from A. Trenaunay.*) 8*d*.

The blocks are of American fir or deal, and have a groove at their base across the width of the block to cause them to adhere better to the fusible lava or to hydraulic mortar placed on the ground. The blocks are coated with a plastic waterproof material.

5292. PUMPS, *R. G. Abercrombie.*—17*th December*, 1880. 6*d*.

This relates to pumps in which a pressure regulator is required, and it consists in making the plunger in two parts, an inner plunger A, and an outer annular plunger B. On the plunger A a collar disc D is secured, between which and the top end of plunger B a spring is inserted, the plunger B being loaded with weights F

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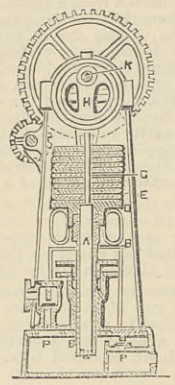

placed on collar disc D so as to exert the necessary pressure. The plungers are worked by links G from excentrics H on shaft K driven by suitable gearing. When the pressure in the filter press exceeds that of the weights F on the plunger A, the latter will rise as B descends, and *vice versâ*, the valves P of the pump remaining at rest.

5294. WHEELS FOR VELOCIPEDES, &c., *J. Radges.*—17*th December*, 1880. 6*d*.

An intermediate wheel is used to transmit the motion, and it consists of a wheel, the periphery of which is recessed, and has a flange on one side, a similar loose annular flange being secured on the opposite side. Bushed holes are formed at intervals in the flanges to receive the pivots of balls gradually tapering to a truncated conical shape at each end, the pivots revolving in the case-hardened bushes of the flanges. This wheel gears with a toothed wheel driven by the pedals, and transmits its motion to another toothed wheel actuating the driving wheel.

5297. TRAMWAYS, *W. F. Clark and A. Ward.*—17*th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to the permanent way in which the rails are supported by metal chairs or sleepers, and it consists in the use of a flat rail with a groove for the wheel, and side cheeks which embrace a longitudinal wooden bearer. In the side cheeks are holes, and corresponding holes are formed in the jaws of the chairs to receive the bearer, and through the holes dogs are driven.

5298. COMPRESSING AND MOULDING GUNPOWDER, &c., *J. James.*—17*th December*, 1880.—(*Not proceeded with.*) 2*d*.

A stationary mould-plate with suitable shaped holes is provided, and both above and beneath it are hydraulic cylinders, the ram of each being fitted with punches corresponding to the holes in the mould-plate.

5300. IRON AND STEEL, *S. Pitt.*—17*th December*, 1880.—(*A communication from M. Rollet.*) 4*d*.

This relates to the manufacture of steel from sulphurous and phosphatic cast irons, and it consists, First, in submitting cast iron at a high temperature to a reducing action to the oxygenised compounds of sulphur in the presence of a slag, which will be more and more basic as the iron is more and more sulphurous; Secondly, in finishing the refining of the cast iron so treated in a basic converter, or in a furnace with a basic sole.

5301. OBTAINING MOTIVE POWER, *E. W. Hughes.*—17*th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to means to enable a fly or driving wheel to be constantly revolved without other motive power than gravitation and centrifugal force.

5305. FORMING SHEET METAL, &c., INTO VARIOUS SHAPES, *H. R. Minns.*—17*th December*, 1880. 6*d*.

This relates to machines for forming sheet metal, card, leather, or other materials into shapes and forms such as hollowing, curving, and flanging in one operation. The shaping rollers B revolve in bearings, and

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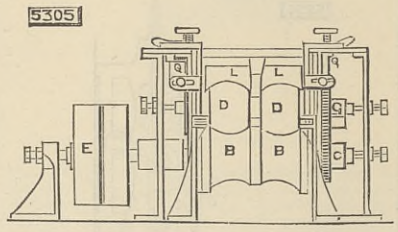

are driven by fast and loose pulley E, and carry a toothed wheel C gearing with another wheel G on the shaft of the top rolls D, corresponding to the shape of the rolls B which have a flange, so as to curve and flange at one operation. The rollers B and D are adjustable sideways by set screws, and the rollers D are adjustable vertically. Springs Q exert the necessary pressure. Behind the rollers B and D are other rollers L.

5307. PRODUCING ROTARY AND RECTILINEAR MOTION, &c., *J. Frearson.*—18*th December*, 1880.—(*Not proceeded with.*) 4*d*.

One part of the invention relates to obtaining rotary motion without the use of a rotating crank, and another to obtaining rectilinear motion for feeding metals or other materials into machines.

5309. MARKING OR DECORATING VITREOUS OR GLAZED SURFACES, *O. Vallette.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d*.

Vitrifiable colour in a powder, borax, and some fatty substance, are mixed together and placed in a flask. A stamp, consisting of a glycerole of gelatine applied to a plate, is used, and the mixture is applied thereto, and then applied to the surface to be ornamented, which is then placed in a muffle.

5310. TREATING TOBACCO, &c., *T. W. Beale.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to the treatment of tobacco with quinine or other drugs possessing properties to neutralise the poisonous matters contained in the tobacco.

5312. HEATING AND COOLING HUMAN OR ANIMAL BODIES FOR MEDICAL OR SURGICAL PURPOSES, &c., *W. P. Thompson.*—18*th December*, 1880.—(*A communication from J. Leiter.*) 6*d*.

This consists mainly of tin or tinned lead pipes disposed in the form of coils or bent backwards and forwards, so as to cover the desired part, and through which hot or cold water is passed from an elevated vessel.

5313. METALLIC ALLOYS OR COMPOUNDS, *G. A. Dick.*—18*th December*, 1880.—(*Partly a communication from C. A. J. Dick.*) 4*d*.

This consists of an alloy specially applicable for castings, and composed of over 50 per cent. wrought iron or mild steel combined with not more than 25 per cent. of copper and tin, with or without the addition of not more than 10 per cent. of lead. The alloy must also contain not more than 2 per cent. of phosphorus.

5314. REGULATING OR GOVERNING PATTERNS OF WORK TO BE PRODUCED IN BRAIDING MACHINES, &c., *F. E. A. Büsche.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d*.

A rotary shaft driven from the braiding machine carries a cam to impart the lifting motion to the slide carrying the lifter bars. The directors as well as the stop actions of the braiding machine are connected with hooked wires combined with levers or guide rollers. The wires pass through loops of horizontal needles operated upon by perforated pattern cards, as in a jacquard apparatus, the hooked wires being lifted by the lifter bars in the slide.

5317. TRAM RAILS, &c., *C. Dunscombe.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d*.

The rails are of cast iron or steel, preferably formed in one piece with the sleeper, the top surface being chilled, and anchoring jaws extending downwards and outwards from the bottom of the sleeper. The crossings, points, and junctions are similarly formed, and a movable point or switch which can be taken up without disturbing the rail sleeper, is employed, and is made of Bessemer steel or other metal, such switch swinging on a cylindrical conical-headed screwed bolt of phosphor bronze.

5327. COLOURING MATTERS FOR DYEING AND PRINTING, *J. A. Dixon.*—20*th December*, 1880.—(*A communication from Dr. C. Kœnig.*) 4*d*.

This relates to the manufacture of yellow colouring matters, consisting of tetranitro-naphthol, obtained by energetic nitration of a monoholagen compound o naphthalene, so as to produce the corresponding tetranitro halogen-substituted naphthalene compound, and in then substituting in the latter hydroxyl for the halagen, so as to produce the tetranitro naphthol, or its sodium or other salt.

5351. SURFACE CONDENSERS, *I. R. Blumenberg.*—21*st December*, 1880. 6*d*.

The main objects of the invention are to produce a condenser of small exterior dimensions and weight, large condensing surface, and using a minimum quantity of condensing liquid, at the same time also affording a facility for being increased in size to almost any extent, and also avoiding the strain on tube joints by unequal expansion by heat. The condenser consists of a chamber of a U form, the two arms of which diverge outwardly from the bend. It is made in two halves bolted together, and through it passes the pipes or chambers containing the gas or vapour or steam to be condensed, water being forced through the intermediate space in the opposite direction to the passage of the gas or vapour or steam. To increase the size of the condenser any width of flat rubber or corrugated intermediate chamber may be placed between the two arms.

223. APPARATUS FOR GLAZING RICE, COFFEE, &c., *H. J. Haddan.*—18*th January*, 1881.—(*A communication from A. Leytens.*)—(*Complete.*) 4*d*.

The apparatus is composed of a frame of any suitable shape and construction, provided with discharge openings. In the centre of this frame is the drawing shaft, which sets the apparatus in motion. Upon this frame rests the fixed stone E made of (Venetian) talc or of any other suitable material. The upper part of this stone is surrounded by a metallic sieve F, through

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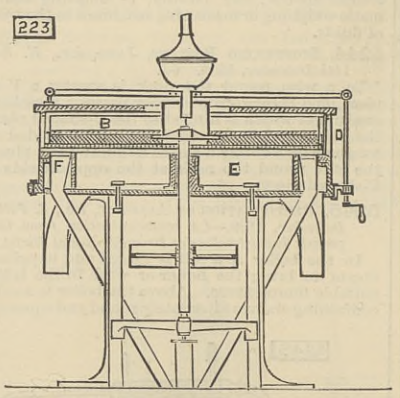

which the glazed rice is conducted to the fall pipe. Over the stone E is the ventilator B, provided with blades, and with a brush for removing that which results from the shaking, and from the friction of the rice between the polishing plate D and the stone E.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

242,177. HARVESTER BINDER, *W. R. Baker, Chicago, Ill., assignor to the McCormick Harvesting Machine Company, same place.*—*Filed March 3rd*, 1881.

Claim.—In a grain-binder, a support E for the com

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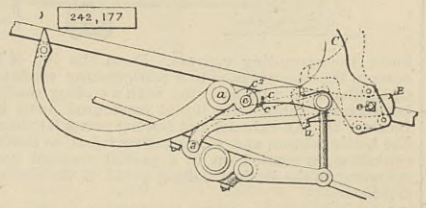

pressing and tripping fingers C, hinged to the binding arm, in combination with a pin C, on support E, and a lip C¹, on the binding arm, all arranged to operate substantially as and for the purpose specified.

242,440. STEAM PUMP, *David Evans, Connellsville, Pa., assignor to Boyts, Porter, and Co., same place.*—*Filed March 16th*, 1881.

Claim.—(1) In a single-cylinder steam pumping engine, an oscillating flat valve arranged in an auxiliary

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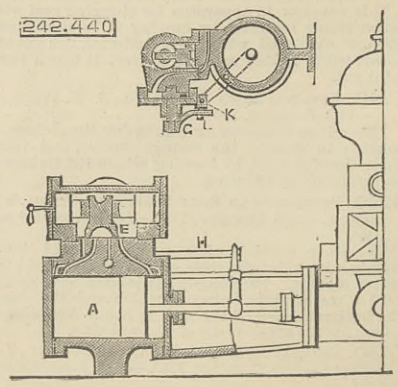

steam-chest, formed upon one side of the main steam-chest, and having direct communication with it, substantially as and for the purpose specified. (2) In a steam pumping engine, an oscillating flat valve arranged in an auxiliary steam-chest formed upon one side of the main steam-chest, and having direct communication with it, in combination with a piston-valve and the steam-cylinder A, substantially as and for the purpose set forth. (3) In a single-cylinder steam pumping engine, an oscillating flat valve arranged in an auxiliary steam-chest formed upon one side of the main steam-chest, the seat of said valve having the oblong ports $h\,h^1$, whereby to cause the slide valve E to be operated so as to cause it to open the whole length of the port at once, substantially as described, for the purpose specified. (4) In a steam pumping engine, the combination of the flat oscillating valve G, provided with a stem g, and pendant arm I, with the rod H, having gibs $l\,l$, and the fixed guide k for said rod, all constructed and arranged substantially as specified. (5) In a steam pumping engine, the combination, with the slide valve E and its steam-moved piston, having piston heads at each end and arranged in relation to such valve, substantially as described, of an oscillating flat valve provided with a face recess, and arranged in an auxiliary steam-chest communicating with the main steam-chest, substantially as described.

242,464. INDUCTION PIPE FOR BOGIE LOCOMOTIVES, *William Mason, Taunton, Mass.*—*Filed April 2nd*, 1881.

Claim.—(1) The connecting-bolts and the springs applied to them as set forth, in combination with two next adjacent sections of the steam-pipe, adapted to each other by a spheric-segmental joint, all being constructed and arranged substantially as specified. (2)

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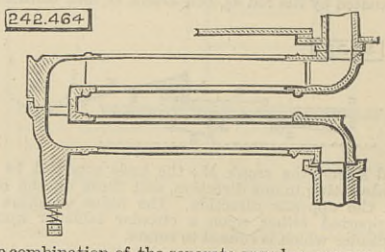

The combination of the separate annulus, convex and flat, as described, with the two pipe-sections or elbows thereof adapted to such annulus, as explained, and held together and to it by bolts and springs, all being constructed and arranged substantially as set forth.

242,488. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES, *Elihu Thomson, New Britain, Conn.*—*Filed January 10th*, 1881.

Brief.—By a peculiar construction of the commutator-plates, each one of the three plates extends 180 deg. around the commutator. *Claim.*—(1) In a dynamo-electric machine, a commutator containing three or more segmental blocks, substantially as described, each block covering an angle equal to the angular distance of the commutator brushes apart, whereby the armature wire terminals are put into connection with both commutator brushes when at or near the neutral point. (2) In a dynamo-electric

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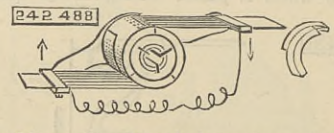

machine, a three-branched armature coil system, the free terminals of which are connected singly to three segments of a commutator-ring, each segment covering an angle of 180 deg., substantially as described, and provided with a pair of commutator brushes resting on diametrically opposite portions of said commutator-rings. (3) In a dynamo-electric machine, a system of armature coil terminals connected successively to segments of the commutator, and adapted to be put successively into connection with both commutator brushes when at or near the point of neutral polarity, substantially as described.

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ON the Clyde about 300,000 tons of shipping were in hand or ordered at the beginning of the year; about half this tonnage has since been launched, and about 100 vessels more are on the stocks. The output on the Tyne has increased proportionately, an average of two steamers per week having been launched since January. The total tonnage on the Wear has even surpassed that of the Tyne, while on the Tees the total much exceeds that of the corresponding period of 1880.