BOARD OF TRADE RETURNS AND CONTINUOUS

BRAKES. On Monday night Earl De La Warr moved that the House of Lords should go into committee on the Continuous Brakes Bill. This Bill, it will be remembered, proposes to make it compulsory that railway companies shall adopt some form of continuous brake on all passenger Lord Colville of Culross moved the previous questrains. Lord Colvine of Curross moved the previous ques-tion; that is to say, he wished the progress of the Bill to be delayed indefinitely. His arguments may be briefly summed up. They are embodied in the statement that railway companies had not any object in killing or maim-ing people; their great desire was to carry their passengers with the utmost safety, not only on the ground of humanity, but because of that very new word compensation. Accord trains. but because of that very ugly word, compensation. According to the report of the Board of Trade for 1880, the last which had been issued, no fewer than 603,884,000 railway journeys had been made in this country in the course of the year, and only twenty-nine persons were killed from circumstances beyond their own control, being at the rate of one in 20,927,034 persons who travelled on railways, or, including season ticket holders, one person in every 24,600,000. That, if compared with walking in the streets of London was compared with walking in the streets of London, was comparative safety. According to a letter from a practical engineer, there were many accidents which might happen without the automatic brake giving the slightest warning—so long as the couplings did not break—such as a train jumping off the line or taking fire. In the face of such testimony he could not accept any compulsory legislation on the subject from a private member of that House, and he trusted their lordships would support him in moving the previous question. Lord Colville might have used precisely similar argu-ments against any proposal whatever to interfere with the liberties of railway companies. On his showing, the Board of Trade should not inspect bridges, or signals; and it is unfair to the companies to compel them to obtain a continuate here a line and he would be compensated. a certificate before a line can be used to carry passengers. He evidently failed to see that the immunity from danger He evidently failed to see that the immunity from danger now enjoyed by the travelling public results in a large measure from that very interference, the extension of which he deprecates. There was, however, much force in Lord Cairns' argument that it was very desirable that a system of continuous brakes should be adopted, and if the Board of Trade had made up its mind as to the best system and had come to Parliament for powers to compel its adop-tion he for one should be your which diposed to grant the tion, he for one should be very much disposed to grant the request. But that was just what the Board had not done. By the Bill Parliament was asked to stereotype now and for ever, or at any rate until the Act was repealed, a sort of ideal brake, and to submit the question whether the brakes of the various companies answered the require-ments of the Act to a body of gentlemen—the Railway Commissioners—who were utterly unfit to determine such matters. Such questions were altogether foreign to the matters. Such questions were altogether foreign to the business the Commissioners were appointed to transact, and he held that duties of this nature ought not to be thrown upon them. In this we fully agree with Lord Cairns. But is it not certain that such modifications might be made in the Bill while in Committee as would get over this difficulty? The conditions laid down by the Board of Trade are quite intelligible, and there ought to be no great trouble in ascertaining whether any given system of brake did or did not comply with these conditions. The point would not have to be settled by the railway companies unaided, the engineer officers of the Railway Department of the Board being quite competent to Department of the Board being quite competent to decide, not, we will say, on the merits of a brake, but as to whether it did or did not comply with the conditions laid down. Thus it takes no very great effort of skill to say whether a brake is or is not automatic; whether it can be applied by both guard argin being can be applied by both guard and engine-driver, and so on. After something had been said by Lord De La Warr, and others, the previous question was carried without a discus-sion, and so for the present a Bill which has been read a second time is shelved.

The Westinghouse Brake Company has recently issued a pamphlet which deserves particular attention, inasmuch as it brings very grave charges against certain railway companies. The Board of Trade is empowered to obtain from railway companies complete returns of all accidents with, and failures of continuous brakes, and it is obviously of much importance that these returns should be quite accurate; if for no other reason, then because they are used by rival inventors as weapons with which to attack each other; and being issued under the sanction, so to speak, of the Board of Trade, they acquire official importance. Now the pamphlet to which we have referred states in very explicit terms that the returns are incomplete, and that they have been incomplete from the first; and the imper-fection is discovered by comparing the brake returns with the official reports of the Board of Trade inspectors. Thus, on September 2nd, 1878, on the Lancashire and Yorkshire Railway, at Wakefield, a collision occurred between two passenger trains caused by the yonum barber filling to passenger trains, caused by the vacuum brake failing to act owing to the flap of the release valve breaking off. The inspector remarked that this accident furnished a strong argument in favour of the general adoption of automatic brakes. This case was not included in the returns to the Board of Trade, nor, we are told, was any one of the following :---On June 27th, 1881, a collision occurred at Huskisson station, on the Cheshire Lines Railway, between two passenger trains, upon a down gradient, and was caused by the failure of the vacuum brake to act, owing to the coupling coming undone between the tender and the train. Three out of the four passengers in the train were injured. On the 11th August, in the same year, the 8.30 express from King's Cross broke away in the Calton Tunnel, close to Edinburgh. The rear seven vehicles ran back for about 1000 yards, and came into collision with a passenger train standing in Musselburgh. The gradient is 1 in 78. The train was fitted with a Smith vaccum brake. There were ten persons injured. On December 8th, 1881, a collision took place on the Cheshire Lines Railway, near Manchester Central Station. A train fitted with the vacuum brake ran into injured. On December 8th, 1881, a collision took place on the Cheshire Lines Railway, near Manchester Central Station. A train fitted with the vacuum brake ran into another train, which it was following on the same line of

rails. Nine vehicles were badly and eight slightly damaged, and the front train, which was in motion when struck, was severed in three places. There were twenty-seven people injured. In another case the vacuum brake proved use-less. An axle broke near Bawtry on the Great Northern Railway, and rendered the brake *hors de combat*. We have in all particulars of six collisions caused by the failure of the vacuum brake, and concerning four of these not a syllable is said in the Board of Trade returns. It is, of course, possible that the silence of the railway companies or course, possible that the shence of the rankay companies concerned was due to inadvertence; but the public will, we fear, be disposed to assume that the companies wilfully suppressed the mention of a disagreeable fact. But the pamphlet does not rest here. It goes on to point out that in very many cases the returns cannot fail to mislead. For example, we may cite the following comparison of the Westinghouse brake on the Midland and North-Eastern reilways Eastern railways :

	Total brakes in use on engines and car- riages.	Number of reports.	Proportion of reports to brakes.	Miles run.	Proportion of reports to miles run.	should support the ot be co		
land	332	115	1 for 2 9	430,931	1 in 3747	11.3	10.7	
th-Eastern	1984	68	1 for 29	2,734,357	1 in 40,210	686	729	

Mid

Here we see that the failures of the brake on the Midland are apparently ten times as numerous as they are on the North-Eastern. Can this really be the truth ? If so, why so ? The North-Eastern Company uses the Westinghouse brake almost exclusively. On the Midland the Clayton brake is favoured. This is an automatic vacuum brake with a belt of automatic vacuum brake with a leak-off arrangement, which takes it off in about one and a-half minutes after it has been put on. We forbear to draw any deduction; but we think it desirable that some explanation should be given by the companies some explanation should be given by the companies concerned as regards the enormous discrepancy. The Westinghouse pamphlet deliberately states that "the Midland Company for the last half year return only 5 per cent. of the total miles run with the Westinghouse brake, but have managed to provide 21 per cent. of the reports against it. The returns for the last three half-years show that this same company return less than 7 per cent of the miles and 25 per cent of the reports while cent. of the miles, and 25 per cent. of the reports ; while over the whole of the period for which these returns have been issued, the miles run amount to less than 10 per cent. and the reports to 32 per cent. of the totals during the four years ending December, 1881." We have said enough, we think, to show that the returns of the Board of Trade are probably very inaccurate, and it remains to be seen how they are to be wede other

and it remains to be seen how they are to be made other-wise. It is clear that if they are to be of any value at all they must be truthful, and we hope it may be in the power of the Board of Trade to secure accuracy. When we see the most trumpery mishaps carefully recorded in some instances, while important failures, risking the lives and injuring the bodies of many passengers, are passed over in silence, we find it difficult to resist the impression that the officials who prepare the returns are not blessed with that perception of the value of minute accuracy which is essential in preparing returns of this kind, and is usually found associated with perfect honesty of purpose. To us it seems clear that the pamphlet from which we have quoted deserves the attention of the directors of the railway companies concerned, on whom ultimately devolves all responsibility for the accuracy of the returns made by their officials to the Board of Trade.

ELECTRICAL ACCUMULATORS OR SECONDARY BATTERIES.

BY PROFESSOR OLIVER J. LODGE, D.Sc.

No. II.

No. II. A PLANTE and a Faure cell, though the process, and more especially the time, of formation is different, are, when formed, pretty much the same thing; and consist of two plates of lead, one coated with black peroxide of lead (Pb O_{*}), the other with a spongy material consisting of metallic lead in a fine state of division and more or less alloyed with hydrogen; both plates immersed in dilute sulphuric acid of about ordinary battery strength. Two plates in this condition must, as explained last week, give a current when con-nected by a wire, the positive current flowing along the wire from the peroxide coated plate—the + plate—to the spongy metallic — plate, and back through the liquid in the other direction; the spongy lead becoming gradually oxidised, and the peroxide reduced to some lower oxide, all oxidised, and the peroxide reduced to some lower oxide, all the time the current lasts, *i.e.*, until the condition of the surfaces has become either temporarily or permanently the same. In order to bring the plates into the active condi-tion they are first coated with oxide of lead, either electrically—by Planté—or mechanically—by Faure, which is then acted on by an electric current passed through the cell for some considerable time, the current being made to enter the liquid at the plate which is to be peroxidised, and to leave it at the plate which is to be reduced. Hence the former of these plates may be per-manently labelled +; for when charging the cell the current enters at it, and when discharging the cell the current sets out from it. The other plate is similarly always —. There need therefore be no ambiguity about these terms. The + plate is always to be connected with the positive pole of the dynamo, whether the latter is supplying the current to the battery and charging it, or whether the dynamo is receiving the current from the battery and being driven by it. battery and being driven by it.

is undergoing decomposition, and that every such radicle possesses a certain definite charge of electricity which it it is set free by combination with its fellows, or else when it is made to combine with something in metallic communicais made to combine with something in metallic communica-tion with the electrode. It was also stated that the charge of electricity possessed by a dissociated monad radicle is constant; and that diads have twice this charge, triads thrice, and so on. From these considerations it follows— as was proved by Faraday—that for a given weight of substance decomposed, a definite quantity of electricity is required; a quantity which will be known as soon as we know the number of atoms liberated, the electrical charge of each, and the weight of each. Let a be the dissociation of each, and the weight of each. Let q be the dissociation charge of a free hydrogen or other monad atom or radicle. We do not know the value of q yet, we only know that it is perfectly definite and unchangeable. Let μ be the weight of any atom or compound radicle released from a combina-tion in which it acted as a k-ad; in other words, let its active atomicity have been reduced by k, or let k be the number of bonds which have been broken in the act of making it a free radicle—whichever way of expressing it is preferred-then it is necessarily possessed of an electrical

The preference of the number of such atoms delivered up to an electricity Q = N k q must have passed through the cell; and the weight of the substance liberated in the same time is $N\mu$ —call this M. Then

$$\frac{M}{Q} = \frac{\mu}{kq}$$

Now, in the right-hand side of this equation k is the only thing we know; we only know the relative weight of different atoms, not the absolute weight of any. Let k be the absolute weight of a hydrogen atom, and m the number ordinarily known in chemistry as "atomic weight," viz., the number which expresses the weight of any atom relatively to hydrogen, so that $\mu = m h$; then the above equation may be written

$$\frac{\mathbf{M}}{\mathbf{Q}} = \frac{m}{k} \cdot \frac{h}{q}$$

Now, though neither h nor q are yet known, their ratio has been determined by careful measurement, and it is $\frac{1}{2505}$ in C. G. S. units; in other words, the electrical charge of a free hydrogen atom is 9505 times its weight in grammes. And the charge of any other radicle of atomic weight m and with k free bonds is $\frac{1}{2505} k$ 9505 k times its weight in grammes.

If the weight of the substance be expressed in pounds, and the quantity of electricity concerned in its liberation or decomposition in Ampère-hours—as for practical pur-poses is rather convenient—the above number 9505 becomes 12,020, or, with sufficient accuracy in ordinary cases, 12,000. So we will now repeat the above equation in an easy and practically useful form :—

Weight of substance acted on in a single cell, in pounds Quantity of electricity passed = through it, in Ampère-hours

ordinary "atomic weight" of the substance

12,000 times the number of bonds released per atom of the substance.

Whether the "substance" is the constituent which is Whether the "substance" is the constituent which is liberated at the positive or at the negative pole, or whether it is the original compound, which is not "liberated" at all but decomposed, matters nothing. The above state-ment is perfectly general and universally applicable. It applies also when it is recomposition that is going on instead of decomposition.

The expression "number of bonds released or joined per molecule" is not a happy one, but the phrase "change of valency" is no better, and the very simple meaning intended to be expressed is best conveyed by an example. Suppose Cu SO₄ is being decomposed; two bonds are released when Cu separates from SO₄, hence Weight of sulphate of copper decomposed $= \frac{63\cdot5+32+64}{24,000}$ Quantity of electricity passing through it 24,000

But we might equally well write— $\frac{\text{Weight of copper deposited}}{\text{Quantity of E required}} = \frac{63.5}{24,000}$

Take as another example the decomposition of common dilute sulphuric acid, with copper electrodes say, Weight of hydrogen set free ____1

- $\frac{1}{\text{Quantity of E passed through cell}} = \frac{1}{12,000}$
- Quantity of E passed introd Weight of sulphuric acid decomposed $= \frac{98}{24,000}$

Weight of sulphate of copper formed at

 $\frac{\text{the expense of the oxygen electrode}}{\text{Quantity of E}} = \frac{159.5}{24,000}$ Quantity of E

Suppose nitrate of silver is the substance acted on. Here only one bond is released per molecule, so Weight of silver deposited 108

$$\frac{10 \text{ gnt of sliver deposited}}{\text{Ouantity of E}} = \frac{108}{12.000}$$

Weight of nitrate of silver decomposed $= \frac{170}{12,000}$

Finally, suppose the substance acted on is Pb O, the protoxide of lead, then

 $\frac{\text{Weight of litharge oxidised to peroxide}}{\text{Quantity of E required.}} = \frac{223}{24,000}$

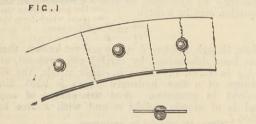
Weight of litharge reduced to metallic lead, the same. Thus a current of one Ampère is able to oxidise on one side of a Faure cell $\frac{223}{24,000}$ lb. of litharge per hour, provided there is no waste, nor any gas given off, and to reduce the same amount on the other side. Or, every pound of litharge on either side of a Faure cell requires

108 Ampère-hours for its reduction and oxidation. If instead of one cell a number n are taken and arranged

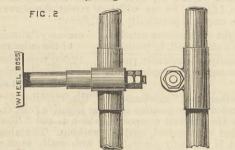
in series, and the current sent through them, all the above action goes on in each cell, so of course the total decomposition will be n times as great. O. J. L. Liverpool, May 20th.

EXHIBITION OF BICYCLES AND TRICYCLES. A COLLECTION OF DICTULES AND INTUCTULES. A COLLECTION of bicycles and tricycles has during the past week been on exhibition in the Aquarium, and some of the machines shown exhibit great ingenuity of design and good workmanship. There are, generally speaking, but two kinds of bicycles and five of tricycles. Of bicycles there are (1) those so commonly known that it is quite unnecessary to describe them, and (2) those which have attached to the main wheel fork a swinging lever and treadle, by which means the rider's sect and a swinging lever and treadle, by which means the rider's seat and, therefore, the rider can be placed much farther to the rear of the driving wheel than in the ordinary bicycle, and the risk of being thrown forward off the saddle when the driver meets an obstruction is very much lessened. Some of the details of these bicycles are very ingenious, and the arrangement of treadle levers will make the bicycle a favourite with many who had pre-viously looked upon it as too dangerous. Many of the makers are using main bearings in which rubbing friction is reduced by are using main bearings in which rubbing friction is reduced by the employment of loose rolling friction balls. Even in these ball bearings there is, of course, some friction, but it is mostly rolling friction. Of the tricycles there are (1) those having the third or steering wheel in front; (2) those having this wheel behind; (3) those having straight through axles for the main road wheels; (4) those having stud axles for the main road wheels; (5) those worked by hand instead of by the feet; (6) those worked by gearing; and (7) those worked by pitch chain. Generally it may be taken that arrangement No. 1 is better than No. 2, and that No. 3 is in any case better than No. 4. Between 6 and 7 there is little to choose, though, per-haps, the pitch chain well made may be generally the better haps, the pitch chain well made may be generally the better arrangement.

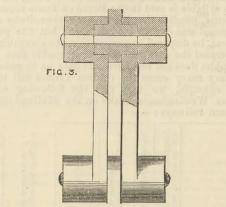
In referring to some of the exhibited machines, and com-In referring to some of the exhibited machines, and com-mencing at one end, we first notice a tricycle, by the Howe Machine Company, having two speeds, one being for going up hill, when the crank makes about five revolutions to, say, four of the wheels. The gearing consists of a steel tape, to which is rivetted along the centre a number of studs, which take into corresponding holes at about $1\frac{1}{2}$ in, pitch in the small wheels on the crank shaft and driving wheel bosses, a piece of flat steel being held by each rivet as in Fig. 1. As either one or other speed



may be thrown into gear they may be both thrown out, so that the feet need not move in going down hill. This belongs to Class 4, the axle being as shown in Fig. 2, and also to Class 2. This tape-driving gear we should not consider as good as a chain, and it is questionable whether there is not too much complication of parts in the double set of gearing.

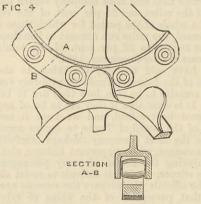


The Manchester Company shows a tricycle belonging to tance. classes 2, 4, 5, and 7, a pair of winch handles at elbow level being connected to the bosses of the driving wheel by pitch chains. The handles are connected to their pitch wheels by friction clutches, so that they are only fast while moving the machine ahead. This seems to be a mistake, and generally in machine the adoption of clutches which prevent going back. machine ahead. This seems to be a mistake, and general, any machines the adoption of clutches which prevent going backwards is a mistake. It reduces the control of the machine,



and in the case of the Manchester Company's machine the rider is powerless when an obstacle presents itself in his path unless he leaves go of one handle and uses the brake, even then he cannot back off. If the handles were tight they would, of course, revolve whenever the road wheels move, which, however, is a small objection; but by having these handles tight, no steering lever would be wanted, as the rider could steer perfectly well by working one wheel or the other a little harder, according to the way he wanted to go. The steering lever on the machine last referred to is worked by side movement of the legs. It is awkward and limited in range. Messrs. Ellis and Co. show nice little bicycles of Class 2. The Swallow Company show some well-made and well-finished and in the case of the Manchester Company's machine

Messrs. Ellis and Co. show nice little bicycles of Class 2. The Swallow Company show some well-made and well-finished bicycles, Class 1, and tricycles of classes 1, 3, and 7. Messrs. S. Withers and Co. showed the Merlin tricycle, belonging to classes 2 and 4. This machine has no gearing or crank, but is driven by a strap on a spring roller and pedal levers. The machine cannot move backwards, but is fitted with a powerful brake. Messrs. Withers and Co. also showed trigges of good design belonging to Withers and Co. also showed tricyles of good design belonging to Classes 1, 3, and 7. The Caroche Tricycle Company showed tricycles of classes 2, 4, and 6, three cog-wheels being used to transmit motion to the drivers, one of them being of the character indicated in Fig. 4, that is, having teeth formed of



left-hand crank pins. The latter pumps serve a double purpose, viz., acting on the up stroke as lift pumps for raising the water from a well in the engine-house to the spacious overhead tank which forms the roof of the boiler-house, and on the down stroke as circulating pumps for the condensers.

The engines are so designed that in case of anything happening: so as to disable the gearing on one side, the damaged side may be disconnected and the other side worked as a single engine. be disconnected and the other side worked as a single engine. The general design is good, being compact without being cramped, and considering their power, they occupy comparatively little space. The accumulator is an exceptionally large one, having a ram of 20in. diameter and a stroke of 35ft. The moving por-tion of the accumulator weighs about 100 tons. The steam boiles of which there are one as the single func-

The steam boilers, of which there are six, are of the single flue-multitubular type, and work up to a pressure of 75 lb. to the square inch. They are fed by a steam force pump, and are also-fitted with an arrangement which enables them to be fed from the accumulator pressure in case of emergency. The engine, boiler, and accumulator houses form one compact building, and are situated near the east end of the dock. The accl chiming boiler, and accumulator houses form one compact building, and are situated near the east end of the dock. The coal-shipping machinery consists of four hoists of the most improved ratern. The framework is entirely of wrought iron. They are capable-of lifting a dead weight of 19 tons to a height of 27ft., and are-fitted with overhead anti-breakage cranes. The object of these-cranes is to obviate the making of small coal which would naturally ensue were the coal tipped from the shoot to the bottom of the hold of a vessel. A sufficient quantity of coal is lowered into the hold in skips by these cranes until a cone of coal is formed of a certain height; upon this cone the contents of the full wagons are tipped, and the fall consequently broken. The-loaded railway wagons are brought up to the hoists on the lowfull wagons are tipped, and the fall consequently broken. The-loaded railway wagons are brought up to the hoists on the low-level railways; lifted, tipped, and despatched from the cradle one the high-level railways, which are constructed on an incline, down which the empties run freely. One hoist has been erected for the Midland Railway Company and three for the Great. Western Railway Company. There are three movable hydraulic quay cranes capable of lift-ing 30 cwt. a height of 56ft. These cranes travel along a perma-nent way, and can be worked at any point along the quay wall, combined hydrants and stop valves having been coupled into the

combined hydrants and stop valves having been coupled into the pressure mains at intervals, to which to connect the cranes. The machinery for working the enormous lock gates and the sluices is also driven by hydraulic power, and consists of one-hydraulic opening and closing machine for each pair of gates, on the continuous shafting principle. By a suitable arrangement of the continuous shafting principle. By a suitable arrangement of clutch gearing, the same hydraulic engines which work the gates are also used for working the ship capstans. The swing bridge-spanning the 60ft. lock is of wrought iron girder work, and turns on a central steel pivot. It is worked by two hydraulic cylinders and rams placed in a pit underneath. A similar bridge will be constructed over the graving dock when the latter is completed. Most of the machinery has been tested. The steam engines-have been running for a week, and so far have worked admirably. The whole of the lock machinery has also been in use. Two coal hoists have been tested, and are now ready for active service. coal hoists have been tested, and are now ready for active service. The remainder will be completed in the course of a few days.

The remainder will be completed in the course of a few days. The gap in the old east pier has now been widened sufficiently to allow of the passage of any vessel, and a large steamer of 4000 tons is daily expected to come in for loading her bunkers. The dock, designed by Mr. Abernethy, with Mr. A. J. Schenk resident engineer, and constructed by Mr. T. A. Walker, the con-tractor, has been built in a remarkably short space of time. The workmanship, masonry, &c., are of the best quality. The area of the dock is twenty-three acres, the working depth being 27ft.

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LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE.-CHANCERY DIVISION.

(Before Mr. JUSTICE FRY.) THE UNITED TELEPHONE COMPANY, LIMITED, V. HARRISON, COX-WALKER, AND CO.

IT will be remembered that in our impression for May 12th we gave a full statement of the nature of this case, illustrated

It will be remembered that in our impression for May 12th we gave a full statement of the nature of this case, illustrated with drawings of the instruments used, and extracts from the patent specifications cited. We now give below, and in full, the judgment of Mr. Justice Fry, which it will be seen sums up the whole for both plaintiffs and defendants. As we have already said, the minutes of evidence in this import-ant case fill several volumes, and to the non-legal mind it appears that an enormous amount of time was wasted in going over and over the same ground, and in proving that to be true which no one disputed. Thus, a competent witnesse having proved a certain point, it seems to be needless to examine at great length half a dozen other equally competent witnesses to prove the same thing. Hours were expended in showing that gas-coke, black-lead, and lamp-black were not identical in their external characteristics. It is possible that all this reiteration and doubling back was necessary, although Mr. Justice Fry did not think so, for he more than once endeavoured to accelerate the movements of counsel. But the true cause of the delay is perhaps to be found in the ignorance of all concerned save the scientific witnesses, concerning the whole subject. How readily an able judge can acquire information is would suppose that Mr. Justice Fry knew next to nothing concern-ing telephones when he began to hear this case. Again, the impression cannot fail, we think, to be left on the mind of everyone who heard the evidence given, or read it, that the greatest ignorance exists at this moment concerning the principles on which the telephone really acts, and the way in which sound is transmitted. We shall give examples of this presently ; but while it is held by one party that a diaphragm or tympanum must be used to transmit speech, it appears on the other hand that such expedients are wholly unnecessary. If our readers will turn to page 340, they will find an engraving of the original Bell receiver. It came out on the t

page 340, they will ind an engraving of the original belt feelver. It came out on the trial that the screw fixing the diaphragm at one side of the tubular electro-magnet was put in to keep the diaphragm from being lost, and that, when the instrument was really in order, the diaphragm was made to lie flat on the mouth of the tube, and was held all round by attraction to the magnet. It was then a true diaphragm, or tympan. It was contended that its presence in this country was an anticipation, vitiating Bell's patents. To this it was replied that, not being in order, it could not speak in this country, and was not an anticipation. To which the defend-ants replied in turn, that not only would it speak, but that they would make it speak; and this they succeeded in doing with the aid of a compound Hunnings transmitter. It was further proved that a few cinders resting on a lump of putty gave just as good results as the elaborate Edison instruments; and the recent re-searches of Mr. W. Smith—to which we refer at more length in another place—show that all our views concerning the transmission of sound require modification, and it may yet be found that vibra-tion, in the ordinary sense of the word, has nothing whatever to do with its transmission, and that the molecular motions while give rise to it are entirely distinct from what are commonly known as sonrous vibrations, which are but the accidental and fortuitous concomitants of the true sound-producing movements. Some of the statements made by Professor Sylvanus Thomson will serve to illustrate the point. He holds, for example, that in the case of the well-known microphone we do not hear a fly walk, but we hear the movement of the particles of carbon put into agitation. When the fly crawls over "the carbon you have the shaking, and that we are told is the walk of the fly : I altogether doubt that." There was no multiplication of sound. "Sound was converted into electric waves, and back again into air waves through the mechanism." The sound principle, he believed,

doned." The contention of the defendants, be it observed, is that the Hunnings transmitter is a microphone pure and simple. Pro-fessor Thomson stated at some length that carbon does not alter in conductivity under varying pressures, but only that conductivity being a function of contact, and the contacts varying with pressure, the conductivity did the same thing. Tympans were not needed for transmitting sound, air waves answering every purpose, and he did not regard the tin foil covering the carbon in Hunnings' trans-mitter as in any way essential to its performance. Professor Dolbear, examined on the same point, said that he considered air waves would act on the heap of crushed carbon without a diaphragm in two ways, depending upon the direction in which the vibrations in the air impinge upon it. In the first case, if the sound vibrations impinging on it were vertical to the surface, the condensations of the air would at first tend to make the particles of coke approach each other and the rarefactions in the air would cause them to recede, because the pressure within the body

particles of coke approach each other and the rarefactions in the air would cause them to recede, because the pressure within the body would be greater than it would be without. If, on the other hand, the vibrations should meet such a body as that at some other angle, then we might have conditions in which the condensation of air which was in the gas coke would result in separating its lumps instead of forcing them together, and in that case the electrical effect would be exactly the opposite of what it would be in the first, namely, the current of electricity, which in the first place would be increased by the condensation, would be decreased by that same condensation. This question of the action of air waves on a heap of loose carbon was made the subject of a great deal of

would be increased by the condensation, would be decreased by that same condensation. This question of the action of air waves on a heap of loose carbon was made the subject of a great deal of inquiry, nothing more being, after all, elucidated than the conclu-sions at which any thoughtful man might arrive. The evidence lost its scientific value at an early stage of the trial—that is to say, subsequent witnesses on both sides only repeated what their predecessors had said in another form. We find, however, in various places valuable statements of fact which, coming as they do from the lips of, perhaps, the most competent electricians living, are not without their value. Thus Professor Dolbear said: "It is highly advantageous in electrical transmission of sound that the points of contact where the resistance is varied should be in a measure slightly disrupted. I mean to say that in the case of the electrical arc we have the possibility of continuing the electrical current, because this is a transfer of material from one terminal to the other, and if it were not for that the current would be stopped. Now, where we have plates like platinum or copper it is impossible to maintain an electrical arc, for the reason that the current which is to be transferred from one place to the other is not transferred with the freedom that it is where coke is employed; and now in this particular case a current of electricity which passes the carbon of electrodes. The stronger the current is the greater will have this effect as the current passes between the carbon and the electrodes. The stronger the aurent which will be transported, which is the current itself, will depend upon the freedom with which the terminals themselves are disintegrated, and, therefore, one may with carbon separate these terminals a great deal further than he could with a piece of platinum." This is a

freedom with which the terminals themselves are disintegrated, and, therefore, one may with carbon separate these terminals a great deal further than he could with a picce of platinum." This is a very neat explanation of the theory of the arc light. Professor Barrett was among the witnesses called for the defence. He stated that he had often made an electro-magnet speak without any sound board, and he produced one in Court "which spoke most beautifully." This was made in 1875 or 1876; with a Reiss transmitter he had heard it speak broken snatches of words as long ago as 1876. A Morse sounder was tried in Court, and was made to speak with such distinctness that the peculiar accent of the speaker was recognised. It was It was

explained that the Morse sounder is an instrument known for thirty years. The principle of its action is said to be the micro-scopic motion of the armature, a motion so small that the most delicate tests do not reveal it. It is due to the internal motion of delicate tests do not reveal it. It is due to the internal motion of the molecules of iron as they are magnetised and demagnetised— Page's discovery. Returning to the original Bell receiver, Professor Barrett explained that anything put across it would do to make it speak, as well as its own diaphragm, as a saw, or a table knife. As regarded Edison's tension regulator, of carbon, Professor Dolbear said that almost anything would do as well as Edison's carbon button, and Professor Barrett said that he had heard two sixpences speak perfectly—the carbon button being taken out and replaced by the silver coins. Nickel also answered. With a polished silver button, the utterance of the instrument was sin-gularly clear. Carbon was preferred for such instruments because it could not be fused. It was well known that pla-tinum make-and-break contacts would fuse together and stick with a very feeble current. Professor Barrett held that the foil used to keep the carbon from falling out of the Hunnings stick with a very feeble current. Professor Barrett held that the foil used to keep the carbon from falling out of the Hunnings instrument was not a tympan. He had tried an elaborate series of experiments, and he found that the more completely the tympan was got rid of the better the instrument worked. He bedded a series of copper wires in putty, and by the side of them a second set, making them together into a gridiron. He sprinkled some powered gas-coke over the whole and spoke to it, and it answered as a transmitter, speech being heard in a Bell receiver. A number of Hunnings' transmitters and modifications of them were put in by Professor Barrett, in which the tympan was done away with and replaced with muslin, a strip of silver foil, a wire coiled with a flat spiral and resting on the carbon, and so on, all of which he stated spoke beautifully. We believe that it is not necessary to go further into detail.

spoke beautifully. We believe that it is not necessary to go further into detail. The judgment, as we have said, gives the sum and substance of the evidence, and, taken with our drawings, will place our readers in full possession of all the bearings of the case. Several points of law, we may add, were considered during the trial, but concerning these it is unnecessary to say anything. The array of scientific witnesses was very large; indeed almost every electrician of note in this country was called by either the plaintiffs or defendants.

Mr. JUSTICE FRY, in giving judgment, said that in this case the evidence on both sides has been of great extent and interest. The instruments which are in controversy are of the highest ingenuity

instruments which are in controversy are of the highest ingenuity and value, and the questions that demand decision are of consider-able perplexity and delicacy. The plaintiff sues on two patents—of these, the first that I shall refer to as the Bell's patent, was granted on the 9th of December, 1876; the second, which will be referred to as the Edison patent, was granted on the 30th July, 1877. The defendants have, as is admitted, made and sold three instruments which are in question; first, a receiver, known as the Cox-Walker receiver, which is alleged by the plaintiffs to be an infringement on the Bell's patent; secondly, another receiver, the Hickley's, likewise alleged to be an infringement of Bell's patent; and, thirdly, a transmitter known as the Hunnings', alleged to be an invasion of Edison's patent.

known as the Hunnings', alleged to be an invasion of Edison's patent. Long before the year 1876, in fact about fifty years ago, dis-coveries had been made, by Faraday, in electricity and the con-nected sciences, which undoubtedly lie at the bottom of the present inventions. The substance of those discoveries I take to be fairly stated in the specification to Bell's patent, when he says—"It has long been known that when a permanent magnet is caused to approach the pole of an electro-merget a current of electricity is inventions. The substance of those discoveries I take to be fairly stated in the specification to Bell's patent, when he says—" It has long been known that when a permanent magnet is caused to approach the pole of an electro-magnet a current of electricity is induced in the coils of the latter, and that when it is made to recede a current of opposite polarity to the first appears upon the wire. When therefore a permanent magnet is caused to vibrate in front of the pole of an electro-magnet, an undulatory current of electricity is induced in the coils of the electro-magnet, the undula-tions of which correspond in rapidity of succession to the vibra-tions of the magnet, in polarity to the direction of its motion, and in intensity to the amplitude of its vibration, or rather to the velo-city of its motion." That invention of Faraday was, as we know, one of the most pregnant of modern discoveries. It had long been known that a vibrating metal tongue or reed could be used to make and break the contact of a galvanic circuit, and thus produce an intermittency in the current, and that similar vibrations caused by the successive presence and absence of the magnetic attraction would be reproduced in another metal tongue or free reed ; and the idea soon suggested itself that if the first tongue were so vibrated as to produce sonorous undulations, similar results could be produced at distant places wherever the current was carried. This was the principle of the musical telephones which existed before 1876, and which in certain cases were found, occasionally and uncertainly, to reproduce vocal sounds with musical ones, especially vowel sounds. An inventor, the German, Reis, had gone astep further and used a membrane to set a piece of metal in motion, but according to the evidence before me, it is clear that before Mr. Bell's discovery there was no practical and trustworthy mode of transmitting articulate sounds to a distance by means of electricity. Mr. Bell appears to me to have scized three ideas. In the first place he

In or before the end of 18/6 Mr. Bell had made an instrument which, in the first place, appears to have had a transmitter and receiver of the same character, each of those instruments consist-ing of a tympan or drum of membrane, which tympan or drum carried a piece of iron at an armature capable of producing induc-tive action; the receiver appears to have been constituted in the same way, and he appears, in the first place, to have used an in-strument of that construction; but in August, 1876, at the Exhi-bition at Philadelphia, he exhibited an instrument made after a comarket different facilities in the the transmitter expirited of a somewhat different fashion, in that the transmitter consisted of somewhat different fashion, in that the transmitter consisted of a membrane charged with an armature, a piece of steel spring, but the receiver was an annular magnet, furnished with a flat plate by way of armature—the external circuit, the annulus, in fact, of the magnet being one of the poles, and the central core being the other pole; and it appears to me to be clear as exhibited at Philadelphia that the armature was not attached in any way, in any physical or mechanical manner, to the body of the receiver, but that it was held down by the force of the galvanic current which passed through that receiver. through that receiver.

through that receiver. Sir William Thomson visited the Exhibition at Philadelphia, and naturally attended with the utmost interest to the instrument there exhibited by Mr. Bell. It appears to have answered to a certain extent in Sir William's presence, and he undoubtedly heard words brought from a distant room to that receiver. The dis-covery, of course, was one of the greatest interest to him, and when he was leaving Boston Mr. Bell placed in his hands a brown paper parcel which contained a transmitter and a receiver, which have been produced in Court, and which have been the subject of a vast amount of discussion. When Sir William Thomson opened that parcel he found that the armature of the receiver was attached to the annulus of the magnet by a screw, and, according to the conclusion which I arrive at, on the evidence, he found the

armature tilted at a certain angle from the plane of the top of the reciver. The William Thomson brought these instruments with him to this country, and at the meeting of the British Association which toose place in September of that year at Glasgow, he exhibited those instruments, and made them the subject of a portion of his address as the vice-president of one of the sections. The words of a statement of the results which have been arrived at by Mr. Graham Bell, but do not in my judgment communicate to the public the exact method by which those results were arrived at by Mr. Graham Bell, but do not in my judgment communicate to the public the exact method by which those results were arrived at the will be necessary for me hereafter, considering the objections made to the patent, to consider more in detail the fact of Sir William Thomson's exhibition of those instruments in Glasgow. I mention them now merely as part of the narrative of the cas:

The the 9th of December, 1876, the letters patent were the subject of a disolaimer and memorandum of alteration which was filed, I think, on the 18th of February, 1878. The specification as originally filed contained five or six distinct plans of operation ; with regard to the first three it is not necessary for me now to say anything more than to observe that they provided for the transmission of several currents along one wire or system of wires. They are necessary to the explanation of the fourth and fifth plans there contained. Speaking briefly, the fourth plan mentioned in that specification provides for the transmission of the human voice, by means of a continuous voltaic current ; it provides for a similar receiver, and it also adds as an alternative plan the use of metal plates or other conductive substances. The fifth plan is founded on the discovery which I have altery is omitted, and the permanent magnets are substituted for the electroical purposes one and the same. It is impossible to doubt the beauty, or the value, or the ingenuity of the discovery that brane had, as I have already observed, attached to it an armature —a piece of steel wire, and the presence of that weight at a parti-cular portion of the tympan seems, according to the evidence before me, to have had some disturbing influence upon the action of the tympan itself. Furthermore, the membrane is liable to be influenced by changes of atmosphere and by the difference of mois-ture in the atmosphere, and was much as the receiver might be at a considerable distance from the transmitter; it is obvious that different atmospheric influences might operate on the two instru-ments, and therefore place them not in harmony but in discord. Those difficulties in the way of the use of the membrane induced Mr. Bell, in the memorandum of alterations to which I have already re-ferred, to point out that a great improvement had to be introduced into the instrument by substituting for the membranous tympan a metal plate or metal disc, which of course was inductive in its own nature and was free from the objections which were found to obtain in the case of the membrane. That, as a whole, the instrument disclosed by the letters patent was new appears to me not to be doubted. What had been done only occasionally and ill before by such instruments as those of Reis, which has happened to communicate speech by intermittent currents; what Sir William Thomson himself could not do with the Glasgow trans-mitter and receiver—because although anxious to exhibit that instrument to the British Association at Glasgow, he had been unable then to show that it could work—what Dr. Muirhead, a witness before me in the course of this trial, could not do in his attempt to copy Sir William Thomson's instrument, that could be done as soon as the complete specification was made known. That the Glasgow instrument, taken as a whole, was incapable of producing this satisfactory result is proved to me by the fact that it failed in the hands of perhaps the most skilful person in the world to deal with such an instrument—Sir William Thomson hims himself.

It remains, however, to enquire whether the other instrument

world to dear with stein an instrument - Sir unian transmission himself. It remains, however, to enquire whether the other instrument alone is claimed, or if not, what parts were claimed, and whether the parts so claimed were new, and whether the invention had been infringed by the defendants. The defendants have used and sold instruments known as the Cox-Walker and Hickley receivers, and no argument has been addressed to me to show that they are not in substance the same as the Bell receiver ; but the difficulty which the defendants present to the plaintiffs' case takes the form of an alternative argument. If, say the defendants, you claim only the receiver in combination with a transmitter like Bell's, we have not infringed, for we have never used such a receiver ; if, on the other hand, you claim the Bell receiver as a substantive and independent invention then it is not a new one. There is no evidence of the user of the Cox-Walker or Hickley receiver, with an instrument like the Bell transmitter, and in fact, it does not appear to have been so used. That Bell's specification claims the receiver he there describes as a substantive invention is the common case both of plaintiffs and defendants, and is also in accordance with my own construction of the specification. Has Bell's receiver the mean anticipated by previous inventions or by public knowledge? Before considering the anticipations, I think it expedient to describe Bell's receiver as claimed by him, and as I understand it. It consists of a horse-shoe magnet, the ends of which are brought into the circuit by means of colls of wire, and in front of which is a metallic plate, capable of inductive action, placed at right angles to the length of the magnet, resting as regards its circumference on the wooden case; the vibrations in this plate are the source of sound in the receiver. In Bell's instrument the receiving and transmitting instruments are interchangeable, and the fourth and fifth plans both, in my judgment, describe an apparatus in which there ar

such instruments as I have described used for both these purposes. The anticipations relied on are the first and second instruments made by Reis, or described by Reis, and the publication of Bell's own earlier plans through Sir William Thomson. Now, with regard to the instrument which has been called the first Reis, it appears to me to be made out plainly in the evidence that it was known in this country before the patent was taken out, but there is no pretence of a plate armature being used in that instrument. The machine depends for its operation on the repeated making and breaking of the currents, and upon the fact that the rod of iron included in the coil of the receiver gives a distinct tick each time it is demagnetised. The repetition of these ticks is made to produce the vocal sound. The essential parts, therefore, it appears to me, of the Bell's receiver are not in any way to be found in the receiver of the first Reis. With regard to the second Reis, which is the instrument described in Mr. Legat's paper, in the "Zeitschrift" of the German and Austrian Telegraph Union, two questions arise. The first is, was it so published as to be part of the public knowledge on this subject before the taking out of Mr. Bell's patent? The only book in which an account of this is said to have been published is the "Zeitschrift," to which I have already referred, which is, of course, in the German language. It contains, however, two plates, the one describing the transmitter, and the other the receiver, and I think it would be difficult for a person looking at those plates, and

having any knowledge of magnetic or electric science, not to come tolerably clearly to a conclusion as to what the object of the instrument was

It appears that the book was deposited in the usual manner in the Library of the Patent-office, and also in the Library of the Insti-tute of Civil Engineers; but in the latter case it was catalogued as a journal, and, somewhat strangely as it appears to me, was not catalogued either under the head of electricity or magnetism, or any kindred subject; but it is to be borne in mind that this paper is to be found, not in some scientific journal, not mixed up with other papers on other subjects, but it is in the journal of a society devoted to telegraphic purposes, the existence of which, I should think, can hardly be unknown to persons skilled in such matters in this country, and where it seems to me very natural that anybody would search for information, as, in fact, Dr. Muirhead did search for it, and to some extent found it. It is true that the only person who is shown to have consulted it in this country is Dr. Muirhead, who, though unable to read German, was enabled by his know-ledge of the technical terms to spell out some information from the paper.

ledge of the technical terms to spell out some information from the paper. Upon the whole, though not without some doubt, I have come to the conclusion that there is evidence before me upon which I infer that the communication made by Legat in that journal must be considered to have been within the knowledge of persons skilled in these matters in this country ; it appears to me that that is the fair inference from the facts proved before me. I need not say in coming to that conclusion I have endeavoured to attend to all the earlier decisions, including the decision of the Court of Appeal upon the Patent Skate case ; and I think that the conclusion which I have already expressed is consistent with those decisions ; though I am bound to admit that different minds might, as a matter of fact, come to different conclusion on the matter.

upon the Patent Skate case ; and I think that the conclusion which I have already expressed is consistent with those decisions ; though I am bound to admit that different minds might, as a matter of fact, come to different conclusion on the matter. Assuming then that the second Reis, as described by Legat, was a matter of public knowledge, it remains to consider whether the instrument as there described was an anticipation of the receiver as patented by Mr. Bell. In my judgment it was not. Looking at the plates it appears to me to be plain that the armature in Reis' receiver was not a disc at all, it was not a plate at all, but that it was a beam, a solid bar—when I say solid, I do not mean that it was rectangular; it appears to me to have been a bar whose section was oval—and that is the result which is conveyed to my mind by the plate, and I think that the model which has been exhibited before me in which that bar is converted into a twisted or curved disc does not really and truly represent the instrument as described by Reis. I think, therefore, that the criticisms of Sir Frederick Bramwell on that model were perfectly well founded, and that there was nothing in the Reis which can be considered to have been an anticipation of the armature of the description indi-cated in Bell's patent. No doubt Reis' invention is coming near to the invention which was afterwards made by Mr. Bell, but it appears to me not to be the same ; and I am not at all convinced that it will operate in the same way. It is perfectly rue there is some evidence before me that there is any evidence which shows that it could be made successfully to speak before Mr. Bell's patent was made known ; and it is obvious that the advances which have been made in telephonic science, very largely in consequence of his dis-coveries, have enabled persons to use instruments in a manner which neither their inventors nor their users could have used them before the discovery, and I think this must be further borne in mind, that instruments as little like

ones that have been exhibited would I have he doubt apply within the description of Reis' instrument as being universal instruments. I next approach the enquiry whether the disclosure which has been made through Sir William Thomson, and through the various scientific papers which copied or examined this instrument before December, 1876, the Glasgow receiver, made the principle of the Bell's receiver which was afterwards patented a portion of the public knowledge. As I have already mentioned, Sir William Thomson explained during his discourse at Glasgow—both the transmitter and the receiver—they were not in action; they do not appear to have been connected, and no experiment was performed or at that time could be per-formed by Sir William Thomson to explain their action, because, as I have already said, he had attempted to make them speak, and he had failed. Both instruments, as I gather, were on exhibition some time afterwards, at first apparently in the room in which the lecture had been delivered, and at a subsequent date in the labora-tory of the Glasgow University, which was open to everybody interested in the subject; and Dr. Muirhead made a rough sketch. The announcement of Sir William Thomson was commu-nicated to Mr. Ayrton, who at that time was thousands of miles off, and a description of it appeared in the *Telegraphic Journal* of October, 1876; every person one may suppose, who is interested in such things, probably within the four corners of the world soon became aware of the discovery which had been announced by Sir William Thomson. That the Glasgow receiver can now be made to speak, though not very distinctly, I know from what has taken place in this Court, because I have heard it ; but I do not forget that the utter-ances which I heard were the result of applying to this receiver a great amount of galvanic energy, and a transmitter, which, so far as I can learn, was of a perfectly exceptional character, a Hunnings furnisheel with seven separate cells; furuher, I have no evidence that anyone ma it purposely with the tilt. In this conflict of evidence I have come to the conclusion that it was far from plain that the tilt of the disc was not an intentional part of the structure. The effect of this tilt on the action of the disc is great, it makes it act, as regards its vibrations, partly as a tympanum and partly as a free reed. As the armature appeared at Glasgow it was in fact inter-mediate between the old form of armature, the free reed, and the latter form of Bell's in which the flat disc was used. The Glasgow instrument differed in other particulars from the Bell receiver; in the Bell the magnet was wholly within the case, and the disc un-ference of the disc rested on the wood, and was held down by the wood; in the Glasgow receiver the magnet was annular, the circumwood; in the Glasgow receiver the magnet was held down by the wood; in the Glasgow receiver the magnet was annular, the circum-ference of the instrument being one pole and the interior core the other, and the disc when held down at all was held down by the magnetic attraction, a form which requires, as I think, a much greater exertion of galvanic force than the mere adoption of a disc greater exertion of galvanic force than the mere adoption of a disc mechanically kept in front of the magnet; lastly, the Bell receiver is capable of being used as a transmitter, a quality which does not belong to the Glasgow receiver. These differences may appear to be small, but small diversities in delicate matters often make the whole difference between success and failure; and in the present case I have the distinct testimony of Sir William Thomson and others that the Bell receiver is superior to the Glasgow receiver,

and my own experiments with the Glasgow receiver, even under the most favourable circumstances, lead me to the same conclusion. I do not forget Professor Sylvanus Thompson's Bristol receiver— I did not at first hear well through it, but subsequently I heard better, but I think that that has been worked with a less tilt than as it was originally made, or than the Glasgow receiver possessed; and with the whole light cast upon the best mode of user by dis-coveries subsequent to 1876—that instrument I may observe was only made in the beginning of the present year; with the single exception of this Bristol receiver, and another instrument very similar in form but having a thinner armature, and a rough and unsuccessful copy of the Glasgow receiver attempted by Dr. Muir-head, I find no case of the Glasgow form of receiver even having been used. The burden being on the defendant to show that the anticipation of the Bell receiver by the Glasgow receiver was by an instrument practically as good as the patented one and of an invention which had passed beyond the stage of mere experiment, I think that they fail in discharging that burden. There remain two other objections to be considered—the first of those depends upon the first clause made in the specification as amended by the disclaimer. That claim is in these words: "The combination substantially as set forth and described respectively in the fourth and fifth plans above referred to, but subject always to the disclaiming notes of a permanent magnet, or other body capable of inductive action with a closed circuit, so that the vibra-tion of the one shall occasion electrical undulations in the other or in itself, and this I claim whether the permanent magnet be set in vibration in the neighbourhood of the conducting wire forming the and my own experiments with the Glasgow receiver, even under

capable of inductive action with a closed circuit, so that the vibra-tion of the one shall occasion electrical undulations in the other or in itself, and this I claim whether the permanent magnet be set in vibration in the neighbourhood of the conducting wire forming the circuit, or whether the conducting wire be set in vibration in the neighbourhood of the permanent, or whether the conducting wire and the permanent magnet both simultaneously be set in vibration in each other's neighbourhood." This claim is said to be a claim to undulatory currents pure and simple; that is, to the combination of a vibrating magnet with a current, all of which was well known to Faraday. To accomplish Mr. Bell's object four points of correspondence or identity are necessary. In the first place, the vibrations of the transmitting magnet must correspond to the vibrations produced by the voice; in the second place the undula-tions of the electric current must correspond to the vibrations of the transmitting magnet; in the third place, the vibrations of the current; and, in the fourth place, the audible vibrations of the air must correspond with the vibrations of the receiving magnet. If all these correspond, the desired result is produced. Mr. Bell's real stages were the first and the last, the bringing together of the vibrations in the air and of the two magnets at the two ends of the energy the unification so to meak of the dinpergem and of the real stages were the first and the last, the bringing together of the vibrations in the air and of the two magnets at the two ends of the operation, the unification so to speak, of the diaphragm and of the magnets—but the first claim, so runs the argument, is to the correspondence of the vibrations of the transmitting magnet with the undulations of the current, a thing as old as Faraday, and hence the patent is void. But the patentee himself has shown his consciousness of what his old knowledge was, because in the passages which I read he explains, as it seems to me, with reason-able clearness that the correspondence between the vibrations of the magnet and the undulations of the current was a thing well known of old. To read the first claim therefore as one to Faraday's invention would be to make the document inconsistent with itself, and I think that the words "substantially as set forth" in the fourth and fifth plans introduced into this claim must be taken to confine the claim to the application of Faraday's principles to cases where the agitating magnet or inductive substance is itself agitated

fourth and nith plans introduced into this claim must be taken to confine the claim to the application of Faraday's principles to cases where the agitating magnet or inductive substance is itself agitated by the voice. I have already expressed my opinion that Mr. Bell was the author of a very remarkable discovery. I think, further-more, that he has endeavoured honestly to describe that discovery in his specification, and where these two things are found, I think it is the duty of a judge to give, if needful, benign interpretation to the words of the document. Lastly, it is objected that by his original specification Mr. Bell claimed to use for his disc or plate either membrane or steel or any inductive substance, and that by his disclaimer and memorandum of amendment he finds steel to be preferable, and claims not any inductive substance, but any equivalent plate capable of inductive action. I am unable to see in this change anything that can affect the validity of the patent. I think the description of the subject matter of the plate is adequate, and that the plate as described must be inductive, and equivalent to a steel plate as regards its capacity to vibrate with the voice. When those qualities are found it seems to come within the description contained in the amended specification. Those being the objections made to Bell's patent they all in my opinion fail, and I think that therefore the plaintiffs are entitled to an injunction to restrain the sale of the two receivers which are alloced to be vibries and infinite or the state of the two receivers

specification. Those being the objections made to Bell's patent they all in my opinion fail, and I think that therefore the plaintiffs are entitled to an injunction to restrain the sale of the two receivers which are alleged to be violations and infringements of that patent. I now approach the second part of the case which deals with Mr. Edison's patent. If a portion of the circuit consists of substances the parts of which are capable of being brought near to one another by pressure, the effect of the pressure will be that the resistance of the circuit will be diminished and the current will be increased. The most important part of Mr. Edison's invention consists in using the principle to produce undulations representing the voice by means of a plate actuated by the voice and causing pressure on the circuit, and according to the view of the plaintiffs' witnesses and of Professor Dolbear it is requisite for the practical success of this plan that there should be used a material of low conductivity. It is further requisite that it should possess, either in itself or in the mechanism by which it is supported, sufficient resiliency to revert to the condition in which it existed before the pressure was exerted. This device was called by Mr. Edison a tension regulator. The principle involved was not new ; the law that the current of a given battery varied inversely with the sum of the resistance of the circuit was old and familiar to electricians; and the fact that resistance was capable in certain cases of being diminished by pressure was known as regards certain materials, though the effect of pressure on the resistance of metals and any other substances

be sent by electricity, and clearly distinguished at the receiving station. Musical tones may also be sent, but my present invention is especially available in transmitting and receiving oral communi-cations. In transmitting musical tones the respective notes each have a definite period for each vibration, hence there is a response at the receiving end from the notes that vibration, hence there is a response at the receiving end from the notes that vibrate in time with the electric pulsations sent, but in speaking there is little change in the musical tone, but considerable in the modulations and inflec-tions of the voice. In my present invention I make use of the vibrations given to a diaphragm or tympan." I pause here to make this characteristic the time of the providence of the time of the tim little change in make this observation, that in considering this specification two questions principally require decision—the first is as to the nature make this observation, that in considering this specification two questions principally require decision—the first is as to the nature of the diaphragm or tympan referred to in the specification; the second is as to the matter of the tension regulator, and what parts necessarily go to make up that tension regulator, as substantially described in the specification. Now, before reading further, I will make this observation : that it appears to me that the words diaphragm or tympan ought to receive their ordinary signification in this specification, unless there is anything to show the contrary. The ordinary signification of the word diaphragm I take to be a mere partition or separation—something which, as one witness said, separates something from something else. It is perhaps most often applied to a separation existing in that which but for the separation would be one continuous cavity; but it is not in my judgment necessarily confined to that use. A tympanum, or, as the word is used in the specification, tympan, signifies in my judgment primarily a thing like a drumhead— a thing in which a substance elastic in itself, but not acting as an elastic substance unless strained, is strained over its circumference and acts in the manner of a drumhead. Now it will be observed throughout this specification that what Mr. Edison we form the as a threat the the tother the formet in the strained formet is circumference and acts in the manner of a drumhead. Now it will be observed throughout this specification that what Mr. Edison refers to is a diaphragm or tympan. I say that, not forgetting that in some cases he uses the one word, and in some cases the other, and according to the conclusion which I have arrived at, which I will now state, in order that it will make more plain the meaning of the specification, I think that the quality which he required in his diaphragm is plainly expressed in the specification, namely that it shell where a with the value. It has been used meaning of the specification, I think that the quality which he required in his diaphragm is plainly expressed in the specification, namely, that it shall vibrate with the voice. It has been urged upon me that a tympan possesses another quality, that of magnifying the vibrations produced by the voice. It is quite true that a tympan does possess that quality, but it is equally true that a diaphragm by no means necessarily possesses that quality, and it appears to me that using the words interchangeably and describing the quality that they must possess, that of repeating vibrations, it would be wrong to require in everything which is to come within the ambit of this specification a quality not belonging to a diaphragm, and not expressed or referred to in the specification as being essential to its operation. Making those observations, I now return to the reading of the specification. "In my present invention I make use of the vibrations given to a diaphragm or tympan, by speaking into a resonant case, to produce a rise of fall of electrical tension upon the line with such accuracy that the electric pulsations or waves will represent the atmospheric sound waves produced by articulation, and the electric waves in such a manner as to reproduce articulation by acting upon a resonant plate." There I find that the diaphragm, or tympan, whichever it is, is to be something which will vibrate, and which by its vibra-tions will give rise to the rise and fall of the electric current, nothing more. Then referring to the pictures or diagrams he says, "The resonant tube or box a is of a size and shape adapted to being spoken into, the same having an opening at one end or side, and a diaphragm or diaphragms b, against which the sound waves from the human voice act, and these and the motion that the diaphragm receiver is the means of producing a rise and fall of electric tension on the line by the devices hereafter set forth." from the human voice act, and these and the motion that the diaphragm receiver is the means of producing a rise and fall of electric tension on the line by the devices hereafter set forth." Now, there again I find that what he aims at is a diaphragm vibrating with the sound waves, nothing more, which by its pressure on the substance below operates on the electric current. Then he says—" The general features thus described pervade my entire invention." We have therefore arrived at the general statement of his invention. Then he proceeds—" But in develop-ing the same many useful and important modifications and variations have been made, which I will proceed to set forth." Then after making some remarks, which it is not necessary for me to read, and referring to the difficulty he had experienced in producing hissing consonants, and to the form of the box which is intended to get over that difficulty, he says:—"The next feature requiring con-sideration is the character of the diaphragm in the speaking instru-ment. Many materials have been employed by me, such as metals, sideration is the character of the diaphragm in the speaking instru-ment. Many materials have been employed by me, such as metals, horn, vellum, celluloid, ivory, &c.; but almost all of these produce a prolonged or secondary vibration from their own resonant character, hence the articulation is defective, and the sound vibrations blend. After extensive experiments, I find that mica is almost entirely free from any resonant action, and hence it will respond with the greatest accuracy to the sound vibrations, and being of a laminated character can be employed of any desired thickness, and when secured at its edges responds with the greatest accuracy to the sound vibrations, and does not require to be strained; furthermore, the changes of temperature and atmospheric condition have little or no effect upon the mica diaphragm or tym-pan." I only pause to observe here that it is plain that the mica structure is not, properly speaking, a tympanum, because it is not strained, and that he therefore shows that what he prefers above all others is that which is more properly described as a diaphragm have that there should be used a material of low conductivity is plan that the resistance of the condition in which it is supported, sufficient resistance of the condition is used by Mr. Edison at ension regulator, the substance of the anticipation of the condition is and supported, sufficient resistance of the condition is and supported sufficient resistance of the condition of t

produced at the receiving station so that oral communications can

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operating for a sufficient time to prevent the current ever entirely ceasing, and in that way a continuous but undulatory current is produced.

I now approach the question which is very intimately connected with the consideration of the specification—Is Hunnings' trans-mitter an infringement of Edison's transmitter? In Edison's transmitter we find, first, a diaphragm or tympan, or plate, which receives the sound of the voice. Below that there is a cork, not of mitter an infringement of Edison's transmitter? In Edison's transmitter we find, first, a diaphragm or tympan, or plate, which receives the sound of the voice. Below that there is a cork, not of the same size as the diaphragm, placed in the centre, and of a smaller area. Below that comes a piece of platina foil, which is the same size as the cork, and corresponds with the size of the cavity in which the tension regulating substance is placed, in which is one of the electrodes in the current. Below that comes the bamp-black or other substance which is used for the purpose of the tension regulator, and below that comes the bottom of the box, which is itself the electrode, in which is placed a screw for the purpose of initial regulation. The Hunnings transmitter is different in this way—that it has no diaphragm or cork separate from or other than the platinum foil, the platinum foil in Hunnings' receives directly the human voice. They are of the same character, in there being a cavity or cell in which the metal bottom is one electrode, and the platinum foil at the top the other, but the differences are, I believe, to be fairly stated as follows :— First, the materials in the cell are different ; coke has been used by Hunnings, lamp-black has been preferentially used by Edison, coke is not mentioned with any of the articles used in Edison's specification. In the next place the size of the particles is different, the particles of lamp-black being, in fact, very much smaller than the particles into which the coke is crushed. In the next place, as I have already pointed out, there is a Catain anount of difference in their action. In Hunnings' the up-and-down motion of the voice is translated, so to speak, to the cork, and which the cork communicates to the foil, and the foil to the particles directly ; in Edison's. The Hunnings' is not metion which is communicated to the cork, and which the cork communicates to the foil, and the foil to the particles directly ; in Edison's. The Hunnings' is not mation of the voice is

the platinum foil, with a tension regulator consisting of a semi-conductive resilient and compressible substance, and it is therefore within the scope of Edison's specification. It has been argued that Hunnings' transmitter acts on a different principle to Edison's, that the one demands compression and the other freedom of motion; that in the other it is not—but the evidence, amongst others of Professor Dolbear, shows that the presence of the foil is essential or useful in both cases. In both cases it acts as an electrode, in both it requires extension in order that an electric current may pass through all parts of the substance which constitute the tension regulator; in both it keeps the enclosed substances in their places. Before passing from this subject, and considering the meaning of the word diaphragm, I think it not immaterial to observe that Mr. Hunnings', acting with the assistance of the patent agent, whose name he mentioned to us, in describing his own invention described the top of the platinum foil as a vibrating diaphragm—that is exactly the condu-sion which I have drawn; that the platinum foil is a vibrating diaphragm with a tension regulator. The discovery Professor Hughes made in 1878, that the vibrations produced by the voice might operate on a heap of particles directly and without the intervention of any diaphragm or tympan, or any such thing, has in my opinion suggested the argument that Hun-nings' and Edison's transmitters operate on different principles ; but not only is it the fact that the Hunnings' transmitter is not used without the platinum foil, but it has not been shown that it can be so used with success, and, according to the evidence of **Professor Silvanus Thompson the same physical principle, namely**,

that of diminishing the resistance and increasing the current by the increase of contact from pressure, underlies the light of the tension regulator of Edison and the microphone of Hughes.

tension regulator of Edison and the microphone of Hughes. I now come to consider the two objections which have been made to the validity of Edison's patent on the ground of the nature of the claims. The first of those is based upon the first claim, which is in these words, "In an instrument for transmitting electric impulses by sound a diaphragm or tympan of mica substantially as set forth. Does that mean that he claims the mica diaphragm or tympan in all instruments for transmitting electric impulses by sound? If it did it appears to me that the claim would be bad, because I think it is really the claim of the application of an old substance to a particular purpose without the use of any ingenuity in that application, without the use of any inven-tion in that application; but if it means that the mica diaphragm is claimed in an instrument for transmitting electric impulses by is claimed in an instrument for transmitting electric impulses by sound, which is described in the specification, then I think that it is not in any way bad, and upon the whole I have come to the con-clusion that it may be read as relating only to the mica diaphragm in combination with the rest of the instrument. It is to be borne in mind that in construing claims one must construct them not as enlarging the operation of the description, but rather as disclaim-ing everything which is not claimed. They are inserted for the purpose of drawing the line between what the patentee knows to be old and what he desires to claim as new in the invention he has

ing everything which is not claimed. They are inserted for the purpose of drawing the line between what the patentee knows to be old and what he desires to claim as new in the invention he has described. I now come, however, to the last and very serious objection to the validity of the patent. It is this—Mr. Edison discovered an instrument of the highest ingenuity which is commonly called the phonograph. That instrument is a purely mechanical one; it has nothing necessarily to do with the transmission of sound to a distance, it is in substance a diaphragm actuated by the voice, which operates upon a style which impresses itself on an impressible plate. The impression which is made on that plate again actuates a style which grain actuates a diaphragm, which again actuates a style which grain actuates a diaphragm in the form of human voice is reproduced on the other diaphragm in the condition of audible sounds. Mr. Edison points out in his specification that the voice can thus be produced by the second diaphragm. He also points out that the instrument may be used in another mode, namely, by connecting the second diaphragm of the transmitter, and using that diaphragm as the diaphragm of the transmitting instrument, in which case the second diaphragm of the instrument is this :—"I am enabled to record the sounds produces the audible sound. The description which is given of the instrument is that originally given by the voice." Then he proceeds to describe the figures :—"Fig. 4 is the indenting transmitter, the diaphragm having a knife-edge point; *i* is the paper which has previously been pased through a mathine to raise a V-shaped rib 6. The movement of the diaphragm of the raise indentage rip the sace dired rip reproduces in the spring 9 has a knife-edge, which has previously been pased through a sacing of the raise and the to rease and raise indented, is pased through a second apparatus in Fig. 5, almost similar to *k*. A spring 9 has a knife-edge, which has previously been pased through a second apparatus in F

Indensity of a string, conveys the same motion to the diaphragm of n_i , and reproduces previous sounds." Now pausing there, it appears to me to be plain that Mr. Edison has described a substantive discovery of the very highest interest and ingenuity by which at one spot this instrument receives and reproduces the human voice. Then he goes on to say, "If these sounds are to be transmitted over a telegraph line the diaphragm 10 is provided with a cork disc and fibrous tension regulator," and these, as I have already pointed out, the second diaphragm, instead of reproducing the voice at the time, acts in fact upon the tension regulator. Now what is the claim made by Mr. Edison in respect of that apparatus? It is this: "The method herein specified of recording the undulations of the diaphragm of yielding material, and the reproduction of sound by such material acting upon a diaphragm to communicate to the same vibrations similar to the original ones, sub-stantially as set forth." It is impossible for me to read that claim and not to believe it to be a claim to the instrument, whether used in combination with an electric current or not, its capacity to produce sound without any relation to the electric current has been notified out and dwalf upon. used in combination with an electric current of hot, its capacity to produce sound without any relation to the electric current has been pointed out and dwelt upon. The mode of indenting was a novelty; the mode of reproducing that sound was a novelty, and the claim appears to me to cover the phonograph in both its appli-cations—its application to produce human sound directly and immenovelty; the mode of reproducing that sound was a novelty, and the claim appears to me to cover the phonograph in both its appli-cations—its application to produce human sound directly and imme-diately at the spot where the voice had been spoken to it, and its application also as a transmitter of the same voice at a distance. Has that remarkable discovery so made by Edison been in any manner described in the provisional specification? The statute, as we all know, requires that the provisional specification shall describe the nature of the invention, and before I proceed to con-sider the provisional specification in this case I think it desirable to refer to some of the authorities which explain the principle upon which I ought to proceed in considering it. In the case of *Bailey* v. *Roberton*, which has been referred to so often during the course of the argument, Lord Blackburn very clearly explains the function of the provisional specification. At page 1874 his lordship says :-"The patent law dating from the time of James gave a monopoly to the invention of the first inventor: it, therefore, gave a monopoly solely to that invention which was his invention; he could not claim an invention greater than the title of the patent, but the titles were of extreme generality; it is in this particular instance 'for improvements in preserving animal substances.' Almost any kind of thing would come under that description ; the mere title gave very little instruction. Then, in the time of Queen Anne, the Attorney-General of the day introduced what was obviously a very great improvement. He made it a condition that the patentee should, within is xmonths, particularly 'describe and ascertain' the invention and the manner in which it was to be performed, if not it should be void. If that was done at the end of six months, that specification fixed what was the invention for which the patent was granted. Then, during the six months, it would have been, and before specifications were invented it must have been, a question o hattre of the invention, but thinks the nature of the invention as stated is too large or too vague, he may require him to amend it; but if not, then he grants a certificate to use the patent publicly without at all thereby making a present of the discovery to the public; and when it came to be a question whether or no what he was doing during that six months did avoid the patent, I take it

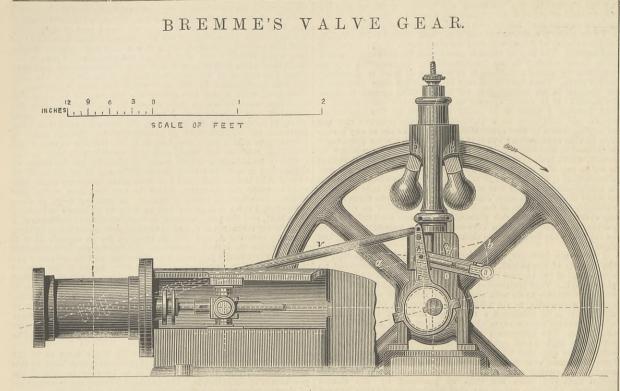
the process must have been to say, look at the nature of the invention described in the provisional specification, and say whether this which you have been doing, and which you say was a part of the patent, is fairly within the nature of the invention you have described; in that case you are protected, but if it is a new and separate inven-tion, and a different one, then you are not protected. I cannot but think that when that is once looked at, it becomes pretty clear that when the nature of an invention has been described in the pro-visional specification in the way which has been mentioned, if something were found out during the six months to make the invention work better, or with respect to the mode in which the operation may be performed—a thing which is very likely to happen when, in carrying out his invention, the inventor finds that some particular bit will not work so smoothly as he expected, and it is necessary to add a little supplement to it—still the nature of his invention remains the same, and it is no objection that in the complete specification, which comes afterwards, the invention or application is described more particularly and in more detail, or even if it be shown that there has been more discovery made, and so as to make the invention which he has described in the pro-visional specification really workable. If nothing more is done than that, I think it is good ; but as soon as it comes to be more than that, and the patentee says, in the provisional specification, I describe my invention as A, and in the complete specification is described in the other." Again in the case of *Newall* v. *Elliott*, the Court of Common Pleas made observations to a similar effect. "The office of the provisional specification is only to describe generally and fairly the nature of the invention, and not to enter into all the minute details, as to the manner in which the invention is to be carried out." And similar language is used by the Master of the Rolls in one of the cases which have been referred to w been referred to where, he says it might be roughly, but it must be

mind the invention is to be carried out. And similar language is used by the Master of the Kolls in one of the cases which have been referred to where, he easy is ingith be roughly, but it must be language in the set of the Kolls in one of the cases which have been referred to where, he easy is ingith be roughly, but it must be language in the set of the provisional specification in this sease, and find that the tille, which is to be cared as part of the provisional specification is, "Controlling by sound the transmission of electric eurrents, and the reproduction of corresponding sounds at a distance." And the inventor proceeds in this manner; he says—"The vibrations of the atmosphere, which result from the human voice, or from any musical instrument or otherwise, are made to act in increasing or lessening the electric force upon a line by opening or closing the circuit, or increasing or lessening the circuit at the receiving station; the electric action in one or more electro-magnets causes a vibration in a tympan, or other instru-ment similar to a drum, and produces a sound, but this sound is the friction of a point or sufface, that is in contact with a properly prepared and slowly moving sufface is very much increased or develope the strength of the electric wave passing at such orit of contact, and from this variation in the friction a greater or less vibration is given to the mechanism or measus that produce or develope the strength of the electric wave passing at such of the audble." I pause there to observe that it is plain that that description refers entirity to the transmission of sound or the con-trolling of sound by means of electric true as that produce or develope the possing a calculation, thereby rendering desa and disting receiving adation the proving worked in a very remarkable manner, without the application of electricity in any shape or form. Then the invention has been disclosed in the proceeding paragraph, "to carry out the peculiarities of my invention unde the transmitting, receiving fairly done.

respect of the first part, and disfinss the action as regards the second. Then arises the question of costs, and, upon the best considera-tion which I can give, I think I shall act in mercy to the parties if, instead of apportioning the costs, I grant the injunction will costs, and I do so accordingly. The form of the injunction will be the usual one. I think it will be found at page 352 of Sir Henry Seton's book : "The injunction be awarded to restrain the defendant, his agents, tenants, &c., during the continuance of the letters patent "--of course you refer to the particular ones-" or any extension thereof from manufacturing or selling, or disposing, or using any instrument of the same construction "--as to the two exhibits which you will introduce, " or only colourably differing therefrom, or any other instrument constructed according to the plaintiff's patented invention, or only colourably differing there-from or being an enlargement of the plaintiff's said patent, and from in any way infringing the plaintiff's said patent."

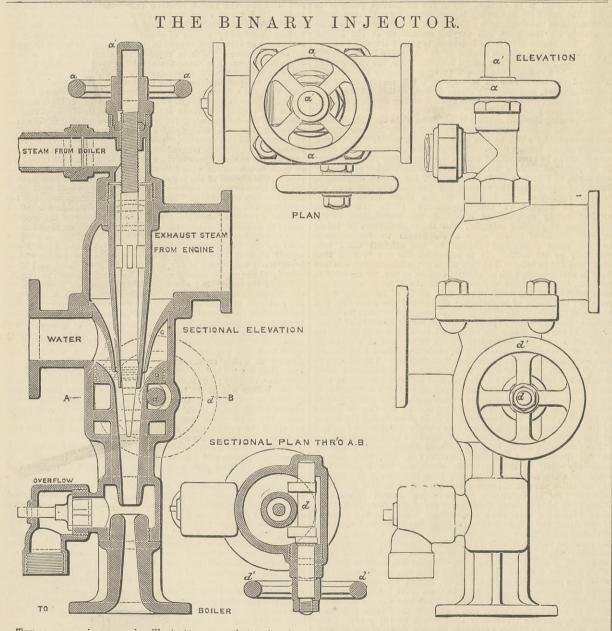
A MECHANICAL TELEPHONE, as described in the Journal of the Franklin Institute, provides a means, without the employment of a battery, for transmitting and reproducing sounds, loud, clear, and distinct, at short or long distances, as may be desired. It consists of a simple helix surrounding a soft iron core, having no magnetic connection, and acted upon by a thin strip of iron con-nected with the north or south pole of one or more magnets. This strip vibrates in unison with the transmitting or receiving diaphragm by means of a felt cushion, or other connecting medium. This construction, it is said, constitutes a magneto-electric machine or generator, whereby the voice itself produces the electric current by which the sounds are transmitted to, and reproduced by, a similar or corresponding instrument at the other end of the line, there being no current in the helix or on the line, excepting that so produced, and no other magnetism in the soft iron core inside the former. A MECHANICAL TELEPHONE, as described in the Journal of the

MAY 26, 1882.



THE accompanying engraving represents a high-pressure steam engine designed for driving electric light machines, which may with advantage be used in all cases where uniformity of speed is essential. This engine is fitted with Bremme's valve gear attached to a pair of governors. The crank has been removed in the drawing for the sake of clearness, and it is assumed that it is at its dead-point after accomplishing the indoor stroke. The excentric virtually coincides with the crank, and the fly-wheel turns in the direction shown by the arrow. As will be easily understood from the drawing, the rigid excentric rod E is hinged at A to the radius rod R and at B¹ to the valve rod V. The radius rod R is free to swing on the pin O attached to the radius arm D, which is forged on to a short weigh-shaft held in suitable bearings, so that its centre is at A. The radius arm D, as shown in its extreme is giving excellent results in practice.

position, forms with its neutral position $a \ b$ an angle of about 30 deg., and is so attached to the governors that their action reduces this angle more or less, and the result is that while this angle is 30 deg. the cut-off takes place at about $\frac{7}{5}$ of the stroke, but a slight reduction of the angle greatly quickens the cut-off and the deviation in the speed is reduced to a minimum. It is a and the deviation in the speed is reduced to a minimum. It is a noteworthy fact that as the amount of lead is determined solely by the distance between points A and B and remains a constant quantity, the exhaust steam has no derogatory effect in very early cut offs with a single valve by means of this valve gear. By regulating the steam admission direct by the slide, the action of intervening steam is prevented, and the action of the governors becomes instantaneous in its result. It is stead that this gear



THE accompanying engraving illustrates a somewhat curious in-jector made by Messrs. Weild and Co., Gorebrook Ironworks, Long-of a non-condensing engine open to the exhaust, necessarily equal sight, Manchester. It was for a long time a puzzle how an injector working under a given pressure could force water into a boiler in which there was a still greater pressure, but the Binary injector does more than this, for the exhaust steam from an engine is made use of to feed the boiler with water.

The section which we give will make the interior of the instru-ment intelligible. The theory of the action of the injector we give as stated by Messrs. Weild. The injector is not perceptibly intermittent in its action, although the exhaust from the engine comes in puffs. The pressure of the steam cannot be less than about 18 h absolute and this contains in the steam. about 18 lb. absolute, and this, coming in contact with the feed, is condensed, and the velocity of influx of the steam to the injector is thus very high.

Between the blasts or puffs the reciprocation of the piston

of a non-condensing engine open to the exhaust, necessarily equal the atmospheric tension. The continual supply and condensation of such steam provides, without intermission, a propulsive energy sufficient to introduce the feed-water under ordinary pressure sumcent to introduce the feed-water under ordinary pressures, as we conceive the following rough calculation will tend to show : Friction neglected, steam of 147 lb. per square inch, or 21184 lb. per square foot, absolute pressure, will flow into a vacuum of 10 lb. per square inch below the atmosphere, which corresponds to a absolute pressure of 47 lb. per square inch, or 676'8 lb. per square foot, with a velocity = $8\sqrt{-\frac{2118'4-676'8}{.0378}} = 1554'8$ ft. per sec.

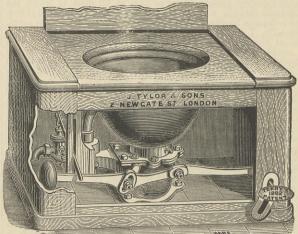
.0378

The head of water requisite to balance a pressure of 75 lb. per square inch above atmosphere $=75 \times 2^{\circ}25 = 169$ ft. nearly. Velocity of efflux under such head $= 8\sqrt{169} = 104$ ft. per sec. Suppose

each pound weight of steam of atmospheric tension propels 12 lb. of water, and is thereby condensed, the equivalent resultant velocity will be $\frac{1554\cdot8}{113} = 119$ ft. per sec.; this is equal to a head 113 of 219ft., or a pressure of 97.5 lb. per square inch. If the original temperature of the water be 50 deg., the resultant heat at which the feed leaves the injector will approximate 149 deg. The injector has been doing excellent work wherever it has been fitted.

PEDAL ACTION WATER-CLOSET.

THE pedal-action closet illustrated above has been patented by Mr.J.H. Terry, and is manufactured by Messrs. J. Tylor and Sons, of Newgate-street, E.C., where one can be seen in action. The advantages it possesses over those closets actuated by hand are— increased cleanliness, especially in public buildings where the hand-action closets are very liable to become objectionable. The arrangement secures considerable failtry in the secure of the failtry in the secure of the secure security of the secure of the security of th arrangement secures considerable facility in use, and as there is

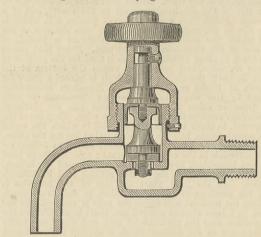


no hand-action, and no necessity for seat fittings, the closet may be flushed when the seat cover is down, which can only be done with hand-action closets by having a hole through the cover. There is a smaller number of moving parts than with hand-action of the same class

The arrangement is being fitted to all kinds of closets, whether hopper, valve, pan, earth, or ships' closets, at nearly the same cost as the hand-action. Amongst other places in which these closets have been fitted may be named Claremont, the seat of H.R.H. the Duke of Albany.

ASHTON AND SPERRYN'S WATER COCK.

THE accompanying engraving illustrates a new form of screw-down cock, made by Messrs. John Russell and Co., Queen Victoria-street, for gas, steam, and water, the arrangement being such as to secure the advantages of the screw-down valve with much of the quickness of the plug cock. It will be seen that the



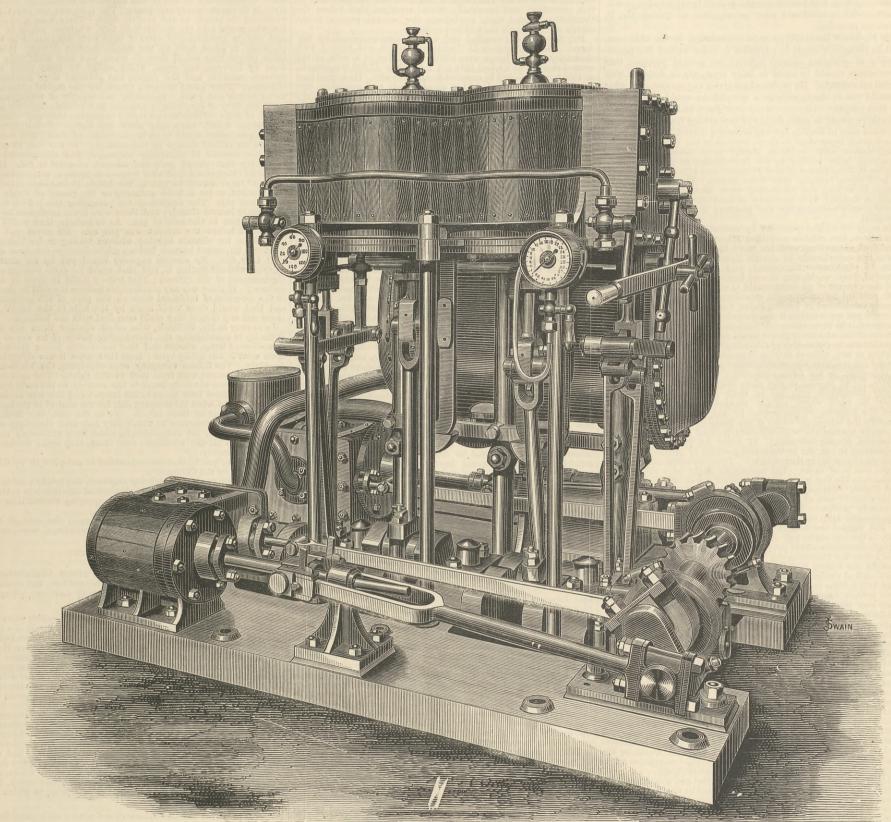
valve is kept in equilibrium by the cup leather on the stem, which also keeps the cock tight at the handle without any stuffing-box. The cock is strong, and offers advantages which will be at once recognised by those conversant with the defects of those which have gone before it.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty :—Anthony Brumage, engineer, to the Indus, additional, for service in the Himalaya; Thomas Soper, engineer, to the Asia, additional, vice Jolliffe; and James A. Reynolds, engineer, to the Northampton, additional, tempo-varily rarily.

Soper, engineer, to the Asia, additional, vice Jolliffe ; and James A. Reynolds, engineer, to the Northampton, additional, tempo-rarily. AMERICAN SOCIETY OF CIVIL ENGINEERS.—The Society met on May 3rd, at 8 p.m., President Welch in the chair, and Mr. John Bogart, secretary. Details were announced of the Convention to be held at Washington, May 16-19 inst. The following candidates were elected members:—William G. Curtis, San Francisco; Edward C. Kinney, Des Moines; Gustav Lindenthal, Pittsburg; Thomas C. McCollom, U.S.N., New London; David Reeves—transferred— Philadelphia. A paper on the "Improvement of the Potomac at Washington," by William R. Hutton, member of the Society, was read by the secretary. The different plans proposed were described. Those of the Board of Survey of 1872, of a committee of taxpayers in 1877, of Colonel Abert in 1878, of the Commissioners of the district in 1879, and its modification in 1881, all preserve the main channel of the river on the Virginia side, and leave a large area of flat low land to be reclaimed along the present water front of Washington, virtually extending the city streets about three-plans a narrow channel adjacent to the present shore line is retained for a part of the lower city water front. The objections urged against these plans are their excessive cost, the removal of the water front to far from the business pootion of the city, the increased diffi-culty of drainage, the reclamation of too much land of a character very expensive for maintenance, and in the project of the district Commission special difficulties connected with the proposed flushing basin. The author advocates the deflection of the main channel of the river below Georgetown, across the flats to the Maryland shore, and its maintenance, substantially, along the present water-line of the city. He claims that this is entirely practicable, that the low land left on the Virginia side will be less objectionable, that the deep channel close to the city will be of permane

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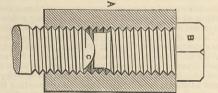
COMPOUND YACHT ENGINE. MESSRS. COPLEY AND CO., MIDDLESBROUGH, ENGINEERS.



ABOVE, we illustrate a compound engine of which we spoke in the high terms which it deserved in our notice of the exhibits at the Naval and Submarine Exhibition. Our drawing explains itself. The air and circulating pumps make one stroke for four of the main pistons, worm gear being used to bring down the speed, as shown. The engines make 400 revolutions per minute. The cylinders are 7 in. and 11 in. diameter by 8 in. stroke.

STUD FIXER.

THE accompanying woodcut illustrates a form of long nut in section, as used in a good many engineering shops. It is, however, but a short time since we saw fitters fixing studs by means of a pair of nuts locked together, a very unsatisfactory method. Another way is to have a short piece of square iron, into the



ends of which are holes drilled and tapped for two sizes, the bottom of the hole having a piece of brass or copper driven in to prevent bruising the top of the stud. A better tool is that shown herewith, in which A is a hexagon or square nut, and B a screw which may be of a length to suit the length of the stud C that it may be desirable to take hold of.

MORRIS' INDICATOR DIAGRAM CALCULATOR.

MORRIS INDICATOR DIAGRAM CALCULATOR. THE Wealemefna is a well-known instrument for measuring lengths by rolling the edge of a small disc over them. Mr. E. Russell Morris, of the Morris Patent Engineering Works, High-street, Birmingham, has recently adapted it to a new use. We illustrate the instrument herewith. To use it it is only necessary to place the gridiron parallel ruler on the diagram, and run the counting wheel beside the edges of the bars. The average pres-

inch, it is merely necessary when measuring diagrams on these scales, to multiply the result by 2, 3, 4, 5, or 6 ; and in the second place, each of the divisions representing rb_0 lb.—mean pressure—on the roller is a fiftieth of an inch, which is as fine as is consistent with distinct and easy reading. The rollers are machine divided, and the workmanship and finish of the instruments leave nothing to be desired. We have tested this instrument carefully and find that it more accuracy than the ordinary method and in about one-tenth of the time. No difficulty will be met with in dealing with other scales than those divisible by 5 and multiply the figures shown by the instrument by the quotient. Thus, suppose the scale is 36 lb, to the inch and the instrument shows 5.65. If the scale was 35 lb, to the inch then instrument shows 5.65. If the scale was 35 lb. to the inch then

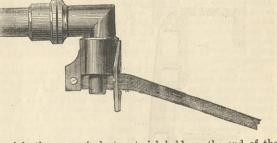
the average pressure would be $\frac{35}{5} = 7$ and $7 \times 5.65 = 39.55$

but being 36 we have $\frac{36}{5} = 7.2$ and $7.2 \times 5.65 = 39.66$ lb. The instrument cannot fail to prove extremely useful to engineers who have a large number of diagrams to calculate, the saving of time effected by its use being enormous.

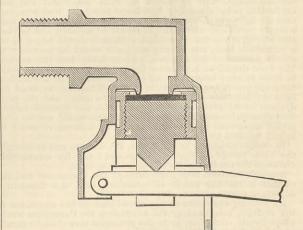
BALL VALVE.

BALL VALVE. At the last Building Exhibition there were several forms of ball valves, to some of which we referred. Another of these as made by Messrs. Dale and Co., London, we now illustrate. It is of the same order as that made by Messrs. Woodhouse, Osborne, and Co., as illustrated on page 230 of our current volume, so far as regards the form of the seating, but the arrange-ment is different. The valve closes upwards instead of hori-zontally, in a simple continuation of the barrel of the valve

casting. The essential feature of the valve, however, is the simple and easily-renewable form of seating, which consists of a



piece of leather or equivalent material held on the end of the valve by a screw collar. This is clearly shown in the section





THE ELECTRIC LIGHTING COMMITTEE.

THE Select Hybrid Committee of the House of Commons considering the Bill introduced by the Board of Trade to facilitate electric lighting, and several private electric lighting bodies in conjunction with it, continued their investigation on Friday, Mr. E. Stanhope presiding.

Sir Frederick Bramwell, in cross-examination by the chairman, said he thought it would be advisable in order to test the practicability of adopting electric lighting for general purposes that experiments should be made in large areas, say in districts with 50,000 inhabitants. He preferred not giving any opinion as to what it would cost to supply so large a quantity as would be necessary for that purpose. He was aware that fears had been expressed that there would be great danger of fires arising from the conductthat there would be great danger of fires arising from the conduct-ing wires used in electric lighting becoming heated, but he did not attach much importance to them, because in the hands of careful manipulators such accidents should never occur. The same objections were offered to the introduction of gas, and many persons in consequence of such prejudice and apprehension refused to have pipes brought into their houses. There would be no danger in leaving the conducting wires uncovered, so that they could be touched with impunity in some cases, but in others it would greatly endanger life and property if they were not quite insulated.

could be touched with impunity in some cases, but in others if would greatly endanger life and property if they were not quite insulated. In reply to various questions by several other members of the Committee, the witness said that his experience told him that municipal authorities were far more likely to let private bodies make the experiment in electric lighting while they looked on than to experiment themselves, and when success had been achieved, they would step in and buy up the private companies, and the expense of so doing would in all probability be less than that entailed by making the experiments. Electric lighting was already established in Berlin, Paris, Vienna, and New York ; but he could not say whether it was intended to make experiments on a large scale in those cities. Doubless experiments would be made in some cities, and other places would rely upon the result of those experiments to guide them in deciding whether to adopt electric lighting or not, without making experiments on their own account. He did not see that the establishment of private companies, even in opposition to the local authorities, would damnify the rate-payers, for at present it was clear that the ratepayers did not supply themselves with gas in most instances. Still it was likely, in cases where private companies set up apparatus, that the granting of concessions by the local authority would damnify the ratepayers where it was found desirable for the latter to supply themselves with the electric light and to buy up the successful private companies. It might be worth while for his orporation to buy the business and goodwill of private companies desirous of supplying their district. The concessions made to them might also be of value. The ratepayers might have entered into business in the first instance and supplied the electric light if they had chosen. Ratepayers could always forestall private companies if they liked ; but, as he had said repeatedly, ratepayers almost invariably preferred to look on while other persons m

Ratepayers would not obtain any advantage from supplying them-selves with the electric light, instead of being supplied by private companies. Mr. W. Spottiswoode was likewise examined in favour of the companies' case. He said he had tried the electric light in his own house and with successful results. The subject had now got beyond the experimental stage, and he believed it could be supplied at a cost comparable with gas, and could be relied upon to give a supply of light to whole communities. He was of opinion that con-cessions should be given for twenty-one years, subject of course to power by the Board of Trade to prevent an inefficient system being continued for that period to the exclusion of better methods; and installations to be successful ought to be of a substantial character and on a large scale. He estimated that £100,000 would be the cost of lighting a square mile. The electric light companies might be placed under the same conditions as gas companies. In reply to questions from opposing counsel and members of the Committee, Mr. Spottiswoode said there need be no risk of fire from the electric wires, and as people became accustomed to using the light there would be no danger. The powers necessary to secure a fair return. The Board of Trade would have to insist upon a tension so low as to avoid danger, but he could not suggest any limit of tension. The tension at present adopted was not beyond practical insulation. Accumulators might be a useful auxiliary to wires in the case of a breakdown, and electricity might be conveyed to houses in that form. Subdivision of light had been completely effected by means of the incandescent light. He would suggest stringent regulations to ensure that the supply was adequate, and the wires ought to be laid underground. Dr. Charles Wm. Siemens was the next witness on the same side.

perly insulated; and he considered that the wres ought to be hard underground. Dr. Charles Wm. Siemens was the next witness on the same side. He was first examined by Mr. Rodwell, and he stated that the incandescent lamp had opened the way for the application of electric light to domestic purposes. The arc light was cheaper in regard to motive power then the incandescent lamp, but the latter was the most useful for small places. The electric light ought to be supplied both to street lamps and private houses in order to be economical, and in a densely populated district the proper area for one engine should be about a quarter of a square mile. That would limit the size and number of the conductors, and so would be more convenient and less exposed to risk. Assuming 2000-horse power for that area, and that the light was distributed to public and private buildings, such a supply would cost £100,000. In regard to economy and service-able supply, it was desirable that installations should be necessary to a permanent basis, and twenty-one years would be necessary to able supply, it was desirable that installations should be put up on a permanent basis, and twenty-one years would be necessary to ensure permanent installations, and to fairly test the system. The wires should be laid under the pavement, and there should be boxes at every interval of 500 yards for putting in the connec-tions and generally getting at the wires. When not required for light the electricity could be used for motive power, and the same dynamo would provide both supplies. He had himself largely used electrical energy for motive power. Gas would not be alto-gether superseded by electric light, for he believed it would be largely required for heating purposes. In cross-examination by Mr. Jeune, Dr. Siemens said he thought the wires should be placed underground; and for considerable distances the conductors would require to be large. Some conversation took place between the Committee and the counsel as to the course of procedure, and the Committee adjourned.

Adjourned. On Monday the chairman announced that on the conclusion of the evidence submitted by the companies, the Committee would adopt certain resolutions as to the principles they thought should be embodied in the Bill; on Thursday they would communicate these conclusions to the parties, and then adjourn over Whitsun-tide.

Mr. Michael expressed great surprise at this decision, and

pointed out that if that course was carried out he should have no opportunity of proposing clauses until it was too late for them to be accepted.

Point of the provide the pr

Replying to the Committee, Dr. Hopkinson said he thought local authorities ought to have the right to be heard before the Board of Trade, and Corporations might undertake electric light-ing; but that would be a question of cost. There were several instruments in use for measuring the consumption of electricity, and there need be no difficulty in ascertaining what should be charged to the consumer

and there need be no difficulty in ascertaining what should be charged to the consumer. On Tuesday Mr. E. H. Johnson, the agent of Mr. Edison in this country, was the first witness examined. He said, in reply to Mr. Moulton, that the size of the conductor was to be arrived at by finding out the amount of the electric force. If they wasted too much the conductors would become heated. There was no element of uncertainty between the machines and the lamp, and they knew the exact amount of electricity that would be concerted. much the conductors would become heated. There was no element of uncertainty between the machines and the lamp, and they knew the exact amount of electricity that would be generated with a given engine. Supposing that they were working with an engine within 10 per cent. of maximum efficiency and generating efficiency, from there to the lamp there was no element of uncertainty. The economical supply of electricity could not be settled by installations other than on a large scale. Taking a square mile or 33,000 10-candle jets, he estimated that everything properly chargeable to the plant for the distribution and making of the supply would be £100,000. Unless they knew all the con-ditions in any particular square mile, it was impossible to get accurate figures; but that estimate to £10,000 or £15,000 one way or the other he was positive about. Asked if any con-ception of the real conditions of such a supply could be obtained from such installations as those seen in the winter in London where lamps were lighted along the public streets, witness said that these were isolated and small installations, and corresponded exactly with having a machine in a man's house for producing gas, and comparing it with the cost of gas supplied by the gas company. It would be like arguing the cost of a ship from the model. They would only get reliability and economy by working on a large scale. In any of the installations they would be obliged to work tenta-tively, because of the precariousness of the demand. It would take a great many years of electric lighting to get it co-extensive with the gas system. It would gradually increase, for amongst other reasons this—that as the output of electricity displaced the cost would naturally decrease, and as the electricity displaced the price of gas; and if they did not start even they would become even, and thus the demand for the electric light would gradually increase.

price of gas ?—If we are put on favourable conditions we can closely approximate to the price of gas. Witness went on to say that with regard to the term which ought to be granted to installations of this kind in order to make them commercially sound it may impossible to installations of price of gas i—I we are put on ravourable conditions we can crosery approximate to the price of gas. Witness went on to say that with regard to the term which ought to be granted to installations of this kind in order to make them commercially sound, it was impossible to institute such a state of things in twenty-one years. The time was too short for educating the people to the electric light. There were a chosen few who would take the electric light now, whatever might be its cost, but the great mass of users of light were determined in the character of their light by the simple question of cost. It was those people they would have to reach, and that could only be done by lowering the price, which would be done when the dynamo machine and the engine had attained their maximum efficiency. They would not get a return for the capital embarked under twenty-one years. Electricity was capable of taking upon itself the duty of supplying a constant and reliable light for any length of time. There was no reason to suppose that any change of system would materially alter the nature of the supply. Any improvement would be an improvement of detail, and would involve no radical change in the methods. It was easy to mea-sure the amount of electricity consumed, and the amount of electricity that passed gave the amount of work it did. In a public Bill the, could deal with tension, insulation, measurement, &c.; and those should be put in the hands of technical persons, but whether under a local authority or the Board of Trade he could not say. The conditions for protecting the public were sufficiently known already; and there were fewer conditions to be observed than in the case of gas. As to leakage, that would be found out before the current was put on. He never put on conductors for electric lighting without testing it for leakage. That was important because leakage might develope into heat and heat into fire. No electric engineer would put up an electric machine without testing it, and that

used. When all the conditions were there, and the first state of the cost accurately. The witness was further cross-examined at some length by other counsel, and by the Committee. Mr. Crompton, electric lighting engineer, was briefly examined, speaking distinctly, as the result of practical experience in putting up installations, of the practicability of supplying electric light for averal use

mr. Monoton addressed the Committee upon the case of the Electric Lighting Company, and the proceedings were again adjourned.

An agricultural show was held in April at Albany, Grahamstown. Messrs. Richard Hornsby and Sons were competitors, and received first and second prizes for engines, thrashing machines, ploughs, winnowers, &c.

winnowers, &c.
TRIAL TRIP OF THE STEAMSHIP LADY LONGDEN.—This steamer, which, as previously noticed by us, is the pioneer vessel of a line intended for the inter-postal trade of Ceylon and Southern India, underwent her trials on the measured mile in the Lower Hope Reach on the 16th inst. Her average speed was 12⁵26 knots per hour, and during the seven hours she was under steam no stoppage had to be made on account of heated bearings, or any other defect. Owing to the boiler valves not having been finally set, the runs were made under a maximum pressure of 58½ lb. only, whereas her working pressure is designed at 80 lb. Had the full figure been averaged. The speed attained is, however, for a small commercial steamer of only 133 tons register, highly satisfactory. The Lady Longden has been built by Messrs. Forrestt and Sons, of Britannia-yard, Millwall, and engined by Messrs. Mitchell, of Limehouse, and will start on her journey to Colombo, viâ the Suez Canal, in a few days' time. The voyage out is expected to occupy about five weeks, and all preparations have been made by her spirited native owner, Mr. Iambayah, of Colombo, to inaugurate the enterprise, to which we heartily wish a successful result.

ANEXLY ARRANGED LEVEL for civil and mining engineers is being made by Messrs. J. Davis and Son, Derby. It is specially designed to overcome the present difficulties of levelling underground, and is considered an improvement on that described in the "Trans-actions of the North of England Institute of Mining Engineers," by T. Lindsay Galloway and C. Z. Bunning, vol. xxvii., page 3. The improvement consists in doubling its range by being able to lengthen the uprights. The instrument consists of two uprights 3t. long. each of which can be lengthened to 6ft. Each upright has a glass tube attached to a scale of feet, tenths and hundredths of a foot, which is fitted at its lower end into a stop-cock, and by means of an india-rubber tubing, the two glass tubes of the uprights are connected. To level with the instrument, the two glass tubes in the uprights and the flexible tubing must be so filled with water that, when the two uprights are placed side by side on a level the water will half fill the glass tubes. The water finds its level in the glass tubes when levelling, and the difference of the readings of height of water is the difference of level between them. After the first reading the operator closes stop-cocks between the tubes, and proceeds as before until the distance has been completed, when the difference of the total additions of the uprights will give the difference of level. PHOTOGRAPHY.—As some engineers interest themselves in taking

PHOTOGRAPHY.-As some engineers interest themselves in taking photographs of their own machinery, we may say a few words of a book, amongst others, recently received, entitled "Practical Photo-graphy, being the Science and Art of Photography, Developed for Amateurs and Beginners," by O. E. Wheeler, published at the *Bazaar* office. Whether photography should be styled an art or not is a quesoffice. Whether photography should be styled an art or not is a ques-tion which is sometimes debated with considerable warmth, but most engineers who have had no experience in photography will, upon their first attempt, have little hesitation in granting that there is much art in the production of a good picture. Mr. Wheeler's book is practical in the sense that it is descriptive of the processes to be carried out, and the cautions to be observed, while he uses no space for a history of the art. Now that the dry-plate process may be so readily carried out by plates ready prepared, and by means of simple camera, no doubt the number of engineers who will place themselves in possession of a small camera, so as to be able to take a picture at the moment when a piece of apparatus or machinery even, and thus the demand for the electric light would gradually increase. Mr. Moulton : What is the relative amount of lighting got from a pound of coal when you use it in the incandescent lamp or when you use it to produce gas?—That depends upon the lamp, and the engine and the dynamo machine. With 56 lb. of coal, which I understand is required to produce one thousand candles by gas, we can produce three thousand candles of light by incandescence. You have 3000 candles of light in an hour by 56 lb. of coal by electricity and you would only have 1000 if produced by gas, and in the mere production of light the arc would give a still larger power.— Considering that the return of light is three times that of gas from coal, do you think that the other arcs which "are very different in the two cases will enable you to supply electricity at about the

RAILWAY MATTERS.

THE Cleator and Workington Junction Railway Company has opened a branch line from Rowrah to Distington.

ON Tuesday the Select Committee of the House of Commons appointed to inquire into the merits of the Regent's Canal City and Docks Railway Bill decided that the preamble of the Bill had been proved.

THE Tunis correspondent of the *Times* says that in order to pro-tect efficiently the positions in the south it has been decided to construct a railway between Tebessa and Gafsa, and the Com-mander-in-Chief has gone to Gabes to study the measures necessary for the preservation of peace in Southern Tunis.

A SELECT Committee of the House of Commons has passed a portion of the Omnibus Bill of the London and South-Western Railway, authorising the construction of a short railway, com-mencing by a junction with the Metropolitan District Railway at their South Kensington Station, passing under Pelham-street and Pelham-rescent, and terminating in the Fulham-road, almost oppo-site College-street, where the South-Western Company propose to erect another station, and thus form a new terminus.

By one clause in the Metropolitan District Railway Bill, which has just been passed by a Select Committee of the House of Commons, the company will henceforward have powers to charge one halfpenny, in addition to the ordinary mileage fare, to all third-class passengers by any trains run in compliance with the Cheap Trains Act, if the distance travelled exceeds the mile by a fraction of half another mile. Hitherto the company has been precluded from charging on any distance under half a mile. Some of the stations are under half a mile apart.

of the stations are under half a mile apart. THE St. Gothard Tunnel and Railway was opened with great ceremony on Sunday last, and for four days banquets and *fêtes* have occupied the time of a large number of invited Germans, Italians, and Swiss. It is stated that Prof. Colladon, the consult-ing engineer and the inventor of the compressed air apparatus employed, has not received an invitation. The St. Gothard Com-pany apparently thinks it has got its tunnel and is independent of those who have laboured to make it; but if the "windy stretch" was to give again much trouble, an invitation might be sent to Prof. Colladon, but acceptation would remain with him.

Prof. Colladon, but acceptation would remain with him. THE Queenborough Pier of the London, Chatham, and Dover Railway Company has been burned down by a fire, which appears to have been more disastrous in its consequences than was at first supposed. Two men were lost and several narrowly escaped, and there being a high wind, and the massive timber structure being saturated with creosote to preserve the wood, all attempts to cope with the fire were futile. Besides the pier itself, many of the buildings connected with it and contents were destroyed, including the telegraph office and all the instruments and batteries, account books, and documents both of the railway company and Custom-house; also about twenty railway trucks, many of which were laden with merchandise, including a large case of silver goods. Arrangements have been made for carrying on the Flushing traffic wid Dover until Queenborough Pier is reconstructed, and the whole of the staff from Queenborough has accordingly been transferred of the staff from Queenborough has accordingly been transferred to that port.

In the southern gallery of the Crystal Palace at Sydenham, beneath the great clock, Dr. Salvatore Garau, of Samassi, Sardinia, exhibits a working model of his method of establishing communi-cation between the passengers and guards of railway trains. By his system—which is an electrical one—it is not necessary to make electrical connections in adding fresh carriages to a train; they are made automatically, by means of an extra pair of very small metallic buffers, with long range and weak springs, placed at the end of each carriage. When an alarm is given, it is not done by breaking a constant current, but by establishing one ; consequently there is no waste of battery power when no alarm is being given. By pressing a stud in any carriage compartment the long arm of a lever falls over by force of gravitation. The rising of the short arm completes the circuit, and constant ringing of the bell in the guard's carriage is set up, until the guard replaces the fallen lever of the passenger compartment in its normal position. The appa-ratus at the Crystal Palace—which attracts the attention of many visitors—is not made to scale, but is a rough working model, con-structed merely to explain the principle of the invention. THE New York Tribune says that an agreement relating to the

Wistors—is not made to scale, but is a rough working model, constructed merely to explain the principle of the invention.
THE New York Tribune says that an agreement relating to the proposed underground railway in New York has been entered into and the specifications for the construction of the railway have been prepared. The parties to the agreement are the New York Underground Railway Company and Origen Vredenburgh, as owner of the franchise of the New York Central Railway Company. Mr. Vredenburgh also controls the Broadway Connecting Underground Railway Company. According to the agreement Mr. Vredenburgh surrenders the franchise held by him and his interest in the other roads to the New York Company, and receives in return 3,000,000 dols. of the capital stock of that company, with which he also contracts to construct the proposed railway and fully equip it. The entire length is about six and a-half miles. Mr. Vredenburgh's remuneration is to be 2,000,000 dols, in the company's bonds and 1,000,000 dols, of the capital stock, which is fixed at 10,000,000 dols. for each mile completed and equiped. The tunnel through which the road is to be run will be divided into two parts, one for the up and the other for the down track. It is to be of brick laid upon a concrete foundation. The floor is to be an inverted brick arch, and the arched roof of the same material is to be from 5½tt. to 6ft. each side of the grade centre, and not less than 15ft. high above grade. The wall separating the tunnels is to have arched openings at intervals at not less than 30ft.

THE American Manufacturer states that "the Pennsylvania THE American Manufacturer states that "the Pennsylvania Railroad Company has a new double-headed passenger locomotive which has been named 'Jumbo,' on account of its size. The engine weighs 120,400 lb, or a little over 60 tons, about 15 tons heavier than a class 'K' engine, and is fitted with a 5ft. driving wheel with a 33in. truck wheel under the smoke stack, while in the rear of the driving wheels there is one six-wheel swivel truck, which will enable the engine to turn a very sharp curve. The cylinder is a 7×24 , the same size as those used on the class 'K' engines; and the water tank, which has a capacity of 2000 gallons, surrounds the entire fire-box, which is 8ft. deep. The engine is so constructed as to run in either direction, and has a pilot at each end, thus doing away with the use of a turntable. This locomotive is one solid frame, there being no break between the tender and end, thus doing away with the use of a turntable. This locomotive is one solid frame, there being no break between the tender and the engine proper; and although the engine is a trifle shorter than the class 'K' engines, yet it is at least 3ft. higher than the average locomotive, while the cab, which is entirely closed, is about three times the size of that of other engines. Theodore N. Ely, superintendent of motive power of the Pennsylvania Railroad, is the inventor of this locomotive, and it was built at the Altoona shops a few weeks ago, under the supervision of J. B. Collin, the mechanical engineer of the company. Either hard or soft coal may be used. 'Jumbo has a patent hot-water reversing gear, which has never been put into practical use on any engine in this which has never been put into practical use on any engine in this country. As is generally known, engines are reversed by the power of the steam, but 'Jumbo' is so constructed as to be reversed with of the steam, but 'Jumbo' is so constructed as to be reversed with the hot water from the boiler, and virtually reverses itself, saving the engineer physical work, as all he has to do is to touch a spring, and the engine will instantly change its course. The injector checks enter the boiler behind the dome, thus protecting the pipes in case of collision, which, it is expected, will prevent the escape of steam and hot water. Assistant road foreman of engineers, Alex. B. Todd, says: 'Jumbo' is probably the heaviest locomotive in the world. If there are any engines as heavy, they are in Belgium, as in no other country can be found engines weighing over 50 or 55 tons.' Jumbo will be run on local trains from Philadelphia to West Chester and Paoli."

NOTES AND MEMORANDA.

M. POBEK, of Breslau, finds that the chief poisonous agent in illuminating gas is carbonic oxide.

The use of the Siemens regenerative gas furnace enables a ton of crucible steel to be melted with an expenditure of only $1\frac{1}{3}$ tons of coal, as against $2\frac{1}{2}$ tons of coke in the ordinary furnace

coal, as against 2½ tons of coke in the ordinary furnace. FROM the annual report to the members of the British Iron Trade Association, published by Messrs. E. and F. N. Spon, and containing all possible statistics relating to the production, con-sumption, export, and import of iron and steel, their ores and coal, it appears that the iron, steel, and allied trades showed very large increases under almost all headings, as compared with the immediately succeeding years, but curiously the total product of ore from the greatest English iron ore district was 23,529 tons less than in 1876. Within the year dealt with steel shipbuilding had increased from 38,164 tons to 71,533 tons, or an increase of 33,369 tons, or 87 per cent. tons, or 87 per cent.

tons, or 87 per cent. IN a little book on "Portland Cement for Users," by Henry Faija, published by Messrs. Lockwood and Co., it is stated that generally a light colour denotes light burning, a light weight denotes light burning, or, perhaps, an over-clayed cement; a dark colour denotes a heavily burned cement, though occasionally this may be due to peculiarity of the raw materials; a heavy weight denotes a heavily burned cement, or, perhaps, an over-limed cement. Generally a light colour and light weight are characteristic of a quick setting cement, and a heavy weight and dark colour a slow-setting cement. The specific gravity is given as from 3'00 to 3'05, and should never be less than 2'92. Two only cohalt mine worked in the British Jales is Foel Hiraddug

THE only cobalt mine worked in the British Isles is Foel Hiraddug THE only cobalt mine worked in the British Isles is Foel Hiraddug Mine, in the parish of Cwm, near Rhyl. The ore occurs in the carboniferous limestone, which seems to have furnished a good deal of iron ore from shallow pockets, judging by the numerous pits scattered about near the mine. In working one of these pockets Mr. Gage discovered the cobalt. He noticed some black strings in the limestone, and on testing them with the blowpipe he ascer-tained that the black colour was due to oxide of manganese in some cases, and to oxide of cobalt in others. On further examination of the pit, he discovered a vein of cobalt ore, which has now been worked continuously on a small scale for several years, the ore being worth about £6 12s. per ton on an average. worth about £6 12s. per ton on an average.

worth about £6 12s. per ton on an average. In the manufacture of Siemens steel in England the consumption of coal varies very greatly. At one works it is only 12 cwt. per ton of ingots, at another 15 cwt., and at another 164 cwt. the coal in the latter case being, however, very inferior. At one of the most important open-hearth works in England the average con-sumption of coal is as follows:—Coal used per ton of ingots, 12 cwt. 15 lb.; coal used per ton for furnaces and producers, 17 cwt. 1 lb.; coal used per ton for raising steam, 17 cwt. 3 lb.; total, 46 cwt. 19 lb. A considerable quantity of open-hearth steel is, however, worked up into rails and other manufactures, in which the consumption of fuel will be less, and probably if the average coal may be put at 2 tons per ton of finished steel, it will not be much beyond the mark. IN a paper recently read before the Iron and Steel Institute, Mr.

much beyond the mark. In a paper recently read before the Iron and Steel Institute, Mr. Jeans remarks, in speaking of economy of fuel in puddling furnaces, that of the 6397 puddling furnaces in the United Kingdom, pro-bably not more than 1 per cent, are constructed on other than the old reverberatory principle. The heated gases leave the puddling and balling furnaces at nearly the temperature of melting iron, so that their waste heat should be sufficient to produce all the steam required in the mills and forges, and at Dowlais and elsewhere this has been done with satisfactory results ; but the rule still is that the whole of this source of power is absolutely lost, and Mr. Mene-laus informed the Coal Commission of 1869 that in South Wales alone there was used for the production of steam in forges and mills over 250,000 tons of coal yearly, which might all be saved. THE Journal of the Franklin Institute describes a new electric

THE Journal of the Franklin Institute describes a new electric gas lighter, consisting of two positively operated movable electrodes arranged to meet over the gas orifice and then recede out of reach of the flame. They are operated by the turning on and off of the gas, by the ordinary horizontal cock of the gas-burner. One of the electrodes is rigidly secured to the rear end of the cock-spindle, and is carried by the rotation of the latter through a vertical arc past the side of the burner. The other electrode is pivotted, near its lower end, to the side of the burner, and provided with a sector pinion which engages with a similar pinion formed on the forward end of the cock, so that the motion of the cock will cause the latter electrode to be moved in the same manner as the former. The arrangement is such that the two electrodes move in opposite directions, passing each other when in line with the gas outlet, and falling back in opposite directions out of the flame. Small project-ing fingers of platinum are secured to the ends of the electrodes, and pass each other with a frictional contact, whereby the produc-tion of the electric spark is insured. THE experiments of Nystrom and Rothen show that phosphor-THE Journal of the Franklin Institute describes a new electric

THE experiments of Nystrom and Rothen show that phosphor-bronze wires have an electric conductibility about one-fifth as great as that of copper, or one and a-half times as great as that of iron. The Journal of the Franklin Institute says : Bede has found that 1 kilometre (1003 633 yards) of phosphor-bronze wire, 2 millimetres ('0787in.) in diameter, has a resistance of 28 ohms, while an iron wire of the same dimensions has a resistance of 40 ohms. A wire which is well hardened at the drawing-plate has a tensile strength of 120 kilogrammes (264 55 lb.) per square millimetre, and stretches only about 1 per cent. before breaking. A wire which is properly annealed stretches about 60 per cent., but the tensile strength is only about 40 kilogrammes per square millimetre. The rupture of a telegraphic or telephonic wire may cause accidents to men or houses in cities. Bede has shown that when a wire of phosphor-bronze breaks its elasticity brings the fragments towards the neighbouring supports before they have time to do any injury. In Brussels a large number of telephonic lines have been supplied with phosphor-bronze wires of $\frac{1}{15}$ millimetre ('0315in.) in diameter. In Ghent nearly the whole telephonic network is laid with the same wires. This small diameter can be employed because the resistance of the wire to oxidation secures its durability. THE experiments of Nystrom and Rothen show that phosphorresistance of the wire to oxidation secures its durability.

At the meeting of the Chemical Society on the 18th May Mr. W. H. Perkin read a paper "On Rotary Polarisation by Chemical Substances under Magnetic Influence." The object of the author was to discover, if possible, whether any relationship existed be-tween the chemical composition of substances and their power of rotating the plane of polarisation when under the influence of magnetism. The apparatus used was similar to that employed by Becquerel. The liquids being placed in the tubes closed at their ends with glass plates, the ends of the tubes were inserted a short distance into performing in the armatures. Water and short distance into perforations in the armatures. Water and carbon disulphide were used as standards. The author's results, which were calculated for unit lengths of the fluids, agreed pretty closely with those of De La Rive and Becquerel, but seemed to which were calculated for unit lengths of the fluids, agreed pretty closely with those of De La Rive and Beequerel, but seemed to bear no relationship to chemical composition. On consideration it seemed probable that unit lengths of vapours would give better results. It was soon apparent that the direct estimation would be attended with too many difficulties; the results of the observations obtained with unit lengths of fluids can, however, be referred to the lengths of columns of liquids which would be formed by the condensation of unit columns of their vapours, in other words to lengths related to each other in proportion to their molecular weight, making the necessary correction for difference of densities. This can be done by the simple equation $\frac{r \times m w}{d}$, r being the

observed rotation, m w the molecular weight, and d the density. Having made this calculation for the substance under examination and for the standard with which it is compared, the molecular coefficient of magnetic rotation, or more briefly the molecular rotary power, can be obtained by dividing the former by the latter. The numbers thus calculated clearly indicate that the molecular magnetic rotary power follows the chemical composition,

MISCELLANEA.

OF the Admiralty contract for leather belting, 15,000ft. run of single and double belting has been secured by the Patent Anhydrous eather Company, of Southsea, Portsmouth.

MESSRS. C. GRIFFIN and Co., London, are publishing in a handy, pamphlet form, a reprint of the series of articles which has appeared in our columns on "The Foundations of Mechanics," by Mr. Walter R. Browne, M.A., C.E.

THE North British Railway Company are prepared to spend the sum of £100,000 upon the erection of a new wet dock at Silloth. The contract for the work has been placed in the hands of Messrs. Scott and Son, Newcastle, and a commencement with the work will shortly be made.

MESSES. SIEBE AND GORMAN, of the Neptune Works, West-minster, have published a new edition of their "Manual for Divers, with Instructions for Submarine Operations." The manual contains a good deal of information which may be looked upon as supplementary to that contained in the paper we published last weak week

AN article on the future of North Australia, the Colonies and India, after speaking of agriculture and stock, says :--"Surface gold, from which the Chinese derive great wealth by a mere scratching of the ground; permanent reefs of extreme richness, requiring capital and machinery to work, but affording a certainty of profitable results; tin, copper, and probably coal and other valuable minerals; these, however, perhaps more than the agricul-tural and pastoral industries, require the impulse of road construc-tion and railway progress to further their development."

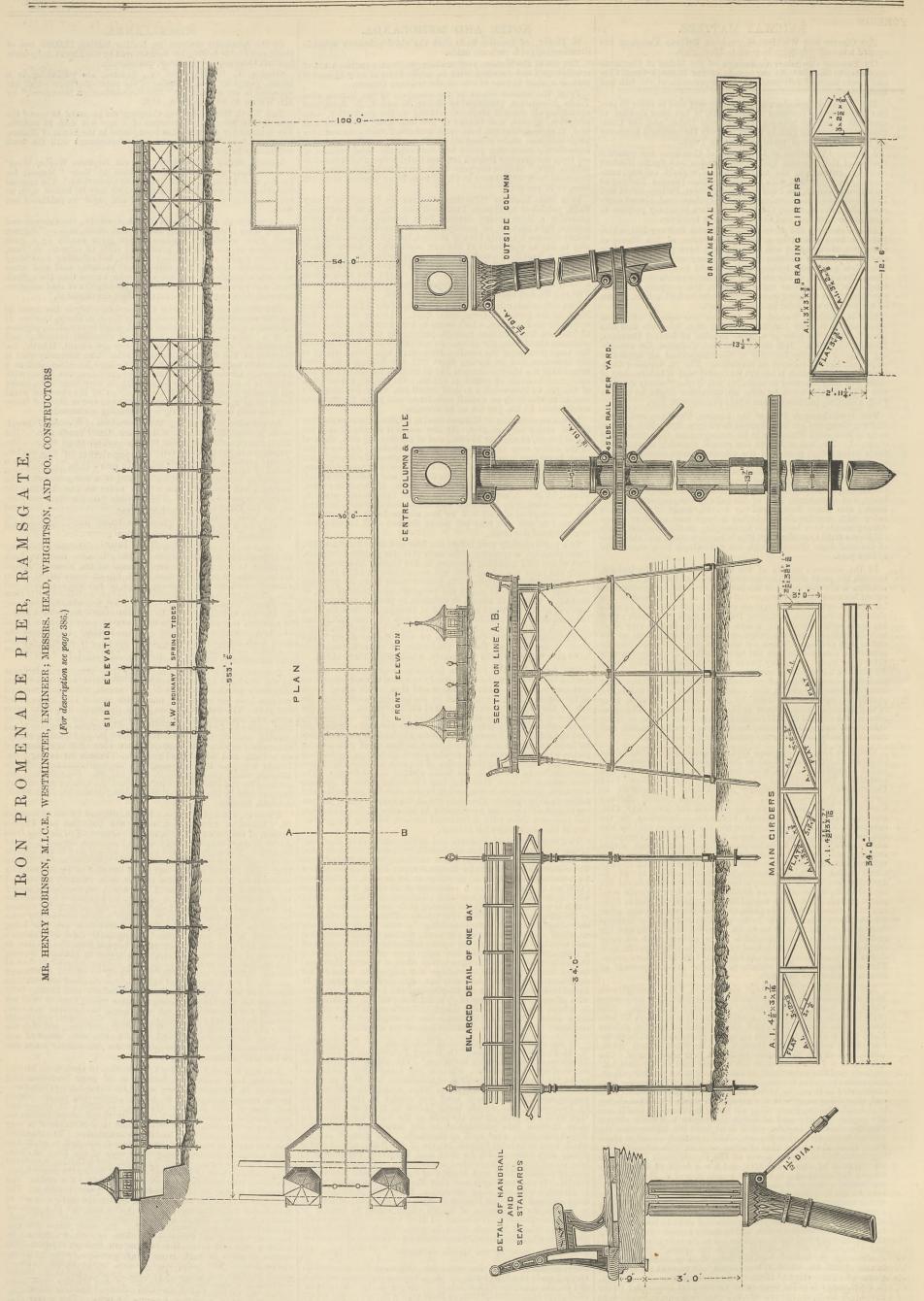
tural and pastoral industries, require the impulse of road construc-tion and railway progress to further their development." THE British and Continental Electrical Directory is the name to a publication compiled and published by Mr. J. A. Berly, London. If contains a quantity of statistical and metrical information, together with a short chronological history of electrical invention and application. Several well-known names are absent, Hjorth, the inventor of the dynamo, amongst them. The Directory part is deficient in many respects, and seems to have been compiled as a framework into which the name Berly, and one or two others with which it is associated, may be set forth in very large type, under all possible heads, the best known names in the electrical world being all of apparently less importance than two or three of lesser position with which Mr. Berly is presumably connected. As extended strike among the ironworkers of Western Pennsyl-vania is impending, which will render 30,000 hands idle. The *Times* correspondent says the workmen ask advanced wages. The employers, in the present overstocked condition of the iron market, decline granting the advance, but would probably not object to a proceeding at Pittsburg, which resulted in a disagreement. The workmen will demand a new scale of prices on June 1, when the strike is expected to begin. The iron interests elsewhere are wait-ing for the Pittsburg action, so that the strike is expected to extend over a wide section. The New York boiler-makers struck on Monday for a 10 per cent. advance. Several employers conceded this demand, but 2000 men are out. As our readers are aware, we receive various questions from our correspondents involving answers which, in some cases, we have

this demand, but 2000 men are out. As our readers are aware, we receive various questions from our correspondents involving answers which, in some cases, we have ourselves to fish for. A correspondent, signing himself "Kings-bridge," asks us some questions which are of an electrical order, some of which we cannot answer, and do not know anyone who can. They are, however, interesting, and are as follows:—(1) How are Faure's secondary batteries constructed, and what are the sizes? (2) Ditto as to Sellon's. (3) In last Saturday's *Echo*—20th May— in a leader, it is stated that in two years' time the patent of one of the best dynamos will expire. Which is this? (4) Is there any good book published with illustrations of the various dynamo machines and lamps in use? (5) Are there any good telephones and transmitters which are not covered by patents ! IN addition to the 966 lives and thirty-three vessels saved last year

and transmitters which are not covered by patents ! IN addition to the 966 lives and thirty-three vessels saved last year by the National Lifeboat Institution, 155 lives were saved from shipwreck by shore boats and other means, which had received last year. The number of lives saved during the fifty-eight years from the establishment of the institution, to the end of the year 1881, either by its lifeboats or by special exertions for which it has granted rewards, is 28,724. Last year two gold medals, thirty-three silver medals and clasps, forty-six votes of thanks inscribed on vellum, and £5783 were granted as awards for saving lives. During the year 1881 the receipts of the institution amounted to £36,419, while the expenditure was £37,781. Contributions are received for the Lifeboat Institution by all the London and country bankers, and by the secretary, Mr. Richard Lewis, 14, John-street, Adelphi, London.

bankers, and by the secretary, Mr. Richard Lewis, 14, John-street, Adelphi, London.
A USEFUL, interesting paper was recently read by Mr. Alexander M. Chance, of Birmingham, before the Chemical and Physics Section of the Society of Arts, on "The Recovery of Sulphur from Alkali Waste—Schaffner and Helbig's Process: A Record of Recent Results." The author quoted statistics with regard to the imports of brimstone and pyrites into the United Kingdom, and he showed that taking 350,000 tons as being the amount of pyrites actually imported for the manufacture of soda, from 80 to 90 per cent. of the sulphur was lost in the alkali waste, representing a money value of £357,000. This had hitherto been regarded by manufacturers as part of the cost of production ; but recently the method known as the ammonia-soda process has been so successfully established on a large scale in England that soda ash was being produced by it much more economically than by Leblanc's process, had become of vital importance. Mr. Chance referred to that of Messrs. Schaffner and Helbig as seeming to offer a satisfactory solution of the question, and said that the chemical combinations discovered and applied by Messrs. Schaffner and Helbig fully realised the conditions claimed for them—that, from 90 to 95 per cent. of the sulphur in the vat waste might be recovered in a commercial form ; that practically the whole of the calcium compounds were also recovered, principally as carbonate of lime, and that the re-agent by which these remarkable results were obtained was itself recovered, with the exception of the unavoidable losses due to the manipulation of the process.

A NOVEL way of facilitating the collection of cloth from bleach-fields has been recently introduced at the large linen-bleaching works of M. Duchene-Fournet at Le Breuil-en-Ange-Calvados-by the managing engineer, M. Dupuy. According to La Nature each piece of cloth is 100 metres long-or 328ft. M. Dupuy had long thought of constructing a railway with special mechanism for bringing in the cloth, but a steam engine in a bleachfield is very objectionable on account of the smoke and cinders. The objection does not apply to electricity, and M. Dupuy has had a small line objectionable on account of the smoke and cinders. The objection does not apply to electricity, and M. Dupuy has had a small line made along the meadows, crossing the ends of the lines of cloth, with a Siemens dynamo-electric machine and collecting apparatus in one vehicle, a set of Faure accumulators, giving the motor force, in another (the tender), and a series of trucks for the cloth. The line is 500 metres in length and has twenty-one branches. The train goes to the fields empty. On stopping, the machine is set to actuate the collecting apparatus, to which one end of a piece of cloth is brought. The pieces are previously connected end to end, so that the work goes on continuously. The cloth passes into the cloth is brought. The pieces are previously connected end to end, so that the work goes on continuously. The cloth passes into the locomotive truck, and thence, over rollers, to a truck attached, in which a man sits to guide it. Thus one man will collect 5000 metres of cloth in half an hour, an operation formerly taking eleven hours. The train, when loaded, carries 10,000 metres— nearly 33,000 ft.—of cloth. The Faure accumulators in the tender —which, it is stated in the *Times*, are of the Regnier type, large model—are arranged on three shelves and in hampers containing two each. They are sixty in number, and the weight is 500 kilo-grammes—1250 lb. The system, which has been in work about two months, has, it is said, given entire satisfaction,



MAY 26, 1882.

3.82

FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame Boyveau, Rue de la Banque. BERLIN.—Asher and Co., 5, Unter den Linden. VIENNA.—Messrs, GEBOLD and Co., Booksellers. LEIPSIC.—A. TWIETMEYER, Bookseller. NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, Beekman-street.

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

- 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. P. B. S.—The pamphlet has been sent you. H. S. (Manchester).—Your letter has been forwarded to B. and J. in the usual way.

- P. B. S. The pamphlet has been sent you.
 H. S. (Manchester). Your letter has been forwarded to B. and J. in the usual way.
 J. HALDEN. For information concerning Low's drawing board, inquire of Messra. Wrinch and Son, provide.
 H. B. RIDER. Generally the diagrams are about one-sixth actual size. Figs. 8, 22, 23, 14, 15, and 16, are about one-third actual size. Figs. 8, 22, 23, 14, 15, and 16, are about one-third actual size. Figs. 8, 22, 23, 14, 15, and 16, are about one-third actual size. Figs. 8, 22, 23, 14, 15, and 16, are about one-third actual size. Figs. 8, 22, 23, 14, 15, and 16, are about one-third actual size. Figs. 8, 22, 23, 14, 15, and 16, are about one-third actual size. Figs. 8, 22, 23, 14, 15, and 16, are about one-third actual size. Obtained it through any bookseller.
 H. D. Engineering instruction can be obtained at University and King's College, Manchester, and Mason's College. Birmingham: at Cooper's Hill College, Staines, and, indeed, at nearly all the Colleges and Universities of any importance in the kingdm.
 DORBET. We suspect that you are working with too much coke and too much blast, and so bringing your iron doors too hot. It is also more than likely that your bricks are bad. Try ramming up your cupola with good sand instead of fire-brick, or, if your foreman does not know how to his, or the proper stand. S. Try a new lining, reduce your pressure of blast and your coke, and report further.
 E. M.CA. (Liverpool). Before you can obtain a certificate as second engineer you must serve as third or junior engineer for one rul year at sea thar is, you must have been tas a for 56 days. If you have not been regularly apprenticed you must show that you kave, nevertheless, been engaged for three years in workshops to the satisfaction of your employer. Service as a firman will not count. If you apply to the Board of Trade Examiners in Liverpool you can obtain full information.

HOT BLAST STOVES.

HOT BLAST SPOVES. (To the Editor of The Engineer.) Srs,—In your issue of the 12th inst. we notice, under the head "Hot flast Stoves," that you state that the Seaton Carew Iron Company at West Hartlepool are adopting Whitwell's system of hot blast stoves. Will you please correct this ? the firm in question having adopted our patent stoves, as have also a number of other firms in various parts of the country. We may say that the principal feature in our stoves is that the puter in casing is the coldest part of the stove, and the most intense heat is in the centre. There is also an arrangement by which every part of the brickwork is accessible for cleaning. The first cost of the stove is very slight, as compared with any other stove, so that a greater number may be erected for the same outlay; this has the advantage of greater regularity, and the loss of a stove for cleaning is not felt by the furnaces. Most satisfactory results have been obtained by the Askam and Mowzell Iron Compuny, who have adopted them. Massicks AND CROOKE. Millom, Cumberland, May 22nd.

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MEETING NEXT WEEK.

CHEMICAL SOCIETY.-Thursday, June 1st, at 8 p.m.: "The Spectro scopic Study of Chlorophyl," by Dr. Russell and W. Lapraik.

DEATH. On the 22nd inst., at Carleton, Pontefract, WILLIAM POWELL, Esq. M.I.C.E., in the fifty-ninth year of his age-late of Douglas, Isle of Man.

ENGINEER. THE

MAY 26, 1882. THE FORTH BRIDGE.

THE Bill for this great undertaking was passed on the 19th inst. by a special Committee of the House of Commons, after an exhaustive inquiry, extending over eight days. The Right Hon. Colonel Stanley, an ex-

opponents of the Bill were the Caledonian Railway Company, the traders and Commissioners of Grangemouth, the trustees of the port of Alloa, and the Glasgow Shipowners Association, all of whom appeared by counsel. Apart from the case itself, the proceedings were of special, and even vital, interest to engineers, because, for the first time, an attempt was made by a parliamentary Committee to appoint some authority to exercise a species of control and supervision over the responsible engineers of a difficult and novel work. Fortunately for the profession at large, the engineers associated with the Forth Bridge had sufficient weight with the Board of Trade to induce that body to join with them in pointing out to the Committee the infinite mischief which must inevitably result if the responsible engineers of an undertaking were subject to the con-trol of an outsider, however judicious or eminent. In the end, after a lengthened conference with Mr. Farrar and Mr. Calcraft, who were instructed by Mr. Chamberlain, the President of the Board of Trade, the Committee practically withdrew the clause they had suggested with reference to outside inspection, and accepted an undertaking on the part of the Board of Trade, that General Hutchinson or part of the Board of Trade, that General Hutchinson or some other of the inspecting officers, should inspect and report on the works every three months during their pro-gress. It will be well to record the exact words of Mr. Farrar, the Permanent Secretary of the Board of Trade. In reply to Colonel Stanley, he observed :— "The Board of Trade have been anxiously trying to meet the view of the Committee without, on the other hand denerating from principles which they think other hand, departing from principles which they think are important in the interest not only of the promoters, but of the public and of public safety. They feel that anything that can be done in the way of inspection, and in throwing light upon what is done in an undertaking of this magnitude, is a duty they ought to undertake. On the other hand, the duty of controlling the engineer in the detail of the work, and of rendering themselves responsible for the material used, for the details of the construction, and for the work that is done, is a responsibility which they think they could not properly undertake, and which, if they professed to undertake, would relieve the company and their engineer of responsibility. They have, therefore, endeavoured to meet the views of the Committee by a clause which will give them the power of inspecting during the progress of the works, and of reporting and showing to the public how the works are proceeding with showing to the public how the works are proceeding with-out taking out of the power of the engineer the control of the work. They will probably be able by that inspection to test the way in which the work is proceeding, and should there be any considerable carelessness, or deviation from the original intention, it is probable their inspectors will be able to detect it. At the same time I wish to guard the Board of Trade entirely against the supposition that they can be held responsible for the nature of every piece of steel that is put in, or for the mode in which every rivet is inserted; that is a thing utterly impossible for them to do without taking the work out of the hands of the engineer, but I believe that this clause will give the

public adequate security.' Although the opposition to the Bill was strenuous and lengthy, not a single point was established. The result was summed up at the conclusion of the inquiry by the chairman, who remarked that "probably no living autho-rity could in any way sit in judgment upon the design, nor had any experiment in subtract to the design have nor had any opposition in substance to the design been brought before the Committee." Rarely has such a quiet brought before the Committee." Rarely has such a quiet yet stinging rebuke been administered to the opponents of an undertaking, but it cannot be said to have been undeserved. Pilots, captains of vessels, and nautical witnesses by the score, were put forward to show that the proposed arched form of the soffit of the bridge would win the parigation of the unper parts although it was in ruin the navigation of the upper ports, although it was in evidence that only once in two months did a vessel pass the site of the bridge with masts as high as 140ft, which headway would be afforded by the arched bridge over a total width of about 1700ft, at mean tide. One captain of a steam vessel of 360 tons said he should not think it safe take his vessel through an opening 1300ft. in width, although he was aware that the Thames Conservancy rules require the maintenance of a clear channel of but 300ft. in width for the immense traffic on their river. Another captain said that there should for safety be a clearance of 30ft. between the top of the masts and the clearance of sort, between the top of the maximum waves at the site of the bridge being only 3ft.! To bring forward such evidence was to court a rebuke, especially as the nautical witnesses for the promoters were of the highest experience, and included such men as Captain Scott, R.N., who was for three years navigating officer of the guardship stationed in the Forth; Commander Kingscote, R.N., of the Lord Warden, which from December, 1879, has been anchored within a few cables length of the site of the bridge; and Admiral Fellowes, who similarly had often served in the Forth, and knew the exact requirements of the parimetic. the navigation.

The engineering opposition simply resolved itself into a contention that, although apart from questions of naviga-tion, the design of Mr. Fowler and Mr. Baker was probably the best that could be devised, yet by the expendi-ture of a certain amount of money that design might be adapted to a bridge with a level soffit and a uniform heading of 150ft. So far the contention was unassailable, but in going into detail, and in attempting to make an estimate of such a work in ten days, the engineers came to utter grief, and were easily demolished in cross-examinatoter grier, and were easily demonstred in cross-examina-tion. It was no matter for surprise, therefore, that the chairman volunteered the statement that no "opposition in substance" to the design had been brought before the Committee, for probably there was never a more shadowy opposition to any great project. It was elicited by one of the members of the Committee that the expenses of a considerable part of the so-called "navigation" opposition had been guaranteed by the Caledonian Bailway Company

now, at the request of the authorities, on view in the House of Commons.

THE METROPOLITAN BOARD.

THE Metropolitan Board of Works has lately published s annual report, and eaten its annual dinner. The former its annual report, and eaten its annual dinner. is accompanied by a brief review of the principal works accomplished by the Board since it came into existence rather more than a quarter of a century ago, and the latter was marked by the presence of the Prince of Wales, together with sundry statesmen and other celebrities. The Board has risen in popular estimation during the later stages of its progress, the substantial work which it has accomplished being sufficient to commend it to the approbation of a community pervaded by the practical spirit of Englishmen. At the recent dinner the Chairman of the Board, Sir J. McGarel-Hogg, declared the readiness of himself and his colleagues to sacrifice their position, if it were deemed necessary for the welfare of the metropolis that they should thus be superseded by some new authority. Certain it is that if the Board should shortly be made to disappear, it will have lived long enough to earn a dis-tinguished place in the history of the metropolis. Its works will testify of it in ages yet to come, and if present promises are not belied, it will be seen that the creation of the Metropolitan Board was the first term towards arising London a new and noble dowald step towards giving London a new and noble development. The metropolis is unquestionably on the path of improvement, and it would be sheer ingratitude to forget that the Metropolitan Board had to undertake the rough pioneer work, with little to encourage its early efforts. It has now lived to be famous, and if it gives place to another authority, there will be no reason to regret the previous existence of the departed power. It is true that the Board will leave a debt behind it, but there are good assets to show, and there is nothing extravagant in the liabilities which have been incurred. We may be thankful that London is not as Paris, the French capital having a burden of debt four times greater than that of the Metropolitan Board, while the population of London exceeds that of Paris by considerably more than one-half. We do not say that this financial comparison is altogether exact or complete; but there is a wide margin for any necessary corrections, and on the whole London has been immensely improved at a moderate cost.

The functions of the engineer in these days are very closely associated with questions of local government. The annual report of the Metropolitan Board abounds with references to engineering work. The primary mission of the Board was to carry off the drainage of the metropolis, as as to extinguish an intelemble metropolis, so as to extinguish an intolerable nuisance. Sir Stafford Northcote was very near the mark when he signified that if the members of the House of Commons had not been personally annoyed by the state of the Thames under the windows of the committee-rooms several years ago, it is possible that the Board would not have been constituted. Perhaps some people will be ready to say that if Parliament held its sittings at Woolwich there would soon be a further change in the metropolitan drainage works. On this which we never arrest come additional calicatement of the seven seven and the seven seven and the seven seven additional seven seven additional seven seven seven and seven subject we may expect some additional enlightenment at no distant period, by means of an investigation directed by the Home-office. In the meantime, in communicating by the Home-office. In the meantime, in communicating with Sir William Harcourt, the Metropolitan Board has asked to be allowed the benefit of examining the river during some genuine hot weather, before being called upon to encounter those gentlemen who consider that the main drainage outfalls are making the Lower Thames intolerable. The Board proposes to enlarge the sewage reservoirs at Barking and Crossness by about 50 per cent, so that none of the sewage shall escape during the flood tide. It is acknowledged that an escape of this kind has "occasionally" taken place of late, owing to the large increase in the volume of the sewage. The growth of the popula-tion also takes effect in another way. Houses are being built and roads formed where recently there was little else than green fields and open ditches. Hence the statement that the floodings from heavy storms of rain which have occurred on several occasions in recent years in some of the populous suburbs of London, principally those on a low level, have made it necessary for the Board to determine upon the construction of some additional large sewers to carry off the storm water. These are accompanied by storm outlets, for not even the ingenuity of the engi-neer can provide for a total severance between the drainage and the river. The storm water must either overflow on to the land or into the Thames, and the latter is the lesser The works which are required to drain London are evil. not readily appreciated in their magnitude and complexity. The main and intercepting sewers under the charge of the Metropolitan Board are about 250 miles in length, and require a force of 125 men to keep them clear of obstruc-tions. The cost thus incurred during the past year was close upon $\pounds 14,000$. This subterranean battalion bears somewhat the same relation to the main drainage of the metropolis that the platelayers do to our railways. The service may appear humble, but it is of great practical importance. The sewer men must have a dismal life, and we only trust their working hours are reasonably brief.

we only trust their working hours are reasonably brief. While the Metropolitan Board is required to do no harm to the Thames, it has at the same time to take care that the Thames does no harm to the metropolis. The river has been somewhat unruly of late years, for reasons which we have occasionally discussed, and the present report bears witness to the tendency of the river to rise higher and higher. One survey has to be followed by another. and higher. One survey has to be followed by another, and the Board found it necessary last year to add six inches to the height for which it had stipulated only a few months before as that to which the riverside premises should be raised. Passing from the river to the road, we observe that Northumberland Avenue is not as yet a profitable speculation for the ratepayers, though it opens 19th inst. by a special Committee of the House of the members of the Committee that the expenses of a Committee of the House of the Bornel Line to the members of the Committee that the expenses of a considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the members of the Committee that the expenses of a considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the members of the Committee that the expenses of a considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the members of the Committee that the expenses of a considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the members of the Committee that the expenses of a considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the considerable speculation for the ratepayers, though t opens up a magnificent approach from Trafalgar-square to the considerable speculation for the ratepayers of the conset of the considerable speculation for the ratepayers o land is occupied with houses. The Victoria Embankment cost £200 last year for water to lay the dust, and £1600 for lighting, including both gas and the electric light. The entire cost for the repair, cleansing, and watering of the carriage and footways, is nearly £10,000 a year. The sphinxes which so persistently gaze at the hieroglyphs of the Egyptian obelisk cost—with the other ornaments about £4500. We hope the Board will be induced to make these creatures "face about," so as to conform to Egyptian precedent. Only let us fancy Landseer's lions being made to stare up at the Admiral on his column ! It seems as if our local authorities were doomed to blunder in the region of art. The Corporation astonish the public with a "griffin," and the Metropolitan Board commits a paradox with the sphinxes.

The construction of new streets raises somewhat knotty questions with regard to the dislodgment of the working classes. The Board obtained a Street Improvements Act in 1877, by means of which some wonderful things were to be done; but Parliament so jealously guarded the interests of the labouring population that the law has in some cases been found impracticable for carrying out the contemplated scheme. Thus the authorised new street from Tottenham-court-road to Charing-cross, and that which was to be made from Oxford-street to Piccadillycircus, were both menaced with such difficulties that the attention of Parliament had to be called to the subject. The Artisans' Dwellings Act is a cognate matter, and it is to be hoped that the report of the Select Committee appointed at the instance of Sir Richard Cross will show how to reconcile the wants of the metropolis with the interests of the ratepayers and of the poor. With regard to bridges, the Board has now an extensive jurisdiction, and has done good service. Nine of the Thames bridges have become the property of the Board, and are free of toll. This abolition of bridge tolls has set the traffic of London free, and has distributed it more widely, to the great advantage of the public. The Corporation and the Metropolitan Board are now consulting together as to what can be done to meet the demand for vehicular communication across the Thames below London Bridge. Their conclusion—if they can arrive at any—is anxiously awaited.

Into all the doings of the Board it is impossible to enter within the limits of a single article, unless we content ourselves with a species of catalogue. Parks, commons, and open spaces form an interesting chapter. The Fire Brigade is a wonderful institution, although there is a general impression that it is not big enough for such a contingency as may possibly present itself some day. There is no need to say much just now about the gas supply. As to the electric light, the Board is true to its first love, and maintains the Jablochkoff lamps on the Victoria Embankment and Waterloo Bridge. On the water question we are encouraged by hearing of the progress of the constant supply and the setting up of hydrants. Tramways are a feature of recent date. Passing over a variety of miscellaneous matters, we come to the sequel, where the Board reviews its work of six-andtwenty years. The main drainage has cost a sum which is travelling on towards six millions. On the embankment of the Thames, and on new streets, and other street improvements, the Board has expended more than ten millions, besides contributing $\pounds 600,000$ towards the cost of smaller undertakings. Then we have the bridges made free at the cost of nearly a million and a-half, while parks, gardens, and commons have taken nearly half a million. The Artisans' Dwellings Act has swallowed up $\pounds 1,400,000$. The development of the Fire Brigade has also been achieved at some cost. The total capital expenditure of the Board has thus considerably exceeded twenty millions, but on the whole London has no reason to regret the outlay.

THE INSTITUTION OF CIVIL ENGINEERS.

ANOTHER session of this representative Institution has closed, and has been marked by the success which has characterised its conduct for several years. The objects of the Institution have been so frequently set forth that it is unnecessary to do so again. But one feature in its management during the past three or four years causes us to turn to Tredgold's definition of the profession of a civil engineer, namely, "the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states both for internal and external trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation, and docks for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters, and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construc-tion and adaptities of making the construction and adaptation of machinery and in the drainage of cities and towns." This definition, it will be seen, includes to this day every branch of the engineering profession, not even excluding that of the electrical engineer. Notwith-standing, however, its comprehensiveness, it was for many years the custom to recognise only those who designed roads and bridges and similar public works as civil engi-neers, and hence the formation of societies of engineers, who, not being engaged in these directions, became known as mechanical engineers. It cannot be disputed that formerly a large proportion of those engaged in the con-struction of machinery were of a lower educational standard than those engaged on harbours, docks, and so forth. The tendency of modern manufacturing processes and of structural methods as well as of communication has been, and is more and more, to rely on machinery the design and construction of which, as it has become more elaborate, has surpassed the capabilities of the older millwright and machinist and called forth the highest powers of the skilled engineer. This fact has been recognised by the management of the Institution of Civil Engineers, for the Institution is now largely composed of those whose vocations are widely different, as the last report of the Council says, "from those of the designers of roads, bridges, and similar public works, who, very erroneously, had often alone been recognised as civil engineers." Having recog-

nised this, then, it became very necessary to increase the range of subjects for papers read at the meetings, so that all interests might be consulted. Thus, of the fifteen papers read and discussed during the session just closed, nine of them were by men whose avocations are not described in the latter part of the preceding quotation; and described in the latter part of the preceding quotation; and the address of the president, Sir W. G. Armstrong, may be classed also amongst these. The three papers which occupied the last two nights of the session were on milling machinery, while others have been on the construction of guns and carriages, cold air machinery, coal washing machinery, the electric light, and the gas engine, while those of another class have been on river conser-uation of guns of pretable waterup design of structures to vancy, analyses of potable waters, design of structures to resist wind pressures, and harbours and estuaries. These show that a Catholic spirit has entered the Institution, and its increasing popularity cannot but be part of the cause of the comparatively sparsely attended meetings of some of the other more special societies. Thus the Institution of Mechanical Engineers' meetings have not been so well attended as they ought, judging by the popularity of papers on mechanical unbertured before the reset. In this time on mechanical subjects read before the parent Institution. The latter could not, perhaps, dispose of all the papers that might be usefully read, so that the small attendance at some of the meetings of the Institution of Mechanical Engineers is probably due to the occasional instead of weekly arrangement of its London meetings, and, perhaps, to the hour at which those meetings take place. Very few people can spare a couple of days from their works to attend such meetings, and to most people it would be more convenient to attend one meeting each week or fortnight than two meetings on successive days once in three months, so that the material advantages are on the side of association with the older body, though, perhaps, there are some respects in which this is not altogether the case. It is, however, sufficiently so to cause the very rapid growth of the numbers of applicants for election contemporation of the numbers of applicants for election or transfer, the numbers being 300 during the past seven months, besides 150 recommendations in favour of the admission of students, and the elections have increased the numbers of all classes to over 4150, or by Increased the numbers of all classes to over 4150, or by nearly 4 per cent. since last year, the Institution now con-sisting of 1326 members, 1542 associate members, 534 associates, 20 honorary members, and 728 students. The summer meetings of this Institution, and of the Iron and Steel Institute, are well attended chiefly be-cause men make more or less a holiday of it, and semi-pleasure excursions are arranged for them, so that there is just enough buying to ottend to the that there is just enough business to attend to to make the pleasure part of the meeting enjoyable. The publications of the Institution of Civil Engineers are, moreover, enriched by information extending over so wide a range and culled from the whole world—some in the form of abstracts from foreign "Transactions," and some the discussion of papers by correspondence, so that a man need not come from Edinburgh, say, to London because he has a little experience which may be valuably contributed to the "Drecondings" contributed to the "Proceedings."

THE EXTENSION OF CREWE WORKS.

The recent extension of Crewe Railway Works by the erection of a new foundry has been the occasion of a demonstration, and on Saturday the members of the Manchester Association of Employers and Foremen, to the number of about 100, made a special excursion to the works, over which, in the absence of Mr. F. W. Webb, they were conducted by Mr. Charles Dick, the chief indoor assistant superintendent. Occupying an area of 85 acres, with roofed-in buildings and workshops, covering 27 acres, the Crewe works are now, without doubt, the largest and most complete locomotive building establishment in the world, and give employment to nearly 6000 hands. The old works have been so frequently described that any detailed reference to the various departments, and the splendid plant with which they are supplied, is unnecessary, and we can only sketch very briefly a few of the new features of special interest. The new foundry, the last of the additions, is an extensive building, the largest, it is supposed of its kind in the world, covering an area of 420ft. by 120ft, the whole of the work of which has been carried out by the London and North-Western Company's own staff of men, from the designs of Mr. F. W. Webb, the locomotivesuperintendent, and chief mechanical engineer. The foundry, which is not yet in working order, will be furnished with five eupolas, two of which will be placed in an external adjunct. This pair of cupolas will be surrounded by a platform with cast iron floor, covering at either end drying stoves, with lines of rails running through the centre to the three remaining cupolas, and the material will be surplied to the cupolas by a hydralic host, the lifting ram of which is 12in. diameter. The roof of the building is carried in three spans on iron columns and good light and ventilation are provided, special provison having been made for the escape of steam, smoke, and other gases. Iron pillars and the tops of the side walls carry iron girders running the whole length of the building, along which are

side and underside plate at the firing hole, and thus dispensing with the ordinary water ring. This alteration requires special machines for drilling both plates at the same time and for rivetting the fire hole door, both of which have been well designed for the purpose. Hydraulic machines for removing the buckle from old springs without injury and fixing the buckle on new springs, attracted considerable notice, as did also a set of very handy tools supported by templates on the locomotive and driven by a cord from the line shaft, by which six horn blocks are refaced in place on both sides at the same time, and the cylinders rebored and the valves refaced. Amongst the heavy class of machinery was a powerful hydraulic punch for cutting the fire door holes out of a cold plate in one operation. In doing this the plate is brought in contact with the punch by a pressure of 350 lb., which is then increased by an intensifier to 1800 lb. to the square inch. The steel works, which are capable of turning out 30,000 tons per annum, are supplied with both Bessemer and Siemens-Martin plant, and the steel rail and tire mills and forge are full of powerful machinery, including steam hammers from 30 tons downwards, and one machine particularly noticeable was a toothless saw for cutting steel angles cold. During the day the party were entertained at luncheon, provided by Mr. Webb, at the Mechanics' Institution, and here one new feature which is being introduced elicited general approval. One section of the Institution originally used as a bowling alley is now being fitted up with various tools which will be driven by a gas engine, and this will be a machine shop open to the members for the construction of models, the execution of repairs, &c., and for the youths especially will certainly form a very useful school for practical mechanics. The day's proceedings were brought to a close by tea at the Royal Hotel, followed by the usual votes of thanks.

PORT ADELAIDE AND THE COST OF DREDGING.

Some useful figures relating to the cost of dredging at Port Adelaide during the year 1881, by the several dredgers owned by the South Australian Government, are given in the report of the President of the Marine Board. The material raised consisted the President of the Marine Board. The material raised consisted principally of red clay of a most tenacious character, which adhered to the buckets, and so thoroughly blocked them that much time was lost in consequence of the frequent stoppages to clear them. At Port Adelaide, 377,826 cubic yards, fifty-four less than in 1880, were raised at a cost of $\pounds 21,885$, or $\pounds 485$ less than in 1880; No. 2 dredger's work fell off about 4000, and No. 3 about 8000 yards, but No. 5 lifted about 11,000 yards more. It was at first intended to deepen the inner bar to 20ft at low It was at first intended to deepen the inner bar to 20ft. at low water, but in consequence of the delay above mentioned, this water, but in consequence of the delay above mentioned, this was for the present abandoned, and a depth of 18ft. at low water is now being reached. It is hoped that by the end of this year that not less than 17ft. at low water will have been obtained along the whole of what is known as the inner bar; or a length of two and a-half miles, with an average width of 160ft. Allowing for the rise and fall of tides—about 8ft.—this will give a double 3 for the rise and fall of tides—about 8ft.—this will give Allowing for the rise and fall of tides—about δft .—this will give a depth of 25 ft, at high-water springs. The original depth was only 2ft. 6in. on the shallowest part. The president thinks that the cost of another first-class dredger will be money well expended. He says it has been suggested that a dredger similar to the South Australian Company's Torrens—which discharges over the side by means of a shoot—should be procured; but the Board do not think that a better type of dredger than the Wallaroo—No. 5—can be secured for their purposes, and as one of the same size, and two barges similar to those now in use, can be constructed at the dockyard for about $\pm 35,000$ —including the cost of engines and boiler, for which tenders will be called for in the colony and in England—the Government have given the necessary authority for immediately commencing called for in the colony and in England—the Government have given the necessary authority for immediately commencing the work, which will give employment to a number of hands for a considerable length of time. As a piece of colonial information it is mentioned that "the Priest-man's crane and another are keeping certain district coun-cils and private persons fully supplied with silt, which is brought from the inner bar, and sold to the former at 6d. per load, and to the latter at about cost price, viz., 1s. per load, delivered on the wharf. This arrangement was the result of correspondence extending over some years, deputations, and, correspondence extending over some years, deputations, and, latterly, discussion in Parliament, particulars of which, and correspondence extending over some years, deputations, and, latterly, discussion in Parliament, particulars of which, and the Board's views as to their position in the matter, may be seen in the secretary's report of the 9th August last, printed as a Parliamentary paper." This may therefore be an important matter, but it sounds peculiarly otherwise. The number of cubic yards of silt brought to the surface in Port Adelaide during the year was as follows :—No. 2 dredger, 36,683; No. 3, 134,823; No. 5, 203,749; spoon barges, 642; and Priestman's crane, used as a dredger, 1929; or a total of 377,826 cubic yards. The average quantity raised monthly by the Nos. 2, 3, and 5 dredgers was 2056, 11,235, and 16,979 respectively, the best month's work being in November, when No. 5 lifted 21,004 cubic yards. The Willunga—No. 3—never raised 14,000 yards in any one month, and the Wallaroo—No. 5—never raised less. The cost per cubic yard for raising and discharging was equally in favour of No. 5, being 13'41d. as against 15'15d. for No. 2— raising only—and 14'22d. for No. 3. It will thus be seen that No. 5 raised 68,926 cubic yards more than No. 3, and that she has done all her work at '81d. per cubic yard cheaper. The total cost for raising and discharging by the Nos. 2, 3, and 5 dredgers—omitting shillings and pence—was £2316, £7989, and £11,388 respectively. The repairs to the dredging plant, caused by the great wear and tear, always amount to a considerable sum, such expenditure during the year on the three dredgers being, for No. 2, £660; No. 3, £2678; and No. 5, £3488; or a total of £6826. The wages of the men employed in connection with lifting and depositing material amounted to £5831, or about one-fourth of the whole expenditure; and sundries, shoos, and with lifting and depositing material amounted to ± 5831 , or about one-fourth of the whole expenditure; and sundries, shops, and management cost about the same proportion.

PROPOSED STATE PURCHASE OF CANALS.

in length. The whole of the foundry machinery will be driven by a wall engine at one end of the building, and the steam power will be supplied by three "locomotive stationary" boilers. In the engine-room are two of Root's patent blowers, supplied by Messrs. Thwaites Brothers, of Bradford, from either of which the requisite blast may be obtained for any of the cupolas at will, and in the same room are powerful pumps for replenishing the hydraulic accumulators as required. In passing through the works a number of new special tools were shown to the visitors, and as indicating the most recent improvements in locomotive construction several of these may be briefly noticed. The locomotive cylinders, instead of being cast singly, are now cast in pairs in one piece, not only doing away with the joint which has always been a source of trouble, but being produced at less cost, and special machinery has been designed for planing up the valve faces and boring the steam ports. A special quartering machine for boring out crank pin holes and wheel bosses from a fixed enture has been designed by Mr. Webb, who has also introduced a hydraulic wheel press for forcing wheels on to the axles and ensuring their being at the proper angle. Another improvement introduced by Mr. Webb is a new machine for flanging the outbe laid before a Select Committee. He intimates that he has evidence in his possession showing that on a canal in his district, which has become the property of the railway company, illegal practices prevail, "Evidently perpetrated for the express purpose of throwing the whole trade upon the railway." The captains of the canal boats have told him cases of this kind. For float-ing a cargo of rails in his own boat from Sheffield to Hull, Ing a cargo of rais in his own boat from Shemeid to Hull, one captain paid ± 14 to the railway company, whilst his own receipts, including use of boat, &c., only amounted to ± 9 . Another was charged for carrying 20 tons of sand a sum as for a full cargo of 50 tons. Mr. Chappell says there is an enormous mass of this class of evidence, but the men are too poor to spare either time or money to come up to London to give it before a Select Committee. Mr. Chappell thinks that with the present control of canals by railway companies it is no wonder our ironworks and collieries are languishing, and that Dronfield becomes a deserted and ruined town. If Government would only appoint a Royal Commission, and place upon it men who understand the subject and could cross-examine the railway experts, he is perfectly certain the State would purchase the canals, and by developing the water-ways "save this country, and hundreds of thousands of miners, and the working classes generally, from the ruin which is now gradually stealing over them."

THE IRWELL VALE BOILER EXPLOSION.

THE inquiry into the cause of the boiler explosion which occurred on the 1st inst. at the Irwell Vale Dyeing and Bleach-ing Works, Radcliffe, and by which three men were killed, has brought out clearly the difficulty which boiler insurance companies encounter in their effort to get proper examinations of the boilers placed under their care. The boiler which exploded was made in 1866, and was of the ordinary two-flued Lancashire type. Its in 1866, and was of the ordinary two-flued Lancashire type. Its length was 25ft. 9in., and diameter 6ft., and the flue tubes were 2ft. 2in. diameter; the thickness of the plates in the internal flues as well as those in the cylindrical portion of the shell was $\frac{1}{2}$ in. and the ends were $\frac{1}{2}$ in. thick. The boiler was provided with the usual mountings and the safety valve—which was of Cow-burn's dead-weight construction, measuring $3\frac{1}{2}$ in. diameter—was estimated to be loaded to 44 lb., though the blowing-off pressure by the gauge was 40 lb. per square inch. The boiler was well housed in, the rooms over it extending to a considerable distance on either side, so that no dampness from the roofs could get to by the gauge was 40 fb. per square inch. The boner was wen-housed in, the rooms over it extending to a considerable distance on either side, so that no dampness from the roofs could get to the seatings, and there had apparently been no leakage at the seams near to the part where the boiler gave way. From some cause, however, it was evident that the fourth, fifth, and sixth plates near to and in line with the left seating had become reduced by external corrosion, more especially the fifth plate, at which part the primary rent occurred, and following nearly the lines of rivets round the circumference of the shell this belt of plates was flattened out, whilst the back portion of the boiler being lifted by the reaction of the escaping steam and water, the furnace angle iron also gave way. The connection between the ends of the boiler being reversed, the front part was driven forward about 10ft. and the back portion, with the flue tubes attached, was projected about 18ft. in the opposite direction, wrecking the building in which the boiler was situated, besides doing much damage to the surrounding pro-perty. Mr. Fletcher, chief engineer to the Manchester Steam Users' Association, examined the boiler on behalf of the coroner after the explosion, but neither he nor his assistant were able to throw any light on the cause of the corrosion of the plates, and throw any light on the cause of the corrosion of the plates, and could simply state that the disaster had occurred through the plates becoming thinned, a fact which was palpable to any ordi-nary observer. From the examination of Mr. McDougall, the chief engineer of the company with whom the boiler was insured, it appears that the last examination made in the flues was on the 5th Lanuary 1880 at which the theorem the states in It appears that the last examination made in the fittes was on the 5th January, 1880, at which time the plates in contact with the seating were found corroded, and this was pointed out to the firm, who were recommended to have portions of the brickwork removed in places, and also to take efficient means to prevent the dampness, which was presumably the cause of the injury. Several inspections of the fittings of the boiler were made, whilst working since the examination referred to the recent on whilst Several inspections of the fittings of the boiler were made, whilst working, since the examination referred to, the reports on which were produced at the inquiry, and in the communication sent to the firm since that time it appears that their attention was called six times to the fact that the company desired a thorough examination of the boiler to be made annually, and that eight days' notice should be given. If possible, also, the general public holidays—such as Christmas and Whitsun-tide—should be avoided, owing to the great pressure put upon the staff of inspectors at these times. It seems that the boiler was cleaned out at Christmas last, and on Saturday, the 31st December, the firm wrote to the insurance company to send an inspector on the following Tuesday, but as company to send an inspector on the following Tuesday, but as Monday was observed as a holiday, the letter was not received until Tuesday morning, and owing to the inspectors being all until Tuesday morning, and owing to the inspectors being all previously engaged, it was found impossible to send a man on so short notice. Impressed with the necessity of having an entire examination made of the boiler, Mr. McDougall sent a special letter to the firm in July last, and again since the commencement of the present year he called their attention to the length of time which had elapsed since the last examination, stating that as he was unable to furnish them with particulars of the actual condition of the boilers, an early opportunity to make a thorough examination was particularly requested. Before the firm afforded an opportunity, however, the explosion took place. There is apparently no difference of opinion between the chief engineers of the several insurance companies regarding the means of pre-venting the unfortunate explosions. All boilers require periodiof the several insurance companies regarding the means of pre-venting the unfortunate explosions. All boilers require periodi-cally complete examination, and what is wanted is opportunities for making those examinations. Mr. Fletcher stated in his evidence that an "entire" examination should be made once a year of each boiler, from which we presume he meant this to be desirable as a general rule, as he added that under favourable circumstances a boiler might go for two or three years or even longer without such an examination. The verdict of the jury concerning the three men who were killed was "accidental concerning the three men who were killed was "accidental death," but the manager of the works was blamed for not afford-ing the insurance company reasonable facilities for the examination of the boiler. The foreman further stated that in the opinion of the jury efficient examinations of boilers once a year by certified inspectors ought to be enforced by Government, and the coroner's attention was directed to the fact that in the annual report of the insurance company published last year Mr. McDougall had expressed similar views.

THE RAILWAY HALF YEAR.

WHEN five out of the six months of the railway half year are about concluded, there are usually facts accumulated sufficient to indicate the nature of the probable result of the working as a to indicate the nature of the probable result of the working as a whole—at least approximately. In the present instance it is certain so far that there is a favourable result. Traffics are very considerably in advance of those of the corresponding period last year; and as in that time there was a prolonged winter, very severely felt, it may be assumed that working expenses

will on the whole have been lighter in the mild one that has been passed through. The weekly traffic returns tabulated show that the two chief of our passenger railways have increases that each considerably exceed $\pm 100,000$, and that seem likely to rise to $\pounds 150,000$ each by the end of the half year; and all the other great companies have increases in proportion—the main trunk lines having been especially favoured. Against this is to be set lines having been especially favoured. Against this is to be set the fact that on most of the railways there is an increased amount of interest to be paid owing to the larger capital. One or two lines have, however, savings in dividends to set against this—the $4\frac{1}{2}$ per cent. stocks of the North-Eastern Railway, for instance, falling to 4 per cent. in one case, and another in a few months also declining in the rate. But even where there is no reduction in the rate of interest, the increased earnings on most of the railways are far more than sufficient to pay the increased interest, and in many instances the surplus is such that an addi-tion to the dividend of the companies is sure, though its amount tion to the dividend of the companies is sure, though its amount cannot be stated until the termination of the half year, when the total of the increase will be known, and when the proportion that working expenses have borne to receipts will be in some approximate measure determinable. It is evident, then, that the railway half year has been a prosperous one so far as it has gone, and as all the companies have enlarged receipts to show, it is a fair deduction to draw that the fact shows a general and large revival of trade in all its great centres. It remains to be seen what the harvest prospects of the year may prove, for should they be favourable it may be believed that that revival will be not only increased in the cities, but that it will also make while the first only increased in the cities, but that it will also make itself felt in the rural districts, and so materially swell the earn-ings of the great companies. The railway returns, so far, give proof that there is growth in the trade of the country, and they furnish every indication that the shareholders in the companies will derive this year a not inconsiderable benefit from that growth.

COKE FOR IRON SMELTING IN SPAIN.

DURING the last few years there has grown up with very little notice a trade in coke for iron smelting in Spain and for allied purposes. In the last month Newcastle sent 2167 tons of coke to Bilbao; Middlesbrough, 1650 tons; and Newport and Glasgow each sent not inconsiderable quantities. It is therefore evident that there is growing in Spain a demand for coke. That demand is partly for iron smelting purposes. It may be that at first the Spaniards will simply try to smelt some part of the iron that they need for their own uses, but beyond this, in the future, it is by no means improbable that there will be an attempt to smelt iron in Spain instead of sending the ore to England, Germany, and other countries. It is remarkable that during the last few years the growth of the export of ron ore from Spain has been to an extent that could not have been looked for, and though there are with some Spaniards still sentimental objections to the shipment of so much of their wealth, yet it is by no such considerations that any change will be brought about. But the cheap labour of Spain, and the economy that under certain circumstances would result from the transmission of pig iron instead of ore, might DURING the last few years there has grown up with very little result from the transmission of pig iron instead of ore, might conduce to such a change in no early future. At the present time the largeness of the demand for ore in this country makes the carriage of coke very cheap for a return cargo, and hence it is that the use of the fuel is growing. Whether it would be found of equal advantage if there was less demand for ore and more for coke, and rates changed their proportion, cannot be very readily determined, but the largeness of the trade with Spain, the growth of the export of coke to that country, and the possibilities of the increase of ione smalling at the cost of a Span, the growth of the export of coke to that country, and the possibilities of the increase of iron smelting at the cost of a limitation of the supply of iron ore here, seem to combine to give great importance to the subject. Of late we have depended increasingly on Spain for the supply of iron ore from abroad, and we have altogether neglected the supply from Norway that was a few years ago much utilised ; but it is possible that the course of events may bring the supply of the north again into demand for smelting here.

THE EMPLOYERS' LIABILITY ACT.

THE first step has been taken towards obtaining an authorita tive legal decision upon the right of workpeople to so contract themselves out of the Employers' Liability Act as to bind their widows in the event of death under circumstances which would otherwise entitle them to damages. Earl Dudley, upon being such for $\pounds 150$ damages by the relict of a sinker killed by falling down a shaft when he was in peril of being drawn over the pulley, admitted liability, and the service of all legal notices by the plaintiff, that Sir Rupert Kettle, the judge of the county court in which the action was brought, might pronounce upon court in which the action was brought, might pronounce upon his plea that, because the deceased had contracted himself out of the Act, damages could not be legally claimed. The deceased, like the other miners, subscribed 4d, a week to the Field Box, and his lordship subscribed as much as the men. From this common fund surgical and pecuniary relief, together with help to widows, was dispensed at the discretion of the Earl's agents. Sir Rupert ruled that this was an absence of mutuality and a want of sufficient consideration on which to found a contract; moreover that the bargains of individuals to prevent the operamoreover that the bargains of individuals to prevent the opera tion of a system of public policy, specifically established by Act of Parliament for the benefit of the whole community, were illegal—in other words, that it is incompetent for workmen to contract themselves out of the Employers' Liability Act. The widow was therefore awarded her $\pounds 150$. If this decision should not be overturned in the Superior Courts there are few arrange-ments which have been made with workpeople in view of this Act which will not have to be revised; and Sir Rupert prepared his judgment in the full knowledge that they will have to be so revised.

THE ST. GOTHARD RAILWAY.

In occasional self-justification Englishmen quote the old saying, "the better the day the better the deed," but they do not heartily think it for all that. The Swiss and Italians do, and so they inaugurated the engineering triumph of their countries last Sunday, and have kept up the inauguration almost ever since by getting fresh batches of important or influential visitors each day from Germany and their own countries, and special trains have been running for amusement, just as they do sometimes two or three times a week when it is Sir E. Watkin's Saturday out, and he wants to make new friends and show them the tunnel works. The tunnel is 9.25 miles in length, and was begun in November, 1872, and nearly finished by M. Louis Favre, but unfortunately he died before his great work was completed, and M. Colladon has been consulting engineer, especially with relation to the pumping and perforating machinery. The tunnel itself was completed and handed over by the contractors on the 29th December. It was fully described in THE ENGINEER of the 5th March, 1880. The St. Gothard Railway connects the railway system of Italy and Switzerland with Germany and the North without going into French territory, and will probably

THE SCARCITY OF IVORY.

OUR Sheffield correspondent recently referred to the scareity of ivory. It is probable that the scarcity will increase. From private sources we learn that on May 15th there were only $127\frac{1}{2}$ tons of ivory in stock in London. The smallest stock for many years was in March last, viz., $107\frac{1}{2}$ tons; the largest in July, 1878, viz., $301\frac{1}{4}$ tons. At present there are pro-bably in dealers' private warehouses about 40 tons, while at one time the private dealers used to hold over 100 tons in their own warehouses. Eight ivory cutters in Sheffield cut up £124,000 worth of tusks in a year, and the two largest cutlery houses add a value of £16,000 each per annum to that total. One-fourth of all the ivory imported into England is used in Sheffield for cutlery hafting and other purposes. It does not appear that any really the ivory imported into England is used in Shefneld for cuttery hafting and other purposes. It does not appear that any really satisfactory substitute for ivory has yet been produced. The material known under various names, but generally called celluloid, has not served more than a limited purpose. The same may be said of vegetable ivory. None of these things will take the peculiar polish of ivory. An enormous trade could be done in a really satisfactory substitute for the elephant's tusks.

LITERATURE.

The British Navy; its Strength, Resources, and Administration. By Sir T. BRASSEY, Vol. II., Part II. London : Longmans, Green, and Co. 1882.

THE second volume of this work has now been out for some little time. The remarks we made as to the first volume apply in a measure to the second. There is a great quantity of valuable information, and the writer has been frawn on into what appeared originally to form no part of his programme, namely, a comparison of the strength of the vessels of the chief naval Powers. This is, we think, valuable to many who are not concerned with much of scientific interest. The subjects dealt with are—armour and armour experiments; guns and gunnery; torpedoes and armour experiments; guns and gunnery; torpedoes and torpedo boats; comparative strength and resources of naval Powers; unarmoured ships; harbour defence and coast service vessels; and lastly, naval expenditure and estimates. To write critically on the manner in which all these are dealt with would occupy much space. We believe the general impression left on the minds of most readers is supprise at the stores of valuable information ably readers is surprise at the stores of valuable information ably dealt with ; but there is a certain amount of difficulty in grasping the organisation of the book. In so comprehen-sive a work this is likely to be the case, and in a measure may be unavoidable. We have the familiar example of the irritation constantly felt in consulting Bradshaw's railway guide, compared with the simplicity which is achieved in some others, but achieved at the sacrifice of achieved in some others, but achieved at the sacrifice of completeness. Sir Thomas Brassey's book is the Brad-shaw of naval matters, and the great advantage he pos-sesses in obtaining information is likely to continue, whether he is in an official position or not—among other causes, for the simple reason that he acknowledges any assistance very handsomely. There are numbers of admir-able woodcuts, and, in short, there is nothing likely to rival it. Lastly, the price is very low.

Der Praktische Eisen-und Eisenwaarenkenner. Von Eduard JAPING. Wien : A. Hartleben. 1882.

IF a knowledge of the German language was more common in this country than it is, we should think that Herr Japing's "Practical Guide to Iron and Ironwork" would find its way on to the shelves of engineers, ironfounders, and contractors. It is a very useful compilation of facts relating to iron and steel in the raw state, and in the various forms of plates, rails, girders, bars, rods, tubes, wire, hollow-ware, castings, forgings, nails, screws, and tools, of all kinds. It is freely illustrated with woodcuts, and tables of weights and sizes, and in some cases prices are given. The addition of the English and French equivalents increases the usefulness of the work. It forms Vol. 97 of the publisher's well-known Chemico-Technical Library, and is a favourable specimen of the laborious compilations which are produced in such large numbers in Germany.

Neuere Betriebscrgebnisse mit E. Jarolimek's Gesteins-Dreh-bohrmaschinen. Wien : Manz'sche Buchhandlung. 1882.

This is a reprint of a paper which appeared in the Oesterreichische Zeitschrift für Berg und Hüttenvesen in the early part of the present year, giving a description of E. Jarolimek's rock drill, together with a series of reports of trials in various rocks.

TENDERS.

BOROUGH OF SOUTH SHIELDS.—CORPORATION TRAMWAYS.

FOR the construction of tramways between the Pier and Tyne Docks, a distance of 2¹/₂ miles—the total length, taken line, being 31 miles. Gauge, 3ft. 6in. Mr. Matthew Hall, Borough Engineer.

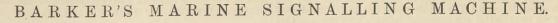
James Gowans, Edinburgh-accepted 12,244 1 6

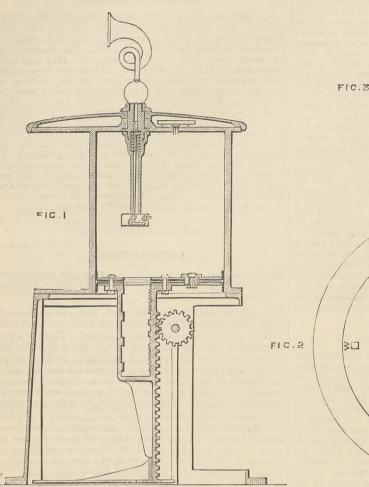
INCKTON.-RIVER BRIDGE.

FOR bridge over the river Stan, at Inckton, near Christchurch, Hants, with approaches, for the Inckton Bridge Company. Mr. T. Stevens, Richmond-chambers, Bournemouth, engineer. Quantities supplied

is all mitorit in furt the fort of is ributing the cu	£	s.	d.
Butler, Leeds	4160	0	0
	4037	0	0
Dyne, Steel, and Co., Newport	3548	0	0
	2994	0	0
	2994	0	0
Hoare Bros. and Walden, Bournemouth	2837		0
Jenkins and Son, Bournemouth	2788	0	0
	2750	0	0
	2750	0	0
	2495		0
Hayter, Portsmouth-accepted	2200	0	0
Engineer's estimate	2611	0	Q

MAY 26, 1881.

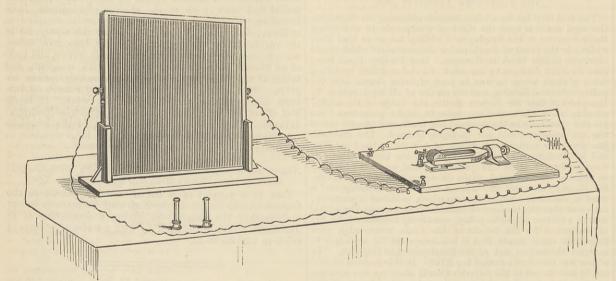




In the recent Naval and Submarine Exhibition was a safety marine signalling machine, arranged so as to give signals accord-ing to the compass course steered. The machine is illustrated by the accompanying engravings, from which it will be seen that it consists of a cylinder, supported by a stand, the cylinder being fitted with a plunger for compressing air. Fast to the plunger is a signal-box, containing eight signals of a different number and order—representing the thirty-two points of the compass; these signals may be called "cams" of different lengths. Over the cylinder is a dial or compass. Suspended from the dial plate—see Figs. 1 and 2—is a tube containing a spring valve—also held fast by the compress air, the regulation of the dial or compass plate regulates the signal to be given by means of the lever, which comes in contact with the signal cam or cams presented by the action of the compass, so that that signal and In the recent Naval and Submarine Exhibition was a safety presented by the action of the compass, so that that signal and no other can be given. When the plunger reaches the head of the cylinder the entire signal has been given through the foghorn for sailing vessels with air compressed to 13 lb. to the square inch.

On steam vessels the machine is fitted so as to operate the steam whistle or steam Siren. When the plunger has reached the top of the cylinder, the ratchet wheel shown is disengaged from the driving wheel, and the weight of the "rack," "plunger," and "signal-box" drops to repeat the signal in from fifteen seconds to two minutes, or instantly if required, and thus the interval between signals is regulated by a drop valve in the plunger. Any desired signal may be given by simply revolving the dial-plate to correspond with the course steered. Should any change in the course be required it is not necessary to wait for the ship's head to swing, but the compass plate may be turned, and thus telegraph to any vessel within hearing what is intended to be done. An approaching ship will thus be kept from putting her helm the wrong way. The code of signals arranged for the machines must of course be learnt by all mariners in order that the full advantage of the arrangement may be obtained, but the value of the design which enables a machine to act at all times On steam vessels the machine is fitted so as to operate the steam value of the design which enables a machine to act at all times as a fog signal or whistle, and to those who know the code, to telegraph by a modified Morse system, will be recognised by everyone. Fig. 3 shows the inside of cylinder developed.

THE INDUCTOPHONE.



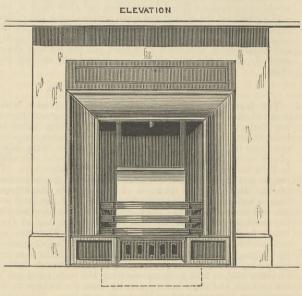
and-break arrangement comprises a tuning fork, one prong of which carries a light contact piece which in its normal position makes contact with the disc carried by the binding screw just outside the prongs. Between the prongs of the tuning fork is a small electro-magnet, the armature of which, when the current goes through the magnet coil, attracts the prongs, and assists in prolonging the tune, during which the fork vibrates indefinitely. There is a binding screw in connection with one end of the coil between the prongs of the fork. The other terminal screws are shown on the base-board of the annaratus, the necessary connecshown on the base-board of the apparatus, the necessary connections between them being made by wires underneath the board. It will be understood that when the fork is vibrating the current alternates between the main line and a short circuit. main line is a flat discor coil of insulated wire of small section. This is placed in a frame like that of a looking-glass between two sheets of cardboard. The current traversing this coil gives rise to lines of force similar to those of a magnet. It is unnecessary to describe such lines of force, as they are well known. It is also well known that if a magnet, a piece of wire, iron, steel, &c., be moved in such a field of force, the inductive electrical action varies accord-ing to the number of lines of force which impinge upon the

According to our promise we herewith give an illustration of the apparatus with which Mr. Willoughby Smith has carried out his investigations. The circuit includes a number of Leehlanche cells forming the battery to give the current required. The make-and-break arrangement comprises a tuning fork, one prong of the pole of the magnet, and the recognised law is that the intensity, or the lines of force, varies as the square of the distance, taking the pole as this point of origin. Taking then a piece of iron as the diaphragm of a telephone, the number of lines of force impinging on the diaphragm varies in different parts of the field. Mr. Willoughby Smith finds that the greatest intensity is at the centre of the flat disc, and, of course, at or near this position the results obtained are better than in other The effect on the iron disc is the same whether you positions. alter the lines of force or the position of the disc. Thus the action is nil if the current is stopped, and the lines of force, so to speak, extinguished, or if the disc is taken out of the field altospeak, exclusion of the electrical action on a disc is constant, the only gether. If the electrical action on a disc is constant, the only sound heard is at the time of making or breaking the circuit, and the rapidity with which the make and break is made influences the pitch of the note heard by means of the disc. We are supposing here that our notice of this apparatus in our issue of last week has been considered. Mr. Willoughby Smith's tuning fork arrangement causes great rapidity in the make and of last week has been considered. Mr. Willoughby Smith's tuning-fork arrangement causes great rapidity in the make and break, and therefore great rapidity in the electrical changes in

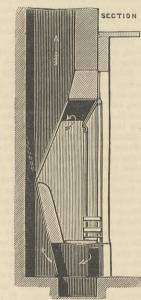
the circuit, and in a material such as the disc influenced by the the circuit, and in a material such as the disc influenced by the circuit, the result being that sound waves synchronous with those of the fork are given out by the diaphragm of the tele-phone, and this when the telephone or diaphragm are altogether unconnected with the circuit, except so far as to be within the influence of the lines of force. In all previous experiments the receiver has been connected in the circuit, but it has been left for Mr. Willoughby Smith to discover that no such connection is required in order to obtain good results.

CRANE'S PATENT REGISTER STOVE.

THE accompanying engraving illustrates a stove being intro-duced by Messrs. Deane and Co., King William-street, E.C. The fire-box is formed of Stourbridge lumps fitted into a cast iron



frame, so constructed as to form at the back of the side lumps, side flues communicating with the bottom of the stove. A register door is fitted above the low-back lump. When this register door is closed a strong draught is created, and the smoke and other products of combustion are conveyed down the side flues and directly under the fire, the greater part being again



drawn through the fire, and the remainder carried into the chimney through an opening below the level of the fire. The front is closed by a raised hearth, as indicated in the drawing. When the fire is well alight, the register door may be opened, and the anthracite is then burned as in an ordinary grate.

IRON PROMENADE PIER, RAMSGATE.

IRON PROMENADE PIER, RAMSGATE. A PROMENADE PIER for Ramsgate has been recently constructed under a Provisional Order which was obtained in the session of 1879. The engravings which will be found on page 382 will explain the general arrangement of the pier, as well as some of the chief details. The leading dimensions of the pier and its details are also given, so that little description is required. The position of the pier on the foreshore was selected so as to give a clear height of about 20ft. from the ordinary high-water spring tides to the deck, by which it has been placed above the reach of the heaviest seas. The pier extends seawards a distance of 550ft., the width of the body being 30ft., widening out at the entrance and also at the head to the increased areas shown. The total area of the pier is 23,157 square feet. The piles were fixed into the hard chalk and flinty foreshore by an arrangement which was found to answer very well. Instead of screwing or driving the piles into the ground, and thereby causing a disruption of the strata surrounding the point of support, a hole was "jumped" out to a size rather larger than the blade of the screw. Into this hole hydraulic concrete was tipped, after which the pile was out to a size rather larger than the blade of the screw. Into this hole hydraulic concrete was tipped, after which the pile was screwed truly into position. The accuracy with which the work was carried out is evidenced by the horizontal lines of the girders and of the deck being perfect. The work was commenced in the summer of 1880, and was carried on uninterruptedly during the following winter, which was an unusually stormy and severe one. The pier was publicly opened in July, 1881. The total cost of the works was about £10,000. Wind shelters, &c., have been erected at the head, which are, however, omitted from the drawing as they are subject to future modification and extendrawing, as they are subject to future modification and exten-sion. The works were designed and carried out by Mr. Henry Robinson, M. Inst. C.E., of 7, Westminster-chambers, the con-tractors being Messrs. Head, Wrightson, and Co., of Stockton-on Tees, and Westminster.

A COMMITTEE of thirty-six members of the Chamber of Deputies has been appointed to examine the scheme submitted by the scientific society presided over by M. Duclerc, for the construction of a maritime canal connecting the Atlantic and the Mediteranean.

LETTERS TO THE EDITOR.

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

THE FOUNDATIONS OF MECHANICS.

THE FOUNDATIONS OF MECHANICS. SIR,—Nothing will give me more pleasure than to discuss with Mr. Browne the questions which I have raised in the letters which you have kindly published for me in THE ENGINEER. I venture to hope that Mr. Browne will fall in with the sug-gestion which I am going to make, and discuss one point or at most two at a time. Unless he thus restricts himself the discussion would occupy much more space than you would, I fancy, be disposed to give us. I shall leave Mr. Browne to select for himself what point he will discuss first. Perhaps it would be as well to select the follow-ing, which bears closely on the words to which he takes exception, namely, that the ultimate cause of the motion of a railway train or a pit cage may be hunted down to the furnace. I did not intend these words to be understood in the trite and extremely vague general sense attributed to them by Mr. Browne, and consequently I propose that Mr. Browne shall state whether motion can under any circumstances be acquired by one body x, unless another body y or other bodies z, &c., part with some of their motion to it? I maintain that the sole cause of motion is motion; that nothing can produce motion but motion. If Mr. Browne admits this well and good—one point is settled between us, and we get firm ground to tread on. If he does not admit it, then I must ask him to maintain his theories by appropriate arguments. I know that Mr. Browne has already contended in your pages in

by each engine to the other is the measure of the pull. It may perhaps save time here if I point out to Mr. Ramsbottom, to whom you have, I see, interpreted my views very accurately, that every pull, such as that of a locomotive on a train, is virtually statical as regards the engine and train. In fact there is no such thing as a dynamical action in this connection, so far as the pull is con-cerned. The pull, engine, carriages and all are moved through space, and they derive their motion from that of particles of water in the form of steam, which acquired its motion in turn from that of the oxygen atoms in the furnace. A bolt in a carriage screwed up tight is in just the same condition as the draw-bar. The pull at the two ends is in both cases alike. The functions of the tie bar are discharged when it combines the engine and train into a con-crete whole. To believe in a dynamical pull is simply to believe in a delusion. I shall be glad to hear from Mr. Ramsbottom where to look for the power stored up when two bodies are moved away from each other. Φ , Π . London, May 16th. London, May 16th.

THE GREAT BELL FOR ST. PAUL'S.

SIR,—As the great bell for St. Paul's has now arrived safely, may I suggest through you that it be not cracked like the West-minster bell by being struck unmercifully on only one side, but clapped lightly simultancously on both sides to give the vibratory ellipses—as, in fact, are railway forgings at Crewe Works by the Ramsbottom hammer, without needing an anvil block. The arrangement is carried out readily by link gear. Nottingham, May 23rd. CONSTANT READER.

STRAINS IN IRONWORK.—Professor Henry Adams is about to deliver a course of eight elementary lectures on "Strains in Iron-work" in the Hall of the Society of Engineers, 6, Westminster Chambers, S.W., on Tuesday and Friday evenings, 6.30 to 8 p.m. The lectures will commence on Friday, 2nd June, 1882. The fee for the course is one guinea, and the subject will be treated as fully as possible without the use of mathematics, and is suited to engi-meering and architectural students, pupils, foremen, and draughts-men. A note-book and pencil will be required, but no text-book. Questions for home work, founded upon the lectures, will be sup-plied, and written answers examined. Tickets can be obtained from Professor Adams, at 60, Queen Victoria-street.

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

(From our own Correspondent.)

(From our own Correspondent.) THE Birmingham Corporation have lately given out a contract involving the expenditure of £80,000 for the building of spacious new gas offices with an art gallery over them, to adjoin the present block of new municipal buildings; and it has been made an imperative condition that none of the ironwork used shall be of Belgian manufacture. They are understood to have come to this decision after careful deliberation, and with the full knowledge that a portion of the ironwork which forms part of the present municipal buildings is of Belgian origin. This decision is looked upon by engineers hereabouts as an acceptance of the position which they have long maintained, that joists and girders made of English iron will bear a greater strain than those of Belgian production, and that architects by employing the foreign manufactures have not really effected economy, inas-much as a greater quantity of iron has been required to bear a given strain than would have been necessary if English girders had been used. English mills are not unadapted for the rolling of girders and joists of the general sections which the Belgians are accustomed to supply. The contract is for 280 tons of ironwork made up roughly as for dd tons of varied roofs. The value of the contract is between \$3000 and \$4000, and it has been secured from Messrs. Barnsley and Sons, builders, Birmingham, who have the contract for the whole of the work, by Mr. George Fletcher, of the Brunswick

43000 and £4000, and it has been secured from Messrs. Barnsley and Sons, builders, Birmingham, who have the contract for the whole of the work, by Mr. George Fletcher, of the Brunswick Works, Wolverhampton. Among the other engineering work for which constructive engineers are this week tendering is a contract that the Gas Committee of the Smethwick Local Board are prepared to give out for the supply of a two-lift telescope gasholder of 152ft. diameter.

are this week tendering is a contract that the tast commutete of the Smethwick Local Board are prepared to give out for the supply of a two-lift telescope gasholder of 152ft. diameter. Because of contracts of this nature which are about, and on account of the good supply of foreign constructive engineering work which is just now under execution in this district, plate, girder, tee, and rivet iron have been in rather improved inquiry on 'Change yesterday in Wolverhampton and this afternoon in Birmingham. Ordinary plates were to be had at as low as £8, but boiler plates were £8 10s. to £9 and £9 10s. Tee iron of ordinary qualities was priced at £7 10s. to £8, but for marked sorts from £8 10s. to £9 10s. was here again required. Rivet iron was £8 to £8 15s. per ton, whilst best best sorts were £9 15s. to £10. Staffordshire bars rolled by the "list" houses maintain the favour which they have long enjoyed abroad amongst buyers with whom quality is more important than price. That this should be so in the face of the severe competition which such manufactures have lately been subjected to from the productions of houses who up to recently were generally considered second-rate, is strong testimony to the positive value of the "branded" irons. Earl Dudley's bars remain at £8 2s. 6d., and the bars of Wm. Barrows and Sons, Jno. Bradley and Co., the New British Iron Co., and such firms, at £7 10s. From other houses bars of very capital quality are abundant at £7 to £6 15s. Hurdle bars were to be had at as low as £6 per ton. Gas strip was reported this afternoon as in good request at about £6 10s. per ton, but the buying is irregular, some makers being busy, while others have not much to do. Hoop makers announced orders still on their books for United States consumption, which they will not clear off until the end of July or August. In such cases execution on United States account has latterly been partially suspended to allow of the mills being employed on more pressing work; hence the present accumulation. Manufacturers h

The improvement noted last week in sheets required by the gal-vanisers has strengthened in the interval. For this week some big contracts for corrugated sheets reached them through London merchants, mainly on Australian account. One Birmingham firm, whose position, however, is exceptional, reports more orders for galvanised sheets during the last two or three weeks than during any similar period in their history. Specifications for black sheets, in execution of old contracts, were more plentiful this week even than last, and so too were absolutely new contracts. Prices were rather better. For a contract embracing "singles" alone scarcely anything under £8 per ton would be accepted; but

were more plentiul this week even than last, and so too were absolutely new contracts. Prices were rather better. For a contract embracing "singles" alone scarcely anything under £8 per ton would be accepted; but where an equal quantity of doubles and lattens was included in the order, singles might have been got on the £7 10s, basis. Doubles were £8 7s. 6d. to £9; and lattens. £9 10s. to £10. Next week the amount of work turned out at the mills and forges will be greatly restricted, for the mills and forges will be laid off for the holidays on an average the first three days of the week, whilst in a few cases the whole week will be given. The Australian mail delivered this week has brought some good orders for light descriptions of merchant iron. Prices, however, in Melbourne show little or no improvement. When the mail left, bar and rod iron was saleable at £10 to £11; hoop iron for trade purposes was offered at £11; sheet iron, in the black, was tolerably firm, with assortments of Nos. 8 to 18 quoted at £11 10s., while for Nos. 20 to 26 £13 10s. was required. Plates were dull, at £11 10s. to £12 10s. For galvanised corrugated sheets quotations ruled, according to brand, at £21 to £22 and £22 10s. for 26 w.g. Fencing wire was in good request, at, for Nos. 6, 7, and 8 respectively, £13, £13 10s., and £14 per ton. Tin-plates were offered in Melbourne at 15 per cent. advance on invoice for good assortments, and a good business was reported. I. C. coke plates were quoted at 20s. to 21s. The demand for pig iron in Birmingham this afternoon was quite as good as last week. The activity was chiefly in part-mine pigs produced in other districts than Staffordshire. Of these pigs sales were reported up to, in exceptional cases, 4000 tons in a line. Native part-mine pigs sold in parcels varying from 500 tons up to 1200 tons. Derbyshire pigs were 45s. to 47s. 6d., and Northamp-tons 44s. to 46s. per ton. Native part-mines were 47s. 6d. to 50s.; native all-mines, 67s. 6d. to 70s. for hot blast sorts ; hematites were again

South Staffordshire.

colliers employed at the Diglake whole Collieries Awdley, North Staffordshire, belonging to Messrs. W. Rigby and Co., to the number of over 400, have struck against a reduction of 5 per cent. As the struggle is likely to be a prolonged one, the men have issued an appeal to the public for support, their union funds being very low. The coal trade of the Staffordshire district funds being very low. The coal is in a very unsettled condition.

Messrs. Chubb and Son, whose lock-works are in Wolverhampton, have just completed at their London safe works what is stated to be the largest strong room which has been made by them. It measures 20ft, long by 12ft. wide, and is 7ft. 9in. high, the whole room being made impregnable without any brickwork. The room is of immense strength; the floor is made of double boiler-plates, and the walls and roof are of the same thickness. The screws are all put in from the inside, and at irregular intervals, so as to prevent the possibility of their being cut or drilled out from outside. The door is of hard steel, plated throughout, and is held by twelve massive bolts, all actuated by one throw of the handle, and one turn of the key secures the whole, while two additional locks are employed for treble safety. Inside the strong room is divided into two compartments. The iron is rolled to special sections, so as to avoid the danger of wedging open the door frames, which is possible where the iron is rivetted edge to flat. Messrs. Chubb and Son, whose lock-works are in Wolverhampton,

THE NORTH OF ENGLAND. (From our own Correspondent.)

(From our own Correspondent.) (From our own Correspondent.) Those most qualified to judge agree that the tone of the iron market held at Middlesbrough on Tuesday last was better, and that the tendency of prices was in favour of sellers. Very few warrants were offered for sale. The makers seemed as indifferent as ever about parting with their iron. Consumers, on the con-trary, having recovered from the effects of the strike, and being certain of steady work for some time to come, were more ready to buy. Merchants' prices seemed still nearer to those of makers, and the firmness of the Glasgow market assisted to keep up the improved feeling. The makers' price for No. 3 g.m.b. was still 43s. 6d., and the merchants' was from 43s. to 43s. 3d. What business was done was mostly at the latter price. Now that the strike has terminated there is no more mention of the proposition to curtail production still further. It is said that the smelters have recently come to the conclusion to buy up all the warrants they can lay their hands on in order to take away from the "bears" this, their last and only resource. It is said that 30,000 tons have recently been pur-chased in this way. During the last week the stock of Cleveland pig iron in Connal's stores has decreased 2599 tons, the total quantity now being 16,821 tons, or 10,000 tons less than at the beginning of the month. Shipments of pig iron from Middlesbrough have improved, and up to Monday last they amounted to 52,854 tons, or about the same as last month. The demand for finished iron is extremely brisk for immediate stowed, provided quick delivery could be promised. For forward delivery buyers are less cager. Ship-plates are quoted at £7 5s., and bars and angles at £6 10s., f.o.b. Middlesbrough less 24 per cent. discount. There is, however, a certain amount of undersell-ing going on by holders of second-hand lots, and for these a lower price is generally asked. The steel trade is flat, orders being few and difficult to get. The demand

There has been considerable discussion as to whether the Board There has been considerable discussion as to whether the Board of Arbitration is to be resuscitated after its recent failure to enforce its awards or not. The general feeling among the employers and the public is that it is of no use, and had better be allowed to die a natural death. The ironworkers do not appear to be much more eager for its continuance, inasmuch as they have found they cannot make sure of forcing it to side with them under all circum stances. Meanwhile it is expected that after their recent experi-ence the manufacturers will look to their association, and make it much stronger than it has ever been ; and while they will in future not be less ready than in the past to listen to argument, they will be more careful to have force ready should argument fail. The Moor Ironworks have been re-started after standing still for

The Moor Ironworks have been re-started after standing still for week in consequence of the failure of Messrs. Johnson and Reay. a week in consequence of the failure of Messrs. Johnson and Reay. They are now being worked by Mr. Peat, the provisional liquidator in the interests of the unsecured creditors. It is expected that by about three weeks the more profitable contracts will be worked off, and that the liquidator will decline to work upon the losing ones, which constitute the preponderance of the 24,000 tons said to be on the books. In three weeks' time therefore it is likely the works will be brought to a stand unless some very favourable offer be made to tempt the creditors to part with their rights.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

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prize and silver medal for Invincible hand lawn mower-both S. Edwards' patent.

At Manvers Main and Oaks collieries the telephone is now in usc, and is found a valuable addition to the other appliances for the efficient working of their pits. Conversation can now be carried on with great clearness between the offices on the surface and the workings, which are more than a mile apart. The telephone apparatus, which consists of Johnson's patent transmitter, and Bell's patent receiver, with a suitable ringing alarum, has been fixed by Messrs. Tasker, Sons, and Co., of Sheffield. Messrs. Drabble and Sanderson, steel refiners, of the Ebenezer Works, Sheffield, have just completed what is believed to be the largest circular saw ever made. It is S7in. in diameter, or lin. more than the biggest ever finished before. The thickness of the plate is No. 5 B.W.G., or ‡in., and the makers reckon upon the substance of the plate itself holding it steady when revolving, so that a guide will not be required on the saw-bench. There are sixty teeth to the saw, the space between each being 4½in. At Manvers Main and Oaks collieries the telephone is now in usc,

NOTES FROM LANCASHIRE.

NOTES FROM LANCASHIRE. (From our own Correspondent.) Manchester,—There is at length some indication in the market that buyers are gradually arriving at the conclusion that prices have about touched the lowest point, and although any large busi-ness is scarcely possible just prior to the Whitsun-tide holidays, there have been a few more inquiries stirring in the market during the past week, especially for forge pigs, with also a little foundry iron. The offers made by buyers are, however, at very low figures, and under what makers are asking, although they have been giv-ing way slightly upon late rates, but upon the basis of 6d. to 1s. per ton under maker's prices a fir business might be done, and merchants who have been "bearing" the market are showing a disposition to cover sales where they can secure Although makers are but little inclined to come down to buyers' terms, several tolerably good cares have been placed during the last few days. Lancashire makers of pig iron are asking about 55. 6d. for No. 4 forge, and 46s. 6d. for No. 3 foundry, less 2½, delivered equal to Manchester sho to these figures do not lead to business, and totska are accumulating rather heavily. Not-withstanding this, offers by buyers at 1s. per ton have been given out have chiefly passed into the hands of sellers of Lincolnshire iron, which is injuoted at 45s. to 46s. less 2½, with, however, sellers at 6d. and in some cases 1s. per ton its have been given out have chiefly passed into the hands of sellers of Lincolnshire iron, which is injuoted at 45s. to 46s. less 2½, with, however, sellers at 6d. and in some cases is. per ton under these figures. Middlesbrough iron is still practi-ate jo lots bought under makers' prices. The finished iron trade there has been are ther better inquiry for sheets for export, chiefly of vastralia, with also a few American inquiries coming in ; and the home demand for galvanising of the tabe. is done down if the galves also. (From our own Correspondent.)

rather better induity for sheets for export, chieny to Australia, with also a few American inquiries coming in ; and the home demand for galvanising purposes shows an improvement. In plates also a fair trade is being done. With these exceptions, however, finished iron is very quiet, and bar makers report new business coming forward only in extremely limited quantity. Even where makers have orders still on their books which would keep them going over the remainder of the quarter, complaints are made that customers will not specify for their deliveries, and in view of the present unsatisfac-tory state of the trade the stoppage of mills is in some cases under contemplation. For delivery into the Manchester district prices, which are rather easier, average about $\pounds 6$ 7s. 6d. to $\pounds 6$ 10s. for bars, $\pounds 6$ 15s. to $\pounds 7$ for hoops, $\pounds 7$ 17s. 6d. to $\pounds 8$ for common plates, $\pounds 9$ to $\pounds 9$ 10s. for best boiler plates, and about $\pounds 8$ 5s. for good Statfordshire sheets. The condition of the engineering branches of trade continues generally satisfactory so far as

The condition of the engineering branches of trade continues generally satisfactory so far as the amount of work in hand is concerned, and in view of the usual Whit-week stoppage for the holidays it has been necessary in some establish-ments to resort pretty largely to overtime. Messrs. Nasmyth, Wilson, and Co., of Patri-croft, near Manchester, are erecting for the Avon Colliery, owned by the Great Western Railway Company, a set of winding engines and head gear on the Köepe system, of which I shall be able to give further details when the plant is completed. This system, which is quite new to English coal mining, has only as yet been adopted at one other colliery in this country, the Bestwood, near Nottingham, where it has been found to work very satisfactorily. At the Avon Colliery the coal will be got from much deeper mines than at Bestwood, the depth of the Avon Colliery shaft being 550 yards, and it is claimed that the greater the depth the better the system— of which I have previously given a brief descrip-tion—works, its application at the Great Western Co.'s Colliery will be a matter of interest to mining engineers. The cylinders of the winding engines will have a diameter of 30in, with a 5ft. Gin. stroke, and the weight of coal per lift, without the cages, will be fifty cwt. The same firm have also in hand very powerful blowing engines for the West Cumberland Iron Company, in which a specialty will be introduced in the shape of apatent balance arrangement ; in these engines the steam cylinders will have a diameter of 30 in, and the air cylinders will be 90in., whilst the stroke will be 10ft.

air cylinders will be 90in., whilst the stroke will be 10ft. The coal trade is very quiet, so far as the ordi-mary general business of the district is concerned, but the unexpected continuance of the North Wales strike has taken away some of the pressure of stocks which would otherwise have been felt on the market. The local demand for house fire coals is exceedingly dull, and although works still take fair quantities of common coal for ironmaking and steam purposes, supplies are far in excess of requirements. Engine fuel is only in moderate demand, and plentiful, with stocks of slack accumulating. Pits are working about four to five days a week, and although quoted rates are without material change, there is a good deal of pushing in the market, which will no doubt lead to some more or less reduction with the close of the month, the leading Manchester firms having already agreed upon some concession in this direction which will come into force with the commencement of June. The average pit prices are about as under:—Best coal, 8s, to 8s. 6d.; seconds, 6s. to 7s.; common, 4s. 9d. to 5s. 6d.; burgy, 4s. 3d. to 4s. 9d.; good slack, 3s. 6d. to 3s. 9d.; and common about 3s. per ton. The commencement of the gas coal season is bringing inquiries into the market for this class of fuel, and several contracts have been made on the basis of 6s. 3d. to 6s. 9d. per ton for good

bringing inquiries into the market for this class of fuel, and several contracts have been made on the basis of 6s. 3d. to 6s. 9d. per ton for good Lancashire screened gas coal at the pit mouth. A fair amount of coal is going away for ship-ment, steam classes meeting with an extra demand in consequence of the North Wales strike. Better qualities, suitable for house fire purposes are also in tolerably good demand for shipment coastwise, but the foreign trade in only moderate. For delivery at the high level, Liverpool, or Garston docks steam coal averages 6s. 6d. to 7s., and house coal 7s. 9d. to 8s. per ton. Coke continues in fairly good demand at late Coke continues in fairly good demand at late

rates. Barrow.-If I am able to chronicle a slightly Barrow,—11 I am able to enronicle a signify better tone for the week in the hematite pig iron market, it must not be taken as an indication that the tone of business has improved. During the week sales have been rather more abundant,

NOTES FROM SCOTLAND. (From our own Correspondent.)

mines. active.

(From our own Correspondent.) TowARDS the close of last week an improve-ment took place in the Glasgow iron market in consequence of the good trade being done in ex-ports, and the demand for No. 3 special brands at the manufactured ironworks. The price advanced nearly 1s, per ton, but the advance almost imme-diately brought out a number of sellers, and the throwing of their holdings upon the market brought back quotations almost to the point from which they had started. This week the market has been quict, with less business doing than usual. The past week's exports, although not equal to those of the preceding week, are about 3000 tons larger than the corresponding week of last year. At a number of the ironworks a material reduction has taken place in stocks, and comparatively little iron is being sent into the public stores.

comparatively little from is being sent into the public stores. Business was done in the warrant market on Friday forenoon at from 47s. 8d. to 47s. 9åd. cash, and from 47s. 10d. to 47s. 11d. one month; the afternoon's quotations being 47s. 10d. to 47s. 7åd. cash, and 48s. to 47s. 9d. one month. On Monday the market was depressed, with busi-ness in the morning from 47s. 8d. to 47s. 4d. Tuesday's market was irregular, with prices between 47s. 5d. and 47s. 7d. cash in the forenoon, and 47s. 5d. to 47s. 4d. cash, and 47s. 7d. one month. On Wednesday the market was easier, with business at 47s. 4åd. to 47s. 3åd. cash, and 47s. 5åd. one month. To-day—Thursday—the market was closed in consequence of the day being observed as a holiday in honour of the Queen's birthday, and there will be no more business done in warrants until Tuesday next. This week the values of makers' iron have remained very steady, the quotations now being as follow:—Gartsherrie, f.o.b. at Glasgow per ton, No. 1, 58s. 6d.; No. 3, 53s. 6d.; Coltness, 59s. and 55s.; Langloan, 59s. and 54s.; Summer-lee, 57s. 6d. and 45s. 6d.; Clyde, 51s. and 49s.; Monkland and Quarter, each 48s. 6d. and 47s.; Govan at Broomielaw, 49s. and 47s.; Shotts at Leith, 59s. and 54s. 6d.; Carnon at Grangemouth, 49s. 6d.—specially selected, 52s.— and 48s. 6d.; Kinneil at Bo'ness, 47s. 6d. and 48s. 6d.; Gengarnock at Ardrossan, 51s. 6d. and 48s. 6d.; Eglinton, 48s. 6d. and 46s. 6d.; Dalmel-lington, 48s. and 47s. Business was done in the warrant market on

mouth continue comparatively small, and show a decrease to date since Christmas of close upon 18,000 tons.

18,000 tons. The malleable trade is still busy, with scarcely so good prospects for the future. There is much activity in the different branches of the engineer-ing trade, especially marine engineering. A large number of additional firms have in the course of the week conceded an advance of wages to their man. men

men. The strike of moulders in the lighter branches of the ironfounding trade, after lasting for four months, is now at an end. The men in the employment of Messrs. John Shaw and Co., Maryhill Ironworks, have resumed work at an advance of 2½ per cent., the same terms also having been accepted by the operatives in the district of Kirkintilloch. The original demand of the men was 7½ per cent., which they would no doubt have obtained long ago had this branch of the trade not been very slack. There is a continuance of activity in the coal trade, the demand for shipping coal being very good.

good

An important conference was held on Tuesday between the secretary of the Fife and Clack-mannan miners and delegates of the Employers' Association, for the purpose of considering the request of the men that the 12½ per cent. deducted from their wages about six weeks ago should now be returned. Statistics were produced by the secretary of the men to show that since the reduction took place the trade has improved. The accuracy of his figures were in some respects disputed by the employers, but they nevertheless made a promise that they would make an effort to obtain higher prices for their coals, in which case the men's demand would be conceded at the

case the men's demand would be conceded at the end of three weeks, on condition that they gave up their policy of restriction and reverted to working full time. Messrs. Wm. Baird and Co. have discovered a new coal-field in the neighbourhood of Irvine, in proximity to collicries which they are at present working, and are making preparations for open-ing up what is expected to prove a very valuable addition to the mineral resources of the district.

WALES & ADJOINING COUNTIES. (From our own Correspondent.)

THE new Taff Vale Railway station at Cardiff. "The new Taff Vale Kalway station at Cardiff, with its subway, was opened this week. The whole has been designed and carried out by Mr. H. O. Fisher. Next week the agricultural show —Bath and West of England—will be opened at Cardiff, and it is expected that the various rail-ways will be taxed to the utmost.

The Cyfarthfa Railway Bill, now in the House of Lords, has been postponed until the second week in June.

THE ENGINEER.

The Cambrian Steamship Company has been floated at Swansea, capital £40,000 in 800 shares of £50 each. This company is building an addi-tional steamer to run between Swansea and New York. Four thousand tons of patent fuel left Swansea last week.

York. Four thousand tono of patent fuel left Swansea last week. The tin-plate trade of the Llanelly works is look-ing up, and general, but slight, improvement must be noted. So far, the improvement has shown itself in an increased demand, and a slight increase of a few pence per box. Prices are still much too low, many orders being on hand from 15s. 3d. to 15s. 6d. per box, ordinary coke plate. Fifteen per cent. less production is scarcely likely to affect the condition of things; but the remedial influence is at work, for the feeble tin-plate works are succumbing right and left. The iron trade is dull, and little business is doing. I hear of few, if any, substantial orders being placed. Newport has been making large consignments to Santos, Rotterdam, and Havre. The coal tram-men of Cardiff have been organising, in order to oppose the Bute Dock Bill. Last week a fine iron screw tug for Messrs. Guy and Son, of Cardiff, was launched from the yard of Messrs. Finch and Co., Chepstow; length 35tft., breadth left, 6in., depth 10ft. 6in. Her engine will be 350 indicated horse-power, and is being con-structed by Mr. J. Hall, of the Cardiff foundry. It is a single cylinder high-pressure surface con-densing engine with duplex expansion valves of the Bodmer type, and the gear for adjusting the grade of expansion is of an entirely novel design. The point of cut-off ranges from $\frac{1}{5}$ to $\frac{1}{5}$ of the stroke. The boiler pressure is 85 lb., and the en-gine will run at 128 revolutions per minute.

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 nistake has been made by looking at THE ENGINEER Index and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.

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

16th May, 1882.
2286. ELECTRIC LAMPS, R. Kennedy, Glasgow.
2287. TREATING LINEN, F. Glaser.—(H. Knab, Bavaria.)
2288. ELECTRIC LAMPS, E. L. Voice, London.
2289. The PLATES, T. Bowen & E. Jenkins, Morriston.
2290. WINDING YARN, B. M. KNOX, Kilbirnie.
2291. RAISING WATER, W. Anyon & J. Lund, Manchester.
2292. Woven FABRICS, E. Brigg, Bradford.
2292. Woven FABRICS, E. Brigg, Bradford.
2294. DISINTEGRATING, R. Prentice, Stowmarket.
2295. DYNAMO-ELECTRIC MACHINES, B. H. Chameroy, Maisons Lafitte.
2296. COMPOUND FUNNELS, F. Livet, Notting Hill.
2297. OABINETS, W. R. Lake.—(A. FitzGerald, U.S.)
2298. OPERATING SEWING MACHINES, W. R. Lake.—(J. Kaarney, San Francisco, U.S.)
2290. CABINETS, W. R. Lake.—(A. FitzGerald, U.S.)
2301. FASTENINGS for GLOVES, J. Hinks, J. Hooper, and G. Moore, Birningham.
2302. ORNAMENTING WINDUM, J. Mitchell, Paris.
2303. DRVING WINDUM, J. Mitchell, Paris.
2304. DRVING WALL PAPER, A. M. Clark.—(J. S. Warren, W. H. Fuller, and J. H. Lange, U.S.)
2304. WASHING DISHES, R. Bramwell, Bayswater.
2304. MASHING DISHES, R. Bramwell, Bayswater.

17th May, 1882.

2305. REGISTERING APPARATUS, J. MORTIS, Liverpool. 2306. FOUNTAIN INKSTANDS, F. F. Benvenuti, Swansea. 2307. DRY CLOSETS, F. Versmann. - (H. Kleucker, Bruns-arich Computing). 2307. DRV CLOSETS, F. Versmann. - (H. Kleucker, Brunswick, Germany.)
2308. ABSORBING POWDERS, A. E. Robinson, Edgbaston.
2309. SPRING MOTORS, H. J. Haddan. - (A. Marquè and J. Montenis, Bordeaux.)
2310. SCHOOL DESKS, W. R. Thomas, Peterborough.
2311. GRAPNELS, J. Anderson & W. C. Johnson, London.
2312. CHLIDEN'S COTS, G. W. von Nawrocki, - (L. Schmetzer, Germany.)
2313. TABLES, G. W. von Nawrocki, - (L. Schmetzer, Germany.) 2313. TABLES, G. W. von Nawrocki,—(L. Schmetzer, Germany.)
2314. ROOFS, G. W. von Nawrocki.—(L. Schmetzer, Germany.)
2315. MARKING APPARATUS, W. BURTOWS and G. Dawson, Leeds.
2316. ROLLING BARS, J. FARMER, Glagow.
2317. PULLEYS, A. W. L. Reddie.—(E. W. Merrill, U.S.)
2318. ELECTRIC MOTORS, J. A. Cumine, Clerkenwell.
2319. FENCING WIRE, E. G. Rock.—(J. Lees, J. W. Rock, and C. G. Moore, Oamaru, New Zealand.)
2320. WATER WHEELS, A. Figge, London.
2321. LETTER FORMS, B. C. Scott, Regent's Park.
2322. STRAM STREING ENGINES, G. Robson, Sunderland.
2323. PRESERVING BEVERAGES, W. A. Barlow—(H. Hold, Switzerland.)
2324. STEAM SDIELERS, F. H. F. Engel.—(A. W. Schultzs)

Sviitzerland.)
2324. STEAM BOILERS, F. H. F. Engel. - (A. W. Schultzs and G. Meyer, Hamburg.)
2325. BOOTS, &C., P. M. Justice. - (S. H. Hindley, U.S.)
2326. DRIVING MACHINERY, C. Truman, Birmingham.
2327. ATTACHING KNOBS, T. H. P. Dennis, Chelmsford.
2328. DOUBLING COTTON, F. J. Smith, Heywood.

18th May, 1882.

18th May, 1882.
2329. Gas ENGINES, W. B. Hutchinson, London.
2330. CHECKING APPARATUS, W. B. Llewellin, Bristol.
2331. BEDSTEADS, S. Isaacs, Birmingham.
2332. ADJUSTABLE CHAIRS, J. COWAN, Liverpool.
2333. CANOES, J. T. Grindrod.-(*E. Jackson, Manilla.*).
2334. PEMAINERT WAY, F. C. Glasco, *Manilla.*).
2335. LAMP FITTINGS, C. Defries, London.
2336. CHORTNO, RAILWAY CARRIAGES, T. J. Handford.
-(*W. A. Stern and H. M. Byllesby, New York.*)
2337. ENGINES, H. Guthrie, Longsight.
2338. ANIMAL CHARCOAL, H. E. Jones, Stepney.
2339. ANIMAL CHARCOAL, J. W. Ingham, Bow.
2340. DYNAMO-ELECTRIC MACHINES, C. W. Vincent.-(*W. B. F. Biphinstone, Canada.*)
2341. METALLIC TUBES, W. Lake.-(*G. Goving, U.S.*)
2345. GAS-MOTOR ENGINES, S. and H. N. Bickerton.
Ashton-under-Lyne.
2346. OVERMANTLES, G. H. Haywood, London.
2347. SUPPORTING CARDLES, E. Edwards.-(*H. Deetjen and C. Berlin.*)
2348. INCANDESCENT LAMES, S. H. Emmens, London.
2349. DEFINICAL APPARATUS, S. H. Emmens, London.
2340. DEFINICAL APPARATUS, S. H. Emmens, London.
2340. DESECOLLARS, H. J. Haddan.-(*R. Fesch and Co., Leipzig.*)

20th May, 1882. 2377. GULLIES, H. Kelly, Hampstead. 2378. PRESERVING LEATHER, W. E. Gedge.-(J. M. N. F. Granger, Paris.) 2370. CONSUMING SMOKE, H. C. Paterson, London. 2980. VELOCIPEDES, A. Phillips, Birmingham. 2381. HOT-BLAST STOVES, E. A. COwper, London. 2382. CALES, J. Gordon, jun., Dundee. 2383. COCKS, J. C. Mewburn.-(E. Chatel, Paris.) 2384. FOG SIGNALLING, W. E. Langdon, Derby. 2385. HOSE COUPLINGS, T. L. Dawtry, Stretford. 2386. DRAWING APPARATUS, L. A. Groth.-(R. Schrke, Berlin.) 2387. CABS, N. D. Spartali, Liverpool. 2388. COMBING WOOL, C. D. Abel.-(F. Glaser, Berlin.) 2380. LIGHTING LAMPS, G. BINSWANGER, Germany.) 2390. LIGHTING LAMPS, G. BINSWANGER, LONDON. 2301. SECONDARY BATTERIES, J. Pitkin, Clerkenwell. 2302. SCREWS, S. I. and J. Adams, Romford. 22nd May, 1882.

22nd May, 1882.

22nd May, 1882.
2393. TRICYCLES, F. J. Cocks, Yardley.
2394. PIANOFORTES, S. Peppler, London, and J. Carter Southampton.
2395. FIREPLACES, H. Greenhous, Worcester.
2396. LANTES, J. H. Radeliffe, Oldham.
2397. ELECTRIC DETECTOR, B. Coyle, Dublin.
2398. PUMPS, H. Egells and W. A. Kux, Berlin.
2399. SEWING MACHINES, A. A. Fisher, San Francisco.
2401. AgcIoMERATING METALS, J. Wetter.-(A. Simon and V. Petit, Paris.)
2402. TOERS, B. Rhodes, London.
2403. FRAMES, P. M. Justice.-(G. S. Street, Canada.)
2404. IRON and STEEL, P. Williams, Blaenavon.
2405. KNOCKING UF SHEETS, T. H. Hewson, London.
2406. TRICVCLE, H. H. Hazard, London.
2407. Extlosive COMPOUND, H. H. Lake.-(J. Gemperté Vienna.)
2408. COLUNG WIFE, H. Lake.-(G. Gale, Canada.)

2407. EXPLOSIVE COMPOUND, H. H. Lake. — (J. Gemperlé Vienna.)
2408. COLING WIRE, H. H. Lake. — (G. Gale, Canada.)
2409. ELECTRIC ACCUMULATORS, H. H. Lake. — (H. Lory, Paris.)
2410. SCISSORS, E. G. Brewer. — (J. E. Donop, Paris.)
2411. PREVENTING SLACK BOPES, A. J. BOULt. — (Gilde-meinter and Kamp, Germany.)
2412. MARKING APPARATUS, T. Green, Leeds.
2413. LAWN MOWERS, R. KIrkman, jun., Cosby.
2414. INSULATING MATERIAL, J. Fleming, Hampstead.
2415. WATER INDICATOR, G. Binswanger, London.
2416. ELECTRIC BATTERIES, H. Lake. — (J. Wallace, U.S.)
2417. RING FRAMES, J. Nuttall, Farnworth, and J. P. Tapley, Patricroft.
2418. STAYS, A. Ottenheimer, Stuttgart.

ORNAMENTING WINDOWS, J. Mitchell, Paris.—16th May, 1882.
 DRVING WALL PAPER, A. M. Clark, London.—A communication from J. S. Warren, W. H. Fuller, and J. H. Lange, New York.—16th May, 1882.
 Boors and Shors, P. M. Justice, London.—A communication from S. K. Hindley, Worcester, U.S. —17th May, 1882.
 Spools, W. R. Lake, London.—A communication from J. M. Parker, Pawtucket, U.S.—19th May, 1882.

Patents on which the Stamp Duty of £50 has been paid. 1980. WHEELS, J. Cleminson, Westminster.-17th May, SUPPLYING AIR, W. T. Sugg, London.-20th May 2007. 1879.
1879.
2129. SPINNING FRAMES, J. Barbour, Belfast.—28th May, 1879.
2055. RALLWAY SLEEPERS, W. Brown, Smethwiek.— 23rd May, 1879.
2217. FLOOR-CLOTH, F. Walton, Twickenham.—4th June, 1879.
2039. PRODUCING PLATES, C. Wayte and C. Herzog, London.—22nd May, 1879.
2060. PREFARING METAL PLATES, D. Grey, Maesteg.— —23rd May, 1879.
2024. HORSESHOES, J. A. Huggett, Clapham.—21st May, 1879. 2141. CHAFF-CUTTER, T. Clarke, Nova Scotia.-29th May, 1879. 2282. IRON FORGINGS, G. Ratliffe, Liverpool.—10th June, 1879. June, 1879. 1983. HOSE COUPLINGS, E. Schultz, Berlin.-19th May, 1879.
1879.
185. TRANSMITTING, &C., MOTION, T. A. Weston, London.—19th May, 1879.
192. CLEANING BOOTS, T. Bradford, Manchester.—20th 198 2002. OLEARING DOOLS, T. DIRHOND, Mathematical and Market and Ma May, 1879. 2123, PAPER-OUTING MACHINES, R. Furnival, Man-chester.—28th May, 1879. 2144. EXHAUST STEAM, J. Wright, Tipton.—29th May, 2646. MOULDING BRICKS, E. de Pass, London.-30th June, 1879. June, 1879. I5. TRAVELLING CRANES, L. Higginbottom and T. Mannock, West Gorton.—21st May, 1879. 20. Boors and Shoes, J. Blakey, Leeds.—21st May, 1977. 201 2020 TRACTION, J. L. Haddan, London .- 22nd May, 204 EYE-SHADE, W. R. Lake, London .- 22nd May, 2049. 47. LOCK MECHANISM, J. Reeves, Birmingham.-29th May, 1879.

Patents on which the Stamp Duty of £100 has been paid. 2062. [BEARING SPRINGS, G. Spencer, London.-4th June, 1875.

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MAY 26, 1882.

2351. SAGGARS, A. J. Boult.-(G. Heubach, Lichte.) 2352. PERAMBULATORS, J. Preston, London. 19th May, 1882

WATER-SPOUTS, J. T. King .- (G. K. Reber and T.

2308. SIRAP TASTENERS, D. Matsdon, C. P. Robert, Germany J.
2359. TIP VANS, W. Mead, London.
2360. MAKING TEA, W. H. Crispen, London.
2361. VELOCIPEDES, G. D. Macdougald, Dundee.
2362. ENGINES, C. Woodward, Leeds.
2363. TOBACCO PIPES, J. Stanley, Manchester.
2364. DYNAMO-ELECTRIC MACHINES, R. Werderman, London.

2364. DYNAMO-ELECTRIC MACHINES, R. WERDERHAM, London.
2865. CEILINGS, W. R. Lake. - (J. Budd, U.S.)
2866. PREVENTING EXPLOSIONS, T. Sheehan, London.
2867. AIR FILTERING, J. S. Brundstaetter, Liverpool.
2368. INDICATORS, G. Hambruch, Berlin.
2862. BULGE BARREL MACHINES, E. G. Brewer. - (*R. Hinchliffe, Canada.*)
28710. ELECTRIC ARC LAMPS, J. Brockie, Brixton.
2872. FRUIT SYRUP, T. Webb, Clapton.
2873. CLUMP SOLES, L. V. Patin, Paris.
2874. SPOOLS, W. R. Lake. - (J. M. Parker, U.S.)
2875. AIR PUMPS, C. Gimingham, Newcastle-upon-Tyne.
2876. CLARET, J. Proser, Upper Clapton.
20th May, 1882.

20th May, 1882.

Inventions Protected for Six Months on Deposit of Complete Specifications.

Deposit of Complete Specifications.
2260. PLANING METALS, G. Richards, Manchester.—A communication from J. Richards, San Francisco.— 13th May, 1882.
2261. FERULES, W. H. Beck, Cannon-street, London. —A communication from A. A. Roland, Paris.—13th May, 1882.
2278. OXIDE of LEAD, H. H. Lake, London.—A com-munication from G. T. Lewis, Philadelphia.—15th May, 1882.
2302. ORNAMENTING WINDOWS, J. Mitchell, Paris.—16th May, 1882.

2374

16th May, 1882.

1847. EARTHENWARE PIPES, H. Doulton, Lambeth.-19th May, 1875. 19th May, 1875.
 1964. SUPPORTING SHELVES, M. Ker, London.—28th May, 1875. 1964. SUPPORTING SHELVES, M. Kor, London.—28th May, 1875.
1837. INITATING LEATHER, H. Loewenberg, London.— 19th May, 1875.
1864. SULPHATE of SODA, &c., W. Jones and J. Walsh, Middlesbrough-on-Tees.—21st May, 1875.
2296. RAISING CARRIAGE HEADS, E. Rowse, London.— 23rd June, 1875.
1880. PISTON PACKINGS, A. M. Clark, London.—22nd May, 1875.
1950. ROLLING TEA-LEAF, W. Haworth, London.—28th May 1875. May 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 9th June, 1882. 181. VELOCIPEDES, G. Moss, Barbican.-13th January, 194. SAFES, D. R. Ratcliff, Finsbury.-13th January, 194. SAFES, D. R. Ratchi, Flisbury.—194. Mataday, 1882.
195. WORKING WIRE ROPES, G. Cradock and I. Gooder, Wakefield.—13th January, 1882.
205. REDUCING ROCK, J. C. Mewburn, London —A communication from J. Tayler. –14th January, 1882.
210. VELOCIPEDES, W. Soper, Reading.—14th January, 1882.
216. PREVENTING the FOULING of CABLES, & C., T. Cock-shott, East Greenwich, and H. M. Goodman, Cat-ford —16th January, 1882.
222. FOUNTAINS, C. H. Kessell and C. Kessell, London. —16th January, 1882.
224. ELECTRIC LIGHTING, W. R. Lake, London.—A communication from J. S. Williams.—16th January, 1882.

224. ELECTRIC LIGHTING, W. K. LARE, LORDON.-A. communication from J. S. Williams.-I6th January, 1882.
230. LAMPS, C. W. Siemens, Westminster -- 17th January, 1882.
234. DYNAMO-ELECTRIC MACHINES, W. R. Lake, London.-A. communication from C. A. Hussey and A. S. Dodd.-17th January, 1882.
253. LAMINATED SPRINGS, H. Woodruff and G. Barson. Sheffield.-18th January, 1882.
254. MOVING TARGETS, S. T. Lander, More.-19th January, 1882.
255. CARRIAGE LAMPS, W. HOWES and W. Burley, Birmingham.-19th January, 1882.
296. SINGEING HOGS, F. Engel, Hamburg.-A com. from J. H. & J. D. Koopmann.-20th January, 1882.
296. SINGEING HOGS, F. Engel, Hamburg.-A com. from J. H. & J. D. Koopmann.-20th January, 1882.
205. ELECTRIC LAMPS, J. N. Aronson, London.-21st January, 1882.
205. ELECTRIC LAMPS, J. N. Aronson, Isedia.-23st January, 1882.
239. REOULATING ELECTRIC LAMPS, E. de Pass, London.-A communication from B. Abdank.-23st January, 1882.
239. REOULATING ELECTRIC LAMPS, E. de Pass, London.-A communication from B. Abdank.-23st January, 1882.
239. REOULATING ELECTRIC LAMPS, F. de Pass, London.-A communication from H. F. Schöller.-26th January, 1882.
239. REOULATING ELECTRIC LAMPS, E. de Pass, London.-A com. from B. Abdank.-23st January, 1882.
240. MORTENING PAPER, F. C. Glaser, Berlin.-A communication from H. F. Schöller.-26th January, 1882.
241. MACHINE GUNS, O. Jones, London.-31st January, 1882.
242. MACHINE GUNS, O. Jones, London.-31st January, 1882.
243. MACHINE GUNS, C. Jones, London.-31st January, 1882.
244. MACHINE GUNS, O. Jones, London.-31st January, 1882.
247. FLECTRO-MAGNETS, G. Little, New Jorsey.-1st Excenter 2005.

1882. 7. Electro-magnets, G. Little, New Jersey.—1st

 A97. ELECTRO-MAGNETS, G. Little, New JOINEY. - 100
 February, 1882.
 530. METAILIC BEDSTEADS, J. R. C. Taunton and G. O.
 Stan, Blumingham, -3rd February, 1882. 539. METATLIC BEDSTEADS, J. R. C. TAURION and G. O. Aston, Birmingham.—3rd February, 1882.
551. FIBROUS MATERIALS, F. Wirth, Frankfort-on-the-Maine.—A communication from the Society for the Manufacture of Wood Pulp.—4th February, 1882.
604. DECORTICATING TEXTILE FABRICS, A. Berthet, Paris.—8th February, 1882.
632. SIGNALLING, S. C. C. Currie, London.—9th February, 1882. 604. Paris

March, 1882. 1491. SADDLE BARS, J. Oldmeadow, Cheltenham.-28th

March, 1882.
1491. SADDLE BARS, J. Oldmeadow, Cheltenham.-28th March, 1882.
1527. RAILWAY SIONALLING, H. Morris, Manchester.-20th March, 1882.
1587. SECONDARY BATTERIES, A. Tribe, Notting Hill.-1849. FRINTING, W. R. Lake, London.-A communica-tion from P. Reid & J. Eastwood.-18th April, 1882.
1867. ELECTRIC ARC LAMPS, A. B. Brown, Edinburgh. -19th April, 1882.
1890. EYES, F. Kingston, Deptford.-20th April, 1882.
1890. EYES, F. Kingston, Deptford.-20th April, 1882.
1890. EYES, F. Kingston, Deptford.-20th April, 1882.
1900. EXTRACT of MALT, T. Dence and J. J. Mason, London.-21st April, 1882.
1920. HEATING ANPARATUS, J. Keith, Edinburgh.-22nd April, 1882.
1923. CENTRIFUGAL SEPARATORS, F. H. F. Engel, Ham-burg.-A com. from H. Petersen.-24th April, 1882.
1952. NUL LOCK, H. J. Haddan, Kensington.-A com-munication from W. Courtenay.-25th April, 1882.
1955. VALVE, E. H. Greeven, Cheapside.-A communi-cation from G. A. Greeven, Cheapside.-A communi-cation from G. A. Greeven -27th April, 1882.
2042. TEMPLES for LOOMS, W. R. Lake, London.-.26th April, 1882.
2043. CENTRIFUGAL BEARES, A. Archer, Liverpool.-.26th April, 1882.
2044. ZTEMPLES for LOOMS, W. R. Lake, London.-.A communication from La Société de Tassigny Fréres et Cie.-29th April, 1882.
2066. SECONDARY BATTERY, C. H. Catheart, Sutton, and C. B. G. Cole, London.-.2nd May, 1882.

communication from La Societé de l'assigny Frèces et Cie. - 29th April , 1882.
2068. SECONDARY BATTERY, C. H. Cathcart, Sutton, and C. B. G. Cole, London. -- 2nd May, 1882.
2223. CAR COUPLINGS, H. J. Haddan, Kensington. -- A communication from R. M. Brooks. -- 11th May, 1882.

Last day for filing opposition, 13th June, 1882. 227. RANGEFINDER, G. W. Hart, Portsea.—17th Janu-

RANGERIDER, G. W. Harr, FORSA, "I've state ary, 1882.
 RING SPINNING, E. Clarke, Todmorden.—17th January, 1882.
 CIGARETTES, W. H. Beek, London.—A communi-cation from E. F. Leblond.—17th January, 1882.
 PLOUGHS, J. HORINBY, Lincoln, and I. Trolley, Spittlegate.—17th January, 1882.
 INHALATION CHAMBERS, W. A. Barlow, London.— A communication from L. Encausse et Canésie.— 17th January, 1882.

A communication from L. Encausse et Canesle.— 17th January, 1882.
251. RECORDERS, R. Pickwell, Kingston-on-Hull.—18th January, 1882.
254. BRAKES, W. Wakefield, Dublin.—18th January, 1970.

255 SEWING MACHINES, M. H. Pearson, Leeds.—18th unuary, 1882. THREE-LEGGED IRON POTS, D. Cowan, Stirling.— Jan 263.

 THREE LEWIS 1882.
 CAGES OF HOISTS, J. Lindley, Manchester. -19th January, 1882. 267

January, 1882.
 Zib. EXTRACTING GOLD and SILVER, L. F. Gowans, London.—19th January, 1882.
 ELECTRO-HYDROTHERAPEUTIC TREATMENT, W. A. Barlow.—A communication from L. Encausse et Canésic.—19th January, 1882.
 SPADE, N. W. Wallace, King's Royal Rifles.—19th January, 1882.

 TRENCHES, A. M. Clark, London.—A communica-tion from M. E. Pidgeon.—19th January, 1882.
 SECONDARY BATTERIES, J. Humphrys, Norwood. SECONDARY BATTERIES, J. Humphrys, Norwood. --20th January, 1882.
 METALLIC SLAGS, S. Pitt, Sutton.--A communi-cation from G. Rocour.--20th January, 1882.
 FIN. FINSPHATIC SUBSTANCES, H. Y. D. Scott, Syden-ham.--21st January, 1882.
 SANITARY CLOSETS, J. Holroyd, Leeds.--21st Jan-uary, 1882.
 S. COLLECTING MONEY, J. Kaye, Kirkstall.--21st January, 1882.

Hours Boors, M. Boars, N. Boars, Norwoon, 21th January, 1882.
404. GLASS BOTTLES, T. Wood, Portobello.—26th January, 1882.
417. GAS ENGINES, S. Withers, Torquay.—27th January, 1882.

418. LATHES, J. Dewrance, London.-27th January,

1882.
 438. DECORATING PAPERS, J. IMTAY, LONDON.—A communication from A. Cottais.—28th January, 1882.
 446. INSPECTING SHIPS, C. A. Fox, Birkenhead.—A com. from R. P. C. Sanderson.—28th January, 1882.
 509. SAIT-CARE. G. S. Hazlehurst, Runcorn.—2nd February, 1882.
 544. CUTTING BRICKS, G. Otway, Brixton.—4th February, 1882.

Aston.—8th February, 1882. 744. STAPLES, W. Randle, Birmingham.—15th February,

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1431. COPPER PLATES, T. Smith, Stoke-on-Trent.-24th

1431. COPPER PLATES, T. Smith, Stoke-on-Trent.-24th March, 1882.
1673. CHRCULAR KNITTING MACHINE, H. BARTATI, Not-tingham.-6th April, 1882.
1724. COLOURING MATTERS, J. Erskine, Glasgow.-A communication from the Farbwerke vorm. Meister, Lucius, and Brüning.-12th April, 1882.
1815. AUTOMATIC OFTERATOR, L. A. Groth, London.-A communication from L. Freyre.-17th April, 1882.
1888. MARINE ENGINES, J. F. and M. Rankin, Greenock. -20th April, 1882.
1902. ASH GUARDS, W. Selley, Manchester.-21st April, 1882.

1882.
1944. SUPPORTING SHIPS, W. L. Wise, Westminster.—
A com. from J. A. Westerman.—24th April, 1882.
1966. PREVENTING SMOKE, W. Begg, Sale.—26th April, 1999. 1882.

1882.
2010. SHOES, D., P., and N. Fraser, Arbroath.—28th April, 1882.
2016. GLOVE FASTENERS, W. J. Walden, London.—28th April, 1882.
2026. REFRIGERATOR, W. R. Lake, London.—A com. from D. W. Davis & E. W. Voigt.—28th April, 1882.
2031. SPINDLES and PULLEYS, G. Golland, Nottlingham. —29th April, 1882.
2046. WINDLASSES, A. B. Brown, Edinburgh.—1st May, 1882.

1882. 2047. BRIDGES, W. W. Wynne, Hornsey.-1st May, BRIDGES, W. W. Wynne, Hornsey.—1st May, 1882.
 GAS ENGINES, C. M. Sombart, Magdeburg.—1st

1882.
2057. GAS ENGINES, C. M. Sombart, Magdeburg.—1st May, 1882.
2078. CONNECTING LINKS, G. Turton and J. Brunlees, Westminster.—2nd May, 1882.
2003. DRVING WALL PAPER, A. M. Clark, London.—A communication from J. S. Warren, W. H. Fuller, and J. H. Lange.—16th May, 1882.
2025. Boors and Shoes, P. M. Justice, London.—A communication from S. K. Hindley.—17th May, 1882.

Patents Sealed.

(List of Letters Patent which passed the Great Seal on the 19th May, 1882.) 5065. CURING FISH, G. Leach, London.-19th November, 1881. 5090. BorrLes, E. Edwards, London.-21st November, 1881

1881.
5091. GENERATING HEAT, H. Defty, Middlesbrough.— 22nd November, 1881.
5097. BEDSTEAD, A. J. Boult, London.—22nd November, 1881.
5103. DISTILLING WATER, E. Wimshurst, Victoria Park. —22nd November, 1881.
5106. VELOCIPEDES, W. E. Price and W. D. Overton, Hampton Wick.—22nd November, 1881.
5110. GENERATING MOTIVE POWER, R. Hallewell, Blackburn.—23rd November, 1881.
5113. VELOCIPEDES, W. T. Eades, Birmingham.—23rd November, 1881. November, 1881. 5122. IRON and STEEL, J. C. Bromfield, Brighton.—23rd November, 1881.
November, 1881.
Lano and STEEL, J. C. Bromfield, Brighton.-23rd November, 1881.
Stand STEEL, J. C. Bromfield, Brighton.-23rd November, 1881.
Stander, 1881.
Stander, 1881.
Spinning, W. T. Emmott, Manchester.-24th November, 1881.
Stander, 1881.
St

and 5248. (1 F. Hoyer, Liverpool.—30th November, 1881. ORNAMENTAL GLASS, H. H. Lake, London.—30th November, 1881. 61. SECONDARY BATTERIES, H. E. Newton, London. 5261. -1st December, 1881. 5273, CAPSULES, J. Imray, London.-2nd December, 1881. FURNACES, J. Redgate, Nottingham. -3rd Decemver, 1881.
5295. REGULATING the FEED of ELECTRODES, H. E. Newton, London.—*3rd December*, 1881.
5298. CRANES, W. D. Priestman, Kingston-upon-Hull. —*3rd December*, 1881.
5323. CUTING MACHINES, W. LOrenz, Carlsruhc.—6th December, 1881. ber, 1881. 5295. REGI

5323. CUTTING MACHINES, W. LOPENZ, Carlsruhe.—6th December, 1881.
5337. CLIP OF HOLDER, R. Burgess, Shepherd's Bush. —6th December, 1881.
5352. MELTING COMPOSITION, R. Corsham, Stoke New-ington.—7th December, 1881.
5375. ROUNDABOUTS, F. Savage, King's Lynn.—8th December, 1881.

5489. BOTTLES, F. Wirth, Frankfort-on-the-Maine. –
15th December, 1881.
5571. FLOOR COVERINGS, A. M. Clark, London. –20th December, 1881.
5685. WEARING APPAREL, W. R. Lake, London. –27th December, 1881.
387. PURFYING COAL GAS, J. Walker, Leeds. –26th January, 1882. January, 1882. 835. ALBENTOS PAINTS, C. J. Mountford, Birmingham. Asherics - 21st February, 1882.
 Ovens, B. Cochrane, Durham.-24th February, 12 2nd 904. 904. OVENS, B. Cochrane, Durham.—24th February, 1882.
1003. FISH JOINTS for RAILS, A. Davy, Sheffield.—2nd March, 1882.
1013. TRAPS and TUBES, A. M. Clark, London.—2nd March, 1882.
1019. FIRE-RESISTING BRICKS, C. J. Mountford, Birmingham.—3rd March, 1882.
1057. SUGAR, C. Scheibler, Berlin.—4th March, 1882.
1083. FLOATING LIGHTS, J. Imray, London.—6th March, 1882.
1085. ELECTRO MAGNETS, W. P. Thompson, London.— —7th March, 1882.

March, 1985. ELECTRO MAGNETS, W. F. 4000, -7th March, 1882.
-7th March, 1882.
1183. Corkscrews, G. W. von Nawrocki, Berlin. --11th
1188. London. --16th March, March, 1882. 1271. TELEPHONES, A. W. Rose, London.—16th March, 1882 1309. MEASURING DISTANCES, J. P. Nolan, Tuam .-1209, MEASURING DISTANCES, J. P. Nolan, Tuam.— 17th March, 1882.
1399, FURNACES, J. Burch, Stockport, and W. Evans, Manchester.—22nd March, 1882.
1499, FURE-ENGINE HOSE, W. R. Lake, London.—28th March, 1882.
1552, SCREWS and BOLTS, W. R. Lake, London.—30th March, 1882.

(List of Letters Patent which passed the Great Seal on the 23rd May, 1882.) BLASTING ROCK, E. Edwards, London.-24th November, 1881.
 PERAMBULATORS, T. Steen, Ripley.-25th Novem- bro, 181
 bro, 181
 SLIPWAYS, J. Thomson, Newcastle-on-Tyne, and G. Cooper, Penarth.—25th November, 1881.
 Cooper, Penarth.—25th November, 1881.
 VENTIATING, F. Lonholdt, London.—25th Novem-transport ber, 1881. 5171. BREWING, A. Kinder, London.—26th November, 5171. BREWING, A. Kinder, London.—26th November, 1881.
5173. ROTARY ENGINES, W. A. Barlow, London.—26th November, 1881.
5174. SCOURING FABRICS, L. Webster, Dewsbury.—26th November, 1881.
5175. RECORDING SPEED, D. YOUNG, London.—26th November, 1881.
5180. WASHING, &C., MACHINES, T. Bradford, Manchester.—28th November, 1881.
5200. GAS BURNERS, W. Snelgrove, Malksham.—28th November, 1881.
5200. MASHING, MACHINES, W. W. Tonkin, Surrey. —29th November, 1881.
5200. CAATING TIN-PLATE, A. N. Hopkins, Birmingham. —29th November, 1881.
5203. CAATING TIN-PLATE, A. N. Hopkins, Birmingham. —29th November, 1881.
5235. LIGHTING by ELECTRICITY, W. R. Lake, London. —30th November, 1881.
5236. STEERING APPARATUS, J. N. Holliday, Sunderland. —30th November, 1881.
5206. FRIGTION COUPLINGS, J. C. Eckardt, Stuttgart.— 1st December, 1881.
5271. PURFYING COPPER, F. Claudet, London.—2nd December, 1881.
5272. ELECTRIC LAMPS, W. F. King and A. B. Brown,

130. DOCTORY, 1007.
13071. PURIFYING COPPER, F. Claudet, London--2nd December, 1881.
5272. ELECTRIC LAMPS, W. F. King and A. B. Brown, Edinburgh.-2nd December, 1881.
5278. PURIFYING GAS, J. B. Spence and J. Desvignes, London.-2nd December, 1881.
5280. FUSHLE PLUGS, H. J. Harman, Manchester.-2nd December, 1881.
5294. TRICYCLES, N. K. HUSberg, London.-3rd December, 1881.
5291. PREFARING CHROME RED, &C., W. Spence, Lon-don.-3rd December, 1881.
5292. SPINNING COTTON, &C., J. Leyland, Bolton.-3rd December, 1881.
5359. BOOTS and SHOES, F. Richardson, Providence, U.S.-7th December, 1881.
5371. FURNACES, J. Bissett, Glasgow.-8th December, 1881.
5351. BOLLER, MULS, W. P. ThOMPSON, London, Oth 1881 ROLLER MILLS, W. P. Thompson, London.-9th December, 1881. 5417. STEAMERS, W. H. Marks, London.—10th December, 1881 1881.
5537. BREECH-LOADING GUNS, T. Nordenfelt, London. —17th December, 1881.
5589. BREECH-LOADING FIRE-ARMS, T. Nordenfelt, London.—17th December, 1881.
5618. ELECTRIC LIGHT HOLDER, D. Graham, Glasgow. —22nd December, 1881.
5706. LUBRICATING BEARINGS, H. Reisert, Cologne.— 29th December, 1881.

29th December, 1881. 5707. Rose Cutters, C. D. Abel, London.—29th Decem YARN, C. W. Lightoller, Manchester, and J. Longshaw, Preston Brook.—29th December, 1881.
 DYEING, &c., W. Birch, Salford.—9th January, 1889.

119. SASH FASTENINGS, E. R. Wethered, Woolwich .-

SASH FASTENINGS, E. R. Wethered, Woolwich.— 9th January, 1882.
 January, 1882.
 OLABS, J. Abbott, Bideford.—12th January, 1882.
 OLI CAP, T. Watson, Paisley.—21st January, 1882.
 ELECTRIC LIGHT, W. P. Thompson, London.—26th January, 1882.
 PERAMBULATORS, &c., E. Andrews, Sudbury.— 30th January, 1881.
 WASHING SILK, N. Bradley, Manchester.—11th February, 1882.
 SPINDLES, R. B. Thomson, Dundee.—10th March, 1882.

1882.
87. SLIDE VALVES, W. Jones, Manchester.—11th March, 1882.
18. GAS-MOTOR ENGINES, C. G. Beechev, Liverpool.— 18. GAS-MOTOR ENGINES, C. G. Beechey, Liverpool.-18th March, 1882.

List of Specifications published during the

week ending May 20th, 1882.
3945, 2d.; 4048, 2d.; 4248, 6d.; 4250, 8d.; 4290, 6d.;
4360, 6d.; 4369, 6d.; 4375, 6d.; 4379, 8d.; 4415, 6d.;
4418, 6d.; 4430, 2d.; 4434, 6d.; 4435, 6d.; 4439, 6d.;
4440, 6d.; 4442, 6d.; 4448, 6d.; 4450, 6d.; 4451, 6d.;
4452, 6d.; 4453, 6d.; 4454, 6d.; 4455, 4d.; 4458, 6d.;
4459, 6d.; 4460, 6d.; 4461, 6d.; 4464, 6d.; 4465, 8d.;
4466, 6d.; 4470, 6d.; 4472, 6d.; 4473, 2d.; 4474, 8d.;
4477, 10d.; 4481, 6d.; 4492, 8d.; 4496, 4d.; 4499, 6d.;
4503, 6d.; 4404, 6d.; 4510, 6d.; 4511, 4d.; 4513, 2d.; 4517, 6d.; 4518, 2d.; 4521, 2d.; 4522, 6d.; 4523, 2d.;
4525, 8d.; 4526, 6d.; 4527, 2d.; 4528, 6d.; 4529, 6d.;
4530, 4d.; 4533, 6d.; 4534, 6d.; 4535, 6d.: 4536, 1s. 4d.;
4537, 6d.; 4539, 4d.; 4540, 6d.; 4543, 6d.; 4546, 6d.;
4547, 6d.; 4548, 8d.; 4549, 2d.; 4550, 6d.; 4551, 6d.;
4552, 6d.; 4553, 6d.; 4554, 2d.; 4555, 2d.; 4557, 6d.;
4561, 4d.; 4562, 4d.; 4564, 2d.; 4565, 2d.; 4566, 2d.;
4567, 6d.; 4569, 6d.; 4570, 2d.; 4572, 6d.; 4574, 8d.;
4575, 6d.; 4576, 6d.; 4579, 2d.; 4580, 2d.; 4581, 2d.;
4582, 2d.; 4583, 2d.; 4585, 6d.; 4587, 6d.; 4589, 2d.;
4590, 4d.; 4591, 2d.; 4493, 6d.; 4598, 6d.; 4599, 4d.;
4601, 2d.; 4602, 2d.; 4603, 6d.; 4609, 2d.; 4610, 2d.;
4614, 2d.; 4615, 6d.; 4616, 8d.; 4621, 4d.; 4630, 6d.;
4632, 2d.; 4633, 2d.; 4634, 4d.; 4635, 4d.; 4639, 2d.;
4642, 6d.; 4646, 6d.; 4652, 6d.; 4681, 4d.; 5440, 6d.;
5580, 4d.; 380, 6d.; 650, 4d.; 819, 8d.; 838, 6d.
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*** 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.

2482. ELECTRIC MACHINES, E. G. Brewer. -7th June, 1881. -(A communication from T. A. Edison, New Jersey, U.S.) 8d. This relates to the interposition of resistances in the field magnet coils, or in the main circuit, and other-wise regulating and controlling the generation of the current.

Current.
3945. MARKERS USED BY TAILORS, &C., J. Taylor, Birmingham.—12th September, 1881.—(Provisional protection not allowed.) 2d.
The pipeclay, crayon, or other material used to mark cloth, &C., is provided with a metallic case, in which it is held with its edge projecting when in use, and within which it may be withdrawn so as to protect it when not in use.

when not in use.
4048. MATCH-BOX, J. Darling, Glasgow.-20th September, 1881.-(Provisional protection not allowed.) 2d.
The object is to protect a match from being blown out when lit in the open air, and it consists in forming a perforated chamber in the box.

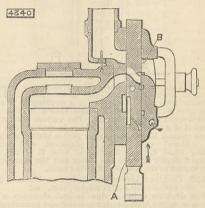
a perforated chamber in the box.
4248. PETROLEUM LAMP BURNERS, B. Schwarz and R. Huppertsberg, Bertin.—1st October, 1881.—(Com-plete.) 6d.
This relates to burners for burning heavy hydro-carbon oils, and it consists in introducing a high conical ventilator between the burner and the lamp glass, its edge projecting up beyond the wick tube. The ventilator is provided with helical slits, so that air entering is caused to travel in a spiral form. The upper edge of the ventilator may be formed with teeth so as to break up the current of air.
4250 SEPARATING GASES FROM EACH OTHER, &c., E.

So as to break up the current of air.
4250 SEPARATING GASES FROM EACH OTHER, &c., E. P. Alexander, London.—Ist October, 1881.—(A communication from H. Haug and the firm of W. Lefeldt and Lentsch, Germany.) 8d.
This relates to a continuous mode of separating mixed gases by centrifugal force, and consists in the use of a revolving drum, in which the gases range themselves according to their different specific gravities, suitable exits being provided to draw off the separated gases.
4255 SECONDEX GAINANC BATTERES A Watt

Separated gases.
4255. SECONDARY GALVANIC BATTERIES, A. Watt. —Ist October, 1881. 4d.
The inventor uses lead coated with a mixture of calcium hydrate, manganese dioxide, and sodium or calcium chloride, or the material known in the alkali trade as Weldon mud, mixed with pulverised coke or granulated lead. A second form has alternate layers of carbon and manganese dioxide.
42900 Pulverye Econoccut, fra. W. P. Loke

Of CATOON and manganese cloxide.
4290. PRINTING FLOORCLOTH, &C., W. R. Lake, London.-Brd October, 1881.-(A communication from C. E. Benedict, Buffalo, U.S.) 6d.
An endless apron receives the material to be printed, and receives a step-by-step movement, so as to bring the material under a printing platten, to which a reciprocating motion is imparted.

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and consists in arrangements whereby in case of the engine running slow or becoming stopped from any cause, the gas supply will be cut off. A third improve-ment consists in substituting one or more washers or discs of asbestos millboard for the springs ordinarily used for retaining the slide cover. Other improve-ments are described.

ments are described. **4380.** MANUFACTURE OF SNOW, F. N. Mackay, Liver-pool.—Th Octsher, 1881. 6d. This consists, First, in causing water or spray to enter a chamber in which a vacuum is maintained, any suitable refrigerating fluid being caused to cir-culate round such drum; Secondly, to the production of a great degree of cold by the compression and ex-pansion of air or gas, which is compression and ex-pansion of air or gas, which is compression and ex-pansion of air or gas, which is compression and ex-pansion of air or gas, which is compression and ex-pansion of the compression pump; Thirdly, in passing the air after each expansion through coolers, round which the air after its final expansion is caused to circulate; Fourthly, in causing the air after expan-sion to pass through water or have water injected into it; Fifthly, in apparatus for carrying the whole of the process into effect. re chan. mosphere or Thirdly, in Thirdly, in ach coolers,

4369. TREATING NITROGENOUS SUBSTANCES TO OBTAIN THEREFROM AMMONIA OR SALTS OF AMMONIA, W. and H. Marriott, Huddersdeld.—7th October, 1881.

and H. Marriott, Huddersfield.--Tth October, 1881. 6d. The apparatus employed consists of two retorts or cupolas and a saturator. In the first retort coal or coke is consumed, the combustion being maintained by a fan and a steam blower, and this retort is of such size as to effect the combination of all the oxygen of the air or steam admitted to it with the ignited coal or coke, thereby forming carbonic acid, carbonic oxide, and hydrogen. These gases, mixed with the nitrogen from the air, are conducted to the bottom of the second retort, containing the nitrogenous sub-stances to be treated. The gases there meet a current of air, the oxygen in which combines with the carbonic oxide and hydrogen, and thereby generates sufficient heat to decompose the nitrogenous sub-stances. The gases from the second retort pass to the saturator, which contains subpluric acid, wherein all the ammonia or ammoniacal salts are retained, and the residual gases, after traversing a series of con-densers, are finally burnt.

densers, are finally burnt. **4375.** TIMEKEEFERS' AND OTHER MOVEMENTS, *H. B.* James, New York.—Sth October, 1881. 6d. The object is to equalise and strengthen the power of coil mainsprings for timekeepers and other me-chanical movements, and to simplify, improve, and chanen the adjustment of timekeepers, whether governed by a balance or a pendulum. It consists, First, in equalising the power of coil mainsprings by having a part of the outer coil of such a pliable nature and thickness as not to break, but clasp and control

the expanding coils, and thus reduce the force in the strong turns, making them equal to the weaker turns, and adjust them by having that portion more or less pliable; Secondly, in attaching a short inflexible segment outside of the outer end of the mainspring for a going barrel; Thirdly, in the application of a similar short segment and hock for the mainspring in a going barrel; Fourthly, in applying within the mainspring coils a spring brace, consisting of one or nore thicknesses of spring. The invention further relates to compensation balances with adjusting screws or weights.

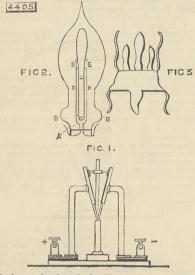
4379. Rolling, Straightening, PUNCHING, BARB-ING, COILING, OR CUTTING INTO LENGTHS METALLIC WIRE, &c., J. Westgarth, Warrington. - Sth October, 1881. 8d.

1381. 8d.
This relates to machines for producing barbed fencing wire as described in patent No 2375, A.D. 1880, and it consists in rolling a double-headed or rail section of wire cold by passing a flat wire between rollers formed with grooves to produce the required section, and then through straightening rollers, beyond which is a horizontal punch, which forms slots in the web. The barb is cut from a flat strip of metal and inserted in the slots by suitable mechanism, one of the swallow-tails and one of the split nibs of the barb being turned up, while the other tail and nib are bent down.
4398. SECONDARY BATERING on Product of the super straightening the straightening turned up.

Dent down.
4398. SECONDARY BATTERIES OR ELECTRICAL ACCUMULATORS, A. W. L. Reddie. — 10th October, 1881.—(A communication from E. Volckmar.)—(Not proceeded with.) 2d. The perforations to lead plates are filled with granules or filaments of lead, and then submitted to pressure.

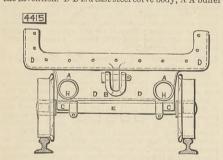
4405. IMPROVEMENTS IN AND APPARATUS FOR PRO-DUCING THE ELECTRIC LIGHT AND IN THE MANU-FACTURE OF CARBONS THEREFOR, A. M. Clark, London.—10th October, 1831.—(A communication from Madame J. de Changy, nèe de Dagn, Paris.) 10d. from 10d.

10.d. One part of this invention refers to several modes of rendering the carbon incandescent without its being traversed lengthwise by the current. Fig. 1 shows one method of carrying out the invention. The carbon is introduced between two inclined metal-lic or carbon electrodes resting upon an insulated block, or one of insulating refractory material. The two electrodes alone are in circuit, and the point of carbon closes it. Another part of the invention relates to a method of preparing carbons by causing porous substances, such as linen thread, to absorb carbon from a bath of some boiling hydrocarbon, and afterwards subjecting them to calcination. Other



methods are also described. Fig. 2 shows an incan-descent lamp also the subject of this patent. The tubular neck A is formed with a swelling at B for engaging with the metallic clips shown in Fig. 3, which serve to form contact. The carbon holder is formed of a steel tube, upon which is spun a tube of glass enamel D. At the upper part a platinum wire is soldered with silver or platinum, said wire being itself connected by glass tube E united to enamel sheath D, while the latter and the platinum are united to the scaled end of the neck.

4415. COLLERY AND OTHER CORVES ON WAGONS, R. Hadjield, London.—11th October, 1881. 6d. The drawing shows a view in end elevation of a corve or wagon body constructed and cast according to the invention. D D is a cast steel corve body, A A buffer



boxes cast thereon, B B coupling shackles, C C pedestals, E E axles, H H timber buffers. The height and holding capacity of the corve body may be in-creased by bolting thereto auxiliary side pieces enclosed within an angle iron frame, and secured at bottom by wrought iron strips.

enclosed within an angle iron frame, and secured at bottom by wrought iron strips.
4418. CALCINING SULPHIDE ORES OF COPPER AND OTHER METALS, R. Mackenzie, Spain.—11th October, 1881. 6d.
This relates to a process and apparatus for continuously roasting or calcining sulphide ores of copper and other metals, and it consists in effecting the roasting in a closed furnace, which is fed by a hopper at top, the roasted material being withdrawn by inclined lateral shoots at bottom. During the roasting steem is passed through the material, and the other, 1881.—(Yoid.) 2d.
4430. BIOYCLES, T. T. Harrison, Bristol.—11th October, 1881.—(Yoid.) 2d.
This relates to the top of the front wheel where they are connected together, and are then carried back to a point where they are curved outwards behind the rider's legs, and are continued in an upward direction to a position near the rider's hands.
4434. TRUCYCLES, A. M. Clark, London.—Ilth October, 1881.—(A communication from S. N. Silver and C.

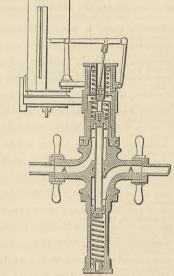
ward direction to a position near the rider's hands.
44384. TRICYCLES, A. M. Clark, London.—11th October, 1881.—(A communication from S. N. Silver and C. E. Page, U.S.) 6d.
The tricycle is provided with two pivotted foot hevers connected with arms loosely mounted on the driving axle, and provided at their outer ends with diving axle, and provided at their outer ends with dosely on the axle and provided with friction clutch dogs catching on the inner surface of the flange of a disc fastened on the axle. The brake is operated by a handle sliding on a square rod, surrounded by a spring, and the front or guide wheel is connected with

a like rod provided with a handle and spring, these handles and springs being also used to increase the power for propelling the vehicle.

power for propelling the vehicle.
4435. SMELTING ORES AND OTHER MATERIALS CONTAINING LEAD, &c., J. W. Chenhall, Glamorgan.— 11th October, 1881. 6d.
This relates to improvements in the fireplaces of reverberatory furnaces employed in the calcination and reduction of ores and other materials containing lead, and it consists in placing such fireplace at a considerably lower level than the working bed, with an upright shaft to convey the gases from the fireplaces to the furnace. A side hopper supplies the coals and is provided with doors to avoid free access of air, of which only sufficient must pass through the fireplace to effect partial combustion. Abreast of the fireplace and gas fue therefrom is another flue for conveying air, the upper exit of which is near the bridge, and at the bottom of it and at the ashpit are doors to regulate the passage of air.
4440. INDICATORS FOR STEAM ENGINES, &c., A. Buder.

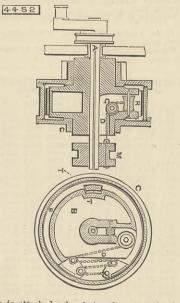
the passage of air.
4440. INDIGATORS FOR STEAM ENGINES, &C., A. Budenberg, Manchester.—12th October, 1881.—(A communication from C. F. Budenberg and B. A. Schaeffer, Germany.) 6d.
The object is to produce diagrams which will show the amount of work done during the double stroke of the piston in addition to all the other particulars usually shown by diagrams, and consists in soforming the indicators that a combined diagram from both ends of the cylinder may be taken at the same operation, such diagram consisting of a closed curve, one half





below and the other half above the atmospheric line. The indicator is provided with two inlet pipes A connected to the opposite ends of the cylinder of the engine leading one to an upper cylinder and one to a lower cylinder, in both of which is a piston, the two pistons being connected and actuating the lever carrying the pencil which produces the diagram on the pare mounted on the ordinary revolving drum.
 4422. SECURING TUBULAR HANDLES TO CULINARY VESSELS, &c., C. Exard, Manchester.—12th October, 1881. 6d.
 A socket is cast on the side of the vessel, the bottom of such socket being wider than the top. The handle in a wedge formed in the socket entry between the butt joint and spreads out the lower end so as to prevent the withdrawal of the handle.
 4451. DISCHARGING TORPEDOES UNDER WATER, P. Brotherhood, Notting-hill.—12th October, 1881. 6d.
 Withich are two parallel tubes fixed to end discs made to enter the vessel is fixed on an axis parallel tube ine of discharge a cylindrical casing, within the var vessel is fixed to end discs made to revise by stitable gearing, so as to bring each tube alternately opposite an opening leading to the inserted, while the other tube is opposite an opening leading to the discharge by a through which the torpedo can be discharged by a theory by sitable gearing, so as to bring each tube alternately opposite an opening leading to the inserted, while the other tube is opposite an opening leading to the inserted, while the other tube is opposite an opening leading to the inserted, while the other tube is opposite an opening leading to the inserted, while the other tube is conposite an opening leading to the inserted, while the other tube is charged by a through which the torpedo can be discharge by a bine of discharge, so as to guide the torpedo as it is isoharged.
 4452. FRICTIONAL COUPLINGS AND BRAKE APPA- BAUS, W. L. Wise, Westminister.—12th October, 12th October, 12th October, 12th October, 12th October,

discharged.
4452. FRICTIONAL COUPLINGS AND BRAKE APPA-RATUS, W. L. Wise, Westminster.—12th October, 1881.—(A communication from L. Mégy and J. de Echeverria, Paris.) 6d.
The drawings show a vertical longitudinal section and a vertical transverse section of one form of coupling. A is the driving shaft; B a collar or carrier keyed on the shaft A, which carries B round in its movement of rotation; C a pulley forming a case for a spring R, and provided, when required, with a pinion; this pulley runs loose on the bosses of the collar B; T is a recess provided in the collar to receive the pro-jection T¹ attached to the spring, and by which it is driven. At each of the extremities of the spring



there is attached a bracket or lug. On the first of these brackets is fixed the end of a small chain D, which passes over a roller on the second bracket, returns over a roller on the second bracket, returns over a roller on the second bracket, roller on the second bracket, and thence over the rollers E and G to the collar M, which turns with the shaft A, but may slide on it. If by any means the collar M is caused to move lengthwise on the shaft A, the small chain D will be tightened or slackened according to the direction of movement, and the end of the spring R will be brought nearer together or

further apart, thus effecting the uncoupling or coupling.

coupling.
4453. Locks on DAMS, J. M. Bibbins, Pennsylvania. -12th October, 1851.-(A communication from J. du Bois, Pennsylvania.) 6d.
This relates to dams or gates which are made in sec-tions and raised by admitting water beneath them, and lowered by permitting such water to escape. A suit-able frame carries jointed levers or gates, the axes of which lie across the river, side shoots or flumes being provided to admit water under the leaves or for with-drawing it. The leaves are preferably in three sec-tions which lie flat upon the bottom when down, but can be raised by admitting water underneath.
4455. IMPROVEMENTS IN THE CONSTRUCTION OF

can be raised by admitting water underneath.
4455. IMPROVEMENTS IN THE CONSTRUCTION OF SECONDARY BATTERIES OR APPARATUS FOR EFFECT-ING ELECTRICAL STORAGE, J. W. Swan, Newcastle-on-Tyne.-13th October, 1881. 4d.
This is an improvement on the Planté battery, and consists in scraping, abrading, or making incisions in the lead plates, so as to expose a larger surface to the action of electrolytic gases, and thus render the lead plates capable of rapid transformation into the condition necessary for storage. The inventor also presses the lead plates—which are to be used as pole plates of a battery—between other similar plates which have been incised or routhened, so as to com-municate to the plates pressed between them their incised character.
4458. VACUUM PUNPS, W. H. Akester, Glasgone.-18th

4458. VACUUM PUMPS, W. H. Akester, Glasgow.-13th

4458. VACUUM PUMPS, W. H. Akester, Glasgow.-13th October, 1881. 6d. This relates to mercury or gravity pumps, and in its simplest form it consists of an external tube with an internal lip a little distance from the top, the tube being swelled out or contracted at parts instead of being of uniform bore. The lip is ground to form a tight joint with a stopper, the space above the lip serving as a reservoir for mercury to form a lute. The stopper forms part of a second tube so formed that when in position the top of it projects beyond the external tube, and is enlarged to receive a cork. A few inches from its lower end the tube is enlarged and receives a stopper, the lower end of the tube being then contracted and formed with a capillary bore. The bottom of the external tube is connected to a lowering which the vessel secured to the top of the internal tube is exhausted. 4458. GRINDING CURLING STONES. A. Hay. Haude.

internal tube is exhausted. 4459. GRINDING CURLING STONES, A. Hay, Haugh, Ayr, N.B.-13th October, 1881. 6d. A cylindrical grinding surface of any suitable grind-ing material is mounted on a shaft driven by suitable means and capable of motion endwise. One part of the grinding surface is larger than the other, and the two parts are connected by a curve of a shape to suit the stone which is carried by a revolving shaft mounted at right angles to the shaft of the grinding surface, and which is acted upon by a weighted lever so as to force the stone well against the grinding surface.

4460. TENTERING, STRETCHING, AND DRYING FABRICS, &c., J. L. Norton, Piccadilly.-13th October, 1881. 6d.

dd. The clips to hold the selvedges of fabrics while being Stretched and dried without leaving pin marks on the selvedges are stamped from brass, and consist of a flat or curved base with corrugated uprights turned at right angles at each end, and serving as supports to carry a hinged or movable top cover arranged to give an excentric action, so that when closed the fabric is held firmly against the base, the pull of the fabric tending to tighten the grasp. 4461.

31. METAL KEGS OR VESSELS FOR CONTAINING PAINTS, &C., J. Storer, Glasgow.-18th October, 1881. 6d.

 6d . This relates to vessels with a nozzle at the upper end usually closed by a screw plug, and through which the paint can be withdrawn, and it consists in so fitting the upper end to the can that it may be removed, and the can be used as an open paint pot, a handle being pivotted inside the can to carry the pot by.

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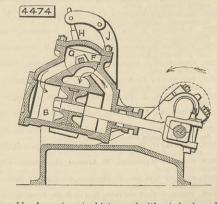
flexible transfer comb or other suitable apparatus. 4485. STRETCHING AND "WINDING-ON" WOYEN FABRICS, &c., J. Lodge, Huddergield, and M. Old-royd, Dewsbury.—13th October, 1881. 8d. This relates to the finishing of woollen cloths, and consists in means for obviating the necessity of work-men opening and stretching the cloth while winding it on the roller previous to the blowing, boiling, or steaming process. For this purpose a travelling end-less chain is used, and fitted with clamps or hooks similar to those of a tentering machine, and delivers the cloth in a stretched condition to a roller covered with emery or perforated copper or zinc, and from which the cloth is delivered to and taken up by the roller.

4466. WARP OR STRAIGHT-BAR KNITTING MACHINES, &c., W. Dexter, Nottingham.—13th October, 1881. 6d.

6d. This relates, First, to the arrangement and mode of operating warp or straight-bar knitting machinery; and Secondly, to the introduction into fabrics pro-duced on such machines of an additional or second thread interwoven between the stitches or loops of the needle thread, whereby a rigidity is given to the fabric.

4470. CHILDREN'S COTS, ROCKING-BOATS, &c., J. Middleton and G. J. Scott, Birkenhead.—13th October, 1881. 6d. This consists of a cot, which can be used as a child's sleeping cot, rocking-boat, and perambulator alternately at will.

4474. MOTORS WORKED BY HYDRAULIC OR OTHER FLUID PRESSURE, &c., W. L. Wise, Westminster.— 18th October, 1881.—(A communication from L. Megy, Paris.) 8d. The motor is worked by fluid pressure, and is



valve F, which has a cylindrical face and works her-metically in the valve chest, is caused to move to and fro with it, while the lever H, fixed to the slide valve rod G, and the end of which works through a bracket pivotted in the support J, imparts a rotary movement to such valve.

4478. PNEUMATIC SIGNALLING APPARATUS FOR RAILWAY TRAINS, C. D. Abel, London.—13th October, 1881.—(A communication from P. Rimachevsky and W. Tagaitschingf, Russia.—(Not proceeded with.)

W. Tagatterningy, Russia. (10) Protective and 2d.
This relates to pneumatic signalling apparatus whereby, on a coupling breaking, an audible signal is sounded on the engine or in the guard's brake.
4477. GYMNASTIC APPARATUS, A. W. Turner, Birmingham.—14th October, 1881. 10d.
A strong pillar is supported on feet, and the top is formed with a socket to receive a pole, to the top of which ropes are secured. Openings are formed in the pillar, and through it a beam is passed and fixed to work on a pivot. At each end of the beam a platform is mounted, the two being connected by a rod, so as to cause them to maintain a horizontal position as the beam is rocked to and fro by the occupants of the platforms alternately pulling the ropes.
4481. ROTARY PUMP, L. A. Groth, London.—14th Octo-

forms alternately pulling the ropes.
forms alterna

pipes by centrifugal force. 4402. VELOCIPEDES, &C., W. Harrison, Manchester.— 14th October, 1851. 8d. The objects of the invention are, First, to prevent the cross binding of velocipede bearings; Secondly, to prevent the extra friction of the bearings by the constant cross binding caused by the twisting of the fork; Thirdly, to enable the rider to raise or lower the handle bar; Fourthly, to means for facilitating the steering; Fifthly, to ring or sound an alarm; Sixthly, to secure rubbers more firmly to the wheels; Seventhly, to make the spring more easy for the rider; and Eighthly, to make a velocipede work by utilising all the force of the body more easily, and to carry one or more persons.

persons.

Persons. 4496. IMPROVEMENTS IN REGULATORS FOR ELECTRIC MOTORS, J. H. Johnson, London.—15th October, 1881. —(A communication from La Société Anonyme La Force et La Lumière, Brussels.)—(Not proceeded with.) 4d

4*d.* This relates to a means for controlling electric motors by means of a chain, the resistance of which varies as it is loose or tight, and firm pressure or weak pressure is inserted on its links.

pressure is inserted on its links.
4407. WRINGING AND MANGLING MACHINES, H. J. Haddan, Kensington.—15th October, 1851.—(A communication from J. Kinleyside, Hamilton, Ontario, Canada.) 6d.
This consists of four brackets pivotted in pairs at the ends of a rod which passes through the machine and serves to carry the delivery shoot, said brackets being arranged in pairs at each side, one bracket on each side carrying a lever holding the upper roller, and the other brackets the lower roller, the levers carrying the upper roller being supplied with com-pression springs made to actuate them, and thereby causing a separation or bringing together of the rollers, said levers being pivotted on the upper parts of said brackets, the brackets carrying the levers hold-ing the upper rollers being supplied with stops to prevent the springs bringing the rollers too closely together.

4498. MANUFACTURE OF LOCKETS, F. Richardson, Bir mingham.—15th October, 1881.—(Not proceeded with.) 2d.

with.) 2d. The edges are made by drawing an ingot of metal into a wire through ordinary dies or draw plates, and afterwards drawing this wire through dies formed to draw the wire into a square, rebated, and sunk or undercut section, so that the flanged edge is produced solid solid.

4499. LOOMS, S. O'Neill, Castleton.-15th October, 1881.

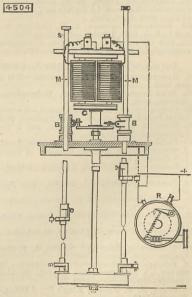
6d. This relates, First, to improvements on the letting-off motion described in patent No. 3810, A.D., 1879, and consists in the use of a friction brake in con-junction with the warp delivery roller; Secondly, to means for applying picking straps or bands to "under-pick "looms in which the axis of the picking stick is placed beneath the slay or batten, and in which the said picking stick passes through the slay to act upon the shuttle, and it consists in dividing the band or strap into two portions and uniting the same by a link. 4502 Hydra Hydra and States and S

4502. HYDRAULIC RAMS, J. Webster, Bolton. -15th October, 1881.-(Not proceeded with.) 2d. This relates to improvements in the "beat valve," or waste valve of hydraulic rams.

4503. SAFETY APPARATUS AND FASTENERS FOR WIN-DOWS, &C., C. Gall, Halifax.-15th October, 1881.

6d. This relates, First, to a sash fastener for windows; This relates, First, to a sash fastener for windows; Secondly, to its combination with an alarm; and Thirdly, to a door fastener and alarm. The window fastener is in the form of a dovetail, male and female, one on each sash. On the upper sash is a catch box bevelled and hollow, and on the lower sash is a plate with two pivotted levers which enter the hollow of the catch box. The alarm consists of a spring hammer which on the window being opened is caused to descend and strike a detonating cap placed on an anvil. anvil.

4504. IMPROVEMENTS IN ELECTRIC ARC LAMPS, J. Brockie, Brixton.-15th October, 1881. 6d. This refers to improvements on patent No. 3071,



so arranged that when one pair is consumed another will be lighted. The figure shows one method of doing this. When a current is passing the shunt magnet M attracts armature C, which lifts both holders, thus separating the carbons, the arc being formed between the pair having the least resistance, or that happened to be last in contact. When M is momentarily cut out by an arbitrary interrupter R revolved by the engine or dynamo, the armature leaves the magnet, allowing clutches B b to relax their grip of the carbon holders, thus permitting momentary contact between the two pars of carbons, and then lifting them up again the correct distance for the arc, which will be established between the same pair of carbons as before. This will be repeated until the carbon holder is stopped in its descent by S, when the arc will be transferred to the other pair. Other improvements are also described. **4505**. PRESEED GLASS, J. G. Sowerby, Gateshead-on-Tyne.-15th October, 1881.-(Not proceeded with.) 2d. This consists in adapting to what are known as deen

2d.
This consists in adapting to what are known as deep cylinder moulds a pillar or corrugated plunger, which produces a pattern inside the article manufactured.
4506. VENTLATING AND EXTINGUISHING FIRES IN MINES, PITS, TUNNELS, &c., J. Onions, Rotherhithe, and W. H. Tooth, Borough.-15th October, 1881.
4d.

4d.

4d. This consists in the application and arrangement of certain machinery so constructed and applied as to effect a sufficient vacuum to exhaust from the work-ing of any mines, pits, and other places, all such in-flammatory gases, vapours, choke damp and so forth, and thereby also produce a current of air in such workings orkings.

4507. IMPROVEMENTS IN INSULATORS FOR TELEGRAPH AND OTHER WIRES, A. E. Gilbert, Clapham.—15th October, 1881.—(Not proceeded with.) 2d. This invention relates to improvements in the ordinary porcelain telegraph insulators, by which friction at the point of suspension is reduced, and improved facilities for attaching and detaching the wires are afforded.

4508. PRODUCTION, COLLECTION, OR STORAGE AND DISTRIBUTION OF ELECTRICITY, J. H. Johnson.— 15th October, 1881.—(A communication from E. U. Parod, Paris.)—(Not proceeded with.) 4d. This refers to automatic apparatus to place the batteries in connection with the generating appa-ratus.

4511. AIR INLETS OR VENTILATION GULLIES FOR DRAINS, B. R. Harrington. Beckenham.—15th Octo-ber, 1881.—(Not proceeded with.) 4d. The gully is of earthenware or metal, and is bell-mouthed, an inlet being formed on the side to fit the rising pipes from the drain. The gully answers the double purpose of admitting air and drainage into the drain.

dram. 4512. REGULATING THE SUPPLY OF WATER TO CLOSETS, &c., W. A. McCormick, Stoke Newington.—15th October, 1881.—(Not proceeded with.) 2d. This consists of an outer and an inner cistern, the latter being pivotted so as to turn over and discharge its contents into the outer cistern, from which it passes to the place to be flushed.

passes to the place to be fushed.
4513. TREATMENT OF SACCHARINE LIQUOR, C. Pieper, Berlin.—17th October, 1881. — (A communication from P. Degener, Berlin.—(Not proceeded with.) 2d. The object is to limit the formation of molasses and increase the production of crystallised sugar when treating saccharine liquor, and it consists in lowering the pressure in the vacuum apparatus so that the boiling temperature does not exceed 57.5 degrees Centiorade. Centigrade.

Centigrade.
4514. FORGING METALS, &C., B. Dearden, near Shef-field.--17th October, 1881. 6d.
This relates to the combination of tools, consisting of a matrix having an opening right through corre-sponding to the section of the article to be produced in connection with the drifts or pushers, for the purpose of compressing or forging metals to any desired shape or form for which they may be adapted.

purpose of compressing or forging metals to any desired shape or form for which they may be adapted.
4517. PROPELLING VESSELS, M. Hedicke, Borough.— If th October, 1881.—(A communication from H. Grauel, Germany.) 6d.
The object is to increase the speed of vessels, and consists in arranging a shaft along each side of the ship over the surface of the water, and on it are secured a number of screws of any suitable construction, which can be regulated and made to travel in different directions so as to allow of the ship being steered and moved backwards.
4518. IMPROVEMENTS IN AND RELATING TO APPARATUS FOR DRIVING OR OPERATING SEWING MACHINES BY ELECTRICITY, H. H. Lake, London.—Tith October, 1881.—(A communication from J. J. Journaux, Paris.)—(Not proceeded with.) 2d.
This relates to a means whereby a sewing machine may be operated by a foot treadle or an electric motor. The motor is movable, so that its driving wheel of the sewing machine.
4519. CARRIAGE AXLE CLIPS, G. Wearing, Stafford.— Uth October 181. 6d.

the driving wheel of the sewing machine. **4519.** CARRIAGE AXLE CLIPS, G. Wearing, Stafford.— 11th October, 1881. 6d. The object is to secure the axle in the clip in the proper position, and to prevent the sliding of the axle in its clips. The clip is made somewhat deeper than the axle, so that whon the axle is inserted therein its upper face is lower than the upper side of the clip, a packing plate of metal being introduced to fill in the space left. This plate has projections to fit into recesses in the axle, and ears are formed on its upper side, between which the wood packing is situated, the clip being then secured to the spring in the usual way.

21. WEIGHING MACHINES, T. Williams, jun., Goswell-road.—17th October, 1881.—(Not proceeded 4521. with.)

with.) 2d. The invention is based on the steelyard principle, but in place of a single lever or arm, two or more shorter levers are employed, each working on an independent fulcrun of its own at reverse ends, and so combined together as to form a compound sus-pended weighing lever for heavy and light weights. Each lever is provided with its own adjustable sliding weight and with a divided index plate.

weight and with a divided index plate. 4522. SAFETY SADDLE BARS, R. Spence, jun., Rich-mond.—17th October, 1881. 6d. The bar is provided with an additional bar above the part which receives the stirrup strap, and its ends take into journals able to rotate and provided with radial slits to receive the additional bar, the journals being supported by hock-like bearings attached to the tree of the saddle, one on each side thereof. The bearings are provided each with an opening at its upper part for the insertion of the additional bar and stirrups in the event of the rider falling off or being thrown

4523. LUBRICATORS, J. Gallie, Jersey.—17th October, 1881.—(Not proceeded with.) 2d. A vessel is closed at top and bottom, the latter having a branch to connect it with the cylinder or other part, and standing up within it are two con-centric tubes, the inner one secured to the bottom, and the outer one secured at top to the inner one, but open at bottom to the interior of the cup. A passage in the bottom branch is fitted with a valve, the spindle of which reaches up inside the inner tube, and is surrounded by a spring. The vessel is filled from the top, the opening being closed by a screw spindle, the act of screwing down which opens the valve in the bottom branch.

act of screwing down which opens the valve in the bottom branch.
4525. LOCOMOTIVE ENGINES OPERATED BY COMPRESSED AR, &c., A. W. L. Reddie, London.--Tith October, 1881.-(A communication from the Pneumatic Tramway Engine Company, Incorporated, New York.) 8d. This relates, First, to an arrangement on the locomotive of small cylindrical storage reservoirs containing air compressed to a very high pressure, and from which it passes to a supply reservoir, where it expands to the pressure required for the proper working of the engine; Secondly, to a pressure-reducing valve placed between the storage reservoirs and the supply reservoir; Thirdly, to an arrangement whereby when the main slide valve is held stationary at the middle of its stroke the cylinder and piston of the compressed air locomotive are converted into a pump which may be utilised to check the speed of the engine on down grades to aid in storping and for the jultilising the momentum of the engine in compressing air locomotives; and, Fifthly, to the expansion gear of such engines.
4526. Sroves AND GRATES, P. Everett and A. Barnard, North L. 2010.

ston gear of such engines. 4526. STOVES AND GRATES, P. Everett and A. Barnard, Norfolk.—17th October, 1881. 6d. The object is to consume the smoke and increase the heat in stoves and thereby save fuel, and it con-sists in forming passages under and round the grate at the other, so that air passing through the same is heated and mixes with the products of combustion, which are thus consumed. A baffle may be fixed in the grate above the passages, and extending toward the front of the grate. 4527. Soap. H. W. Blance and T. T. Wilson. Lineared

4527. SOAP, H. W. Blease and T. T. Wilson, Liverpool. -17th October, 1881.-(Not proceeded with.) 2d. This consists of Castile soap, turpentine, and ammonie

ammonia.

ammonia.
4528. CORKING MACHINES, F. H. F. Engel, Hamburg. —I7th October, 1881.—(A communication from Boldi and Vogel, Hamburg.) 6d.
This relates, First, to the cork press, and consists of three sliding parts instead of one or two as usually employed, so that the cork is compressed more uni-formly; and Secondly, to the mechanism for working an air needle used for drawing the air from the bottle during the corking process.
4529. Automatic REFOLITION INDICATORS F. H. F.

during the corking process.
4529. AUTOMATIC REVOLUTION INDICATORS, F. H. F. Engel, Hamburg.-17th October, 1881.-(A commu-nication from J. Eggers, Hamburg.) 6d.
This relates to indicators to produce diagrams by means of a marker moving over a sheet of paper either stationary or caused to travel by a clockwork move-ment. The pointer is attached to a weight sliding on a stem against the action of a spring, the whole being attached to the revolving body, so that as the weight slides along the stem by its centrifugal force the marker is caused to rise or fall, and so mark the paper with which it is in contact.
4530. ATTACHING VALANCES. CDETAINS. AND OTHER

With which it is in contact.
4530. ATTACHING VALANCES, CURTAINS, AND OTHER TRIMMINGS TO BEDSTEADS, &c., M. A. Dearden, near Doncaster.—18th October, 1881. 4d.
Metal blades of ductile metal, so that they can be easily bent are formed with hooks, to which the valances or curtains are hung, and the ends of the blades are then turned over, so as to grasp the iron frame of the bedstead.

frame of the bedstead. 4581. COLOURING MATTERS, &C., J. A. Dixon, Glasgow. — 18th. October, 1851.—(A. communication from Dr. C. Kanig, Germany.) 4d. This consists, First, in the preparation of soluble compounds of alizarine blue by acting on the alkali salts of alizarine blue with bisulphites of the alkalies or with sulphurous acid in excess, and that whether the said soluble compounds be obtained in the sepa-rate state by crystallisation or precipitation and filtra-tion or be formed on the fabric to which they are to be applied; Secondly, the mode of using salts of alizarine blue direct in dysing and printing by the addition of bisulphites of the alkalies to the said alkaline salts in their application to the fabric. 4588. IMPROVEMENTS IN ELECTRIC LAMPS, R. R. Gibbs.

alkaline saits in their application to the fabric. **4538**. IMPROVEMENTS IN ELECTRIC LAMPS, *R. R. Gibbs*, *Liverpol.*—184 *October*, 1881. 6d. This relates to the automatic lighting of the candles of Jablochkoff and similar lamps. The inventor places each candle between a socket secured to an insulated support, and a socket attached to a lever free to move on a fulcrum at its centre. The other end of the lever consists of a spring, the lever is of metal. The carbons forming the candle are held in position by springs. One conducting wire is secured to one of the fixed sockets and the other is in communication with a movable socket of one of the adjacent candles. When a candle is nearly consumed the ends are shorter than an insulated strip placed in the candle; the movable socket thereupon being acted on by its spring moves into contact with the fixed socket and the current passes on through the next candle. **4534**. RINSING BOTLES AND GLASSES, J. Dollheiser,

passes on through the next candle.
45324. RINSING BOTTLES AND GLASSES, J. Dollheiser, Cologne.—18th October, 1851. 6d.
A sheet metal envelope is fastened to a base-plate and has an exit orifice near the bottom, while from the centre at the bottom rises a perforated inlet pipe, from which three other perforated pipes branch off inside the case. The bottle is placed on the centre pipe and water plays both on the inside and outside thereof, and by acting tangentially on the bottle causes the same to revolve rapidly.
45355. DISTILLING APPARATUS, C. Paulmann, Hanover.

causes the same to revolve rapidly. 4535. DISTILLING APPARATUS, C. Paulmann, Hanover. —1816 October, 1881. 6d. The object is to reduce the fuel used in alcoholic distillation to a minimum, and at the same time increase the yield, purity, flavour, and strength of the alcohol, and remove the fusel oil therefrom; and the apparatus consists of a cylindrical wash column, a rectifier or rectifying column with a condenser placed above it, and which at the same time serves as a preparatory heater, a refrigerator for the spirits, and having a still watcher with glass globe with alcohol-meter at the exit for the alcohol, a regulator for the efflux of the residue of the wash, a test or sample vessel with worm, and, lastly, a singling or feints column or secondary rectifier for continuous auto-matic work. matic work.

column or secondary rectifier for continuous automatic work.
4536. Hor BLAST APPARATUS FOR USE IN METALLURGICAL OPERATIONS, H. H. Lake, London.-18th October, 1881.-(A communication from J. C. Long, Pennsylvania, U.S.) 1s. 4d.
This relates to regenerative hot blast apparatus for heating a blast of air, gases, or vapour to be supplied to metallurgical furnaces, and it consists partly in the combination with specially constructed ovens in which blast is heated prior to passing to the furnace of similar supplementary ovens for heating the combination with specially constructed ovens in which blast is heated prior to passing to the furnace of intensely heating them; and it also consists in the connections by which the gas heaters are connected to the ovens and with each other, whereby the highlyheated combustible gas may be introduced into the oven or gas heater to be burned thered is forced blast of highly heated air from the hot blast main, thus burning the combustible gas there by a forced hot blast to intensify the combustion thereof, and produce an equable distribution of the hot products of combustion and a more equal heating of the

ovens and heaters, and at the same time decreasing the amount of draught necessary to be produced by the chinney; and, lastly, of the air connections em-ployed for this purpose.

ployed for this purpose.
4537. APPARATUS FOR SUPPLYING WATER TO STEAM BOILERS, &c., S. Hallam and J. W. Skepherd, Manchester.—18th October, 1881. 6d.
This relates to an injector in which either the direct steam pressure of the boiler itself or the exhaust steam from the engine may be utilised to force water into the boiler. A is an inner nozzle, B an outer nozzle, C the inlet for live steam, D the inlet for exhaust steam, and E the inlet for water. The inner nozzle is provided with a regulating spindle F. The receiving cone G can slide in its chamber, being

4 5 37

actuated by an excentric operated by a hand-wheel, so as to adjust its position with regard to the nozzles. L is an ordinary overflow valve. An arrangement for automatically adjusting the receiving cone G by connection with the governor or engine, and thus regulating the supply of water to the boiler is de-scribed. cribed.

regulating the supply of water to the boller is described.
4538. DECORTICATING RAMIE, &c., J. C. Mewburn, London.-18th October, 1881.-(A communication from J. B. Sauvadon, Paris.) 4d.
This relates to a portable machine for decorticating ramie or other vegetable fibres, either in the green or in the dry state, and it consists of slide frames, between which are mounted flattening and breaking rollers, and a beater or scutcher acting against a flexible table to beat the pith and foreign matters from the fibres of the plant.
4539. TIRES FOR WHEELS, W. H. Carmont, Manchester. --18th October, 1881. 4d.
This consists in making a number of tires out of one blank, and it consists in rolling a blank into an annular or cylindrical plate of the desired diameter, and wide enough to form two or more tires. Such plate is placed between rolls formed with alternate recesses and projections corresponding in width to the desired width of the tires, and the recesses in one roll corresponding with the projections on the other. These rolls are caused to rotate and approach each other, and they thus divide the annular plate into several rings or tires.
4540. FILTER PRESSES, H. E. Newton, London.--18th October, 1881.- 64. communication from A. L. G.

several rings or tires.
4540. FILTER PRESSES, H. E. Newton, London.—18th October, 1881.—(A communication from A. L. G. Dehne, Germany.) 6d.
This relates to means for rendering filter presses applicable to filtering substances of a volatile nature. The press is mounted in a tray or dish with a gutter formed all round the inside, and intended to receive the edges of an air-tight cover, the joint being made by a scaling liquid. The various pipes for supplying and discharging the matters to be filtered, as well as the lixivating or washing liquids, pass through the bottom of the tray or dish.
4542 Boors AND SHORS H. Orans. Dublin.—18th

4543. Boots AND SHOES, H. Ovans, Dublin.—18th October, 1881. 6d. The object is to form a buckle or button boot or shoe with a seamless front, and it consists in making the opening to allow the foot to be introduced at the side of the boot or shoe.

4546. STEAM BOILERS, E. Crompton and J. T. Cochran, Birkenhead.—18th October, 1881. 6d. This relates to a modification of patent No. 770, A.D. 1878, so as to enable the arrangement of horizontal flue tubes in vertical explindrical shells to be applied to boilers of any size, and it consists in the employment of a horizontal cylindre furnace A, as used in marine

н

F

В

4546

C

A boilers, the shell of the boiler being made hemispherical at top, as shown at B, and the bottom consisting preferably of a quarter of a sphere and a half cylinder, as shown at D. The cylindrical part of the shell joins the top and bottom. The furnace A communicates with a combustion chamber G, from which tubes H lead to the flue F.

lead to the flue F.
4547. WATER-TIGHT SLIDING DOOR FOR BULKHEADS OF SHIPS, &c. E. Crompton and J. T. Cochran, Birkenhead. --18th October, 1881. 6d.
The object is to supply more efficient means of closing openings in ships' bulkheads, and without the risk of their action being deranged by rust or a lodgment of dirt in the grooves. A cast iron or other frame is formed with a continuous groover round the inside and on the top of the frame, and is filled in with lead or other suitable substance, and the door, which is raised or lowered by screw or other suitable means, is formed with knife edges which cut into the lead seems and form a tight joint.
4548. VELOUREDES, S. Hall, Hampstead-road.--18th

seams and form a tight joint. **4548.** VELOCIPEDES, S. Hall, Hampstead-road.—18th October, 1881. 8d. The main object is to prevent excessive vibration, and also to compensate for wear in the bearings, and it consists in the application of helical springs to the front and back wheels between the bearings and the fork and backbone. Wedges are employed to compen-sate for the wear in the axle bearings.

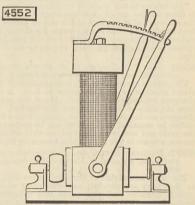
4549. FILING AND CUTTING METALS, T. H. White-house, Walsall.-18th October, 1881.-(Not proceeded with.) 2d. A shaft carries a fly-wheel at one end and fast-and-loose pulleys at the other, the middle being cranked to receive a connecting rod connected to a slide, on the under side of which a file or cutter is fixed at a slight angle to the line of motion, and under which the work is supported in a holder.

4550. STEAM GENERATORS, R. Mills, Westminster.

Ad550. STEAM GENERATORS, R. Mills, Westminster.— 18th October, 1881. 6d.
This relates to improvements on patent No. 3979, A.D. 1876, and consists, First, in arranging the upright tubes of such boilers with a space between each of them, instead of being close together, the heat of the furnace being forced to play all round each tube by a baffle plate or plates placed in the central space enclosed by the tubes; Secondly, in forming boxes, pipes, or rings, which connect together the tops and bottoms of the upright tubes in two halves, bolted together, so that they can be easily taken apart; Thirdly, in employing an apparatus to remove any moisture carried over with the steam, and thus pre-vent priming, and it consists of a vessel placed outside the boiler, and connected by the main tubes of the boller and above the baffle plates, and subjected to the action of the uproducts of combustion. (The jsteam is conducted from the main tubes of the boiler to the external vessel, and afterwards through the coil of tube to the engine.
4551. WATER-CLOSETS, G. E. Waring, jun., Neuport, US

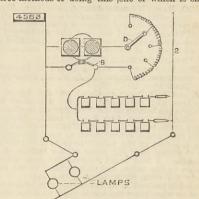
tube to the engine.
4551. WATER-CLOSETS, G. E. Waring, jun., Newport, U.S.-18th October, 1881. 6d.
The pan is formed without a valve, and has a syphon-like outlet rising from the bottom to a certain height, so as to retain a suitable depth of water in the pan. The descending limb of the syphon enters a trap-like receptacle, in which water is retained, but the outlet to the drain is as such a level that the water runs out of the receptacle so far as to uncover the lower end of the syphon. When water is admitted to the pan the trap-like receptacle fills to a higher level, and seals the outlet from the syphon, and the flow of water drives the air from the syphon and fills it with water sufficiently to set up the syphon action, by which the pan is very rapidly emptied. The pan is then again filled by an afterflow.
4552. IMPROVEMENTS IN DYNAMO OR MAGNETO

then again filled by an afterflow.
4552. IMPROVEMENTS IN DYNAMO OR MAGNETO ELECTRIC MACHINES, P. Jensen, London.—18th Octo ber, 1881.—(A communication from T. A. Edison Mento Park, U.S.) 6d.
The object of this invention is to regulate the generative power of a dynamo machine so that only as much current as is required may be generated. The figure shows one method of doing this. The two levers are of soft iron and make contact with the yoke when



in line therewith. The levers become magnetised, diminishing thereby the strength of the lines of force in the magnetic field, and the upper end of each lever has a polarity opposite to that of the particular pole of the magnet to which it is connected. Consequent poles are thereby established in the yoke of the mag-net opposite the ends of the levers, which poles are increased in power by the approach of the levers to the yoke, and the lines of force are shunted away from the field in which the induction bobbin rotates more or less, according to the distance of the levers from the yoke.

yore. 4558. IMPROVEMENTS IN METHOD AND MEANS FOR CHARGING AND USING SECONDARY BATTERIES, P. Jensen, London.—18th October, 1881.—(A communi-cation from T. A. Edison, Menlo Park, U.S.) 6d. The object of this invention is to provide a method by which the electromotive force of a current supplied by secondary batteries may be maintained at a prac-tically constant pressure. The inventor describes three methods of doing this ,one of which is shown



in the figure. The cells are coupled up in series, an connected to positive main conductor 2 by switches The other ends of the two series are connected to positive commutator brush B of a dynamo, the negative brush being connected with the other main conductor. Each of the series has the right number of cells to give the desired electromotive force. Both series may be connected to the main conductor at series may be connected to the main conductor at once by the switches, or one may be used to refa-force the other. When the current from the cells begins to drop in pressure, switch D is moved to the outer set of resistances, and the engine that drives the dynamo is started. This throws a reinforcing current in multiple arc through the cells. At each subsequent drop in the electromotive force, the switch D is moved inwardly to the next contact of the set of resistances, and the standard electromotive force maintained. force maintained.

4554. SEWING MACHINES, M. H. Pearson, Leeds.—18th October, 1881.—(Nol proceeded with.) 2d. The bar of a straight needle is fitted in a slide hinged at the upper end, and to which an intermittent radial reciprocating motion is imparted by a cam on the driving shaft, and the vertical motion is imparted to the needle bar by a heart cam attached to the slide by a crank on the driving shaft. The radial movement imparts a lateral movement to the needle and feeds the material forward. A circular shuttle is used and is mounted in a box on the end of a short hollow spindle, and a rotary reciprocating movement is imparted thereto.

4557. WATER-CLOSETS, J. A. Hornby, Anglesea-19th October, 1881. 6d. The object is to form closets so that noxious gases

shall have free exit to the atmosphere before reaching the trap leading to the basin, and it consists in fitting closets having a ventilating pipe opening into the soil pipe beneath the basin, with valves arranged so that when the soil pipe is open to allow the soil and liquid to flow away, the orifice in communication with the ventilating pipe is closed.

ventilating pipe is closed.
4655. PRODUCTION AND APPLICATION OF OZONISED OXYGEN, B. Hagen, Ealing.—18th October, 1881.— (A communication from L. Q. and A. Brin, Paris.) —(Yoid.) 2d.
Oxygen produced as described in patent No. 1416, A.D. 1880, is collected into gas-holders and passed through a coll arranged in a refrigerator, after which it proceeds to an ozonising apparatus containing a system of pipes wherein it is electrified by means of induction bobbins excited, for instance, by bichromate clements. The apparatus consists of a receiver filled with acidulated water, wherein are immersed a number of pairs of tubes between which the oxygen passes and closes the circuit. The ozonised oxygen is then introduced into a churn containing the material to be treated, and the whole rapidly revolved.
4561. DESTROYING THE PUTRESCIBLE MATTER OF

material to be treated, and the whole rapidly revolved. **4561.** DESTROVING THE PUTRESCIELE MATTER OF SEWAGE, SEPARATING THE SOLID MATTER, AND OBTAINING AMMONIA, J. B. Kinnear, Lincoln's-inn. —19th October, 1881. 4d. This consists in the application of heat to house or tows sewage when mixed with lime or other alkaline matter, for the purpose of destroying the putrescible matter, separating the solid matter, and obtaining ammonia from the sewage. **4562** Survey Butter, L. H. Kitzer, Lead. - 10th

ammonia from the sewage. **4562.** SAWING RAILS, &c., J. H. Kitson, Leeds.—19th October, 1881. 4d. The object is to give facility for adjusting the posi-tion of the rail or bur to be sawn. A pair of engines mounted on an upright frame drive a shaft over head, from which arms depend so as to be capable of being swung to or frohorizontally. The lowerends of the arms carry the saw spindle driven by pulleys and belt from the top shaft. The top shaft also drives a counter-shaft at the base, from which motion can be imparted in either direction as desired to rolls on which the rail rests. rail rests.

rall rests.
4564. SAWING MACHINERY, H. J. Haddan, Westmin-ster.—19th October, 1881.—(A communication from C. Mürer, Metz.)—(Not proceeded with.) 2d.
A frame supports a crank shaft with a fly-wheel at each end, one being heavier than the other, the shaft being actuated by a treadle, and a rod connects the shaft with the saw frame reciprocating in guides.
The movable frame works a set of bellows, a pipe from which terminates near the saw blade.
4565
Supplying Dweilung Houses for with

which terminates near the saw black. As pipe noin **4565.** SUPPLYING DWELLING HOUSES, &c., WITH WATER, W. M. Farley and J. H. Bond, Torquay.— 19th October, 1851.—(Not proceeded with.) 2d. This relates to the mode of utilising the same pipe to draw off the water as is employed to supply it to the cistern, and it consists in the use of valves and a float which cut off the supply when the cistern is full, and when the pressure is turned off the pipe is again opened so as to allow the water to pass to the draw-off taps.

taps.
4568. OPEN FIRE GRATES, W. A. Martin, Southwark. —19th October, 1881.—(Not proceeded with.) 2d. The objects are to effect the consumption of smoke, better combustion, and economy of fuel. A pair of plungers are fitted one on each side of the grate and form the sides of the part containing the fuel. These plungers are formed with a rack gearing with a toothed sector, by means of which they can be projected into the grate and compress the fuel, so that when with-drawn, a space is left at the sides to receive fresh fuel.
4567. DULLING ROOMS for a L MCWloch and L M 4567. DRILLING ROCKS, &c., J. McCulloch and J. H. and J. M. Holman, Camborne.-19th October, 1881. 6d.

6d. The machine consists of three cylinders cast in one so that they are parallel, and consisting of a large central cylinder and two small side cylinders, the former being that in which the pistons for operating the drill work, while the latter receive the screws and nuts for feeding forward the machine, and their outer surfaces serve as guides for the cradle.

aufaces serve as guides for the oradle.
4569. FILTERING OR DRVING SUGAR, YEAST, &c., J. Roper, London.—19th October, 1881. 6d.
This consists in an arrangement of valves connected to the fast and loose pulleys so that the machine may be made to turn at intervals according to the thickness of the cake required. A shallow box is held with its open side downwards, and a second box with its open side downwards, and a second box with top box by cranks. A filter cloth is inserted between the boxes, and the liquor to be filtered or dried is forced through an automatic valve into the top box by cranks. A filter cloth is inserted between the boxes, and the liquor to be filtered or dried is forced through an automatic valve into the top box and is caused to revolve, allowing a certain quantity shifted from the loose to the fast pulley when a sufficient quantity of liquor to ba been dried.
4570. HATS, HELNETS, &c., A. Wilkinson, Maryle-

loose to the fast pulley when a sufficient quantity of liquor has been dried.
4570. HATS, HELMETS, &c., A. Wilkinson, Marylebone.-19th October, 1881.-(Not proceeded with.) 2d. A perforated sheet of copper is placed between the band which fits round the head and the body of the hat so as to ensure better ventilation. The sheet may be made partly of copper and partly of zinc, so as to set up a galvanic action when being worn.
4572. SELF-FEEDERS AND GUARDS FOR THRESHING MACHINES, R. Moore and J. W. Lee, Cambridge.-19th October, 1881. 6d.
A cast iron frame is placed on the top of the machine, and the back is covered with sheet iron, while at the bottom of the front side are bearings for a roller fitted with four T-iron beaters. Above the roller at the top of the rollers, so as to divide the corn as it passes over the roller, so as to divide the corn as it passes over the roller to the beaters of the machine. A feed board receives the corn before it passes to the roller, and rollers fitted to the board carry the corn forward. A guard board is connected to the feed board by levers, and is jointed so as prevent anything passing into the feeder.
4574. HEATING AND ADJUSTING METALLIC TURES, RINGS, &c., & For. Leed. -19th October, 183

prevent anything passing into the feeder. 4574. HEATING AND ADJUSTING METALLIC TUBES, RINGS, &C., S. FOX, Leeds.—19th October, 1881. Sd. This relates to apparatus for heating tubes, &C. and adjusting them in various positions for welding, hammering, and forging, and it consists of a carriage mounted on rails, and on the upper part of which a beam or gantry is placed so as to be capable of swivel-ling horizontally. At each end of the beam is a furnace fitted with tuyeres, one furnace being inactive, while the other is in operation, and when one is worn it may be swung round and the other brought into use. The blast is supplied to the centre of the beam by a flexible pipe. A second carriage running on the same rails carries the mechanism for receiving and manipulating the tube under operation. The invention also relates to apparatus for "necking" or reducing and also enlarging the diameter of the ends of tubes or rings. 4575. TESTING THE STRENGTH OF BOILER TUBES, &c.,

ends of tubes or rings. 4575. TESTING THE STRENGTH OF BOILER TUBES, &c., 8. For, Lecds.-19th October, 1881. 6d. A cylinder somewhat larger and much stronger than the tube to be tested, has metallic rings attached to its ends by bolts passing from end to end and through the rings, the junction being made water-tight, and the ends of the tube to be tested are inserted in the rings. A groove is formed in each end ring to receive a hydraulic packing leather, the end of the tube and the end rings performing the same functions as those of a hydraulic cylinder and ram. A pressure of water is then brought to bear en the tube.

4576 IMPROVEMENTS IN METERS FOR MEASURING ELECTRIC CURRENTS, E. G. Brewer, London.—19th October, 1881.—(A communication from T. A. Edison, Menio Park, U.S.) 6d.
 This relates to a meter consisting of a cell, in which

the metal from one plate is deposited on the other by the action of a definite fraction of the current entering a house to supply electric lamps therein. In order to obtain a correct deposit of metal on the plates with a weak current the plates of the cell are composed of metallic zinc placed in a solution of sulphate of zinc, such plates having a heavy coating of deposited zinc placed on them by the action of an electric current prior to being used in the meter. To provide for a definite small proportion of the current going through the meter a resistance is placed in the line. A wire resistance is placed in the same shunt as the cell, and is arranged so that should the temperature rise the proportionately decreased, and vice versd, for a fall of temperature. Thus the same fraction of current will 4576 R

always pass through the cell. To prevent a counter current in the cell when no lamp is in circuit, a device is provided for automatically breaking the shunt when the circuit of the last lamp is broken. In the figure R is the resistance in main conductor, M is the cell, \mathbb{R}^1 the wire resistance in shunt circuit compen-sating for varying temperature. A, electro-magnet operating lever B, and breaking or making contact with shunt circuit. The inventor also describes a means for automatically regulating the temperature of the cell so that the solution cannot freeze, and other improvements. improvements.

M

4579. BREECH-LOADING FIRE ARMS, H. E. Newton. -19th October, 1881.—(A communication from The Colt's Patent Fire-arm Manufacturing Company, Incorporated, Hartford, U.S.)—(Not proceeded with.)

2d. This relates chiefly to the lock mechanism, the object being to utilise the main spring as the spring not only for the hammer, but for the trigger, sear, pawl, which rotates the cylinder, and also to throw back the hammer after it has delivered its blow, and it consists in an arrangement of levers between the main-spring, hammer, and trigger, to effect this result.

4580. SOUNDING APPARATUS, J. Schwartz, London.-19th October, 1881.-(Not proceeded with.) 2d. This relates to means for indicating the depth of water, and consists in providing vessels with feelers extending down below the keel for some distance, and arranged so that on touching ground such feelers will cause a signal on the ship to be sounded.

4581. BELT FASTENERS, W. H. Steil, Battersea.—19th October, 1881.—(Not proceeded with.) 2d. The ends of the belt are placed a short distance apart, and on the top a tempered steel-plate is placed and the ends secured thereto by wire staples placed transversely to the belt, and which are passed up through the belt and plate from the underside and the points clenched or turned over on the plate. 4582. Improvements in the Arrangement and

22. IMPROVEMENTS IN THE ARRANGEMENT AND COMBINATION OF APPARATUS FOR GENERATING AND STORING ELECTRICITY IN RALLWAY AND OTHER CARRIAGES AND STEAMBOATS FOR THE PRODUCTION OF LIGHT TWERRIN, A. M. Clark, London.—19th October, 1881.—(A communication from Madame J. de Changy, née de Degn, Paris.)—(Not proceeded with.) 2d.

with.) 2d. This invention consists in the combination of a dynamo driven by the axle of the carriage with a secondary battery, so that the battery may be charged during the revolution of the axle, and give current for electric lamps when said axle is at a standstill.

4583. DISTRIBUTING DISINFECTANTS IN PAILS, &c., T. F. Scott, New Cross, and A. J. Campion, Old Broad-street.—19th October, 1881.—(Not proceeded with.) 2d. A pail with a flange at top receives a tank to contain the disinfectant; each time the seat placed above the tank is depressed a portion of the disinfectant is injected into the pail. 4585. Demographic proceeding a proceeding of the placed above the tank is depressed a portion of the disinfectant is injected into the pail.

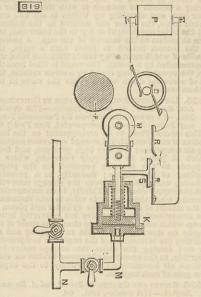
injected into the pail. **4585**. DOUBLE-BARREL FOWLING PIECES, &c., L. Gye, London.-20th October, 1881. 6d. S-mini-The opening of the breech to insert the cartridges and withdraw the case is effected by mounting the breech-plate so that it can turn back like a gate on a hinge on one side of the barrels, the joint pin being vertical. The locking bolt employed for locking the breech-plate is arranged to act upon the safety bolt and set it to safety each time that the locking bolt is unlocked. unlo ocked.

set it to safety each time that the locking bolt is unlocked.
4589. GAS ENGINES, L. Bénier and A. Lamart, Beaumetz, France.-20th October, 1881.-(Not proceeded with.) 2d.
The explosive charge is compressed to two or three atmospheres before being ignited in a receiver, into which it is drawn by a pump. Two vertical cylinders, open at bottom, are used, and their pistons connected to the same beam, which carries a connecting rod, giving motion to the driving shaft.
4590. CHIMNEY FLUES, F. Wirth, Germany.-20th October, 1881.-(A communication from the Society "Gesellschaft des Emser Blei-und Silberverks," Germany.) 4d.
This relates to chimney flues of foundries, metal works, &c., the object being to present a larger surface to the volatile metallic particles escaping through such flues, and it consists in placing their vertical sheets of perforated metal, wire work, &c., in the flues, their direction being parallel to the direction of the draught.
4591. IMPROVEMENTS IN THE MODE of GENERATING Extrements.

116 draught. 4591. MPROVEMENTS IN THE MODE OF GENERATING ELECTRICITY, H. J. Haddan, Kensington.-20th October, 1881.-(A communication from G. Dessaigne, Villefranche, France.)-(Not proceeded with.) 2d. This consists in adjusting magnets on the fly-wheels of ordinary engines, and placing electro-magnets round them, so as to generate currents when the fly-wheels are revolving.

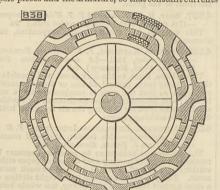
round them, so as to generate currents when the flywheels are revolving.
819. INPROVEMENTS IN ELECTRIC LIGHTING APPARATUS FOR RAILWAY TRAINS AND OTHER MOVING VEHICLES OR VESSELS, S. Pitt, Sutton, Surrey. - 20th February, 1882.-(A communication from E. T. Star, Philadelphia.) 8d.
This relates to improvements on patent dated 21st December, 1881, for driving a dynamo machine from the axle of one of the vehicles of a train, and in connection with a storage battery supplying currents for lamps at the front and rear of said train. The figure gives a diagrammatic view of the various connections. F is the axle of the tender carrying the dynamo. H is a friction wheel, which is made to transfer the motion of F to friction wheel & which is attached to the shaft of the dynamo when the piston K is thrust forward by the steam which acts on the steam brakes attached to the train. N is the main steam pipe for such purpose, and M the branch pipe leading to the piston. Thus, when the brakes are applied, the piston will be thrust forward, making connections between the axle and the two friction wheels, and also between R, S, and RI, so as to complete the circuit with the secondary battery P, which will be thrust jub driven the current from the battery is led to lights at the head and rear of the train, the current to the latter being broken by





which will be an index of the speed of the train to drivers or others behind it.

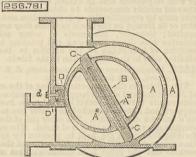
drivers or others behind it.
838. IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, W. R. Lake, London. – 21st February, 1882. – (A com-munication from B. Lande, New York.) 6d. This consists in improvements in the Pacinotti machine by the introduction of air passages into the pole pieces and the armature, so that constant currents



of air pass through the interior of the ring as it revolves. The inventor describes several methods of carrying out his improvements, one of which we illus-trato. The figure is a transverse section of the arma ture showing the arrangement of the air passages.

SELECTED AMERICAN PATENTS. From the United States' Patent Office Official Gazette.

256,781. ROTARY PUMP, Theodore Winkler, Chicago, Ill., assignor to August Leckelt, same place.—Filed July 27th, 1881. Brief.—The piston plates C may be reversed, so as to bring the bevelled faces on the right side, according to the direction in which the piston is moving.



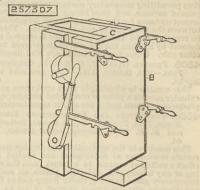
Claim.—In a rotary pump, the combination, with the cylinder A and the piston hub B, of the packing plate or plates C, the spring A^3 , the rods A^3 , the packing bar D, the bow-shaped spring D¹, and the set screw D, all constructed, arranged, and operating as described.

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a water and steam drum C, the hollow saddles or head pieces F, provided with internal flanges D, rivetted or bolted to said drum, and tubes E, expanded into said saddles or head pieces, substantially as speci-fied. (2) In a steam generator, the combination of a water and steam drum C_1 'a water and sediment drum

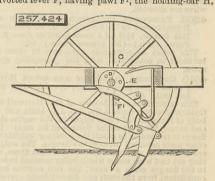
MAY 26, 1882.

D, hollow saddles or head and foot pieces F G, pro vided with internal flanges D C, rivetted or bolted to said drums, and tubes E, expanded into said saddles or head and foot pieces, substantially as specified. 257,307. MOULD FOR CASTING COMPOUND INGOTS, Patrick J. Fitzsimons, Newark, N.J.-Filed Feb-rwary 6th, 1882. Claim.-In a mould for casting compound ingots, an adjustable cover or side-plate B, a central follower C,

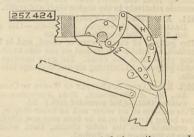


formed upon said cover and adapted to fit accurately within the mould, and devices for securing the cover when adjusted, substantially as described.

257.424. GRAIN DRILL, William W. Winegar, Chambersburg, Ill.—Filed January 28th, 1882. Claim.—(1) In a grain drill, the combination, with the axle or shaft C, of the wheel D, having pins E, the pivotted lever F, having pawl F¹, the holding-bar H,



and the crank-bar I, substantially as herein shown and described, whereby the holding-bar will be operated to hold the trash until the drill-hose have been drawn past it, as set forth. (2) In a grain drill, the combination, with the pivotted lever F that carries the holding-bar H, of the hook K, substantially as herein shown and described, whereby the said



holding-bar can be supported above the ground and held stationary, as set forth. (3) In a grain drill, the combination with the holding-bar H, of the projecting pin L, substantially as herein shown and described whereby the said holding-bar can be raised by and with the drill-hoe and its drawbar, as set forth.

CONTENTS.

THE ENGINEER, May 26th, 1882.

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ABSTRACTS trated.) 389 OF AMERICAN PATENT SPECIFICATIONS.

