HOW THE ELECTRIC LIGHT IS PRODUCED.

No. I.

We have recently had so many questions put to us concerning the production of the electric light, that we have arrived at the conclusion that by far the greater number of engineers know next to nothing about electricity. Nor is this to be wondered at. Until the other day electrical science was regarded as one of the most recondite branches of knowledge, and one which concerned engineers very little. Those who attempted to learn anything concerning it found at the outset that they must learn a new technical language. They must understand all about volts, ampères, farads, ohms, &c., before they could make any progress, and in consequence they turned back disgusted from the very threshold, so to speak, of the school of electricity. But the progress of electric lighting has brought the subject home to every one. Electricity has been popularised. It obtrudes itself into our streets and our homes, and we have had numbers of applicants who want to know if it is not possible to obtain so much information without a great deal of trouble as will enable them to form an intelligent idea of how the electric light is produced. Now nothing can be easier than the acquisition of this knowledge, and this article is specially intended to supply it. It is not intended for the use of electricians, who, if they read it, will one and all complain that we have left a great deal unsaid that ought to have been said. But it is just because electricians have hitherto insisted on saying a great deal that thousands of persons know nothing about the electric light, although they are otherwise well informed. For example, we know by personal experience that the dynamo is regarded as quite similar to the plate glass frictional machine; and that it is generally supposed that the electricity is got out of it by something which rubs on something else. The same ignorance exists with regard to lamps. We do not propose to say anything about electrical measurement, electromotive force, intensity, Ohm's law, ampères, and such like; yet we hope to make those who read this article understand, and that very clearly, how the electric light is produced.

(1) No one knows what electricity is; but for practical purposes it is convenient to regard it as a fluid.

(2) No one knows what a current of electricity is; but for convenience it may be regarded in the same light as a current of water flowing through a pipe.

(3) Electricity can pass freely through the metals; but with great difficulty through glass, sealing wax, silk, wool, dry air, wood, or earthenware. The metals are called "conductors" or "good conductors;" glass, sealing wax, gutta-percha, india-rubber, wool, &c., are called "non-conductors" or "bad conductors." Silver is one of the best conductors known; but it is too dear for electrical use. Copper is the best conductor that can be had for the money, and is extensively used; but iron wire answers well enough for overhead telegraph lines.

(4) When a wire is wrapped round closely with silk or cotton thread, or is coated with gutta-percha, it is said to be "insulated," and it may be regarded as a tube or pipe. The silk or cotton forms the tube, and the copper wire the duct along which electricity can flow. Submarine telegraph cables are insulated with gutta-percha; if a hole be made in the gutta-percha the electricity will flow out through the hole and be lost, exactly as water would flow out of a pipe split by the frost. One of the Atlantic cables, after being partly laid, had to be raised again, as it was found that no signals could be sent from the ship to the shore. A nail was found stuck in the cable; through this nail, which had made a hole in the gutta-percha, the electricity leaked away.

(5) No one knows what magnetism is; but magnetism and electricity are nearly akin. When we see smoke we augur that fire is not far off. In like manner, when we see a magnet, we may take it for granted that electricity is close by.

(6) The magnetic fluid is spoken of now and then; but, unlike electricity, magnetism does not very closely resemble in its action that of a fluid.

(7) Electricity can be obtained in three principal different ways; First, by rubbing glass or sealing-wax with a silk handkerchief or cat's fur; secondly, by putting two substances, one of which is more readily attacked by oxygen than the other. in an oxidising fluid, and so making what is called a "galvanic battery;" and, thirdly, by the use of what is known as the dynamo-electric machine, now called "dynamo" for shortness. There are two other ways in which electricity can be obtained, namely, by heat, and by the discharge of steam through orifices lined with wood. As neither plan is used to obtain electricity for lighting, we shall say nothing more about them.

(8) Frictional electricity, that is to say electricity obtained by rubbing glass or sealing-wax, is useless for obtaining the electric light. We think it better not to explain why, because to do so we should have to say a good deal about quantity and intensity. Such of our readers as want to know more than we tell them here will find plenty of books which will give up treasures of information if they are consulted in a proper spirit.

(9) Electricity is obtained for the electric light by the use of dynamo's at present. It is probable, however, that batteries will be used ere long for this purpose, and we shall say something about them before we have done.

(10) The dynamo is *not* a frictional machine—see (8) above.

(11) Every magnet, whatever its form, has two poles, one of which, if the magnet were freely suspended, would point towards the north, the other towards the south.

(12) Extending beyond each pole is what is known as the magnetic field; in other words, the space over which the influence of the magnet extends. It may be seen when a magnet is made to lie under a card over which iron filings are scattered, the filings will arrange themselves to fill the whole field. The fields are roughly deliniated in the annexed sketch, Fig. 1. N and S are the north and south poles respectively.

(13) The strength of the attraction of the magnet varies throughout the field in the inverse ratio of the square of the distance; that is to say, if a magnet attracts a mass of iron with a force of one pound when the iron is $\frac{1}{10}$in. from the pole, it will attract it with a force of but one quarter of a pound when it is $\frac{1}{5}$in. distant, and so on.

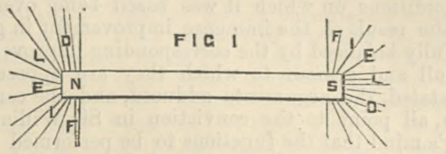


FIG 1

(14) Magnets are very frequently made of the horseshoe shape as in Fig. 2, because both poles can be made to act to attract one piece of iron or "keeper," as it is usually called.

(15) If an insulated wire A—see (4) below—be wrapped round a bar of soft iron B, as in Fig. 3, and the wire be

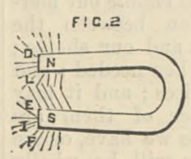


FIG. 2

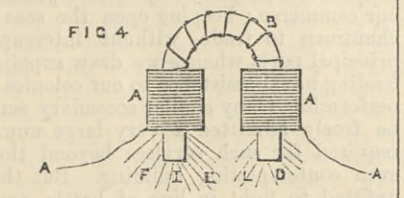


FIG 4

united to any source of electricity, such as a battery or dynamo, as at C, and a current of electricity be sent through the wire—see (4) below—then so long as the current is passing, B will be a magnet with a north pole and a south pole and magnetic fields. As soon as the current ceases to flow the bar will cease to be a magnet. Bars of iron magnetised thus are called "electro-magnets," and are usually of the horseshoe shape, as Fig. 4. In Fig. 4 A A is the wire coiled over and over again near the poles, but only wrapped once over at the middle.

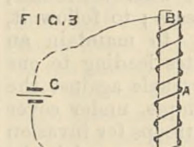


FIG. 3

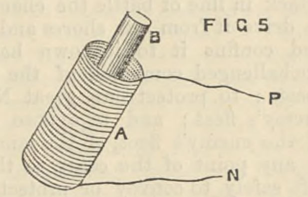


FIG 5

(16) If a bar of steel be treated thus, it will, if the current be small, act but feebly, and if the current be strong it will become a permanent magnet; that is to say, it will not lose its magnetism when the current ceases to flow. Even in the case of soft iron, a very small quantity of what is known as "residual magnetism" remains in the iron core B, Figs. 3 and 4.

(17) If we take a coil of insulated wire, A, Fig. 5, and put a permanent magnet, B, into the inside of the coil, *then, at the moment the magnet enters the coil, a current of electricity will flow through the wire* in one direction, say from P to N. This current will be of momentary duration, not lasting longer that a flash of lightning; and while the magnet is *in* the coil no electricity is to be detected. If now the magnet be withdrawn, at the instant it leaves the coil *a second current of electricity like the first, but flowing in the opposite direction, as from* N *to* P, *will traverse the wire.*

(18) No one knows why these things happen. We cannot tell why a bar of iron is a magnet so long as a current of electricity is running round and round it; nor do we know why a current of electricity flows through the wire coil if we put a magnet into it. These things are as much secrets of nature as gravity itself.

(19) The action described in paragraph (17) is due to the influence of the magnetic field, and to produce currents of electricity it is not necessary that the magnet should be actually put into the coil.

(20) *Currents of electricity are always established in coils of insulated copper wire when they are made to pass through a magnetic field.* One current is set up in one direction when the coil goes into the field, and another current is set up in the opposite direction when the coil comes out of the field.

(21) A coil of insulated copper wire meets with a great deal of resistance in passing through a magnetic field, not because the magnet attracts it, for copper is not attracted by magnets. The resistance is as though the coil were dragged through thick treacle.

(22) It can be proved that the electricity obtained in this way is the equivalent of the work done in dragging the coils through the field.

(23) In all dynamo machines, coils of wire—or their equivalents with which our readers need not now concern themselves—are caused to cut through magnetic fields, and in this way currents of electricity are generated. The magnets are almost invariably horseshoe-shaped, and the coils of wire are mounted on rotating wheels called "armatures," which revolve in the magnetic field. Fig. 6 shows the elements of all dynamos. A A is insulated wire coiled

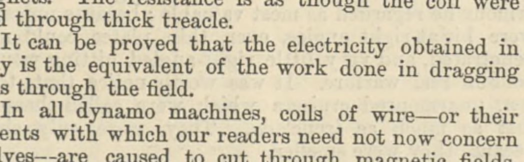


FIG 6

round the horseshoe magnet B. Through this a current is kept circulating by the battery C. At D is the armature. At E E are coils of insulated wire. As the armature is caused to revolve by a belt on the pulley H, the coils cut the magnetic field, each coil cutting a field twice in each revolution. As there are, say, eight coils, there are sixteen cuttings to each turn of the armature, and as the armature makes about 700 turns per minute, we have 11,200 currents, half in one direction, half in the other in the same time. Fig. 7 is a front view of the armature. C C are the wire coils; W W are the ends of the wires. These are all led down to the axle of the armature, and divided into two groups, in this case of six each. All the wires of one group are secured to a brass half roller, R in Fig. 8. These half rollers are secured on the axis of the armature, and are insulated from it by pottery or glass collars, or even hard dry wood, at I. C is part of the main body of the armature in section. W W are the groups of wires. Fig. 9 is a front view of the roller,

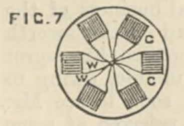


FIG. 7

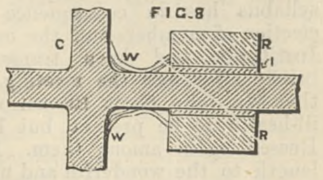


FIG. 8

which is called the "collector," or more frequently the "commutator." The dots show the ends of the six wires—12 ends in all—from the armature coils C, Fig. 7. Now, it will be seen that no current can flow in the coils C C under the conditions; because the ends of the wires are not united, all the ends at which electricity goes in being, say, in the top part of the roller—T, Fig. 9—and all

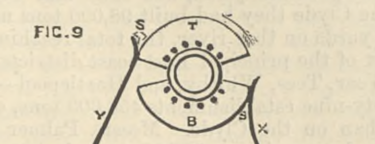


FIG. 9

the ends at which the electricity goes out being in the bottom half of the roller B. But these halves are insulated from each other—see (3) and (4.) In order to establish a connection Y and X are provided. These are copper springs pressing against the rollers, at the lower ends they are connected with wires W W which lead away to the lamp. It may be a mile off. It will be seen that in this way a roundabout connection is established between the wire ends in T and those in B, and currents can pass freely through the coils C C, Fig. 7. The springs X Y are, as we have said, made of flat copper plates. They always catch the eyes of the visitors to the Crystal Palace, because as the machines run what is known as "sparking" takes place, electricity jumping across the small space S S, Fig. 9. Thus, for example, the great machine driving the 150,000-candle lamp in the tropical department is sometimes lit up by sheets of flame round the commutators.

(24) It will be understood that we have described the dynamo in its elementary form. But the arrangement of the coils, of the magnets, and of the commutators is varied almost without end. But in all cases the principle is the same, insulated wire coils being made to cut or pass through magnetic fields. The wire coils are usually wound on small soft iron "cores"—in Fig. 3, B is called a core—which are rendered magnetic in passing through the fields of the stationary magnets. These re-act on the wire—see (17)—and intensify the action.

(25) In Fig. 6 we have shown a battery as actuating the electro-magnet B. In practice batteries are not used. Siemens employs what is known as an "exciter"—that is to say, a small dynamo *with permanent stationary magnets* sends its current through the coils A A, Fig. 6, of a much larger machine with electro-magnets. Several other makers do the same thing. But the favourite plan consists in sending the whole or a part of the electricity generated, through the wires A by coupling them on to the binding screws R R, Fig. 9. We have explained—see (16)—that a little residual magnetism remains in every bar of iron if it has once been magnetised. Enough remains in B, Fig. 6, to excite a feeble current in the armature coils when the machine first starts. This current strengthens the magnetism of B, and this in turn more strongly excites the coils E E and so on. There would be no limit to the power generated were it not that—

(26) Every bar of iron can be "saturated" with magnetism, after which, no matter what the power of the current flowing round it, it can take up no more. Consequently, there is a limit to the power of every dynamo machine in this direction. But there is hardly any limit to the increase in electricity obtained by running the machine at higher and higher velocities; but practical mechanical difficulties stand in the way, and 1500 revolutions per minute is the highest velocity yet ventured upon, and this only with small machines.

We have now explained how electricity is obtained with a dynamo. In a succeeding impression we shall deal with the second part of our subject, and explain how light is produced.

THE INSTITUTION OF NAVAL ARCHITECTS.

The annual meeting for 1882 of the Institution of Naval Architects began on Wednesday in the Hall of the Society of Arts, John-street, Adelphi, the Earl of Ravensworth, president, in the chair. There was a large attendance of members. Proceedings began at noon with the reading of the annual report of the Council, which was of a very satisfactory character. In consequence of Mr. Denny's paper "On Elementary Education in Naval Architecture," read at the last meeting of the Institution, and the discussion which ensued, the Council considered it desirable to take action in the matter, with a view to improving the character of the examination papers set by the Science and Art Department. A deputation was appointed to wait on the Lord President of the Council, and to lay before his lordship the views expressed in Mr. Denny's paper. The deputation, consisting of the Earl of Ravensworth and Messrs. Samuda, Barnes, W. Denny, and W. H. White, was granted an interview with the Lord President and the Vice-President of the Council and the First Lord of the Admiralty on the 7th July last. A report of what took place at this interview will be found embodied in vol. xxii. of the "Transactions" of the Institution. The Council is enabled to report that the deputation met with a very favourable reception, and the action taken in the matter has resulted in the appointment by the Lords of the Committee of Council on Education of a committee composed of three members of the Institution, viz., Sir E. J. Reed, and Messrs. W. H. White and W. B. Baskcomb, to report on the syllabus. A new syllabus has in consequence been issued. After the election of members and the usual formal business of the Institution had been transacted, Lord Ravensworth briefly addressed the meeting. He expressed his regret that Mr. John Scott Russell was still unable, owing to ill-health, to be present, but he hoped soon to see Mr. Russell again among them. He then referred at some length to the wonderful and unprecedented prosperity of the shipping trade of Great Britain, and dwelt on the importance of improvements which effected a saving in coal, on which England depended for her supremacy. The improvements effected in marine engines had reduced the consumption of coal on board ship by about 75 per cent. within the last few years. He had had occasion last year to speak of the great advance which 1880 showed in shipbuilding over previous years, but 1881 had been better still. On the Clyde they had built 98,000 tons more ships in the forty yards on that river, the total reaching 343,823 tons. In six of the principal East coast districts—Blythe, the Tyne, Wear, Tees, Whitby, and Hartlepool—they had built in thirty-nine establishments 456,000 tons, or 156,000 tons more than on the Clyde. Messrs. Palmer alone, on the Tyne had turned out 50,192 tons last year. The Barrow Shipbuilding Company again had built 32,700 tons, and wonderful results had been got in speed, the Servia having run from New York to Queenstown in 7 days 8 hours. He concluded by drawing attention to a convergence of ideas between Sir W. Armstrong and Mr. Denny, the former advocating small men-of-war at the Institution of Civil Engineers, and the latter moderately-sized merchant steamers in a lecture delivered at Greenock.

Mr. Samuda then read a paper

On Armoured Ships and Modern Guns.

This paper was intended to combat Sir William Armstrong's views, which Mr. Samuda regards as entirely mistaken. Sir William advocates unarmoured cruisers on the ground that (1) to resist the most powerful guns afloat, armour of 2ft. thick is required, and it has been necessary to restrict the area of armour surface to ever-narrowing limits, and that armour, therefore, seems gradually contracting to the vanishing point. (2) That even if the victory of armour over guns be established, it would still be a question if it would be worth while to incur the expense of continuing it to resist projectiles, seeing that vessels must still remain assailable by rams and torpedoes, and liable to be lost by casualties other than those of war. (3) That the function of armour may in a very considerable degree be fulfilled by coal, if judiciously applied for that purpose. (4) That, as to the comparative liability of an ironclad and an unarmoured ship to be sunk by projectiles, there is much less difference than is generally supposed. (5) That for the cost of one ironclad we could have three unarmoured ships of far higher speed and carrying collectively three armaments, each equal to that of the armoured vessel; and he then describes a combat between three unarmoured cruisers and one ironclad, considered to be fairly matched because representing the same pecuniary value; and assumes the victory would lay with the three unarmoured ships; and, without entering into the technical questions concerning fleet fighting, concludes that the result would be the same if the number engaged on each side were proportionately multiplied. (6) He argues that we require a far more numerous Navy than we possess or can afford to possess, unless we vastly reduce our expenditure on individual ships; and to do this we must dispense with armour, and that the chief expenditure of the country should be upon fast unarmoured ships, with armour-piercing guns. (7) He condemns the use of cruisers improvised out of ready-made merchant steamers, and forcibly points out the importance of the police service of cruisers, by reminding us of the enormous property we have at all times at sea in our ships, and that, in addition to their loss, we have also to guard against the interception of food supplies, and that the more our population increases and our agriculture declines, the more terribly effective for reducing us to submission would be the stoppage of those supplies. Mr. Samuda agrees entirely in his last suggestion, but he observed that many of the arguments in Sir William Armstrong's paper used to establish the greater value of unarmoured ships over ironclads, really apply equally to both classes, and consequently lose all force when used in support of one only. After quoting the usual arguments against unarmoured, and in favour of steel-clad ships, Mr. Samuda went on to say that the great aim sought to be accomplished by the introduction of armour-clad vessels, was to enable a fleet to stand up the greatest time possible against the fire of her enemy's guns, and unless, or until, a case has been established showing that such a change has been effected in the relative power of the attack and defence as to overthrow the conditions that have previously existed, no case has been made out to warrant a fundamental change. Now, he thought that nothing has yet occurred to warrant such a conclusion. In both cases immense strides have been made. The introduction of long breech-loading guns have greatly increased the power of penetration and added to the power of attack; but steel-faced armour and steel hulls, instead of iron armour and iron hulls, have added equally to the efficiency of defence. Steel-faced armour of similar thickness with iron will afford one-third to one-fourth more resistance, while the superior tenacity and ductility of the material will give it a further important advantage in resisting disruption, and thus, in most cases, restrict the damage that would result both to the ship struck and the crew inside it; while the same characteristic exists as to the ductility and superior qualities of the steel hull, and the additional strength it possesses enables the naval architect to reduce the weight of his ship and to improve his lines without diminishing the strength of the fabric. Instead of a case being established for the suppression of the system at present relied on from the conditions on which it was based being overthrown, that the result of the immense improvement in guns has been fully balanced by the corresponding improvements in the hull and armour to which they are opposed. The facts stated, the arguments adduced, and the conclusions drawn, all point to the conviction in Sir William Armstrong's mind that the functions to be performed by swift armed cruisers and the armour-clad fleet are the same, whereas the service required from them is distinctly and altogether different; and in practice he ventured to think it will be found absolutely impossible with cruisers, however numerous, to perform the service for which the ironclad fleet is specially required. Cruisers will be specially adapted and properly employed in protecting and conveying our commerce; keeping open the seas to enable our merchantmen to trade without interruption between the principal ports whence we draw supplies and our shores; lending naval assistance to our colonies when needed; and performing many similar secondary services; and it may be freely admitted a very large number of them are required for such services beyond those we have, or are even contemplating building. But they will be wholly unfitted to fight in line of battle, and stand up against an armour-clad fleet, where endurance alone will determine the result of the encounter, and where the endurance of the ironclad fleet may be reckoned by hours against minutes on the part of the unarmoured cruisers—even if they elected to oppose the fighting fleet at all; for really, beyond possessing great value for guerilla warfare, no decisive victory could be obtained, or even hoped for, against an ironclad fleet by vessels whose safety, when hardly pressed, would only be secured by their running away. The functions of the ironclad fleet would be—to attack in line of battle the enemy's fleet wherever found; to drive it from our shores and home seas; to follow it, and confine it to its own harbours; to maintain an unchallenged command of the sea routes leading to our coasts; to protect our great Naval arsenals against the enemy's fleet; and to oppose all attempts, under cover of the enemy's fleet, of the landing of troops for invasion at any point of the coast, so that the cruisers might be left safely to convoy or protect our merchant fleets, and enable them to perform the indispensable duty of bringing us uninterrupted supplies. He concluded by arguing that the money spent on ships of war should be looked on as an insurance premium to secure the safety of the country.

The discussion was opened by Admiral Sir G. Hornby, who said that he agreed with all that Mr. Samuda had read. An unarmoured ship could not fight with an armoured ship. All the lessons of warfare, past and present, showed that a scattered force could not contend against a concentrated force. If an armoured ship were attacked by three unarmoured ships, she would attack them one after another in order to ram them. They dare not risk close quarters, and at a distance they could not hit her effectively; besides she could always bring at least one gun to bear on each of her foes. If they could only realise the effect which would be produced by the explosion of a single shell carrying a bursting charge of 37 lb. of powder between decks in a ship, they would hear no more of unarmoured men-of-war. He contemplated with dismay the safety of the country being entrusted to such ships.

Mr. E. A. Cowper asked Mr. Samuda if light draught of water was not an important factor in favour of the unarmoured ship. Captain Noel, R.N., endorsed all that Mr. Samuda had read. The English Navy ought to be equal in power to any two foreign navies. It was perfectly true that steel cruisers now in the Navy were not so fast as ironclads. He found that in 1866 we possessed 180,000 tons of armoured ships. The rest of the world possessed but 240,000 tons. But in 1881 we had 380,000 tons, while the rest of the world owned 900,000 tons, which proved that we were not going on as we ought. He did not advocate too big ships, because they offered too great and too costly a mark to torpedo craft. He did not like guns which were too large because they were fired very slowly, and the chance of hitting a mark when they were fired was not good. Even thin armour he regarded as most valuable; because unless they were hit at right angles, even thin plates could not be penetrated, and very little right-angled hitting would be done in real warfare. It was worth notice that, ton for ton, unarmoured cruisers which were called cheap, cost just as much as ironclads. They were only cheaper because they were smaller.

Mr. Barnaby did not agree with Sir W. Armstrong. Unarmoured ships could not be effectually protected by coal. Although it was quite true that coal would augment the security of merchant vessels if attacked, it was not good enough for regular fighting ships. As to protection by multiplying bulkheads, while he admitted the possibility of rendering ships nearly unsinkable, it must be borne in mind that they might receive injuries which would render them quite useless, by giving them a dangerous heel, or by lowering the bows so much as to lift the rudder out of the water. The use of steel and the introduction of the ram and torpedo had rendered great changes in ships necessary. Many officers looked forward to the time as not distant when big guns would be wholly abandoned, all fighting being done with Whitehead torpedoes and the ram. Sir W. Armstrong had said that large and costly ships might be sunk by small cheap craft. That was true, but it must be remembered that men-of-war had other things to do besides fighting. They were expected to carry thick armour; vast quantities of coal; very heavy guns, and a great many of them; to steam at high speeds; to go on long voyages; to hold many months' provisions for large crews, and at the same time to be small and cheap. This could not be done. If certain work can only be done by big costly ships, we must have them, and if the work was well done they were cheap at any price. If he was told that he might do the best he could with 10,000 tons displacement, he would reply, "for every additional 100 tons you give me you shall have a better ship," and to this there was no limit. As to the question of speed, he might cite a suggestive fact. They had heard recently of a merchant ship which, with a displacement of 8000 tons, and 8400-horse power, had attained a speed of 18·5 knots. Her Majesty's despatch vessel Mercury had steamed at 18⅞ knots, with a displacement of 3700 tons, and 7500 indicated horse-power. The merchant steamer was 420ft. long. The Mercury, for reasons which would be appreciated by naval men, was but 300ft. long. The merchant steamer had about 1-horse power per ton of displacement, while the Mercury required nearly 2-horse power per ton to get the same speed. This would illustrate the gain to be had by using a big ship.

Admiral de Horsey, R.N., agreed with Mr. Samuda. Indeed, he did not believe an encounter could take place between an unarmoured and an armoured ship.

Mr. Samuda replied, and insisted that at any cost we must have a powerful navy to protect the interests of our country which never had more than four months' provisions in it.

Lord Ravensworth, in summing up, said that his twenty-five years' experience in the House of Commons led him to believe that economy would always be the first consideration there, the naval supremacy of Great Britain the second.

A vote of thanks was passed to Mr. Samuda.

Mr. J. Dunn then read a paper on

Merchant Shipping.

The substance of this paper was that the British mercantile marine had grown to an unprecedented extent, and has acquired a larger part of the trade of the world than it ever carried before. Each change in the conditions of trade has appeared to favour it, and our advantage is likely to continue for some while to come. The best method of defending this marine in war time has been a subject of frequent discussion; and one element in the question is the fighting power of modern merchant steamers. During the last few years important changes have occurred in merchant steamers. They have acquired—(1) Increased speed; (2) increased coal endurance; (3) greater structural strength; (4) much better watertight subdivision; (5) improved pumping facilities; (6) greater beam; (7) double bottoms; (8) steam steering gear; (9) in a few cases twin screws. These are some of the chief changes which have occurred during recent years in modern merchant steamers. They have come about to a very large extent as the natural development of our merchant trade. In part they have been due to special effort. They have all improved the commercial value of the ships themselves, and, in that sense, have been of value to the nation. But they have perhaps been of almost equal importance in that degree to which they have affected the conditions of those problems which have so continuously varied during recent years—the naval defence of this country and the provision for the safety of its merchant marine in war. In this way Mr. Dunn trusted that a statement of facts, without any expression of his opinion on them, might be of interest to some of his hearers, as being, to a large extent, the authors of these changes; and of service to the Institution as affording a basis for the discussion of a subject so interesting to every one—the maritime strength and security of the British Empire.

The discussion which followed was short, and not of much interest. Mr. Denny held that thanks were due to the Admiralty for introducing double bottoms; and it was found that bulkheads were extremely useful in dividing cargo steamers which made long voyages and touched at many ports, with a different kind of cargo for each. But it must not be supposed that they secured safety from sinking, for if a compartment became filled the ship might get such a list that she would be easily capsised or sent to the bottom by a heavy sea. No rule could be laid down as to how much of that surplus buoyancy, about which so much was heard, a ship ought to have. As to increase of beam, a small increase did no good. They ought, if they had it at all, to have an increase which would pay by giving plenty of augmented cargo space. He regretted that the Tonnage Commission had virtually put a penalty on double bottoms, which bottoms he regarded as of great value. Concerning twin-screws, to which some reference had been made by Mr. Dunn, he held that they ought always to be used when the engines exerted as much as 10,000-horse power.

Mr. Martell—Lloyd's—agreed with Mr. Denny on some points; but bulkheads, though they suited some trades, did not suit all, and Lloyd's had the utmost difficulty in getting them used, so much did they interfere with the stowage of cargo.

Mr. White — Admiralty — was in favour of twin screws, especially for deep draughts. Bulkheads might exist in plenty, and yet be useless, because they did not reach high enough. He regarded much pumping power as of little value, because holes were so large that no pumps could contend with them, and the fires were drowned out. He found that the rudders used in the mercantile marine had about one-half the area of those used in the Navy. He held that the general introduction of steam steering gear would enable comparatively short-handed ships like cargo steamers, to use large rudders, and these would be found to impart a great element of safety.

Mr. Parker—Lloyd's—was much in favour of twin screws, and he cited the case of a large twin-screw steamer which, on a voyage from San Francisco to Liverpool, made 12 knots an hour until she reached Cape Horn, when one of her engines broke down. She proceeded with the other engine at 9 knots until the Line was reached, by which time her engineers had repaired her broken-down engine, and she made 12 knots the rest of her voyage home. A great point about twin screws was that when we reach 8000 or 10,000-horse power, the parts of the engines become too large to handle for repairs or proper inspection, but by subdividing the power between two sets of machinery this difficulty was got over. The great objection urged against twin screws by the Guion, White Star, Inman, and other companies, was that the screws were liable to injury in going into and out of dock. If that were so, then the docks ought to be altered to suit the ships. He was in favour of plenty of pumping power, but the pumps must be able to deal with coals or grain as well as water. He could cite numerous instances where ships had been saved by pumps. The Bristol City had been kept afloat for twelve days by her pumps.

Mr. MacFarlane Gray said there ought to be trials of pumps, the ship to be put in a safe place, and water let in without giving the engineers notice, and then see how they would deal with it. Ships ought to be able to speak to each other in a fog by the aid of improved sound signal apparatus.

Mr. Kirk was quite in favour of twin screws. He knew of one instance where, when the rudder gear broke down, a ship had been brought safe to port by putting men at the reversing gear of each engine, and going ahead or astern as required. Centrifugal pumps were no doubt useful, if for nothing else than to remove volumes of water coming in from the hatches and deck.

Mr. Ravenhill said that great advances were being made in the speed of merchant ships. On the Clyde they were using phosphor bronze propellers, and he believed that some of the advance in speed was due to this. His own experience was that better economical results could be had from twin screws than from single screws. Mr. Marshall wished to know if the wild steering of the Inflexible—which sometimes wanted a port helm of 18 deg., and sometimes a starboard helm of the same amount—was due to the use of twin screws. Mr. John said that in passenger ships, where safety of human life was a greater object than cargo, plenty of bulkheads were cheerfully enough used; but they would, under many conditions, be intolerable in cargo boats. Iron sailing ships never had more than one, namely, a collision bulkhead; but these were well known to be the safest ships afloat, and were insured at the lowest premium. After a few remarks from other speakers, a vote of thanks was passed to Mr. Dunn, and Mr. Kirk read his paper

On the Triple Expansive Engines of the ss. Aberdeen.

The author began by pointing out that economy of coal in our steamships is a point of so great importance that any step in this direction is worth chronicling, and went on to say that the obvious direction in which to look for saving in fuel is increase of pressure; but unfortunately, as we get higher in pressure, we do not by any means gain in efficiency in anything like a proportionate degree, and the time must come, may indeed not be far away, when farther increase of pressure will not pay, but this time has not come yet. After glancing at the history of the steam engine, he stated that so far, however, as the imperfect data obtainable of steamship performances at sea show, the increase in economy of fuel has made but little progress, and I am not aware that any perceptible increase of economy has been attained by exceeding 70 lb. to 75 lb. pressure. In fact, the compound or double expansion engine has relapsed into the condition of the old single-expansion one. This gradual increase of pressure, using all the time the ordinary type of internally-fired fire-tube boiler, has dissipated at once the mistrust of boilers of larger diameters, and the craving for boilers composed of water-tubes, and other such complicated arrangements. These may yet have their day. He was indebted to one of these water-tube boilers for having driven him seriously to take up the question of utilising advantageously steam of much higher pressure than was at that time generally in use. While he was with Messrs. John Elder and Co., in 1874, Mr. W. H. Dixon, of Liverpool, anxious to attain greater economy of fuel, made up his mind to fit his steamer Propontis with high-pressure water-tube boilers on Messrs. Rowan and Horton's patent, and thus the author had to consider the best engine to utilise this high-pressure steam advantageously.

Being thoroughly convinced that the great secret of success in the ordinary compound engine of the day over the earlier simple engine—even the Woolf engine—lay in the range of temperature through which the steam in any one cylinder passed in the course of one stroke, being very much reduced—nearly halved in fact, compared with a single cylinder—it seemed to him that with these high pressures we must use three successive expansions, and divide the total range of temperature into three parts. Of course this was incidentally favourable to a more uniform distribution of strains, reduced leakage to the condenser, &c. Thus the engines of the Propontis, constructed in 1874 for a steam pressure of 150 lb. per square inch, consisted of three cylinders of progressive capacities, the smallest being the high pressure to which the steam was first admitted, next the intermediate one to which the steam passed from the high-pressure cylinder, and the third the low-pressure cylinder, receiving the steam from the intermediate cylinder and discharging it into the condenser. The arrangement consisted of a three-throw crank with a cylinder above each, and possessed no specialities of construction or design. Unfortunately the boiler very early gave trouble, and ultimately was taken out, but during the time it worked at its full pressure he found, on comparing the diagrams with those of an ordinary compound engine, that these engines ought to have required only about 1½ lb. of coal per indicated horse-power.

From that time till January last year—1881—when Messrs. George Thompson and Co. entrusted to his firm—Messrs. R. Napier and Sons—the building of the ss. Aberdeen, he failed to find anyone who cared to make so long a step, and in doing so he hoped Messrs. Thompson will have their reward. In designing a ship for the long voyage their ships make from this country to Australia and China, more importance attaches to a small consumption of coal than in ships making shorter voyages, and it was necessary to use every device to attain this end. The engines of the Aberdeen are essentially of the same design as those of the Propontis, the cylinders being 30in., 45in., and 70in. by 4ft. 6in. stroke. The boilers, two in number, are ordinary double-ended boilers, constructed entirely of steel, with six of Fox's corrugated furnaces in each, the total heating surface being 7128 square feet. There is no superheater. The construction of these boilers, for so high a pressure—125 lb. per square inch—was facilitated by their being built of steel and to Lloyd's, whose rules allow the shells to be made thinner than required by the Board of Trade, although the internal parts are as strong as those required by the latter. After all, the shell is the simplest and strongest part of a round boiler, where, even if built to Lloyd's, there is superabundance of strength, but to doubly ensure success—the internal parts of a boiler being those which oftenest give trouble—they were made stronger than required by either Lloyd's or the Board of Trade, whose scantlings for these parts are practically the same. The high-pressure cylinder was not jacketted; the second was jacketted with steam of 50 lb. pressure, and the low-pressure one with steam of 15 lb. above the atmosphere. The Aberdeen is a ship built of iron, both ship and engines being to the highest class at Lloyd's, 350ft. by 44ft. by 33ft. When the ship was complete, 2000 tons of dead weight were put on board, and arrangements were made to test the consumption on a six hours' run at 1800-horse power; this, however, by the owners' desire, was reduced to four only. The coal was Penrikyber Welsh coal, and Messrs. Parker and Dunlop, who happened to be on board, kindly undertook to examine the state of the fires, and see the coal weighed. The result was a consumption of 1·28 lb. per indicated horse-power. According to usual analogy, we should expect from this a sea consumption of good Welsh coal of from 1·5 lb. to 1·6 lb. per indicated horse-power. The next trial was to find the maximum speed, which on four runs on the measured mile, occupying two hours, was 13·74 knots, the mean power being 2631, and the consumption of coal during these two hours being 1 ton 17 cwt. per hour. The weight of steam condensed in the jackets, carefully measured into a tank, was 3¾ deg. per cent. of the greatest weight of steam admitted to the high-pressure cylinder—by diagram—the pressure on the jacket of the middle cylinder being 30 lb., and on the low-pressure cylinder 10 lb. In a second experiment the condensed water was still the same percentage when the pressure in each jacket was doubled. The loss of steam from the high-pressure cylinder to the low-pressure, just before release, plus the steam condensed in the jackets, was the same as took place inside the cylinders with the steam shut off from the jackets.

About four years ago—but several years subsequent to the Propontis—Messrs. Douglas and Grant, of Kirkaldy, made a comparatively small set of marine engines for the Isa with triple expansion, by placing the first, or high-pressure, above what in an ordinary two-cylinder compound engine would be the high-pressure cylinder. This makes a neat and, in some cases, a convenient arrangement, but is open to the objection that, if you make the ratios of expansion approximately equal in each cylinder, the strains are very unequal, as also the several ranges of temperature. A better arrangement is to have two low-pressure cylinders, with the high-pressure cylinder on top of one, and the intermediate cylinder on the top of the other.

This was immediately followed by Mr. Parker's paper

On the Economy of Compound Engines.

The reason why, in general, higher steam pressures are conducive to economy is that they render possible a greater measure of expansion, as the most part of the work is done without any further expenditure of heat than originally supplied in the steam before expansion; but there are limits beyond which expansion of steam is not beneficial, and it is to these limits that I wish to draw attention. If we conceive a perfect gas originally at a high pressure, and at any temperature to expand, doing work, the work will be done at the expense of the heat of the gas, and its temperature will fall by an amount proportional to the work done during expansion, unless an equivalent amount of heat be added as expansion takes place. If this heat be added, the relation of the pressure and volume during expansion is such that their product at any time is constant; but if no heat is added during expansion, the pressure falls much below that which it would have been according to this law. In the case of steam we have a much more difficult matter, as any reduction of temperature below that due to the pressure causes immediate condensation. However, when the law by which the pressures and temperatures of steam vary is known, and also the total amount of heat necessary to produce steam of any given pressure, we are able to calculate the variations of pressure and volume of steam, if we know what heat is given to or taken from it, and also what work is done by it during expansion.

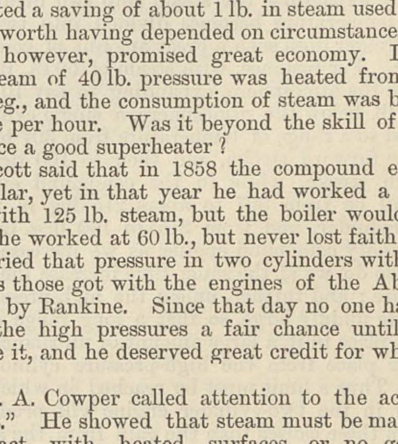
The author then explained at some length what takes place within a cylinder, steam being condensed at the beginning of the stroke, and evaporated at the end. He then went on to explain that it is therefore evident that the greater the amount of expansion the greater will be the range of temperature, and the greater the range of temperature the greater will also be the amount of liquefaction and re-evaporation taking place, so that a point is reached at which with further expansion the greater variation of temperature causes greater losses of heat than is compensated for by the additional work done. Now, provided we can expand the steam continuously, allowing the pressure to fall only as work is done, it is immaterial whether the expansion is effected in one or in more cylinders. In the compound engine as in general use, however, this expansion is somewhat interrupted; the steam after it is cut off in the high-pressure cylinder expands until it fills this cylinder, and at the end of the stroke it expands further, without doing work, into the receiver. This represents a loss compared with what would have been realised by continuous expansion, and, in addition, the steam having to pass through tortuous passages in obtaining its exit from the high-pressure cylinder into the receiver, and from the receiver into the low-pressure cylinder, a loss of direct pressure is experienced, the forward pressure in the low-pressure cylinder when this is fully open to the receiver being generally two or more pounds less than the back pressure in the high-pressure cylinder. These losses of power are represented graphically by the well-known gap between the high and low-pressure diagrams. Although a very considerable loss may thus be shown to take place in the best-designed compound engine, yet the fact has been proved beyond question that the compound engine, even with this loss, is more economical by far than the simple engine; and the reason it is so is because, by expanding the steam into two cylinders, the range of temperature becomes divided into two, and in neither cylinder does such a great amount of condensation take place. For instance, with steam of 60 lb. per square inch above the atmosphere, expanding to say 10 lb. absolute, or 5 lb. below the atmosphere, a single cylinder will be exposed to a range of temperature from 307 to 194 deg. during the forward stroke, and then to 100 deg. during the return stroke, while in the compound engine the ranges will be from 307 to about 215 deg. in the high-pressure cylinder, and from 215 to 100 deg. in the low. In an ordinary compound engine, as we increase the pressure, so also do we at the same time increase the range of temperature; and further, unless the high-pressure cylinder is made unduly large, so that a long range of expansion takes place in it, a large amount of unbalanced expansion takes place from the high-pressure cylinder to the receiver. Thus a limit must be reached in which further expansion in the two-cylinder engine will produce more losses from these causes than the gain from the additional expansion, exactly in the same way as with the simple engine a limit was soon reached beyond which additional expansion was injurious. In other words, if pressures and expansions are carried beyond this limit, we shall have to again compound our compound engines. Where this limit is must be ascertained by direct experiments, and the author was sure that the engineering world are looking forward with intense interest to the results which will be obtained by the s.s. Aberdeen in her forthcoming voyage as an experimental fact towards settling this point. Unfortunately, with marine engines, it is almost impossible to determine their absolute efficiency; the only facts as to their performance which can be accurately noted are the indicated horse-power and the consumption of fuel; this gives a measure of the efficiency of the engine and boiler combined, but in order to eliminate the boiler we would require to know in addition the amount of water evaporated, and also the amount of condensation water and its rise of temperature—this would enable us to know how much water was in the steam when it enters the engine, and also at any subsequent part of the stroke—but these quantities are not measurable in engines of large power, such as are fitted to the ordinary steamers employed in the mercantile marine. The author had constructed diagrams showing the relative volumes and pressures of steam in the case of the s.s. Aberdeen, taken from indicator diagrams kindly given to him by Mr. Kirk, from the performance of that vessel at the power at which she will work at sea, and also from diagrams taken from two two-cylinder compound engines, one of them working at the same boiler pressure, viz., 125 lb. per square inch, and the other at 88 lb. per square inch. It would be observed that in the latter case a considerable departure is visible in the high-pressure diagram from the adiabatic curve—or curve of perfect engine—while very considerable condensation is shown in the low-pressure cylinder, more than that in the high-pressure, and considering the rapid rate of evaporation in the high-pressure cylinder towards the end of the stroke. He believed that a very considerable amount of the steam must even then be left condensed. In the first two diagrams of the s.s. Aberdeen very little evaporation is shown, and this is what we should have expected from the small range of temperature in them. Again, in the case of the engines of the s.s. Northern, being ordinary compound engines working at a pressure of 88 lb. per square inch, although the compression parts of the diagram clearly show that the high-pressure piston is leaky, yet the pressure in this case towards the end of the stroke rises above the adiabatic curve, while very considerable condensation has taken place in the low-pressure cylinder, and had the piston been tight these would of course have been more marked. He might mention that within the last few weeks there has been a steamer completed to work at a pressure of 150 lb. per square inch, with triple expansive engines very similar to those fitted in the s.s. Aberdeen, and in his opinion this description of engine marks one of the most important of recent advances in marine engineering, affording a means of using steam at higher pressures than have hitherto been possible with economy.

Mr. Kirk's and Mr. Parker's paper were discussed together. The discussion was opened by Mr. Denny, who stated that he had built a steam tender and fitted her with a boiler which would carry 120 lb. steam. She had now an ordinary compound engine. He would work her for some time at 90 lb. and find how much fuel she used. Then he would fit a third cylinder on the top of the high-pressure cylinder, and work her with three cylinders and 120 lb., and ascertain the consumption of fuel over some months, and lay the results before the Institution.

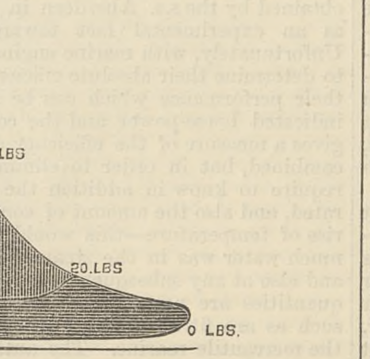
Mr. Longridge, whose report on a compound engine at Audley Hall has recently been noticed in our columns, said that he could not agree with the authors of the papers read. He did not think that three cylinders were necessary to economy. He had carried out many experiments, and investigated authentic reports of the experiments made by others, and had come to the conclusion that for every engine there was a better grade of expansion and pressure than any other. In the old marine engine there was practically no expansion, hence its wastefulness; and the economy of the compound engine was due, not to the fact that it was compound, but to the circumstance that it worked expansively. For every pressure there was a better expansion than any other. For 60 lb. steam the right expansion was about sevenfold in a single cylinder; with two cylinders and 80 lb. they might have an eight-fold expansion; with three cylinders a fifteen-fold expansion and 120 lb.; but the consumption of steam per horse-power would be practically the same in all three types of engine, namely, about 17 lb. per hour. There was a small saving, however, to be had out of the higher pressures. Thus with 80 lb. steam the consumption would be 16·75 lb. As a rule it might be assumed that about ½ lb. of steam per indicated horse-power per hour was saved by each increase of 10 lb. in the boiler pressure above 60 lb.; while each 10 lb. above 40 lb. and up to 60 lb. represented a saving of about 1 lb. in steam used; whether this was worth having depended on circumstances. Superheating, however, promised great economy. In one instance steam of 40 lb. pressure was heated from 287 deg. to 380 deg., and the consumption of steam was but 15·5 lb. per horse per hour. Was it beyond the skill of engineers to produce a good superheater?

Mr. Scott said that in 1858 the compound engine was not popular, yet in that year he had worked a compound engine with 125 lb. steam, but the boiler would not last. In 1860 he worked at 60 lb., but never lost faith in 125 lb., and he tried that pressure in two cylinders with the same results as those got with the engines of the Aberdeen, as recorded by Rankine. Since that day no one had courage to give the high pressures a fair chance until Mr. Kirk had done it, and he deserved great credit for what he had done.

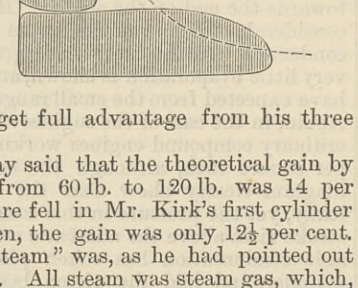
Mr. E. A. Cowper called attention to the action of his "hot pot." He showed that steam must be made to come in contact with heated surfaces, or no good could be gained from warming the intermediate receiver. As to the advantage to be gained from high pressures, he submitted the accompanying diagram.



The whole gain due to raising the pressure from 90 lb. to 125 lb. was shown by the little bit of diagram from A to B. He found that with his hot pot no water was discharged from the low-pressure cylinder at the end of the stroke. On the contrary, the steam was slightly superheated. He illustrated the action of the hot pot by the annexed diagram, where the adiabatic curve is shown by the dotted line. He thought that Mr. Kirk did not expand his steam enough to get full advantage from his three cylinders.



Mr. MacFarlane Gray said that the theoretical gain by raising the pressure from 60 lb. to 120 lb. was 14 per cent.; but as the pressure fell in Mr. Kirk's first cylinder while the valve was open, the gain was only 12½ per cent. The term "saturated steam" was, as he had pointed out long since, a misnomer. All steam was steam gas, which, in practice, contained a great deal of moisture. He was glad to see that Clausius had adopted his views on this point. The question was—was it worth while to use 120 lb., and three cylinders to gain 12½ per cent.? As to the loss due to expanding on the adiabatic curve, he would say that, given dry steam at 123 lb. pressure as 1000, when that steam had fallen to 30 lb. the steam was but 929, the rest water; at 14·7 lb. the steam was 742, the rest water. Taking the $P \propto V^{\frac{10}{9}}$ formula for volume and pressure, then, 1000 at 125 lb. became, at 70 lb., 915 steam, the rest water; at 30 lb., 815 steam; and at 14·7, 742 steam. His experience was that jackets were only used at sea to get pretty diagrams, which jackets always gave. There was this good about Mr. Kirk's scheme—that the first cylinder A might be taken off when the boilers were worn and the pressure had to be reduced, and the engine would go on with B and C. He thought boilers might be made to last thirty years in this way.



Mr. Ravenhill wished to ask what was the relative weight of Mr. Kirk's machinery—engines, boilers, and water—as compared with that of the ordinary two-cylinder compound engine, the piston speeds being the same in both cases.

Mr. Marshall wished to know if the economy gained was worth having at the price of three cylinders? He had handed to him a circular concerning a well-known triple-cylinder engine, in which the first two diagrams were real, the third calculated, he supposed because the pressure was too small to be indicated. The little steamer he would not name, but she had made a sensational voyage across the Atlantic and back, at an average speed of 4·5 knots per hour. He then referred to H.M.S. Nelson's engines, by Mr. Kirk. From a report of her performance in the *Times*, at 47 revolutions per minute she indicated 1087-horse power, on a consumption of 1·7 lb. At 60 revolutions she indicated 3067-horse power, with 1·9 lb. Indicating 6219-horse power, she burned 2·2 lb. per horse per hour. Now at these comparatively low speeds they might take the power as varying as the cube of the speed; and taking the units obtained by dividing the cubes into the powers, they got the following results: At 47 revolutions they got a coefficient of 9·03; at 60 revolutions they got 4·085—which was the best result; for at 13·33 knots the coefficient rose again to 5·577; so that the work really done in driving the ship through the water as compared with that done in all by the engines was the greatest at 60 revolutions. Mr. Joy referred to the performance of the s.s. Howard, built by the Barrow Shipbuilding Company, which required with two cylinders but 2·2 lb. The fact that 1·67 lb. had been got in other vessels would seem to indicate that three cylinders were wanted.

Mr. Kirk replied. Mr. Longridge seemed to hold that expansion was expansion, no matter how got. This was theoretically true, but in this world theory and practice did not always coincide, and in the mercantile marine it had been conclusively proved that compounding was essential to economy. There was no difficulty in making a superheater; he had made one, the steam issuing from which would char wood, but there was no engine which could use it, because lubrication was impossible. To Mr. Cowper was largely, if not exclusively, due the introduction of the modern marine engine. Steam jackets had been advocated as the panacea for all evils, but he did not see much good in them with high piston speeds, though they were serviceable for low speeds. They evaporated water in the low-pressure cylinder which they converted into a boiler; but the steam thus made was of too low a pressure to be worth the cost, and was better drained away. With the Woolf engine it was different; there jackets must be used to prevent the collection of water in the cylinders. He did not see much good in the hot-pot, because the steam was not heated up with waste heat. Mr. Cowper here stood up and explained that when isolated steam was heated the gain as compared with making steam in the boiler was as 1000 deg. to 480 deg. Mr. Kirk asked Mr. Cowper in what ship he had got 1·3 lb. Mr. Cowper replied in the Briton at ten knots, and in the Thetis the same had been done. Mr. Kirk expressed some incredulity, and sat down. Mr. Parker then rose and said that he had heard Mr. Longridge with interest. At sea, unfortunately, they could not measure the feed-water, and so could not tell whether they got on with 17 lb. of steam per horse per hour or not. They had tried 60 lb. steam in single cylinders in the Circassian, which made two Atlantic voyages, and was a stupendous failure. They had made two experiments, one of four hours, the other of three hours, with the Aberdeen, with and without jackets, and found that if they had used the jacket steam in the cylinders the results would have been just the same as with jackets. The true question after all was not consumption per horse-power, but consumption per ton per mile, and this was so complicated with screw and ship's efficiency that it was hard to arrive at just conclusions as to the relative merits of different types of engine.

After a vote of thanks had been passed to Mr. Kirk and Mr. Parker, the meeting was adjourned to 12 noon yesterday—Thursday. On Wednesday evening the annual dinner of the Institute took place at Willis' Rooms.

DESCRIPTION OF THE DAVIS ISLAND COFFERDAM OF 1881.*

By Mr. Wm. Martin, C.E.

The navigable pass is that portion of the dam over which the greatest depth of water is always attained, and extends out into the river at right angles to the lock a distance of 558·89ft. The cofferdam extends out from the river lock wall a distance of 612ft., and parallel to the current of the river, a distance of 237ft., enclosing an area of 3½ acres. The area thus enclosed, besides giving the necessary space required for the dam, gave ample room for all the machinery of construction. A cofferdam may be described as a water-tight wall constructed around the site of any work for the purpose of laying dry the foundation of pier, wall, or any other structure that may be intended, by pumping out the water from the area thus enclosed. The methods used in different works vary according to the uses intended and the facility for procuring the materials of construction. The preliminary steps taken in the one which is the subject of this paper, was to drive two rows of oak piles 15in. in diameter and 20ft. long to an average depth of 8ft. at a distance of 15ft. 8in. transversely and 21ft. longitudinally between centres, between which the frame-work was constructed, the piles serving to hold the frame-work in position until the puddling was placed. The framework consisted of three rows of stringers placed 12ft. 4in. apart, between which the sheeting was placed vertically and driven into the gravel 2ft. The joints of the sheeting were covered with a 1in. strip 6in. wide to prevent leakage of the puddling. At the top of the sheeting are spiked two string pieces 2in. by 13in. on each side of the sheeting to form a bearing for the joist on which the deck was laid, also to bind the tops of sheeting together. The stringers were placed at the centres of pressure of rectangles of equal pressure and were united together by a scarfe joint with an iron rod passing through the entire width of the cofferdam with a nut on each end. One set of workmen assembled the stringers both in respect to height and width, and were followed by another set who drove the sheeting, and still by another who trimmed the tops of the sheeting and put on the 2in. by 10in. string pieces, the joists, and the deck. The most interesting part of the work was the placing of the puddling, and to which this paper chiefly refers. The total length of the cofferdam was 1437ft., 379ft. of it was puddled by material taken from the cofferdam used in the construction of the river wall, the remaining 1058ft. was puddled by material obtained on Davis Island. The method employed in puddling the cofferdams of the land and river walls, was to deliver the material in cars by a tramway from the point of excavation to the river, where it was loaded into boats, from thence transported across the river, where it was delivered into the framework of the cofferdam by hand labour, and having to be watered to settle it. The method employed in puddling the cofferdam of the navigable pass was by forcing the material by means of a centrifugal pump through a pipe, from Davis Island to the cofferdam, the plant of which consists of boiler, engine, piston pump, centrifugal pump, delivery pipe, and the necessary steam and water connections. The pump, which was of the ordinary centrifugal type, was located on Davis Island, a distance of 900ft. from the cofferdam. Alongside and beneath the pump was a tank for mixing the puddling material, 8ft. in diameter and 4ft. deep, sunk to a depth sufficient to secure fall for a water culvert from the river. The piston pump was connected to the delivery pipe by a Y-connection, and was used for clearing the delivery pipe, for priming the centrifugal pump, and keeping the sand from the packing (as described hereafter), and for furnishing water for the agitator hose and the steam boiler. The puddle material, which consisted of loam and sand, was obtained within a radius of 100ft. from the pump by loosening up the soil with a plough and delivering it in close proximity to the tank by horse scrapers, and from thence delivered to the tank by shovels, where it was mixed with water from the culvert and kept agitated by water from hose pipes in the hands of the workmen to prevent the mixture from settling in the bottom of the tank. The puddle material so mixed was taken up by the feed pipe of the centrifugal pump and forced through the delivery pipe to the coffer, the distance to which was constantly increasing owing to the advancement of the completed work. The delivery pipe was laid from the centrifugal pump along the bottom of the river, and thence rose to about 1ft. above the top of the cofferdam by an easy ascent, avoiding any sharp angles. On the pipe at the pump a pressure gauge was used for the purpose of detecting any stoppages in the pump or delivery pipe whereby the free working of the pump might be impaired. These were frequently caused by the puddle material being fed too thick. When the gauge indicated a stoppage the operator slackened the speed of the centrifugal and opened the valve in the wye connection to the piston pump. A stream of clear water was then thrown from the piston pump through the delivery pipe at high pressure, and the pipe was cleared. The check valve in the delivery pipe between the wye connection and the centrifugal pump prevented a back flow into the centrifugal pump. On the bottom end of the feed pipe was a screen with meshes of one square inch to prevent stones, roots, or any material which might prevent the free working of the pump from being taken up by the feed pipe. Above the screen and in the same casing was placed a foot valve for the purpose of holding the priming. One of the principal difficulties experienced in working the pump was the rapid wearing of all the parts of the centrifugal pump with which the sand came in contact. The casing, which was originally ⅝in. thick, wore through in about ten days. This was renewed by a casing 1in. thick, which performed all the work required. The stuffing box wore rapidly until the following device was applied:—A screw was cut in the chamber in the opposite direction to the motion of the shaft. A pipe was put in back of the packing and connected with the piston pump. Water was forced through this around the shaft, and being under a greater pressure than the centrifugal pump, prevented the puddle material from getting into the stuffing-box. Water so applied performed a double duty, acting as a lubricator and preventing the shaft from heating. At the discharge end of the delivery pipe the puddle material was deposited in the framework of the cofferdam and flowed off for a distance of a few hundred feet, depositing in a hard and solid mass. Being delivered in a liquid form, it penetrated every crack and crevice in the framework and required no ramming or watering to settle it. A point noticed in the mass was, that the puddle material composed of loam and sand in its original state, as on Davis Island, was completely separated. The loam being the lighter body was kept longer in suspension and settled on top of the sand. There was delivered into the cofferdam by the above described process 5784 cubic yards of puddle material in twenty-three days' time, equal to 251·4 cubic yards per ten hours working time, or 25·14 cubic yards per hour. The cost of this was as follows:—

	dols.
Cost of pump	145 00.
Repairs, fittings, &c.	382 25.
Pipe	364 09.
Fuel	38 35.
Cost of labour, erecting machinery, making excavations for tank and water culvert feeding the centrifugal pump, &c.	3647 07.
Total	dols. 4575 76.

A comparison of the above figures with the cost of the puddling of the river wall cofferdam, which was procured from Davis Island as described, and the cross-section of which was the same, shows as follows:—

	Length. ft.	Total cost. dols.	Cost per Lin. ft. dols.
Coffer dam of river wall	1165	6628 37	5 69.
Coffer dam of navigable pass	1085	4576 76	4 22.

During the construction of the river wall cofferdam 12½ cents per hour were paid to labourers, and 22½ cents per hour to the mechanics, while during the construction of the navigable pass cofferdam labourers received from 17½ cents to 20 cents per hour, and mechanics from 25 cents to 27½ cents per hour. This makes the above statement still more favourable to the method of pumping. The dimensions of the principal parts of the machinery were as follows:—

Tubular steam boiler	36in. diameter, 16ft. long.
Steam engine	10in. diameter, cyl. 10in. stroke.
Piston pump, steam cyl.,	12in. diameter, cyl., 18in. stroke.
Piston pump, water cyl.,	6½in. diameter, cyl., 18in. stroke.
Centrifugal pump	4in. diameter of discharge.
Delivery pipe	4in. diameter.
Clearing pipe	2½in. diameter.
Priming pipe	1½in. diameter.
Lubricator pipe	1in. diameter.
Agitator hose	1½in. diameter.
Steam pipe to engine	2½in. diameter.
Steam pipe to piston pump	2in. diameter.
Band wheel on engine shaft	4ft. 6in. diameter.
Pulley on centrifugal pump shaft	10in. diameter.
Width of driving belt	10in.

The pressures carried were as follows:—

Steam boiler pressure	100 lb. per square inch.
Gauge on piston pump	70 lb. per square inch.
Gauge on delivery pipe	35 lb. per square inch.

The plant of the above described process, as originally designed, was very much simplified during the progress of the work, much that was complicated having been omitted for more simple devices. The cost of placing the puddling was thereby considerably increased. It is believed that with the improved machinery, as described above, the puddle material can be placed at one-half the figure given.

* Read before the Engineers' Society of Western Pennsylvania, December 20, 1881.

Trial Trip of a China Tea Steamer.—The steamship Minard Castle, which has been built by Messrs. Raylton, Dixon, and Co., of Middlesbrough, for the famous "Castle Line" of Messrs. T. Skinner and Co., proceeded on her trial trip on Saturday. She is almost a sister ship of the Bothwell Castle, built by them for the same firm twelve months ago. The Minard Castle is a handsome vessel of 332ft. over all, 38ft. beam, and 26ft. depth of hold; gross register, 2550 tons. She will carry 4000 tons of tea, as well as coal for her homeward voyage. The engines are by Messrs. T. Richardson and Son, and will indicate 1300-horse power, having cylinders of 40in. and 75in. diameter and 42in. stroke, with very large boiler power. She proceeded to sea on Saturday morning, the 25th inst., having 1200 tons dead-weight on board, and a mean draught of 15ft. 3in., and made a speed trial attaining 13·6 knots per hour, or over 15½ miles.

RAILWAY MATTERS.

ON the Philadelphia and Baltimore Railway it has been found even more important to balance carriage or car wheels accurately than to have them accurately circular.

THE new bell for St. Paul's is too large for transport by rail to London. It will be conveyed by road on a heavy carriage of great strength, now being made by Messrs. Coles and Matthews, of Coventry, who will remove the bell to its destination.

THE *American Manufacturer* says the Bessemer patents in the States for making steel rails have expired. The company which controlled them in that country still holds some mechanical devices, the use of which is offered to any one for 50 cents per ton.

THE *Monitore* (Rome) complains that during all the years the St. Gothard tunnel has been progressing Italy has done nothing towards enabling her commerce to profit by it. Another supplementary line, from Turin to Genoa, absolutely necessary, is now projected, but nothing has been done.

IT is said that the St. Gothard Railway, where it rounds the base of the Axenberg, above the Lake of Lucerne, is threatened with a landslip. A vast overhanging mass of rock is in so precarious a condition that its fall is regarded as inevitable. To avert the peril it has been determined to detach the rocks with dynamite and hurl them into the lake.

THE President of the Board of Trade and the Chairman of Ways and Means have consented to the appointment of a Select Committee to consider whether any, and if any, what change should be made in the standing orders which govern railway legislation, and especially the proposed relaxation of those orders so as to permit interest upon calls being paid out of capital for authorised works during their construction.

REPORTING on the collision which occurred on the 11th January, between Grangemouth junction and Polmont junction on the North British Railway, Major-General Hutchinson remarks that the block system is the only way of preventing this class of accident; but in the case referred to he says, "With a quickly-acting continuous brake on the special train it is probable that this collision would have been avoided."

A TRAVELLER in Iowa while riding along came to a large sign which implored him to "Look out for the locomotive." The *American Car Builders' Gazette* says he accordingly rode down the track for a better view, and while he was obligingly looking out for it, it came along. He saw it; but he had to sit in the ditch and wait until a freight train of forty-one cars passed before he could get back to the other piece of his horse.

THE prospectus has been issued of the Graham's Town and Port Alfred Railway Company, Limited, which is being formed with the object of obtaining such legislative powers as may be necessary for the construction, maintenance, and working of a railway between Graham's Town and Port Alfred, in Cape Colony, and to obtain from the Government of Cape Colony, conventions, subsidies, grants, aids, or other assistance in furtherance of that object. Mr. Samuel Abbott, M.I.C.E., Lincoln, is the engineer.

A TRAIN on the Northern Pacific Railway, near Bismarck, Dakota, broke through a bridge on the night of the 21st inst., having previously, the *Times* correspondent says, run off the track through a wheel breaking. Two sleeping coaches, with a restaurant coach, were wrecked and the bedding ignited. Eight persons were killed and twenty-two wounded. The killed were badly burnt, but it is believed that seven died before the fire reached them. One, who was held fast by the broken timbers, was roasted alive in the presence of the survivors, who were unable to extricate him.

THE *Bulletin* of the Iron and Steel Association says the capacity of the American Bessemer steel rail works is now in excess of demand; that they can this year produce 1,500,000 gross tons; that they do not need to import a ton of steel rails to-day to meet the present demand; and that as a matter of fact indications point to an early virtual termination of all importations of both steel and iron rails. The production of steel rails in America last year was 1,200,000 gross tons, and the importation was 222,597, making a total of 1,400,000 gross tons, in round numbers.

THE *East Anglian Daily Times* announces that the reply of the managers of the leading railways to the deputation representing the Royal and other agricultural societies which waited upon them at the Clearing House on the 3rd inst. relative to the charges for conveyance of live stock to shows has been received, and the concessions include nearly every point sought. The decision arrived at is that stock shall be conveyed at full fares to the shows, but at half fare for the return journey if unsold. Men *bonâ fide* in charge of stock will be conveyed both ways free of charge. The conditions will apply to animals conveyed in horse boxes by passenger or special trains, and in cattle trucks by luggage trains.

WHENEVER an American crack locomotive gets within a dozen or twenty miles of Bound Brook, New Jersey, it becomes restive and eager to dash off and show its best paces. The highest speeds attained by locomotives in America interest the American mind very much. The *Car Builder* says: "The latest score is 72 miles an hour for a short distance, with an incumbrance of five cars. It was a Baldwin engine, 18 by 24 cylinders, on the Central R.R. Another report says that engine '224' made 28½ miles in 25½ minutes, between Yardley and Bound Brook, and one mile was run in 42 seconds, or at the rate of 84 miles an hour! After this, who will taunt New Jersey with being *slow?*"

THE Geneva correspondent of the *Times* says that the opening of the St. Gothard Railway is to be celebrated by a great international *fête*. On the opening day, which is not yet definitely fixed, the first train to run over the new line will leave Milan with the King of Italy and his Ministers and deputations from the Chamber and the Senate. At Bellinzona the train will be joined by the Council of State and the great Council of Canton Tessin. At Altorf it will be joined by the Council of State and the Landrath of Uri; and at Lucerne it will be received by the President of the Swiss Confederation, the members of the Federal Council, the representatives of the German Empire and of the northern cantons, all of whom will return in the royal train to Milan, where they will be entertained by the chief dignitaries of the city.

THE *Valley Virginian* records a case of remarkable coolness and courage on the part of a driver. It remarks that heroes are not always the product of war. An instance occurred recently at Waynesboro, Pa. The extras were late, and, as a consequence, eleven trains were blocked on the main track above Waynesboro awaiting their arrival. Rain and sleet were falling, and the engine of No. 14 being unable to draw its cars, the engineer of the train immediately following it, Mr. R. P. Irving, detached his engine from his own train, and coupling it on to the rear car of No. 14, aided the ascent. After pushing the first train nearly half-a-mile and giving it a good start, Mr. Irving reversed his own engine and started to return to his own train, but ere he had reached it he saw a detachment of the train he had left coming down the mountain at a rapid rate, it having become uncoupled from the engine. In an instant he realised the situation. Thirteen heavily-loaded cars were coming down a 75ft. grade, and each revolution of the wheels was adding to its speed. "With rare presence of mind and an iron nerve that few men possess, Irving started his engine to meet the descending mass and break the force of the collision. He ran up to within a short distance of the cars, and then reversing to lighten the shock, clutched the lever in his firm grasp, and bracing every nerve in his body, awaited the catastrophe. A moment later and the crash came. The shock of an avalanche could scarcely have been greater. One of the cars climbed up on the boiler of the engine and another was wrecked. But the brave man had accomplished his purpose. The wild train was stopped and the engineer had saved many a precious life and thousands of dollars' worth of property. He entered the very jaws of death in the discharge of his duty. But for his daring interposition the wreck would have been terrible."

NOTES AND MEMORANDA.

THE population of the County and City of Dublin is 418,910, namely, 197,740 males and 221,170 females, or 3·4 per cent. more than in 1871. The population of Dublin is 249,602, an increase of 3276 on the population of 1871.

SOLDERING cast iron is generally considered to be very difficult, but it seems to be only a question of thoroughly brightening the surface to be soldered, and using good solder and a clean swab with muriatic acid. Sodium amalgam might be usefully employed for the purpose.

AS an easy test for olive oil, about a teaspoonful of oil is put in a test tube, and a thermometer suspended in the oil, which is now to be heated to 250 deg. C.—472 deg. Fah. For a comparison a second test tube of pure oil may be treated in like manner. Pure olive oil, when heated, grows rather lighter in colour, but most other oils, like cottonseed, peanut oil, &c., grow darker. The latter, also, evolve a penetrating and disagreeable odour, but olive oil has a pleasant smell not unlike strawberries.

THE following approximate weights for practical purposes may be found in every book of tabular information, but from here it may be cut out and stuck on the year's pocket-book fly-leaf:—Cast iron weighs ·2608 of a pound to cubic inch; bar iron, ·2785; steel, ·2833; copper, ·3211; brass, cast, ·3037; lead, ·4106. One foot of common angle iron weighs as follows:—1½in. angle iron weighs 2·7 lb. to the foot; 2in., 3·9 lb.; 2¼in., 5 lb.; 2½in., 6·5 lb.; 3in., 10·4 lb. One foot of bar iron 1in. square weighs 3·340 lb.; 1½in. weighs 7·516 lb.; 2in., 13·360 lb. A square foot of plate ⅛in. thick weighs 5 lb.; $\frac{3}{16}$in. thick, 7½ lb.; ¼in., 10 lb.

MM. GAILLET AND HUET add to the weak but injurious liquors which escape from the distilleries, per-chloride of iron in suitable proportion, mixing the ingredients thoroughly. After the first reaction is completed milk of lime is stirred in, which precipitates the sesquioxide of iron, carrying with it almost all the organic matter. The remaining liquid is perfectly clear, colourless, harmless, not liable to fermentation and offering no inconvenience to the public health. The precipitate forms a manure, very rich in nitrogen and in phosphoric acid. The sale of the manure not only frees the refuse from being a burden upon the industry, but also makes it a source of profit.

A COMMUNICATION has been recently made to the *Academie des Sciences* by M. Adolph Duponchel—the agreement of the curve of sun spots with the actions resulting from the excentricity of the principal planets. He thinks there will be an increase of the mean temperature in any given place during the twelve years to come over that of the twelve years which has just passed. Uranus and Neptune are about receding from their perihelia, and he anticipates an effervescence in the solar atmosphere, analogous to that which occurred between the years 1716 and 1725, and an increasing frequency of spots, of which the maximum will occur, but between 1888 and 1892.

THE average annual outlay of the American people for daily newspapers is, according to the last census and newspaper returns, 26,250,100 dols., being an average price per annum of 7·33 dols., and an aggregate daily circulation of 3,581,187. The number of daily journals in the country during last (census) year is placed at 962, including 114 which were started in the year. The aggregate circulation of daily papers throughout the States is 3,581,197; of weeklies, 3,121,890; bi-weeklies, 156,344; tri-weeklies, 39,890; Sunday papers, 724,671; German dailies, 321,204; German weeklies, 487,798. The average cost of a paper to the annual subscriber is 2⅛c. per copy, the average retail price per copy for the country being nearly 4⅛c. The largest average for a State (viz., Nevada) is 12c., and the lowest, in Delaware, at only 1⅓c. per copy.

IN a recent form of constant cell without acid, a modification of the "Daniell," the copper plate is surrounded by a solution of sulphate of copper, and the zinc by a solution of caustic soda, the porous diaphragm being made from parchment paper folded into the required shape so as to avoid seams, two or three thicknesses being used, according to the resistance required. The zinc and copper plates are formed with two longitudinal slits extending two-thirds the length of the plate, which is bent to form three sides of a parallelopiped; the centre part between the two slits is turned back and upwards, so as to reach above the liquid and form the connections of the cell, and thus all waste in cutting out the plates and, at the same time, soldered connections are avoided. Its electromotive force varies from 1·47 to 1·35 volt, the latter value being reached after the cell has been for a considerable time on short circuit, and its internal resistance for a cell 20 centimetres—7·87in.—high and 3 litres—2·64 quarts—capacity, is about 0·075 ohm.

PROFESSOR STOLETOW, of the University of Moscow, has made some recent experiments in order to determine Maxwell's ratio between the electro-magnetic and electro-static units. The electro-static capacity, c, of a condenser formed of two plates with plain and parallel faces is equal to $\frac{S}{4\pi\delta}$, S being the surface and δ the distance between the plates. The electro-magnetic capacity is $\frac{c}{v^2}$. The condenser is charged and the discharge is received by a galvanometer; by producing 100 discharges per second the galvanometer receives a permanent deviation, from which the value of v can be determined. The *Journal of the Franklin Institute* says, Stoletow's results accord very closely with those which have been previously ascertained, indicating a velocity between 298,000 and 300,000km. (185,170 to 186,410 miles) per second.

A SHORT paper has been published "On the Presence of Grease in Steam Boiler Deposits," by Mr. T. B. Bruce Warren, analytical chemist to the India-rubber, Gutta-percha, and Telegraph Works Company, Limited, Silvertown. Some time ago he was asked to examine a sample of feed-water for grease, as an action was taking place in some boilers that led to the inference that the water contained grease. The feed-water was heated with exhaust steam from an engine. On carefully testing the water, it was found free from smell and taste, and did not affect the rotation of pieces of camphor when thrown into it. On heating the water no smell was perceptible. A portion of the deposit itself from the water was submitted to analysis, with the following results, when carefully dried at 220 deg. Fah. and dissolved in hydrochloric acid:—Soluble solids, 92·71; insoluble, 7·29; total, 100·00. The soluble solids consisted principally of calcium, magnesium, sodium, iron, and silica, with carbonic, sulphuric, and phosphoric acids. The insoluble portion was dried again on the filter after careful washing. Carbon disulphide was poured over the residue, and the collected filtrate evaporated. Not the slightest residuum was obtained, even when the insoluble portion from 500 grammes of deposit was operated on. His friend was so certain that grease was probably present, and he felt great reluctance in giving an opinion until he had exhausted the subject by a very extended examination, when he decided that no grease was present. A little time afterwards, he received a sample of deposit said to have been collected from the top of the water, after the steam was blown off. A portion of this was treated in exactly the same way, and he was surprised to find that without any difficulty at all, he could recover 3·78 per cent. of solid fat. He suggests that the reason why it was not found in the deposit from the bottom of the boiler is that an insoluble earthy soap was formed in the boiler, which floated on the surface of the water in the same way as the scum which is formed when using soap with hard water. The injury to a boiler, where such water is used, results from a portion of this earthy soap coming in contact with the heated junctions of the joints and rivets, where, by keeping off the water, the parts become more strongly heated, the soap then becomes charred or burnt, when the water again comes in contact with the strongly heated metal, producing alternate rapid expansions and contractions.

MISCELLANEA.

AT a recent meeting of the Liverpool Engineering Society a paper on "Paper Machinery" was read by Mr. W. C. Pagan.

A SHEARER named Joseph Carrollan, employed at Messrs. Muntz's metal works, Birmingham, committed suicide, it is said, on Thursday, the 23rd, by jumping into some machinery in rapid motion.

A FRENCH mining engineer, in boring at a depth of 1500ft. in St. Etienne, is reported to have come upon a hot spring, whose waters rushed forth in a column to a height of nearly 80ft. above the surface.

THE prospectus has been issued of a new electric lighting company styled "The Electric Lighting Contract and Maintenance Company, Limited." The capital is to be £2,000,000 in £10 shares. The offices are at 6, Lombard-street, E.C.

THE works of the Barrow Flax and Jute Company, Limited, at Barrow-in-Furness, and the business hitherto carried on by them, employing about 2500 hands, will in future be carried on by Mr. Thomas Briggs, 21, Major-street, Manchester.

THE firm of Close and Ayre, Phœnix Ironworks, York, and the York Railway Plant Company, Albion Ironworks, York, have amalgamated and formed the two businesses into one, which will hereafter be conducted under the name of the York Engineering Company, Limited.

MESSRS. WM. ARROL AND CO., of the Dalmarnoch Ironworks, Glasgow, the contractors for the Tay Bridge, are pushing forward with all possible speed the preliminary arrangements necessary for the commencement of the undertaking, both as regards the necessary shops on the Tay and the preparation of the ironwork in their establishment in Glasgow.

AN Otago company has already produced the 50 tons of sulphuric acid required to entitle it to the bonus offered by the Government, and a second factory has been started in Canterbury. It appears that sulphur can be obtained in almost exhaustless quantities on White Island, an active volcano near Tauranga, so that sulphuric acid ought to have become a profitable speculation without a bonus to start it.

A VERY useful little waistcoat pocket-book for engineers, entitled "Memento de L'Ingenieur et du Constructeur," 1882, is published by the *Moniteur Industrielle*, of which M. Louis Finet is the editor, and M. Jules de Meens manager, at Brussels and at Paris. It comprises 137 pages consisting chiefly of tabular information, much of which is not found in our own pocket-books. It is 2⅝in. by 1⅞in. and rather less than ⅜in. in thickness.

A SUBSIDENCE of land has occurred in Manghold Churchyard, near Ramsey. About thirty-five years ago a tunnel connected with iron ore mines ran underneath the churchyard at a depth of five fathoms below the surface. The timbers supporting this tunnel have evidently decayed. The land subsiding, left a hole fully 18ft. deep and 12ft. square. The land along the route of the tunnel shows signs of subsidence, smaller collapses having taken place previously.

MESSRS. CROSBY LOCKWOOD AND CO. announce new books on "Continuous Railway Brakes," by Michael Reynolds, author of "Locomotive Engine-driving;" "The Boiler Maker's Ready Reckoner," by John Courtney, edited by D. Kinnear Clark, M. Inst. C.E; "A Practical Treatise on the Joints made and used by Builders in Engineering and Architectural Works, &c.," by J. W. Christy; and "Mathematics as applied to the Constructive Arts," by Francis Campin, C.E.

THE Siemens "regenerative" gas-burner has been adopted for the purposes of lighting Holborn, from the Circus to Gray's-inn-road. In Holborn twenty-four lamps have been erected, the consumption of which ranges between 22ft. and 24ft. of gas per hour, with an average illuminating power per lamp of 130 candles. In addition to these Messrs. Siemens have fixed two large lamps, one at either end of the Holborn Viaduct, each of which, burning 65ft. of gas an hour, gives a light equal to 400 candles.

THE Lake of Constance is so low that steamers cannot reach the port of Romanshorn, and passengers from Lindau have to be landed in small boats. The Geneva correspondent of the *Times* says the Rhone was never so low in the memory of man. All the mills on its banks from Geneva to Bellegarde are at a standstill, a circumstance absolutely without precedent. A site in the river selected some time ago by the Geneva Municipality for public swimming baths has had to be abandoned because it has become dry land.

THE American *Nautical Gazette* is informed that the Pusey and Jones Company, of Wilmington, Delaware, is about closing a contract with a foreign Government for a huge ironclad, to be built on the plans of N. B. Clark, a retired engineer of the United States Navy. The *Gazette* only received this information on going to press, but that was time enough to prophesy that "the day is not far distant when our yards will turn out plenty of vessels for non-shipbuilding countries on this Continent, and possibly for some of those of Europe."

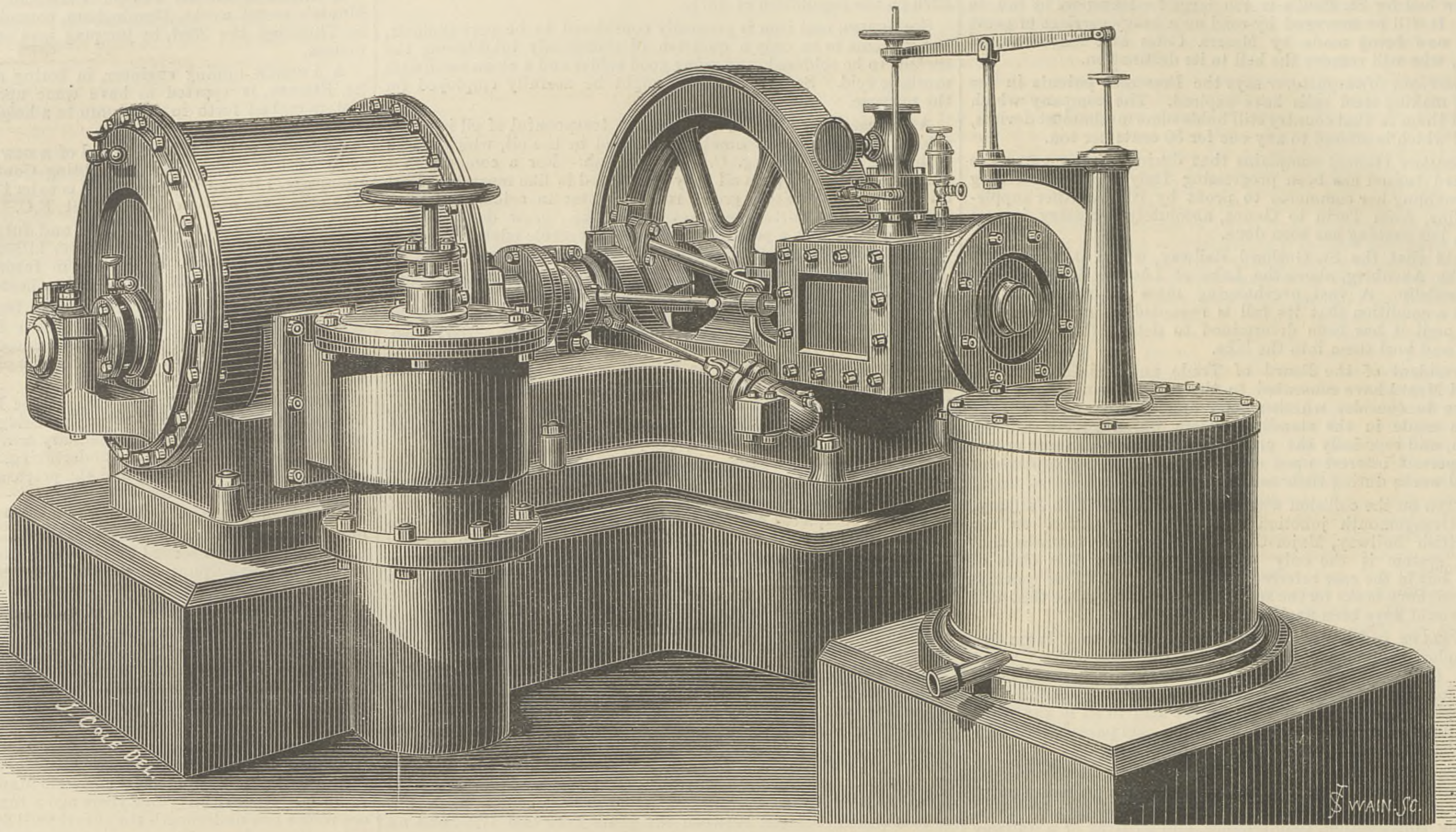
AN estimate has been published showing the several services for which a vote "on account" is required for the year ending March 31, 1883, the total sum required being £3,631,600. The royal palaces absorb £40,361; royal parks and pleasure grounds, £110,921; Houses of Parliament, £37,110; public buildings, £148,064; the Natural History Museum absorbs £45,853—cases cost a good deal in this museum; public buildings in Ireland, £190,208; House of Lords offices, £43,105; House of Commons offices, £50,461; Local Government Board, £428,145; stationery office and printing, £529,450. In Ireland the Lord Lieutenant's household is down for £7587; the Chief Secretary's office, £39,606; the Local Government Board, £135,244.

THE death on the 17th ult. is recorded by the *Scientific American* of Mr. Joseph Earle Sheffield, founder of the Sheffield Scientific School of Yale College, and a liberal benefactor of the college in other respects. Mr. Sheffield was born at Southport, Conn., in 1793. His father and grandfather were extensive shipowners. At fifteen years of age he began his business life as clerk in a shipping office in Newbern, N.C. Subsequently he removed to Mobile, where he became one of the largest shippers of cotton in the country. He returned to the North in 1835, and established himself in New Haven. He was one of the chief projectors of the New York and New Haven Railroad, and was the projector and for many years the president of the New Haven and North Hampton Railway Company. He was also engaged in the construction of the Chicago and Rock Island Railroad. He is chiefly known for his liberal donations to Yale College and other public institutions of learning in New England and in the West.

AT a recent meeting of the Board of Works, a letter was received from Mr. E. W. Goodwin, F.S.A., on the subject of prevention of fires in theatres, in which he suggested that in all newly-built theatres the staircases used by the public should be in short, straight, and easy flights; that every gallery, circle, or tier should have its own staircase and landing near the entrance of the gallery or circle; that extra exits and staircases should be always open until the theatre was closed for the night; and that the materials used for the building of theatres should, if possible, be brick and terra-cotta. As, however, it was from the stage that the danger of fire was most likely to arise, there should be, besides the thick proscenium wall recommended by the Board of Works, a wrought iron proscenium screen always in use as an ordinary act-drop. He also suggested that the lighting of all parts of the theatre should be by electric lights. In the concluding portion of his letter he said that when they remembered that two of the largest theatres had abroad been burnt down three times, and that one theatre, at this season generally crammed to suffocation, had been destroyed by fire four times, the most determined optimist among theatrical managers might well hesitate before he attempted to persuade them that they were creating needless alarm. Most of the theatres were in a high degree dangerous to life and property.

GAS EXHAUSTER.

MESSRS. W. H. ALLEN AND CO., LAMBETH, ENGINEERS.

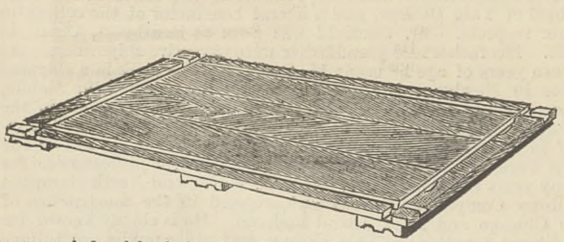


We illustrate one of a pair of exhausters manufactured by Messrs. W. H. Allen and Co., of York-street Works, Lambeth, for a leading continental city. These exhausters are an improvement on what is known as Beale's patent, a machine which has been more used in gasworks than any other for exhausting and forcing gas. The improvements of Messrs. Allen consist in making the segments of cast steel with an internal face, so that the gas is prevented from entering the segment—as in the old form—and escape in this direction is thus avoided. By increasing the size of these segments and decreasing their weight, so that centrifugal force does not come into play, a considerable amount of friction is dispensed with, and scarcely any heat is generated. Some machines of the old form have been known to increase the heat of the gas 10 deg. or 12 deg. in passing through the exhausters only; but in this new form the heat is increased very little. Another improvement consists in making the slide pins of extra large size, and so reducing the wear on these important parts. The exhauster, as now made by Messrs. Allen, is nearly balanced in every way, so that there is an equal strain throughout. The exhauster is combined with, and driven by, a direct-acting steam engine, with double crank and fly-wheel on the opposite side. The engine is fitted with a very simple, yet effective, single slide expansion valve, and altogether the arrangement is very neat and compact, and as the whole of the working parts, including crank, connecting rod, and crosshead, with their bolts and nuts, are made of steel, the lightness of their parts with the beauty of workmanship gives them an excellent appearance. The engines are regulated by a hydraulic governor directly on the engine, as shown. These exhausters are capable of passing 50,000 cubic feet per hour against a pressure of 74in. of water.

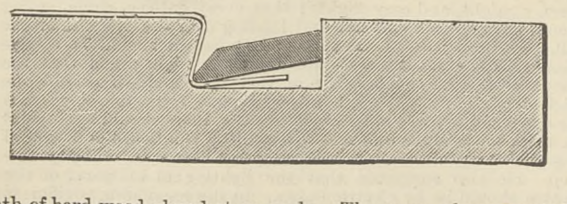
We have already spoken in a former impression of the excellence of Messrs. Allen's workmanship—this is due in a great measure to the special tools used by that firm. Their premises are not large. They were at one time occupied in part by Messrs. Merryweather and Sons, steam fire-engine builders; they have been re-fitted throughout with the newest special tools, and will be found well worth a visit by engineers who take an interest in the production of small machinery of exceptionally fine finish.

LOW'S DRAWING BOARD.

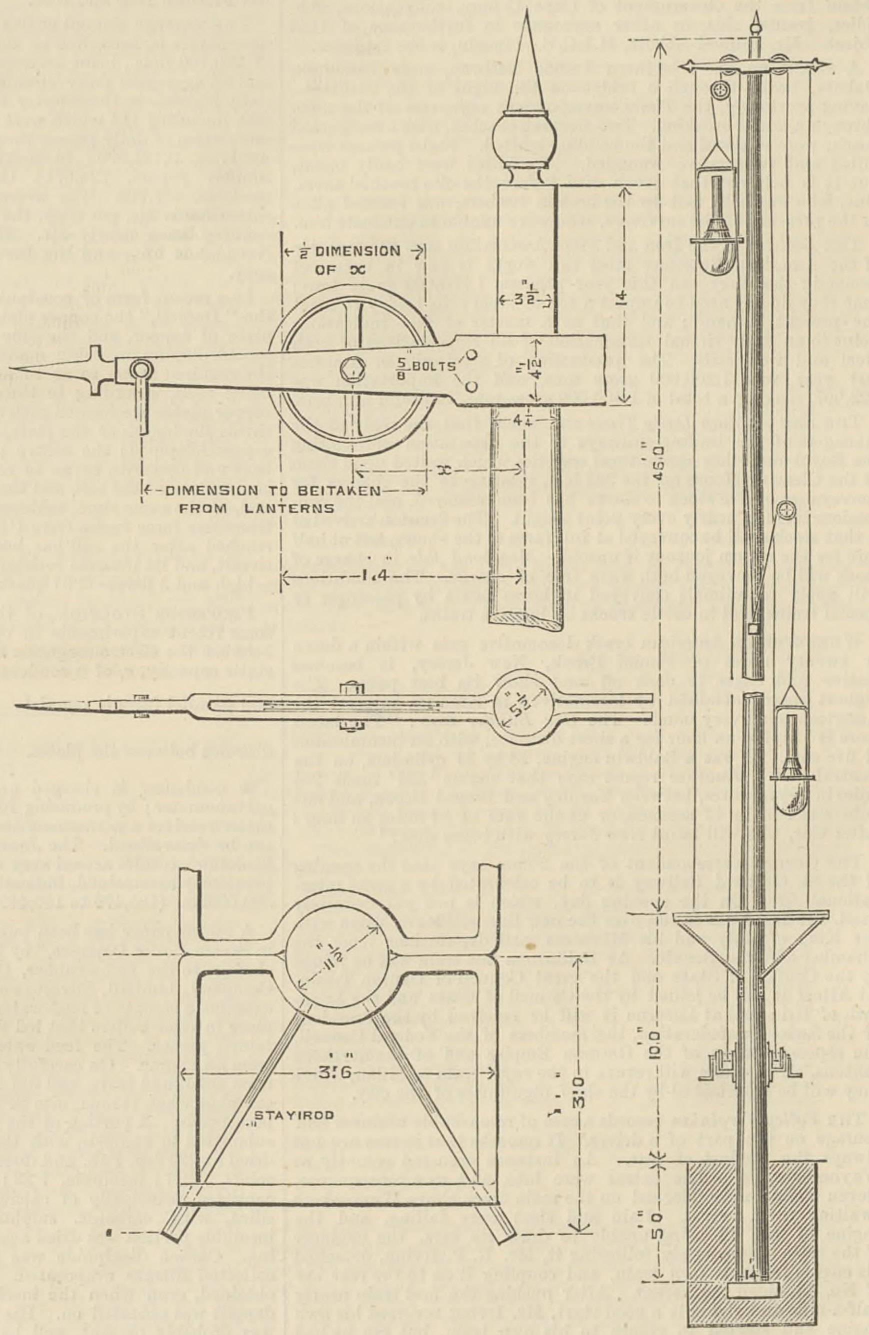
The accompanying engravings show a very neat and ingenious device for stretching and holding drawing paper on drawing boards without the use of glue or pins. It avoids the necessity of the frequent cleansing of the board by washing, planing, or scraping,



accompanied with their attendant "messing" and loss of time; it also prevents the roughening of the board by the accumulation of pin-holes. It is exceedingly simple, consisting only of four rectangular channel grooves, each furnished with a thin



lath of hard wood placed at an angle. The paper when mounted is firmly secured, and cannot lose its grip, as from the angular position of the laths, they act as a powerful circular wedge against the paper by the contraction of the latter in drying. In mounting the paper, it is first wetted on the board in the usual way, and a piece ⅝in. square is cut out of each corner; its edges are then placed over the grooves equally all round, and pressed down into the bottom corner of the inner side of the grooves with the bevelled narrow edge of laths; the latter is then turned over till its other—angular—side rests against the outer side of grooves near the top, forming an angle downwards to the bottom inner corner. The paper in contracting by drying, draws the lower bevelled edge of the laths up on a radius from their outer angular edges into a gradually narrowing space in grooves, thus acting as powerful circular wedges against the paper, firmly fixing it against the inner side of grooves, and are jammed tighter in proportion as the paper contracts more. The paper is gripped close to the edge, and a drawing can be made on to it within ⅝in. of the edges of the standard sizes of the paper. Tracing cloth or paper can be mounted on the top of the drawing paper in the same way, by taking each lath up separately, re-fixing the same on the top of tracing paper in the same manner. In mounting both the paper and tracing paper, the two ends should be done first, then the two sides. Finger-holes are provided behind the laths for the purpose of taking them out when required.



STREET MAST FOR TWO ELECTRIC LIGHTS.

Should the system of lighting our streets by electricity become general, the designers of standards upon which to place the lamps will have to consider not only the practical object in view but the æsthetic tendency of the age. Great improvements have from time to time been made in the designs of posts for the gas lamps, and no doubt the same will happen with electric lamp-posts. We herewith illustrate the posts used by Mr. R. E. Crompton in his street lighting at Norwich. In the engraving the part shouldered down to receive the suspending bracket is shown as 3½in. diameter and as having a square shoulder. In the actual masts this is probably not done, the part receiving the bracket socket being either gradually tapered off from the larger part of the mast, or if shouldered down, then with a round-shoulder, otherwise the strength of the upper part of the mast would be seriously affected. The construction of street masts for electric lamps presents a nice engineering problem, for the masts must not only be handsome, as we have said, but strong. Lack of strength led to the failure of the system of lighting by lamps on masts in Liverpool. There is reason to think that the best results will be obtained by using powerful lamps on high masts, as, for example, at the Mansion House, in the City; but the high masts used in London are so ugly that they would not be tolerated save as experiments. The street mast of the future has to be designed, and, as we have said, its design constitutes a very nice problem. In the United States it is proposed to light very large districts by putting up towers—they cannot be called masts—150ft. high, and carrying at the top six or eight 20,000 candle lights. Such an experiment is worth trying. The great objection to short street lamp masts is that the light dazzles and confuses rather than assists persons. The tall mast overcomes this objection.

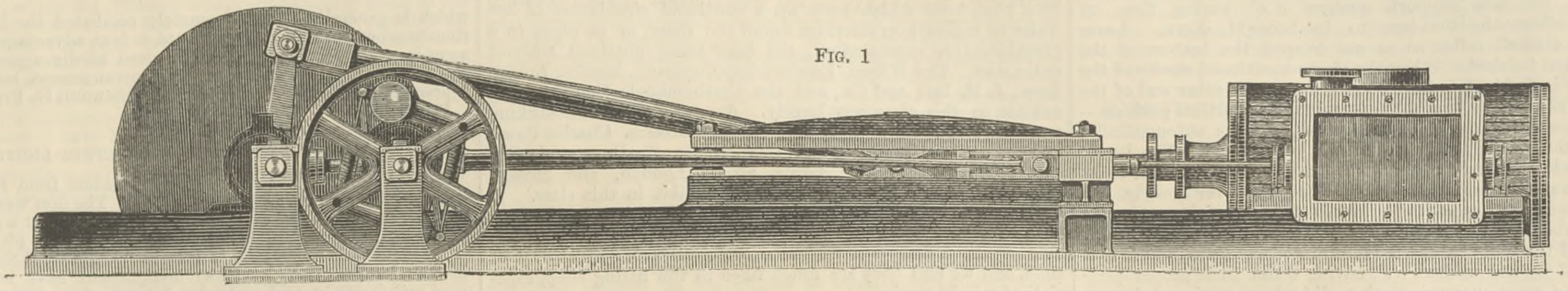
The Tay Bridge.—The operations for rebuilding this bridge have been begun.

Naval Engineer Appointments.—William Fedarb, assistant engineer, to the Lord Warden, vice Brown. William H. Grant, assistant engineer, to the Indus, additional, for service in the Raleigh.

HORIZONTAL ENGINE, WITH LINDLEY'S EXPANSION GEAR.

MESSRS. DEAKIN, PARKER, AND CO., ENGINEERS, SALFORD.

Fig. 1



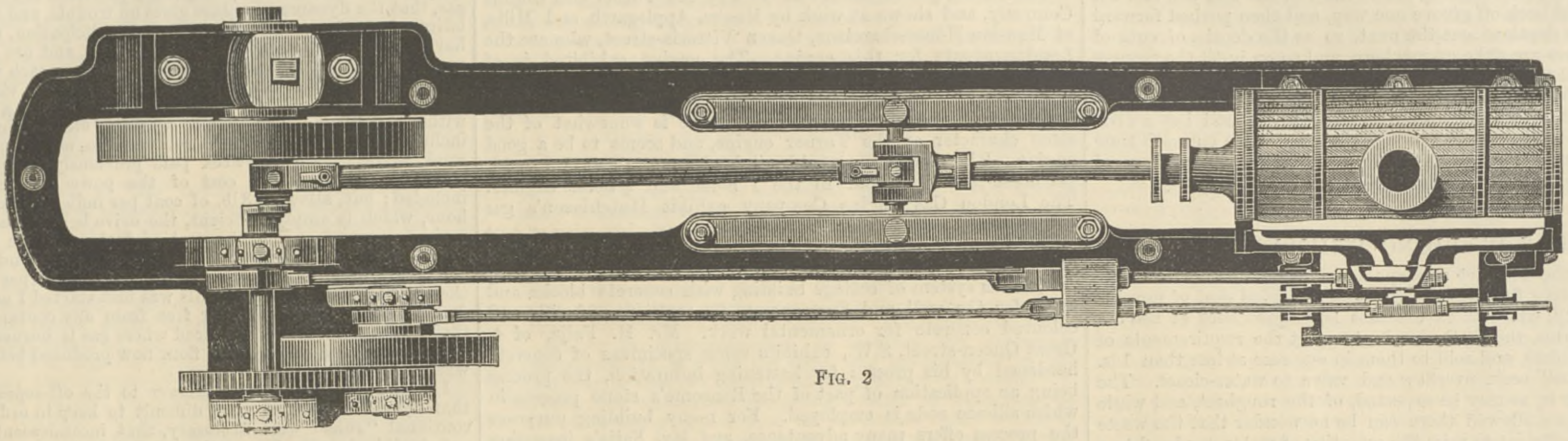
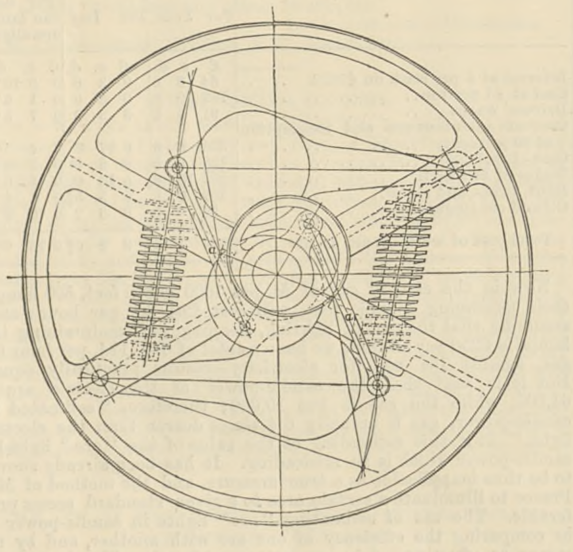


Fig. 2

We represent above Lindley's patent cut-off gear fitted to a horizontal high-pressure engine in the annexed Figs. 1 and 2, as made by Messrs. Deakin, Parker, and Co., of Salford, of which engineering firm the patentee is partner. This gear is a new application of the form of governor known as Hartnell's, which is applied by the forementioned engineers to engines of moderate size, and running, say, 80 or 100 revolutions per minute or more. The Hartnell governor, as now modified by Messrs. Deakin, Parker, and Co., and exhibited for the first time, we believe, at the Royal Agricultural Society's Show last year at Derby, is shown in Fig. 3, a and a^1 being flat steel links connecting the governor weights to the expansion excentric. The outward movement of the weights twists round the excentric, so altering the phase of its motion as compared with that of the main excentric, and cutting off the steam earlier. It is not to be denied that this governor when carefully made and the springs properly adjusted gives off good results. But at low speeds, say below 80 revolutions per minute, it becomes less sensitive and less powerful; hence in such applications it is not well adapted, especially where the engine is required to run with regularity under any great variations of load. In a recent patent taken out by Mr. Lindley he has sought to adapt the "drum-governor" to slow running engines, whose speed we may put down at 40 or 45 revolutions per minute. In this improved arrangement, as represented in Figs. 1 and 2, the drum-governor is mounted on a lay shaft, which is driven by suitable gearing at twice the speed of the

Fig. 3



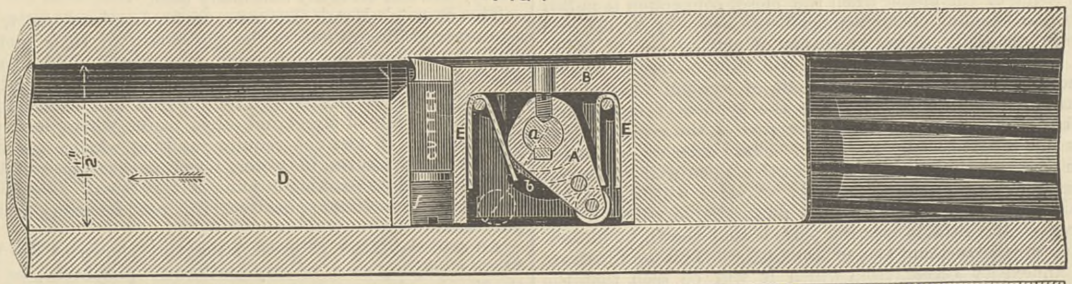
crank shaft of the engine. The expansion excentric is also mounted on this shaft, and coupled up to the weights shown in Fig. 3.

The expansion excentric therefore makes two revolutions, and the expansion valve two reciprocations for each stroke of the engine. To enable this arrangement to give the proper distribution of steam to the engine, the valve-chest has fixed in it a plate which is adjusted so as to bear steam-tight against the back of the main valve. On the inner side of this plate is a central port always in communication with the steam passages in the side, and through them to either end of the steam cylinder as may be determined by the position of the main valve. On the outer face of the central plate are formed one or more ports, communicating with the central cavity, and against these ports rides the expansion valve, which has cut-off edges corresponding to those of the ports in the plate. The cut-off valve is single acting, that is to say, steam is always cut-off at the same edge, consequently the steam is admitted through the plate and main valve to the cylinder, twice only in each revolution of the engine, or once in each stroke. The amount of steam passing to the cylinder at each stroke depends on the position of the cut-off excentric, thus at the earlier cut-off, the expansion valve is on the point of closing as the main valve opens to the cylinder, and at later cut-off, the main and expansion valve open simultaneously, in which case steam is cut-off in the steam cylinder at about half stroke, or less according to the amount of lead given to the valve. Mr. Lindley claims the following advantages in this valve gear arrangement: The steam is cut-off very rapidly on account of the accelerated speed of rotation of the expansion excentric, and also because cut-off takes place during the period of quickest travel of the excentric. The governor is driven by tooth gearing. The expansion excentric being on a small shaft is smaller and lighter than usual, and, therefore, takes less power to move it. Any variation in speed required to make the governor weights move through their whole path and alter cut-off from earliest to latest point, is halved in the speed of engine, and its regularity consequently increased.

Referring to the engine illustrated, the box section bed has been here retained. The cylinder is 20in. in diameter, and answers to a 42in. stroke; the cylinder is lagged with silicate cotton, and has mahogany strips and brass bands. The cast iron piston is furnished with two broad cast iron rings, expanded by a specially rolled steel coil. The Bessemer steel piston rod is 3½in. in diameter. The slide valves are of the same running of metal as the cylinder to ensure uniformity of wear; the expansion valve is balanced. The valve spindles are fixed to two square cast iron slides working in a bracket on the bed. The dimensions of the crank shaft are—7½in. diameter, 6ft. long with a neck 6in. diameter by 10in. long, outer bearing 7½in. diameter by 12in. long. The Bessemer steel crank pin is 4in. diameter and 6in. long in the bearing; it is shrunk and cast into the crank disc. The wrought iron crosshead is furnished with jaws slotted out of the solid. The connecting rod has a length = 2½ times the stroke. The feed pump is worked from the crosshead pin, and its valves and seatings are of brass. Air pump is double-acting, and the condenser is placed behind the cylinder. The fly-wheel is 4 tons in weight, and has a diameter of 14ft.; it is run at 60 revolutions per minute. The engine is quoted as being of 40-horse power.

D'ALBERT'S RIFLING MACHINE.

FIG. 1



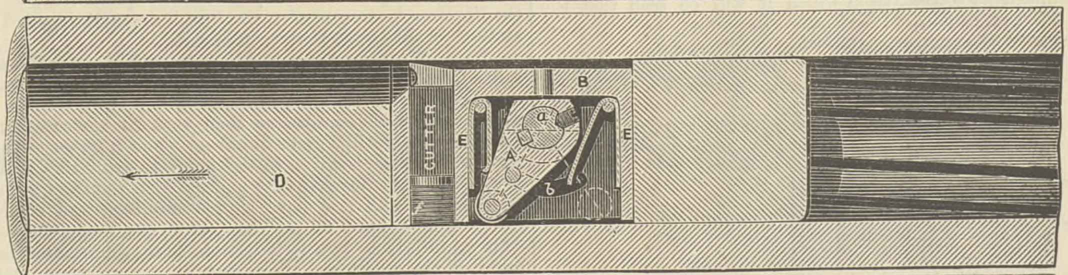
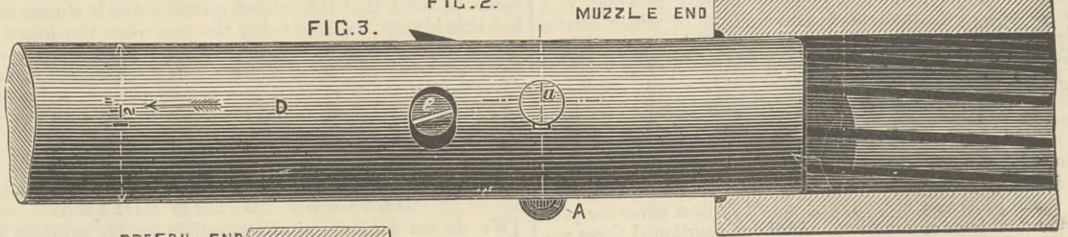
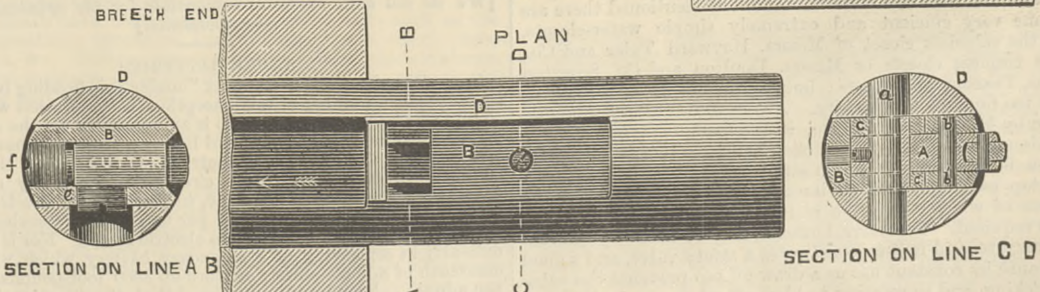


FIG. 2.

FIG. 3.

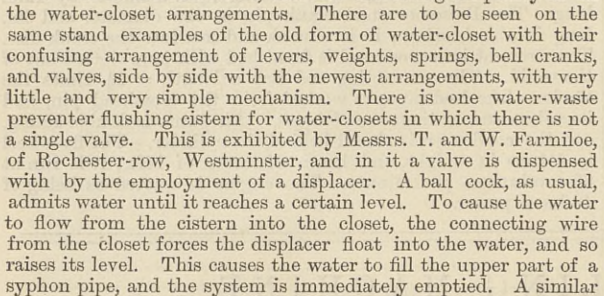




The accompanying engraving illustrates a rifling machine designed by M. C. d'Albert, of Paris. The rifling machine being self-acting in all its parts, the tool works successively the twelve—for example—grooves of the barrel without stopping, at the finish of which a bell indicates to the workmen that the cutter has gone over the twelve grooves, and that he has to give a fresh cut, which being done the tool cuts afresh the twelve grooves—the barrel revolving one-twelfth of a turn each double stroke of the rifling bar—until the proper depth of rifling is attained, the object to be arrived at being to release the cutter from its work on the forward stroke of the bar, and to bring it exactly in position for the cut on the return. This is done by means of the lever A oscillating at its centre a, so that at its extreme positions—Figs. 2 and 3—it gives or takes away the cut. This lever A works in the tool-box B which slides in the rectangular slot in the rifling bar D, and it projects from the bar and is held in a vertical position—Fig. 1—when out of the bar by the springs E E, it butts against the end of the momentary fixed barrel which propel its—each way—until it rides on the bottom of the barrel, as, for example, when entering by the muzzle end—Figs. 1 and 2—it brings back the tool-box with cut off the groove by working in the curved slots C C'. Lever A, its side support washers c c' having flats on them to allow the tool-box to be brought down. Lever A carries a small roller, so as not to spoil the bottom of the groove when finished. When the above-mentioned stroke of the rifling bar is finished, it having come out at the other end of the barrel, so as to allow lever A to take again its vertical position—the springs doing this immediately—it returns automatically, entering the barrel this time by the breech end. The barrel having made one-twelfth of turn, the tool is brought back to its cut by the same means as before stated, the lever A—Fig. 3—being in a directly opposite position to the one shown in the former stroke—Figs. 1 and 2—and by its action in slots C C, in has pushed the tool-box upwards into its place again, where it is firmly held by the washers c c', having taken their proper position in the same manner as they did when cutting a former groove, and so on for each stroke of the bar, the tool-box and cut being brought back off groove one way, and then pushed forward to its proper depth of cut the next, so as the depths of cuts of all the grooves are alike everywhere, and so on until the grooves have attained their proper depth of rifling. The cutter is fixed in the tool-box by means of the side screw e—section through A B—the set screw f being used to give the cut, and has a division on its periphery to facilitate the setting of the cut each time the twelve grooves have been run over. All the pieces are of cast steel, and the whole arrangement works satisfactorily.

THE BUILDING EXHIBITION.

AMONGST the sanitary appliances exhibited, some of the new waste-preventing flushing cisterns present a good deal of novelty and ingenuity, while there are also large quantities of the old and cheap forms, the latter made to meet the requirements of the jerry builders, and sold to them in one case at less than 10s. for cistern, ball cock, overflow and valve to water-closet. The work in these is, as may be expected, of the roughest, and while such fittings are allowed there can be no wonder that the waste of water is sufficient to raise the quantity of water per head to a much greater quantity than is seemingly necessary. It is satisfactory, however, to learn, as some of the manufacturers assert, that there is a demand springing up for the better class of goods, and with the improvement in quality which is in some respects noticeable in the exhibition, there is increasing simplicity in all the water-closet arrangements. There are to be seen on the same stand examples of the old form of water-closet with their confusing arrangement of levers, weights, springs, bell cranks, and valves, side by side with the newest arrangements, with very little and very simple mechanism. There is one water-waste preventer flushing cistern for water-closets in which there is not a single valve. This is exhibited by Messrs. T. and W. Farmiloe, of Rochester-row, Westminster, and in it a valve is dispensed with by the employment of a displacer. A ball cock, as usual, admits water until it reaches a certain level. To cause the water to flow from the cistern into the closet, the connecting wire from the closet forces the displacer float into the water, and so raises its level. This causes the water to fill the upper part of a syphon pipe, and the system is immediately emptied. A similar arrangement is shown, in which a loosely fitting piston in an inverted cylinder takes the place of the displacer float, the sudden rising of the piston when the closet connection is pulled starting the syphon. Both arrangements are very simple, and the latter especially seems incapable of getting out of order. Messrs. John Bolding and Co., of South Molton-street, London, also show a very simple arrangement of syphon waste-water preventing flushing cistern, in which the syphon is started into action by raising a valve in the lower part of the syphon. The valve is simple and certain in action. The Underhay ball valve is fitted to these cisterns; it is a good valve when well made, and its success depends upon nice work. A valve which does not need nice fitting, and which is yet most simple, efficient, and easily renewed in its only wearing part, is that shown by Messrs. Woodhouse, Osborne, and Co., of Doncaster. This we illustrate by the annexed woodcut, from which it will be seen that the



valve itself consists of a simple cylinder of brass, in which is a slot for one end of the ball lever, and one end of which carries a cap for holding a small seating of either india-rubber, leather, vulcanised fibre, or other simple seating material. The valve is certain in action, and it will be seen that wear can only affect the little piece of seating which is renewable in five minutes.

Messrs. R. F. Dale and Co., Bear-lane, S.E., show a somewhat similar form of valve, but in which the seating cylinder moves vertically with the ball lever in the vertical member of an angle bend. Messrs. Doulton and Co., Lambeth, also exhibit a new form of waste preventer cistern, with a bell syphon cover for producing the flow from the cistern. As above mentioned there are now some very efficient and extremely simple water-closets, such as the valveless closet of Messrs. Hayward Tyler and Co., and the trapless closets of Messrs. Doulton and Co., Smeaton and Sons, Pearson, and others; but improvements in this direction are too numerous to specify. A very useful safety appliance is shown by Messrs. Dale and Co. in the form of a safety valve tap, made more especially for kitchen boilers. It is a valve tap, the valve being of the common safety valve form, but enclosed in the tap case and held to its seat by a spring, against the resistance of which the valve is raised by a cam handle when water is required. The valve, however, may be lifted by internal boiler pressure, and it then constitutes a safety valve, and a good one, because its constant use as a draw-off tap prevents the valve from sticking and so refusing to blow off when required to act as a safety valve. Amongst the water fittings to be seen are some remarkably well-finished bib, range and stop, bath and lavatory cocks and valves of American manufacture, finished bright or nickel-plated. These are not only well finished, but are sold at a considerably lower price than the similar but less equally finished article of English make. Why is this? These are shown by Messrs. C. Farmiloe and Sons, of St. John-street, E.C., who also show American drain lead traps and bends made by hydraulic machinery under Du Boise patent. They are well made, of any form, smooth inside and out, and cost no more than cast lead.

Very large displays of fireplaces and ranges are made, and though there seems to be nothing specially new, the collection by Messrs. Ashton and Green contains something for every requirement. Messrs. Lankester and Son, Southampton, shows several ordinary fireplaces, as used in sitting-rooms, provided with a water back pipe, from which keep up a continual circulation of hot water in hollow iron skirtings round the room, or in pipes in a greenhouse or conservatory, the heat being obtained without extra cost. The Wilson Engineering Company, Messrs. Steven Bros., J. M. Bell and Co., and the Coalbrookdale Company also exhibit in this class very largely. Amongst the wood-working machinery there is nothing new, though Messrs. Charles Powis and Co., F. W. Reynolds and Co., Messrs. H. Burr and Co., and Messrs. Lewis and Lewis, all of London, and Messrs. Hempsted and Co., of Grantham, all exhibit in this class. A very useful instantaneous grip vice for engine shops, and in another form for joiners and pattern-makers, is shown by Mr. T. J. Syer. These vices without any doubt save a great deal of time, and we find they are much liked in the fitting shop, especially for light work.

The Turner gas engine is exhibited by the Turner Gas Engine Company, and shown at work by Messrs. Applegarth and Mills, of Mansion House-chambers, Queen Victoria-street, who are the London agents for this engine. The engine exhibited is of ½-horse power, and runs at 140 revolutions per minute. The Ord gas engine, as made by Messrs. Brown and May, is exhibited by Messrs. Wurr and Lewis. This engine is somewhat of the same character as the Turner engine, and seems to be a good engine. The cost of gas used by it is given as about 1·5 to 2d. per horse-power per hour in the 1 horse and ½-horse engines. The London Gas Engine Company exhibit Hutchinson's gas engine as made up to ½-horse power.

Amongst the exhibitors of building materials, such as concrete, there are several who, following Mr. W. H. Lascelles, of Bunhill-row, in his system of cottage building with concrete blocks and slabs for the wall and fine concrete for mullions and cills and coloured concrete for ornamental work. Mr. H. Faija, of 4, Great Queen-street, S.W., exhibits some specimens of concrete hardened by his process for hastening induration, the process being an application of part of the Ransome's stone process in which silicate soda is employed. For many building purposes the process offers many advantages, and Mr. Faija's invention must prove useful to many builders. The free grit grindstones, made by the Ransome process, are exhibited by Messrs. S. and E. Ransome and Co., London. These stones will only last about half the time that a good natural stone will last, but they cut faster by an incredible extent, except to those who have practically tried them at high speeds. Thus, though greater in first cost, they are cheaper when the time taken in grinding work is considered. The larger stones are now made annular in form, and are held by bored side plates clamped together by through bolts. The cost of the larger stones is thus much reduced.

Mr. White, of Abergavenny, exhibits what he calls the Hygeian Rock Cement, and to show its strength exhibits a horizontal prism of red brickwork put together with it, four bricks deep, and two bricks wide, placed on supports six bricks length apart, or about 4ft. 8in., and from its centre is suspended a load of about 8 cwt. This brickwork beam, which was thirteen days old only when this load was put on it, is about 13·5in. deep, and 9·5in. wide. Its breaking strength is thus very considerable. Mr. White's cement is apparently an excellent material, not only for damp courses, tank work, and so on, but on account of its strength for thin walls. It is apparently a bituminous material, and is rather costly, but will certainly find many uses.

The Spence's Metal Company, of 31, Lombard-street, exhibit a number of illustrations of the application of their metal especially for making gas and water pipe joints. This material is now being very largely used in gas works as a substitute, economical in cost and labour, for the iron and sand rust joints, and for all joints of street and other mains where lead was formerly used. It does not require caulking when used either for high or low pressures, in water, sewer, or gas pipes, and so the time occupied in making a joint is very small. Besides these practical engineering applications, it is used for many ornamental purposes.

An artificial stone of great strength is shown by the Victoria Stone Company as a railway platform coping stone, as used at the Fenchurch-street station, the Broad-street station, and on some stations of the Great Eastern Railway.

There are other articles to which we might refer if space permitted, but we must conclude with a reference to the exhibition catalogue. This is certainly much better than for the first of these exhibitions, and better than that for the second; but its arrangement is still a great nuisance. The number of the stand and not the page is given in the index to exhibitors' names, and as some exhibitors are in bays and have bay numbers, some in the body of the hall and have simple numbers, and some in the galleries and have no number, thus one finds the catalogue split up into bays, but no indication as to where these are to be found in the index, and the same with the galleries. Mr. Black seems to think that the subject-matter index is almost sufficient, but this is very far from being the case when the pages are not given, and when the head-line of each page, instead of being some catch-line as "Hall," "Bays," or "Galleries," is an absurd advertisement. The catalogue commences with four articles, and the first, on "Glass and Porcelain in Building and Decoration," is useful and interesting.

LETTERS TO THE EDITOR.

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

FAURE BATTERIES.

SIR,—The short letter of "Lux" under this heading in your last issue reveals a number of misconceptions in connection with a very simple matter. An electric lamp is an apparatus for the conversion of electrical energy into heat and light; a secondary battery is an apparatus for the storage of electrical energy. Now there is no difficulty in conceiving of a circuit, traversed by a current generated by a dynamo machine, in which (say) two-tenths of a horse-power, or 6600 foot-pounds per minute, are absorbed or converted into heat and light by two electric lamps. Nor is there any difficulty in conceiving of a secondary battery which will absorb one-tenth of a horse-power, or store up 3300 foot-pounds of energy per minute. Now let it be supposed that the illuminating power of one lamp only is required, and that it is inconvenient to reduce the current—so that the product E I may be halved. Evidently the secondary battery may be substituted for one of the lamps—provided, of course, that due care be taken that it should absorb neither more nor less than one-tenth of a horse-power, so as to leave 3300 foot-pounds per minute to be converted into heat and light by the agency of the remaining lamp. In this there is no running counter to the principle of the conservation of energy. The statement—made by me in answer to a question—that it is quite possible simultaneously to work an electric lamp, and to charge a secondary battery in the circuit of a dynamo machine, was not, and could not be, "vigorously disputed by another electrician;" for the simple reason that it is the statement of a fact well understood by all who have any claim to the title of electrician. The speaker referred to, who was evidently a *confrère*—as I judge more particularly from the fact of his pointing out to me that the constant I gave in the equation $H.P. = \frac{EI}{750}$ is not precisely that which is generally accepted—merely combated the idea that the simultaneous working above referred to is an advantageous arrangement in practice. The question, I need hardly again point out, was not whether it is an advantageous arrangement, but whether it is possible. DESMOND G. FITZGERALD.

March 27th.

THE ECONOMY OF THE ELECTRIC LIGHT.

SIR,—A few months ago I received orders from two firms in Cork to supply electric light apparatus. The first was for Messrs. Furlong and Son's flourmill, and the second was for a similar establishment belonging to Messrs. Hall and Co. The plant consisted of R. E. Crompton and Co.'s Bürgin machine and Swan's incandescent lamps. Both of these installations have been working most satisfactorily, and yesterday I received a report in which it was stated that Messrs. Furlong much preferred the light to that of gas, that the dynamo machines gives no trouble, and that the durability of the lamps has far exceeded anticipation, most of them having been in operation over 1000 hours, and are apparently as good now as when put up. The average time each week that the lights are in operation is upwards of ninety hours, viz., from afternoon of one day until the following morning, being a continual run without stoppage. The cost of working Messrs. Furlong's lights, including renewals, has been returned to me as under 10s. per week, against £2 5s. per week paid previously for gas for similar hours of lighting. The cost of the power, however, was not included; but, allowing 3 lb. of coal per indicated horse-power per hour, which is amply sufficient, the drive being obtained from the main compound engine, the cost of fuel would be under 7s. per week. After due allowance for interest on capital and depreciation, the saving over the gas represents more than 50 per cent. When the electric light in these mills was first started I anticipated the flour would be superior, being free from any contamination from the vitiated atmosphere produced where gas is burned. This anticipation has been realised, the flour now produced being superior to what it formerly was.

I think these facts are an answer to the oft-repeated assertion that dynamo machines were difficult to keep in order where long continual "runs" were necessary, that incandescent lamps were not durable in actual operation, and that the cost of the electric light exceeded that of gas.

The result of these installations speaks well for the Bürgin machine and Swan lamps, as the latter are receiving a current of 1·3 to 1·4 ampères, and I think the energy displayed by Messrs. Furlong and Hall in adopting the electric light as a permanent means of illumination, and being thus the pioneers in this country in the use of incandescent lamps, deserve the good wishes of all electricians. J. H. GREENHILL.

35, Mill-street, Belfast, 28th March.

SIR,—I recently paid a visit of inspection to this Exhibition, in order to examine into the various systems of electric lighting. I was just engaged in an attempt to deduce the actual probable cost of "arc" lighting, when your article No. IV. on the above. in the issue 24th inst. came to my hand. Although I appreciate the manner in which you have endeavoured to compare impartially the relative cost and efficiency of "arc" and "gas" lighting, still I cannot entirely agree with the results you arrive at, which I think tend to convey incorrect impressions.

Adopting prices either from the article in question, or from the Brush Companies' circulated lists, I deduce the cost of "arc lighting in the case you propose, namely, that of a small town with five miles of streets, to be as follows:—

	£
1 Engine..	300
2 Dynamos at £400	800
32 Lamps at £16	512
Prime cost of plant	£1612

	Per Year. £	s.	d.	Per Day. £	s.	d.	Per hour the lamps are alight. £	s.	d.
Interest at 4 per cent. on £1612	64	8	0	0	3	6	0	0	10·5
Coal at £1 per ton..	109	10	0	0	6	0	0	1	6·
Drivers' wages	91	5	0	0	5	0	0	1	3·
Cost of maintenance and redemption at 20 per cent.	322	8	0	0	17	8	0	4	5·
Cost of carbons	146	0	0	0	8	0	0	2	0·
Wages of two men	255	10	0	0	14	0	0	3	6·
Rent, taxes, and rates	100	0	0	0	5	5¾	0	1	4·43
Oil and contingencies	58	0	0	0	3	2	0	0	9·5
Total cost of work, 32 arc lights.. ..	1147	1	0	3	2	9¾	0	15	8·43

Now in the case of gas at 5s. per 1000 cubic feet, 500 lamps, each consuming 5 cubic feet, will cost 12s. 6d. per hour; and, assuming that the cost of lighting, cleaning, and maintaining the lamps is £250 per annum, we have a total of 15s. 11d. per hour for gas, against 15s. 8½d. for electricity—results practically equal. But it is said that the candle-power of the electric arc is 64,000, while the gas is but 10,000; therefore, "estimated in candle-power, gas is actually 6·4 times dearer than the electric light." It is this estimating of the value of the "arc" light by candle-power which is so misleading. It has been already shown to be thus inapplicable as a true measure, and the method of Mr. Preece to illuminate a certain area to a given standard seems preferable. The use of estimating "arc" lights in candle-power is in comparing the efficiency of one arc with another, and by no means as effecting a fair comparison with other illuminants for ordinary purposes. This is evident by pushing the case to extremes, and comparing a 2000-candle power arc with a 16 or 20-candle power gas jet is sufficiently going to extremes when the requirements of ordinary street lighting are under consideration.

I maintain that the proper method of comparing the efficiency of any two different systems of lighting, having regard to any special case, is either with both systems to produce results which shall equally, or as equally as may be, meet the proper requirements of such case, and then compare their costs, or, *vice versâ*, their costs being equal, compare their relative efficiency. I think there are few that will contend that in the case before us the "arc" lighting would be more satisfactory than the gas. With five miles of streets, and taking full advantage of intersections, many of the arcs would probably be as much as 250 yards apart, and hence to utilise any large proportion of the light, the lamps should be placed at least 40ft. high along the centres of the streets, and even then the intermediate spaces would be to some extent comparatively dark, and the strong contrasts would be objectionable. There is no way out of the difficulty that in street lighting such as this a large percentage of the power of the light is rendered ineffective. (1) A variable amount, from 10 to 40 per cent., is directly stopped by the glass shield or covering; (2) a large amount is, even with the best systems of reflection, diffused where not wanted, and directly lost against the adjacent houses. With the 500 gas lamps there would be one at every 18 yards apart—making no allowance for advantage taken of intersections—or, say, 36 yards apart along each footpath. This, with the efficient forms of burners lately introduced, would give a most adequate light for all ordinary purposes. Cabmen could read the numbers on every door, the name of each street would be clear, and there would be a light at each end of every street crossing, a point of which pedestrians know the importance. Further, a great feature in favour of the gas would be that after midnight it could be, as is usual, turned to half or quarter pressure, effecting a great economy, whilst the arc lights can only be reduced in number, not in power; and thus if sixteen alternate arcs could be made to do after midnight, one dynamo might be stopped, but the engine would have to continue working, and a night shift might be necessary, whilst the efficiency would not be nearly equal to the gas at reduced pressure, and the cost much greater. Again in all electric lighting the great lack of proper storage is felt, and though this may soon be remedied, still no town would at present risk its whole supply of light from moment to moment upon plant consisting of a single set of engine and gearing, any part of which might at any instant give way

In the above I have based my deductions upon figures either taken from the article No. IV. in question, or from the Brush Company's circulars, only excepting the item assumed for lighting, cleaning, and maintenance of gas lamp-posts; and here I may note that the prices of dynamos and electric lamps quoted in the London lists agree with those in the American.

With regard to the remark that double the number of, say, 1000-candle power lamps might be used in place of the thirty-two 2000-candle, and thus improve the distribution, this is no doubt true, but not at equal costs. No lamps of 1000-candle are, as far as I know, quoted in the Brush price lists; but the 1500-candle lamps are quoted at the same as the 2000, with also the same cost per hour for carbons. And these are not the only points in which there would be increase of cost due to greater subdivision of light. The great economy effected in the Brush system of arc lighting, as compared with others, appears to be in the matter of carbons—which for a 2000-candle arc cost only ¾d. per hour, whilst in other systems, I understand, they cost fully double this; and probably in the 1000-candle Siemens' street lamp referred to, the carbons cost over 1d. per hour.

In the above estimate of "arc" lighting I have omitted all cost due to the distribution of the current from a central station through the five miles of streets. I have little exact information on this point to guide me, and if you can afford me any I shall be glad. Assuming that the lamps are worked alternately in a double circuit, as above, and that the wires are uncovered, and carried like telegraph wires above-ground, I do not see how this could be done for less than a first cost of £600; whilst if the wires are coated, and conveyed, as they should be, underground, the cost would probably exceed £2000. This, together with various minor items—such as lamp-posts, &c., also erection of plant — would raise the above estimated cost of 15s. 8½d. per hour to about 20s., allowing only 10 per cent. upon this £2000 for cost of maintenance and redemption.

In conclusion I may say that I have no interest in writing this letter, other than that of arriving at the truth in a matter at present somewhat obscure, and lest I should be misunderstood, let me add that I am convinced there is a great future in store for electric arc lighting, not to mention that by incandescence; but I think the case you have chosen to consider, namely, that of the street lighting of a small town, is one of the most severe and unfavourable which could be selected, whilst in cases of large manufactories, harbours, and docks, the benefits, and especially the indirect benefits, resulting from electric arc lighting might be enormous.

Finally, although having adopted for argument's sake many of your figures, I do not commit myself to them; thus, I think, the £300 for an engine working up to 43 indicated horse-power would be better met by £400; coal at £1 per ton, by 14s.; cost of maintenance and redemption 20 per cent., by 12 to 15 per cent.; cost of carbons per annum £146, by £170, allowing for short ends and waste, and wages of two men, £255 would not cover cost of general management.

GEO. P. CULVERWELL,
Co. Donegal, March 27th. Assoc. M.I.C.E.

SIR,—Referring to the article entitled "Crystal Palace Electrical Exhibition," in the number of your valuable paper dated March 24th, you state that the Hammond Co.'s exhibit consisted of forty-eight Brush lamps; in reality we run a total of sixty-four lamps by four sixteen-light No. 7 Brush dynamo machines.

In the same article you remark that the electrician, Mr. Goldenberg is all the time occupied with testing and insulating. With regard to the latter, I must beg leave to correct you, as such a statement is liable to create an erroneous impression of the daily routine to be followed by any one in charge of these machines. My duties as managing electrician are much more varied than your article would lead any reader to suppose.

L. GOLDENBERG, Electrician.
110, Cannon-street, London, E.C., March 29th.

STEAM ENGINE ECONOMY.

SIR,—Will you kindly allow me to ask Mr. Inglis if he knows of any construction of piston by any reputed firm of engineers that would allow of being so tightened as to cause 30 lb. of friction, or one-third the gross amount of indicated horse-power, in the engine alluded to by him in this week's ENGINEER? Again, as to the manner of driving by means of belts direct from fly-wheel of engine —is Mr. Inglis not mistaken in saying that the Corliss engine alluded to by him drives the mill exactly the same as the engine alluded to by Mr. Longridge? Driving by means of leather belting from fly-wheels I have proved to be very costly and troublesome, and the amount of friction they absorb is enormous, especially when they have to be held up to the underside of the driving pulleys by means of balance weights, &c. In one instance in my experience I dispensed with a very large driving belt, and substituted gearing, and saved over 20 lb. cylinder pressure of friction, as shown by the diagrams taken before and after the alteration. The belt cost nearly £100, and the gearing fixed cost about £180.

400, Monument-road, Birmingham, JOHN SWIFT.
March 21st.

THE USE OF THE THROTTLE VALVE—EXTRAORDINARY INDICATOR DIAGRAMS.

SIR,—Your valuable paper has been the means of disseminating an immense amount of practical knowledge in connection with the steam engine. Still there are some points which are not yet generally understood; the throttle valve, for instance. We have lately been competing for a compound tandem steam engine. In our arrangement of engine there is no throttle valve, the regulating of the speed being effected by varying the cut-off.

We have a rival who makes an engine which is regulated by a throttle valve in connection with a so-called variable cut-off motion, and who contended that it is not desirable or advisable to get the initial pressure on the first piston the same as, or as near as possible to, the pressure in the boiler; that it was advantageous to have the pressure somewhat reduced before it entered the first cylinder.

He also produced the enclosed set of indicator diagrams from a compound tandem steam engine of his own construction, but did not give the scale of the diagrams. The only clue to the relationship they have with each other is the atmospheric line, which exhibits a singular phenomenon. The pressure in the second or low-pressure cylinder is considerably above the atmosphere, whilst the contemporaneous pressure in the first or high-pressure cylinder, from which the pressure in the said second cylinder is derived, is considerably below the atmosphere, showing a very considerable gain of pressure between the high and the low-pressure cylinders, instead of the inevitable loss. We take exception to the statement as to the advisability of reducing the pressure of the steam before it enters the first cylinder, and also to the diagrams, and our client, who is a man of business, and has thought little about the steam engine, is rather puzzled. "Doctors differ," he says.

Now, Mr. Editor, may we ask you if it is not held by common consent amongst leading engineers that it is desirable to approximate, as near as possible, the initial pressure in the cylinder to the boiler pressure, and whether it is consistent with economic practice to reduce the pressure of the steam before it enters the first cylinder of a compound engine? Also, may we ask you if the diagrams enclosed are not very remarkable? X. Y.

March 23rd.

[Engineers know that the initial cylinder pressure should be as nearly as possible identical with the boiler pressure. The steam engine maker mentioned by our correspondent is apparently not an engineer. The diagrams sent us by "X.Y." could not be got simultaneously from a tandem engine, and are on the face of them fraudulent. One *may* have been taken with one load, and the other with a much heavier load; or else the atmospheric line in one of the diagrams has been put on by hand. It is doubtful if the diagrams were taken by an indicator at all.—ED. E.]

MENUSIER'S SYSTEM OF PERMANENT TELEGRAPHIC COMMUNICATION BETWEEN TRAINS IN MOTION AND BETWEEN THEM AND THE STATION.

SIR,—The terrible catastrophe at Charenton, which has brought sorrow deep and poignant to the homes of many families, lends additional interest to the subject of equal telegraphy—interest already awakened by the terrible accident last year at Clichy-Levallois—and to the numerous and serious defects in the existing systems of railway telegraphic communications.

In most countries there is a law in force which prohibits the departure of a train from any station until ten minutes has elapsed from the time of the departure of the preceding train. This rule is one that it is impossible to carry out in all circumstances—and, therefore, the law is insufficient, and therefore practically useless for all purposes. On the block system the lines are divided into distance sections, and in which only one train is allowed to enter at one time. But in both the instances enumerated the carrying out of these rules is dependent upon the use of signals necessary to intimate to the engine driver whether he must proceed or not; and although a great part of the signal machinery is automatic, yet the actual conveyance of the meaning of the signal or communication to the engine driver is done by the *employés* themselves with the aid of flags or mechanical and optical contrivances, and the least momentary abstraction on the part of the signalman may produce a terrible accident. The signals are, moreover, subject to disarrangement, as instance the deplorable Charenton accident, in which the signal was not perceived by the engine driver, or that of Clichy-Levallois, produced by a storm.

Moreover, the continually increasing number of trains compels the use of so many signals that the inevitable result is chaotic confusion; and in order to guard against accidents, a most piercing and sustained attention is necessary, which must not for a single second be at fault.

The conditions required to remove these dangers and to assure safety are as follows: To put all the trains running in one direction in permanent and direct communication with each other, and with all the stations on the line.

M. Menusier's solution of the problem, which appears to unite all the desiderata required, is as follows: Entirely abandoning the principles at present in use—banishing as far as possible all the signals, mechanical combinations, disc lights, &c.—he proposes to replace them by the following system, which, besides being easily applied, unites the advantages of simplicity and cheapness:—Upon the track and between the rails a telegraphic wire is fixed in the ordinary manner, supported by the ordinary insulators at the height of a few inches above the cross sleepers upon which they are fixed. Upon the axletree of one of the vans of each train a circular brush of metallic wire is fixed, in such a way as to overlap the electric or communicating wire. This rotative brush revolves along with the axletree constantly resting or in contact with the communicating electric wire, consequently establishing an electrical current whether the train is moving or at rest, and notwithstanding the oscillations, &c., of the locomotives when passing over the curved tracks. Moreover, since the electrical brush revolves, the friction, and consequently the wire, is considerably reduced.

The electric revolving brush is connected to one of the poles of a telegraphic battery and apparatus placed inside the van; the other pole communicates by means of the wheels and the rails with the earth; the electrical circuit is then completed. It will now be easily conceived that a current sent from the van of one train by means of its electrical brush will pass along the communicating wire and ascend into the vans of the next or other trains, by means of their respective electrical brushes; and therefore set the telegraphic apparatus in action. In other words, the guard of each train will be able at any moment to place himself in direct communication with all the trains either before or behind him, as well as with all the junctions and stations on the line. Moreover a simple line-keeper, furnished with a small portable electrical apparatus, can, if he sees or knows any obstacle or danger on the line, instantly communicate the fact to the trains in danger; the man has merely to connect a wire from his portable apparatus to the communicating wire, and to plant a nail in the ground, to establish instantaneous electrical communication between himself and all the trains. As an illustration of the value of this system, supposing the guard of a trains wishes to be averted of the presence of a train, at a time-measured distance of five, ten, or fifteen minutes behind or before him, he has merely to fix—before moving off—the needle of his telegraphic dial at the figures five, ten, or fifteen; he can then start off with safety, and invariably the guards of each train will know the exact time-measured distance they are separated from each other.

The price of laying down and maintaining M. Menusier's system is comparatively insignificant. The following may be taken as a sufficiently accurate estimate of the cost per kilometre, or 1093·6 yards—English:—

	Cost per kilom. £	s.	d.
56 kilos. of wire, say	1	12	6
1 hanger or bracket		4	2
19 insulators		4	9
19 insulator supports at 10d.		15	10
Cost of labour and transport		12	6
Total	3	9	9

As to the other apparatus necessary for each van, its price added to that of the train is as insignificant as is the £3 9s. 9d. above added to the price of the permanent way.

All the details have been thoroughly worked out—such as the station connections, junctions, level crossings, rain, snow, platelayers' work, &c. Nothing disarranges the system, which is always effective and constant. The system is well worth the attention of our English railway companies.

B. H. THWAITE, A.M. Inst. C.E.

BENTALL'S PLUMMER BLOCKS.

SIR,—The ball and socket plummer block, of which your last issue contains an engraving, is stated to be a new form of plummer block, manufactured by Messrs. Bentall Brothers, of Maldon. This has been made and used by us for some years past, particularly for hollow steam trunnion shafts, which in consequence of unequal expansion, arising from variations of temperature, become untrue and bind in rigid bearings.

We also beg to add that several of the original express locomotive engines which ran upon the London and Brighton Railway about the year 1846, constructed from the designs of that ingenious engineer, the late Mr. J. G. Bodmer, were fitted with the same description of bearings. JAS. SHEARS AND SONS.

Bankside, Southwark, London, March 29th.

THE BASIC PROCESS IN THE UNITED STATES LAW COURTS.

SIR,—My attention has been drawn to an article on the "Basic Process in the United States Law Courts," in your issue of the 17th. As I have acted professionally for Mr. Thomas throughout in this matter, I am in a position to say that your very fairly expressed surmise that, as your information has been derived from exclusively American sources, justice has not been done to Mr. Thomas' case, is correct. As the Examiners' decision to which you allude is now under appeal, it would be obviously improper to say more at present, but I may state that the proceedings alluded to do not touch or affect in any way the patents covering the basic process as actually worked in Europe. Hereafter I may draw your attention to the actual facts of the case, which will show some curious points in the United States practice.

PHILIP M. JUSTICE.
14, Southampton-buildings, Chancery-lane, March 29th.

COMPRESSED AIR LOCOMOTIVES.

SIR,—In your article on the "Channel Tunnel" in the issue of THE ENGINEER for February 17th, you discuss the different methods by which it might be possible to work the traffic after the tunnel is completed, and in considering the feasibility of using compressed air for that purpose, you refer to Mr. Scott-Moncrieff's paper on "Compressed Air Engines for Tramways," and you remark afterwards, "There is a long step between the little tramway engine and the machine able to haul a train of 100 tons besides itself through the Channel tunnel at 40 miles an hour." Will you allow me to suggest that the results arrived at by Mr. Scott-Moncrieff are not necessarily a fair criterion of what can be done with compressed air when applied to purposes of locomotion. You are doubtless aware that a locomotive known as the "Hardie" engine has recently made several trial runs on the Second Avenue Elevated Railroad in this city. From personal observation I can vouch for the following facts. The engine has proved itself capable of hauling a regular train weighing 80 tons, exclusive of 200 passengers with which it was loaded, the entire length of the elevated road, viz., 8¾ miles. This distance was accomplished in the regular time, forty minutes, and the train made twenty-two stops, to take up and set down passengers. The pressure in the reservoirs at starting was 600 lb., and at the end of the trip there was a pressure of 200 lb. still remaining. As the engine will run effectively until the pressure is reduced to 60 lb., it follows that it could have gone a total distance of nearly 12 miles under the same conditions. At the completion of the run, however, the engine ran back light to the engine depôt, a distance of 5¾ miles from the terminus. Now, Sir, as this engine was built to meet the requirements of the Elevated Railway, and only weighs 18 tons, I think it is fair to conclude that one constructed to a similar pattern, with suitably enlarged reservoirs, and weighing say 35 or 40 tons, would be equal to the requirements of the Channel tunnel.

I am not in any way connected with the Pneumatic Tramway Engine Company, for whom this engine was built; but through the courtesy of Mr. Robert Hardie, the inventor, who is like myself a British subject, I have been afforded every opportunity for examining thoroughly its construction and performances, and I can unhesitatingly assert that, in addition to possessing several unique features, it has given results far ahead of any other air locomotive either in this country or in Europe.

This letter is not intended as a "puff" for the Hardie engine, however; I merely wish to show that over here we are inclined to the belief that when the Channel tunnel is completed the difficulty of running trains through it will be successfully met by the use of compressed air. CHAS. W. PORTER.

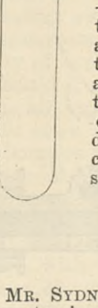
44, W. Eleventh-street, New York,
March 14th.

THE FOUNDATIONS OF MECHANICS.

SIR,—Your interesting and suggestive correspondent "Φ.Π.," in referring to my note of the 17th March, asks me "whether the pull at the opposite ends of a rope, used to lift a load from a coal pit, be an equal pull—omitting the weight of rope." And he further requests me—if I think the pull unequal—to give or refer him to some authoritative formula for calculating this inequality. Your corrrespondent must accept my confession of inability to show how much greater force than one ton would be required to get up and sustain a rate of motion equal to 16ft. per second in a load of this weight. In my note referred to I said that the equality of action and reaction was not so difficult to understand in a statical sense; or up to the limitation point where motion commences. Because it is at this point—just preceding motion—that the opposing resistance has been neutralised, and because the condition of equilibrium attained seems to constitute a reliable basis from which to measure any relative change or disturbance thereof, or is, in reality, one of the foundations of mechanics.

But when the reacting body commences to move in the direction of the acting force there is then a transfer of motion effected, and at the expense of some other body or bodies, which bodies then yield, or have yielded, this supply or store of motion or acting force so called.

Let us suppose an endless and uniform rope of extreme length, carried by a frictionless drum, with equal weights attached to opposite sides of the drum, thus.



Now if we disturb this state of equilibrium by reducing one of these weights in the slightest degree, then the motion thus induced—if not expended on other bodies—would by gravity become an increasing motion, until, with time, I suppose an absolutely incalculable rate of speed would be attained. We may construct propositions of this kind within fixed limits—if specific and precise data be laid down —that will admit of computation. But we do not think that the universe is an empty space; or that an unlimited reception of motion by a body and no transmission or expenditure thereof is possible; and we need restricting limits or standards by which to determine the relative action and reaction of bodies on each other—with all those varying and interdependent conditions consequent thereon, and a statical condition, or one of equilibrium, appears properly to supply such a standard of limitation.

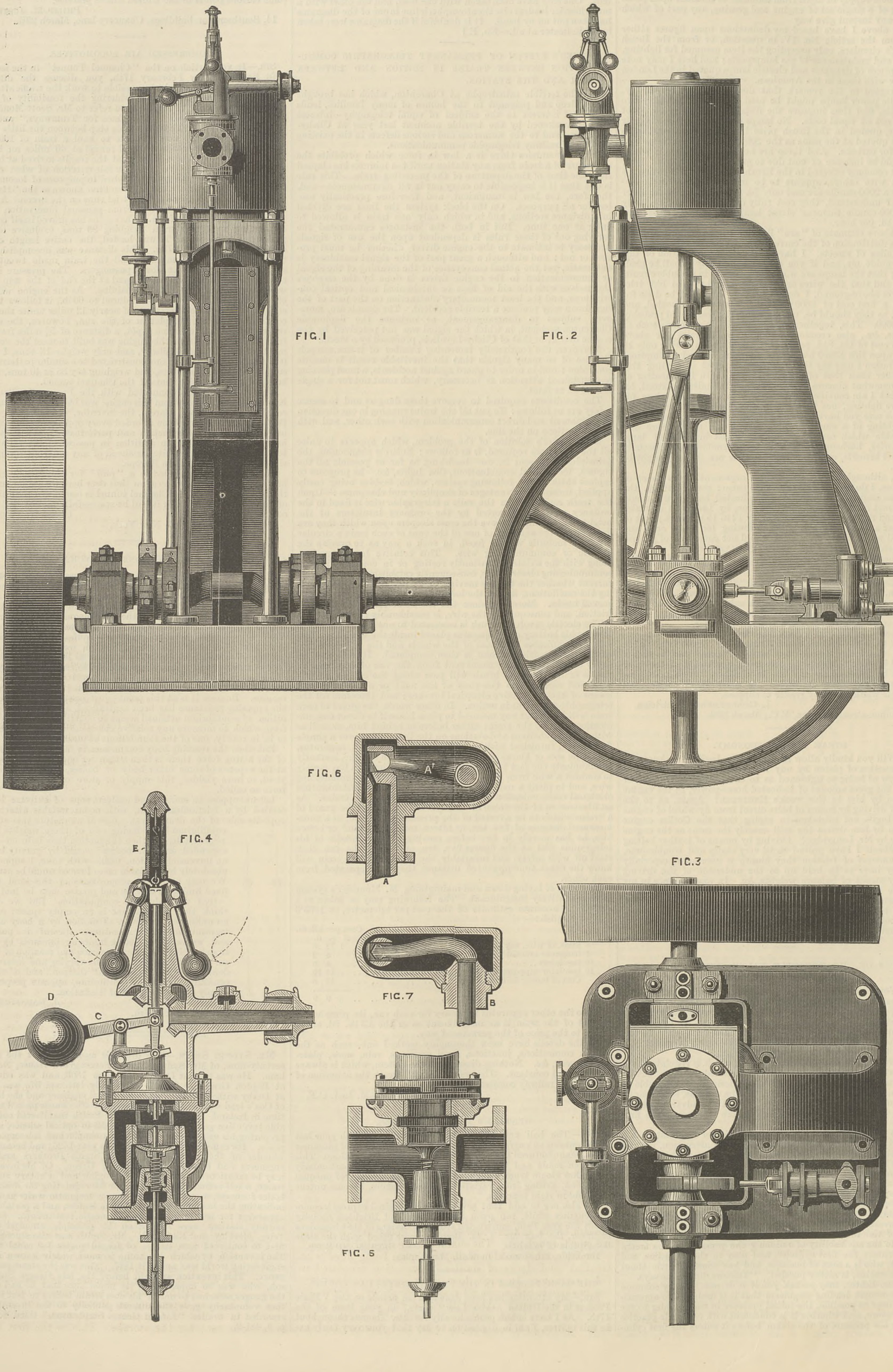
J. RAMSBOTTOM.
Leeds, March 27th.

MR. SYDNEY SMITH.—The death is announced, at the age of seventy-nine, of Mr. Sydney Smith, Forest-grove House, Nottingham. He was born at Derby in the year 1803, and was educated at Repton Grammar School. His early business life was spent at Derby with his father, who was a civil engineer and the builder of Cox's lead works and shot tower. He afterwards passed a short time in Ireland. From his youth Mr. Smith manifested considerable inventive genius, and practical skill in optical science, always preparing his own glasses both for microscopic and telescopic purposes. He came to Nottingham in the year 1826, and became the founder of the well-known firm of Smith Brothers and Co., engineers and brass founders, Hyson Green. Of his inventions may be mentioned a rotary steam engine and a rotary stocking frame, a self-acting damper regulator for regulating the draught of boiler furnaces, a spring safety valve, a magnetic water gauge for indicating the height of water in steam boilers, and a portable gas apparatus for use in public and domestic institutions. Several railway stations were lighted on this principle, amongst others Tring, Methley, and Kegworth. Mr. Smith was also amongst the first to construct iron barges of forged plates for canal traffic. The invention by which his name is most widely known in the engineering world was made in 1847. This was the steam pressure gauge. This invention was laid before the late George Stephenson, who was so impressed by its importance that he had one of the gauges attached to one of his own steam boilers to test it, and then voluntarily gave the utmost publicity to the invention as recorded in Smiles' "Life of George Stephenson," third edition, p. 9, 481-2.

VERTICAL ENGINE FOR ELECTRIC LIGHT PLANT.

MESSRS. TANGYE BROTHERS, SOHO, ENGINEERS.

(*For description see page 235.*)



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. GEROLD and Co., *Booksellers.*
LEIPSIC.—A. TWIETMEYER, *Bookseller.*
NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

PUBLISHER'S NOTICE.

*** *The Publisher begs to announce that next week* THE ENGINEER *will be published on* THURSDAY *instead of* GOOD FRIDAY. *Advertisements intended for that number must be forwarded not later than Six o'clock on Wednesday evening.*

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.*

*** *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.*

SCRUTATOR.—*The Great Eastern was built on the Thames by Mr. John Scott Russell. She was designed by Brunel.*

F. J. SCOTT.—(1) *We know of no simpler form than those made by Robert Browning, of the Strand.* (2) *4th January,* 1878, *is out of print.*

J. WATT.—*It not unfrequently happens that a second patent is obtained for the same invention. If the similarity exists in your case, we do not see how you will be prejudiced.*

R. F. K.—*We do not quite understand your question, but you may find the information you require in Spretson's book "On Casting and Founding," published by Messrs. E. and F. N. Spon.*

W. S.—*The principle of your governor is identical with that of Dunlop's governor. We cannot pretend to say whether your details would be an infringement of Mr. Dunlop's patents, which you can consult at the Glasgow Free Library.*

C. H. G.—*The tractive force of an engine is found by the following formula:*— $T = \frac{D^2 P L}{W}$. *Where* T *is tractive force in pounds,* D *diameter of piston,* P *mean pressure in cylinder,* L *length of stroke in inches, and* W *diameter of driving wheel in inches. Your engine has* 12*in. cylinders,* 20*in. stroke,* 3*ft.* 6*in. wheels, boiler pressure* 120 *lb. Average cylinder pressure may be* 90 *lb. Then* $\frac{144 \times 20 \times 90}{42} = 6172$ *lb. is the tractive force of your engine. The resistance, if you run at slow speed, ought not to exceed* 8 *lb. per ton, and* $\frac{6172}{8} = 771$ *tons.*

W. T.—*The idea of heating the blast for a cupola is very old. The plan you propose would be inefficient, for air is heated with great difficulty and a large surface is required. None of the plans proposed have come into use because the gain has not been worth the trouble and expense incurred. There is also reason to believe that the quality of the iron is not improved by the use of a hot blast. The most likely method of obtaining success appears to consist in passing a portion of the blast through a coke fire. The oxygen would be taken up, and carbonic oxide at a very high temperature would be delivered. This could be mixed with the remainder of the air just before entering the cupola, and igniting there, would burn to carbonic acid Of course, the coke used for heating the blast in this way would be deducted from that to be put into the cupola. The whole arrangement would be a modification of Siemens gas furnace.*

T-IRON RINGS.

(*To the Editor of The Engineer.*)

SIR,—Would any of your numerous readers furnish me with names of makers of welded T-iron rings? T. L. R.

Hungerford, March 24th.

TYPE-WRITERS.

(*To the Editor of The Engineer.*)

SIR,—Will any correspondent kindly give me the name of the firm or firms who supply type-writing machines? M.

Preston, March 29th.

STONE SAWING MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Will any reader give me information, with name and address, concerning some engineering firms, makers of the most approved modern machinery, driven by steam power, for sawing marble or granite cube blocks into slabs of various thicknesses? STONE SAWING.

Aberdeen, March 28th.

BENTALL'S PLUMMER BLOCK.

(*To the Editor of The Engineer.*)

SIR,—The form of plummer block illustrated and described in your issue of the 24th inst. certainly is good and possesses many advantages, but can scarcely be claimed as a novelty, as it has been in use in England and America for many years. We have made them for some time.

THOMAS PIGGOTT AND CO.

Atlas Engine Works, Birmingham, March 27th.

BOX-MAKING PLANT.

(*To the Editor of The Engineer.*)

SIR,—Some time ago reference was made in one of your leading articles to certain "labour-saving appliances," and valuable hints given as to economies in general. You especially mentioned box or case making by automatic tools. Kindly allow me to ask through your columns the names of the American or other makers who supply box-making aud nailing machinery. REGEOG CHALE.

Fenchurch-street, E.C., March 27th.

SELF-CENTREING CHUCKS AND FOUNDRY WORK.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers give me the names of English makers of self-centreing chucks, such as would be used in boring small fly-wheel bosses? I have seen such things in America, but not, as yet, in England. I shall also be much obliged if any of your readers will give me a little information about the form of reverberatory furnace necessary for melting cast iron for high-class castings. How much coal will be used per ton of castings made, including lighting up, and how much will it cost to build such a furnace? MECHANICAL ENGINEER.

Manchester, March 27th.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

(*To the Editor of The Engineer.*)

SIR,—In reference to your issue of the 24th inst., we think you will be interested to know that the 64 lights that we are now running at the Crystal Palace require exactly the same labour as the lesser number named by you, and we consider that the driver, and one man to trim the lamps, would be quite sufficient to work 32 lights, and we should therefore feel justified in deducting from your estimate of £942 5s., the wages of one man, or £127 15s. We may also point out that we always take the cost of maintenance of dynamo-machine at 2 per cent., of the lamps at 5 per cent., and 10 per cent. on the remaining material; or even taking 10 per cent. all round, so as to equalise the maintenance on the engine and on the machine, your estimate will be reduced by £100, bringing down the price per hour to 9s. 8¾d., which is, of course, very greatly reduced in proportion if the plant be used, as in all night work, for ten hours. The fixed charges of interest, maintenance, rent, rates, and taxes would remain the same, and the wages would only be slightly increased.

THE HAMMOND ELECTRIC LIGHT AND POWER SUPPLY COMPANY, Limited.

110, Cannon-street, London, E.C., March 29th.

A CORRECTION.

(*To the Editor of The Engineer.*)

SIR,—In the list of Patents Sealed, mine is stated as No. 4516, whereas 4514 is the number. E. DEARDEN.

Darnall, Sheffield, March 29th.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, April 4th, at 8 p.m.: Paper to be read and discussed, "The Theory of the Gas Engine," by Mr. Dugald Clerk.

SOCIETY OF ENGINEERS.—Monday, April 3rd, at 7.30 p.m.: The discussion will be resumed on the paper entitled "Notes on Electric Light Engineering," by Mr. C. H. W. Biggs and Mr. W. Worby Beaumont, adjourned from the last meeting on the 20th inst. Time permitting, a paper will be read "On the Utilisation of Tidal Energy," by Mr. Arthur Oates, the leading features of which are as follows:—The power and value of tidal energy, and the means of utilising it with a description of the tidal dam, its construction and action. Concluding with a statement of the conditions most likely to render tide utilising works successful.

CHEMICAL SOCIETY.—Thursday, April 6th, at 8 p.m.: The following papers will be read:—(1.) "Observations on the Action of Acetylic Chloride on Fumaric Acid," by Mr. W. H. Perkin. (2) "Note on a Convenient Apparatus for the Liquefaction of Ammonia," by Mr. J. Emmerton Reynolds. (3) "Transformation of Urea into Cyanamide," by Mr. H. J. H. Fenton. (4) "Some Arguments in Favour of Ladenburg's Prismatic Formula of Benzene," by Mr. M. K. Dutt.

THE ENGINEER.

MARCH 31, 1882.

THE IMPORTED MEAT TRADE.

FOR some time past but little has been heard of a branch of trade concerning which a good deal of stir was made at one time. We allude to the importation of frozen meat from Australia. It is not to be supposed, however, that this line of business has become extinct. On the contrary, much has been quietly done to develope it, and the history of the undertaking and a statement of its present position and prospects will not be out of place in our pages, because the success of the enterprise depends almost entirely on the earnest co-operation of engineers. Considerable quantities of beef, mutton, salmon, and so on are imported from time to time, mostly by passenger steamers, such as the Orient; and we have eaten excellent salmon, frozen by Bell-Coleman machines, and imported from Labrador. But the trade is only beginning to be taken up, in the full sense of the term, by cargo steamers, which make much slower voyages than mail and passenger steamers. About a year and a-half ago an attempt was made to form a company at Orange, New South Wales, to export meat to England. The meat was to be frozen at Orange by the aid of machines made under Giffard's patents, and cold storage was to be provided in this country by the same company for the meat when it arrived. This undertaking fell through, and no company was formed. Meat, however, was sent, as we have said, but in limited quantities; and great inconvenience was experienced here by the want of cold storage. The meat was kept on board the steamers; but as these could not remain more than about ten days in dock, the meat had to be sold, no matter what the state of the market, at any price that could be got. Various machines were used, some by Bell-Coleman, others by Haslam, and various makers more or less well-known. None of the dock companies lent their aid until about six months ago, when the London Docks Company took the matter in hand, and fitted up, almost for experimental purposes, a small cold-storage plant at the Victoria Docks, near the Custom-house. The trial was perfectly successful, and the company has now finished a new cold-storage establishment which professes to supply just what is wanted, and can scarcely fail to give a stimulus to the importation of meat, which it apparently wanted.

Under what is known as "Jetty A," Victoria Docks, are ranges of vaults of considerable size. The vaults have arched tops, and are some 20ft. wide and 14ft. or 15ft. high in the middle. In these have been constructed eight storage chambers. They extend in a straight line one behind the other parallel with the wharf. They are perfectly dry. The chambers were made by lining the vaults with heavy planking, a considerable space existing between the stonework and the timber; stout floors also of planks are laid throughout. The chambers are divided from each other by double wooden walls, the space being filled with sawdust, and doors of similar construction are fitted in the partitions. In each door is an aperture about 3ft. square, fitted with a second door, through which the carcases can be passed. Along the side of each chamber is fitted a wooden trunk with holes covered by slides in the sides. Through these holes the cold air is discharged. At first but three chambers were made; subsequently five more were added. Between the first three and the second five is situated what we may call the engine-house, in which are fixed two cold-air machines by Messrs. Hall, of Dartford. The first is a horizontal machine very similar to those illustrated in THE ENGINEER for May 13th, 1881. It can deliver 10,000 cubic feet of cold air per hour. The second machine, which was started about a fortnight ago, has a capacity equal to 30,000 cubic feet, but it is only run at 38 or 40 revolutions at present instead of 60 revolutions, because it supplies at the slower speed more cold air than is wanted. Steam is supplied to the smaller machine by a vertical boiler on the wharf, and to the larger by an old London and North-Western locomotive boiler, which has been put in perfect condition, also standing on the wharf, but at a considerable distance from the engine, to which steam is led by a long steam pipe clothed with Leroy's or some similar non-conducting material. The three chambers first made will hold 600 carcases of sheep each, the five last made 500 carcases each, so that in all about 4300 sheep can be stored. On Monday we saw the chambers being filled from the Protos, a steamer specially fitted for this trade. The carcases were beautifully "dressed" without head or offal of any kind, ready to be hung on the butchers' hooks. The average weight of the carcases is 60 lb. each; therefore the cold rooms will hold in all about 115 tons of meat, worth at 6d. a pound £6450. The sheep are small but fat, and of excellent quality. We may say here that their cost at the Orange slaughterhouses is 1d. per pound, the cost of carriage is 4d. per pound, so that their cost to the London butcher is probably 5d. per pound, and there is absolutely no waste save the hoofs. As the consumer pays 9d. or 10d. a pound, it will be seen that the butchers must make a good profit. The importation of beef from Australia cannot be made to pay, for good beef fit for the London market cannot be had for less than 3d. a pound, and much demand would raise it to 4d., so that it could hardly be delivered into the London market at less than 9d. In future, beef will come from Texas and South America, mutton from Australia.

We shall illustrate Messrs. Hall's new machine in an early impression; meanwhile we may briefly describe it. It is one of a type specially intended for cargo ships. It is 21ft. long, under 7ft. 6in. high, and about as wide. Standing in front, we have at one end a crank shaft and massive fly-wheel weighing 3 tons; at the other end is the air-compressing cylinder. The steam cylinder is on the same plane, and both are at a higher level than the crank shaft. The steam cylinder is 15in. diameter, the compression cylinder 20·75in. diameter, and both have a stroke of 2ft. 6in. The air cylinder stands on top of the tubular air cooler, access to the tubes in which is easily obtained by taking off two circular covers. The steam cylinder is supported by a hollow frame, in the lower part of which is placed the air pump, lying horizontally under the steam cylinder. The air cylinder and the steam cylinder have one piston rod common to both, and in the mid length of this rod is a bearing, which carries the two sides of a double vertical lever, about 5ft. long, the lower end of which works on a link, while near the top are secured the two radius rods of a parallel motion. These radius rods work the air pump, which has two piston rods side by side. To the middle of the vertical beam is jointed the small end of a connecting rod, which passes through the hollow framing before referred to, and works in a vertical plane between the steam cylinder and the air pump, and so drives the crank shaft. At the extreme forward end of the engine is a rectangular box, which is the jet condenser. The top of the air-compressing cylinder is nearly 7ft. above the floor line; indeed, it is nearly as high as the top of the fly-wheel.

Nearer to the front of the machine, and at a considerably lower level, lies the air expansion cylinder 16in. in diameter and 2ft. 6in. stroke. This has two parallel piston rods which lay hold of a sleeper crosshead carrying the small end of the connecting rod, which works a second crank on the crank shaft. The compression cylinder stands over a large snow-box with double door and partitions. The box can be opened in a few seconds by turning a single handle, and the snow can be cleared out in a few minutes. This seems to be a thoroughly practical way of dealing with the snow difficulty. The air trunks in the meat rooms are of large section, and the very small quantity of snow deposited therein causes no trouble whatever. Should it accumulate it can be raked out at once through the air-ways before mentioned. As a fact, however, all the snow seems to be deposited in the snow-box. The admission valves of the expansion cylinder are flat slides, with Meyer's adjustable cut-off slides on the back; the exhaust valves are silent poppet valves, worked by positive motion cams. The air to be cooled is drawn in from outside the building through a cast iron pipe with the orifice protected by wire gauze. At the time of our visit the machine was making thirty-eight revolutions per minute; a steam gauge between the throttle valve and the boiler stood between 75 lb. and 78 lb.; the vacuum was 26in., the air pressure 50 lb., the temperature recorded by a Kew standard thermometer —80 deg. Fah. The standard meat room temperature is 26 deg., but it varies a little from this, for the machine is only worked for ten hours a day. It is found that when the machine is not at work, the chambers being all closed up, the temperature rises very regularly at the rate of 1 deg. Fah. per minute, so that if at night when the engine is stopped the temperature is 16 deg. or thereabouts, it will not rise during the sixteen hours the engine is standing to more than 32 deg. In practice, however, the engine does not stand for more than twelve hours, that is from 6 p.m. till 6 a.m., and a temperature much lower than 16 deg. can be reached if necessary. About this machine there are many excellent features, which, however, cannot be understood in the absence of an illustration.

It appears that the longest time a cargo of meat remains in the cold store is three weeks; sometimes it remains a very few days, all depending on the state of the market. The London Docks Company remunerates itself by charging a rent for the storage. This is the first dock company which has made any energetic movement to aid the importation of meat, and it deserves great credit for its display of energy. The cost of the work done has been very considerable, but we can hardly doubt that the advantage conferred will be appreciated. The one thing wanted to promote the importation of meat has now been provided, and it is not improbable that the example set will be followed. To the London Dock Company will belong the credit of taking the initiative.

MR. LONGRIDGE ON OUR NEW GUNS.

Mr. Longridge has written a letter to the Secretary of State for War which at the present time deserves respectful attention. It consists of what we may call a protest against the want of science in the Arsenal and at Elswick. Mr. Longridge has a special right to be heard, inasmuch as he is the well-known inventor of the first wire gun; and wire guns appear at last to have a fair prospect of adoption. Mr. Longridge met with nothing but disappointment until long after his patent rights had expired. Now that his invention is being taken up he certainly has a right to command attention when he speaks; and the paper read by Colonel Maitland recently gives him a good opportunity of hearing how matters stand and commenting on them. Mr. Longridge begins by noticing the enormous sums of money that have been spent on our guns, dwelling on the fact that the changes in system of loading, in the prop r-tions—that is in the length of bore—and now in the material of which the gun is constructed, are so great as to show that our money has not been well spent in uniform steady progress, but, on the contrary, wasted in having to retrace our steps and begin again. He entirely objects to Colonel Maitland's statement of the powder question. He regards the preference for slow-burning powder and long bores as an unwilling confession of weakness in construction, and he particularly objects to the statement that time is insufficient for the transmission of force throughout the mass of a gun while the projectile is in the bore, and the argument based on it—namely, that whereas wrought iron answered well enough on the exterior of a gun when quick burning powder was used, because only a portion of the strain reached it, now it is well to employ steel. Mr. Longridge says that strain is transmitted at the same rate as sound, that is 15,000ft. to 18,000ft. per second; from which it would follow that it would pass from the interior to the exterior of the gun in about 69 millionths of a second, while experiments have shown that a pressure approaching the maximum lasts for from nearly three to six times this period of time. Then Mr. Longridge objects to the loose way in which the Gun Factory official book speaks of the law of variation of strains in a cylinder as being something between that of Barlow and that of Hart, which differ in the proportion of sixteen to ten. Still more does he object to Sir H. Lefroy's statement that Woolwich had discarded formulæ for "practical rules of thumb," and to Sir W. Armstrong's statement that "critical nicety does not appear to be important, provided that the contraction be on the excess side of what is mathematically correct." Then, again, Mr. Longridge fears that when wire is tried, which he says was never defeated, but only despised, it will not be properly applied. He considers that the provision made in the Elswick wire gun for longitudinal strength is bad, and he objects to the features which seem likely to be embodied in new guns as being either such as ought to have been adopted and retained long ago, or, on the other hand, as mistakes. We might quote more in detail, but we have already given the pith of Mr. Longridge's letter. Briefly, he regards the authorities at Woolwich as singularly wrong-headed and unscientific, we might almost say benighted, and Sir W. Armstrong and Co. as very wild, though no doubt better than the former, and this he expresses in language that is perhaps more calculated to relieve his own mind than to win the Secretary of State for War to his opinions.

As we have said, pleasant or unpleasant, Mr. Longridge's opinion deserves consideration on this subject. There are things in his letter well worth noting, but it is impossible for us to go all the way with him. With regard to his wire gun, undoubtedly it was never properly tried. There is no reason why it should not have done as well in 1855 as in 1881. Of course it is necessary to provide specially for longitudinal strain. Mr. Longridge does not in his letter say how he would do this. Theoretically we hold that the place for it is the exterior, as in Sir W. Palliser's lined guns, rather than the interior. As to the weakness of our guns bringing in length, and length bringing in breech-loading, there is no question as to the fact that quick-burning powder wastes less force but strains the gun more; hence the strength of material will always be the limit to the quickness of the powder, while additional work will always be obtained by increasing the length, the limit to which is a question of convenience. This is really the whole case. It is useless, we think, to term increase of length a retrograde step. Given your strength of material and you have the limit of your maximum pressure, after which any increase in length will always give additional velocity. If Mr. Longridge's gun is stronger it will stand quicker powder; but, however much he dislikes it, the person who gets the same maximum pressure from a larger charge of slower burning powder, and who increases the length, will get better results. With regard to the rate of transmission of strain and adjustment of stress throughout the gun, theoretically, perhaps, Mr. Longridge may be right. The question is, however complicated; when any extension of metal occurs; any given elongation, of course, bears a decreasing relation to the circumference of rings as they get further and further from the axis. In fact, it appears as if a gun could only be constructed to meet one given strain in any desired proportions, while less and greater strains would fall disproportionately on its interior and exterior parts. Mr. Longridge protests against the Gun Factory book, stating that practice has shown that Barlow's law of strains is fairly trustworthy; but, if we turn to Mr. Longridge's paper read before the Institution of Civil Engineers, we find assumptions more open to objection. For example, he says:—"As regards the steel tube, it appears that the inner surface is exposed to a sudden change from — 11·70 to + 15·83, or a range of 27·53 tons per square inch. Now it is generally admitted that a sudden change is equivalent in effect to double the amount of a steady strain, so that in the present case the effect would be equal to a steady strain of 55·06 tons per square inch."

This statement, if we understand it, is an extraordinary one; it implies, for example, that a tube relieved suddenly from a state of compression of 11·7 tons and allowed to come to absolute rest, would be exposed to a steady strain of 23·4 tons in the act. Then the roundness of the statement that a sudden strain is equal to double a steady one partakes of the rule-of-thumb principle that Mr. Longridge condemns so strongly in others. Captain Andrew Noble indeed pointed out how in certain cases the fact of a strain being exerted for a very short space of time enabled a gun to resist it when it must have yielded to a similar strain if continued for a longer period. To pass on to Sir William Armstrong, who has made experimental guns of steel riband, and who, Mr. Longridge fears, will make an indifferent "step-parent" to his "child." We believe that we are right in thinking that Brunel and Armstrong were in consultation about the construction of a wire gun about the latter end of the Crimean war, when they discovered that Mr. Longridge had been before them and had taken out his patent. The problem was not an easy one, and Armstrong wanted immediate results, and we think that the discovery that he was not first in the field threw enough weight in the scale to cause him to turn to his wrought iron coil system. Now that he is making wire or steel riband guns, we think Mr. Longridge need not fear about the tension at which the riband will be wound on, inasmuch as Armstrong has a machine which enables the tension demanded by theory to be given to it throughout. Nevertheless Sir W. Armstrong considers—and this no doubt shakes Mr. Longridge's confidence—that an excess of tension produces little or no harm. He claims no advantage in giving such an excess, but naturally it may be feared that Armstrong will lean to this side rather than the other of the true theoretical tension. Now it happens that Armstrong is by no means alone in this conclusion. We will not mention Captain Andrew Noble, who may be supposed by Mr. Longridge to be more or less under his noxious influence, but the matter was very clearly explained by another very able mathematician—Mr. Canet, of Vavasseur's establishment—on the occasion of the reading of Mr. Longridge's paper above referred to, in his own hearing. The explanation is that a tube strained beyond its elastic limit permanently stretches up to a certain point, so that it has relieved itself to the required amount, being for the future a larger tube sound and good, but rather more rigid than before. Mr. Longridge must surely be aware that the links of suspension bridges have been purposely thus strained beyond their elastic limits so as to obtain rigidity. Again, the provision for longitudinal strength in the Elswick guns does not meet with Mr. Longridge's approval. This is to be regretted, but we think that almost any one who looks at the section of the riband gun in The Engineer of July 29th, 1881, will conclude that in the steel tube backed up by longitudinal riband—not visible in section—the "step-father" has provided more handsomely for longitudinal strain than the "father" has done in the section, p. 27 of Mr. Longridge's paper, where two cast iron pieces are held longitudinally together by "wrought iron bolts," whose heads and screw threads look as if they would shear on firing the first round.

We think that we all ought to sympathise with Mr. Longridge. If steel wire guns in any form come in, he has a right to the credit of having proposed them and held to them without swerving. He had his reasons, and because they were not in his judgment met, popular opinion would not move him. In this, like Prussia with her needle gun, prismatic powder, and breech-loaders, he offers an example which our authorities might well copy. When, however, it comes to "criticising freely" and the like, a plain-speaking man like Mr. Longridge will not complain of our reminding him of a proverb about glass houses.

THE SEWAGE OF THE LEA VALLEY.

About 44 per cent. of the population of the metropolis derives its water supply from the river Lea, while the sewerage of the lower portion of the Lea valley is unsatisfactory. We do not mention these two facts in this connection to suggest that the Lea water is injuriously affected, as this could be immediately refuted by the analysis of Messrs. Crookes, Odling, and Tidy, but that the disposal of the sewage from the districts mentioned is not as complete as it should be is very well known, and the water from the Lea is not quite as good as in even recent years. To some extent the water is affected, and in order to prevent the pollution of the Lea, a scheme for the interception and disposal of the sewage of the valley has been devised and published by Sir Joseph Bazalgette, Major Flower, and Messrs. Law and Chatterton. In their scheme the main sewer commences at Hertford, from thence follows the railway as far as Stratford, and then in a nearly straight line to a point in the Thames about half a mile below Barking Creek. Four main branches into this sewer are proposed to connect it with Sawbridgeworth. One following nearly the line of the railway, and joining the main sewer near Hoddesdon; a second branch from the Epping sewage outfall, following the line of Cobbin's Brook, and joining the main sewer at Waltham Abbey; a third from East Barnet, following the line of Pymme's Brook, and joining the main sewer at Upper Edmonton; and a fourth from the Hendon sewage outfall to join the previous branch below Southgate. The main sewer and these several branches would intercept the sewage from places containing an aggregate population at the time of taking the Census last April of 240,000 persons. It is estimated that the rate necessary for this work, which would affect thirty-nine parishes, would not exceed 7d. in the pound, or 6d. if West Ham were included in the scheme, that rate to pay off the whole cost in fifty years with only the present population. The sewage would be discharged by gravitation, or with but little pumping into the Thames at the point mentioned, after treatment near the outfall, where 100 acres of marsh land would be taken for the purpose, and where tanks of sufficient size to receive the largest sewage flow would be constructed. The scheme is a very big one, involving about fifty miles of main and branch sewers, its great recommendation being that the sewerage question for this very large area would be finally settled, unless objection is made to putting sewage into the Thames half a mile below Barking Creek.

THE CHANNEL TUNNEL.

Sir Edward Watkin continues to invite guests to see the so-called Channel Tunnel works. We cannot call to mind any engineering undertaking which has demanded for its success so much feasting. It would seem, indeed, that it is essential to the prosperity of Sir Edward Watkin's enterprise that numbers of more or less influential people should have a champagne luncheon at Dover two or three times a week. We venture to make a suggestion. So far the male sex have had all the enjoyment, but ladies are influential. Why does not Sir Edward give a ball in a suitable marquee; suppers and flirtations in the tunnel? The House of Commons has, we believe, a standing invitation to the tunnel works, but the invitation does not do much to win favour with our legislators. On Monday Mr. Gregory asked the First Lord of the Treasury whether it was understood by the promoters of the Channel tunnels that they were proceeding with their respective undertakings entirely at their own risk, and that they would have no claim for compensation in case it should be considered necessary for the defence of the realm to stop or suspend their works, or at any time to take possession of them or the tunnel, when constructed for such purpose. Mr. Gladstone, in reply, said that as far back as the 6th instant Sir Edward Watkin had been warned by letter that those who were spending their money at Dover in boring the chalk were doing so at their own risk, and he told Mr. Gregory that the Government could take possession of the works at any time without paying them one farthing of compensation. Mr. O'Shea, anxious that Sir Edward should not be taken unawares, wished to know if he had been told that he had no right to go beyond the foreshore. Mr. Gladstone said that he could not tell, but he slyly added, amid much laughter that he believed "that Sir Edward was very well informed on all matters relating to his company." We are not quite sure to which company Mr. Gladstone alluded. We may take it for granted, however, that the South-Eastern Railway Company is quite safe. Yesterday—Thursday—evening Mr. Hicks asked the Prime Minister whether, having regard to his answer on Friday last to the hon. baronet the member for Buckingham, he would not at once take steps to have the rights of the Crown to the foreshore at Dover decided by a Court of Law, and whether he would not also apply for an injunction to restrain the persons, if any, who are making or are about to make a tunnel under such foreshore, until the rights of the Crown have been determined? In reply to Mr. Hicks, Mr. Chamberlain said: "By request of the Prime Minister, and with the permission of the House, I will answer this question. I have been in communication with the hon. baronet the member for Hythe and the Chairman of the South-Eastern Company on this matter. The hon. baronet has very frankly offered to place at the disposal of the Government all the documents on which he founds his claim to the foreshore. I have directed the legal advisers of the Board of Trade to confer with the solicitors of the hon. baronet in the matter and to report upon the case. As soon as they have been able to do this the case will be submitted to the Law Officers of the Crown for their opinion, and till that opinion has been received I cannot say what course the Government will take in the matter. But in the meantime I may add that the hon. baronet has been warned that the Government claims the bed of the sea below low-water mark and for three miles beyond, and that they will hold themselves free to use any powers at their disposal in such a manner as Parliament may decide, or as the general interests of the country may seem to them to require." We have not heard how money is obtained to carry on the present works. It is hardly probable that the general public will speculate in an investment of which they may be deprived at any moment by the Government without compensation; and the affair is hardly of the kind that tempts widows and clergymen to invest. With a little patience, however, all the facts will, no doubt, be made clear. Whether they will be welcome facts all round remains to be seen.

LITERATURE.

Experimental Researches into the Properties and Motions of Fluids, with Theoretical Deductions therefrom. By Wm. Ford Stanley. London: E. and F. N. Spon. 1882.

This is a very singular and suggestive book. The author —who is well known as an eminent maker of scientific instruments—informs us in his preface that he had undertaken a long series of experiments designed to test the undulatory theory of light, and that, finding himself restrained from continuing these by injury to his eyesight, he transferred his attention to a branch of research akin to the former, namely, the motions of water waves and sound waves. After experimenting on the former in various ways, and apparently without any very definite plan, he seems to have developed certain theories on the motion of fluids and the causes which govern them; and these theories, with the experimental facts by which they were suggested, he has recorded in a large volume of some 500 pages. It need hardly be said that this represents a very great amount of work, both in the way of experiment and reflection. We by no means wish to suggest that this work is without value, or does not deserve to be studied; but we cannot help feeling that its value has been much impaired, and its study rendered difficult, by the imperfect form in which it has appeared. The author complains that he had failed to obtain the assistance of some well-read student to edit it for him. The complaint in itself shows how far he is removed from those ill-trained pretenders to science, who imagine that because they have groped a little in the fog of their own ignorance they have made great discoveries; but we cannot help sharing with him the regret that he expresses. A judicious editor is precisely what the book requires. The author is evidently possessed of great patience and skill in research, and has very much of the valuable quality which Dr. Tyndall calls scientific imagination; but as evidently he lacks the theoretical training needful for so difficult a study, and also the literary ability and experience which would enable him to put his thoughts in clear and exact language. The first deficiency is sufficiently proved by the fact that we have not found a single mathematical expression in the book; so that the theory lacks throughout that precision which the science of number alone can give. To the second almost every page bears witness. The author uses a large number of technical terms, often in senses apparently peculiar to himself; and yet he almost everywhere ignores the first necessity of clearness, namely, preliminary definition. One example will suffice. In page 42 he is suggesting an explanation of the mode in which heat energy may be turned into an equivalent quantity of mechanical energy. This is a question to which every student of physics or engineering will turn with avidity; but what is he to make of such a passage as this: "Here is possibly work that will fully represent the heat lost in its performance, whether it be in separating the millions of surfaces of the atoms of a powerfully cohesive mass of platinum, slightly against its powerful chemical cohesion, of near central contact, of its atoms, equally, to the force shown in dissipating solid carbonic acid to vapour extension where chemical cohesion is represented by a small force."

It is this sort of language which, as we have said, vitiates so much of what, very possibly, may be really valuable speculation on a very recondite subject. Indeed, the whole of the first four chapters, which are almost purely speculative, fall so far short of being generally intelligible that we shall not attempt to deal with them. We may note that in Chapter II. the view is taken—and supported by various experiments—that the particles at the free surface of a liquid are in compression, and not in tension, as usually supposed. Again, in Chapter III., some curious investigations are given as to the tenacity of liquid films, which the author believes to be as high as the weight of a column of the fluid 17in. long. In Chapter IV. we come to a more practical point, namely, the mode in which the molecules of a fluid move past each other. The author holds that this, in almost all cases, is by rolling, not sliding, the molecules being possessed of perfect mobility and rolling over and over as they move round any number of axes in succession. This view seems *a priori* probable, as accounting for the very small resistance to motion in fluids, and it is confirmed by many observations—such as on the smoke coming out of a chimney—where such a rolling motion may actually be seen to take place. Some of the instances are, however, fallacious, as, for instance, the rolling over of the front edge of a thin stream flowing down a gently sloping board, which is simply due to gravity, and independent of the question of rolling or sliding motion within the fluid itself. It is, however, very probable, as suggested, that to this fluid rolling is due the very slight disturbance caused in the sand of an estuary by the inflowing of the tide.

In Chapter V. the resistance experienced by a particle when projected within a fluid is considered. Experiments are given showing that the effect of a blow upon a solid body, like glass, is to shear it all over the surface of a cone having its apex at the point of percussion. Hence the blow is evidently taken up, not merely by the particles exactly in front of the impinging body, but by all the particles, at least, which are within the limits of the cone torn out. The author holds that the effect in fluids is similar; and he tested this by the experiment of firing a rifle bullet into water, of which he gives very interesting details, and also by the projection of coloured fluids into a still fluid. This latter gives rise to the phenomena of vortex rings—or whirl rings, as the author prefers to call them—as in the well-known smoke rings exhibited lately by Sir William Thomson at the Royal Institution. Mr. Stanley differs from him and others as to the explanation of this vortex motion; but as theirs is confirmed by mathematical investigation, while his is a mere general deduction from experiment, we do not think he will find many to agree with him. Here, as elsewhere, the experiments are very elegant and suggestive, while the theory is obscure and doubtful. The motions of a small portion of fluid, when projected, under various circumstances, within a large mass of fluid at rest, are very carefully described and illustrated. In Chapter VII. an attempt is made to bring the motion of fluids in pipes and channels—which to the engineer is a question of more immediate importance—under the same laws; but it is admitted that this has proved very difficult, and that a good deal which is advanced is hypothesis only. The general idea is that the lateral resistance to the flow of any particle in a channel acts through a segment of a cone whose apex is at the particle, and not merely along a plane of division parallel to the sides. It is probable that this hypothesis may be of great use in explaining the eddying motions which arise in a contracted or an uneven channel; but for steady flows, such as those through a pipe, it requires mathematical confirmation before it can compete fairly with the older theory, as developed by the researches of Moseley and others. The same may be said of Chapter VIII., in which the important question of the resistance to the motion of solid bodies in fluids is discussed. Here the author scarcely seems to grasp the principle—long known to mathematicians, but first shown experimentally by Mr. W. Froude to the British Association in 1875—that the pressure in any fluid is less as its velocity is greater. He gives, however, some interesting diagrams of the effect of eddies upon the steerage of ships, as determined experimentally by Prof. Osborne Reynolds.

From henceforward the book deals with questions which, though full of scientific interest, have little connection with the work of engineers, being chiefly the movements of the atmosphere and the ocean, as shown by aerial and oceanic currents, and the form and propagation of waves. There is an exception in Chapter XI., where there is a discussion on the formation of deltas at the mouths of rivers, and on the erosion of river beds; but the statements in the former do not seem important, and the latter can hardly be correct, since it is said that rivers having a section less than a half cylinder—and therefore practically all rivers—should show a tendency to form two lateral streams, with a shallow between them—a tendency which, so far as we know, is wholly unknown.

On the whole, while fully disposed to recognise the skill and perseverance displayed by the author of this work, and the interest and value attaching to his researches, we are unable to repress our regret that they have been suffered to appear in their present form. The book, as we said at starting, is suggestive, but it is not conclusive; it indicates much, but proves very little. What was needed, in our opinion, was that the author should have associated with himself some mathematician and physicist, not without literary experience, who would have separated the experiments from the theories founded upon them, clothed the latter in clear and accurate language, supported or disproved them by strict mathematical investigation, and finally given a better literary form to the whole. Mr. Stanley seems himself to have felt the want of such a coadjutor, but to have failed in finding him. Surely, however, among the young men yearly sent out from the laboratories at Cambridge, Manchester, and elsewhere, it would not be hard to discover some one qualified for the task. Even now we would fain hope that the author will succeed in finding some such assistant, will re-write the book, with his aid, putting it in shorter compass and improved form, and will then publish a second edition; which, we believe, would take its place as a really important contribution to the literature of one of the most difficult, but at the same time one of the most attractive, branches of natural philosophy.

A Practical Guide for Inspectors of Nuisances. By F. R. WILSON. London: Knight and Co. 1881.

Dirty Dust-bins and Sloppy Streets: A Practical Treatise on the Scavenging and Cleansing of Cities and Towns. By H. PERCY BOULNOIS, M.I.C.E. London: E. and F. N. Spon. 1881.

Wholesome Houses: A Handbook on Domestic Ventilation. By E. GREGSON BANNER. New edition. London: E. Stanford. 1882.

THE formality of appointing an inspector of nuisances usually forms one of the duties of local authorities, and as the salaries awarded this class of official are usually inversely proportionate to the number of the qualifications which local magnates, according to their advertisements, deem essential, intending inspectors will be glad to learn that they can find a general description of their duties fully set forth in Mr. Wilson's book, in which the various provisions of the Public Health Act and the Local Government Board regulations and instructions form the framework. Mr. Rawlinson's "suggestions," in fact, form a very important part of the book, and are calculated to give some would-be inspectors a highly exaggerated idea of the qualifications of an inspector of nuisances, as it is not sufficiently clearly pointed out where that part of the information conveyed by Mr. Wilson's book which is essential to an inspector, or that which belongs to the surveyor, begins and leaves off. It is not, for instance, a part of the duty of an inspector of nuisances to select a source of water supply or to "engineer" its conduct into and distribution through a town, nor is it a part of his duty to devise a system of sewerage. The suggestions, however, of the chief of the engineering department of the Local Government Board are here given at length, and impart an apparent importance or responsibility to the work of an inspector of nuisances which does not belong to it, but to the district surveyor or engineer. The duties of an inspector are clearly set forth in the Local Board regulations which are given, and the way to carry them out may be fully gathered from the book, but the inspector must use some judgment in selecting that which he must from that which he need not be fully acquainted with.

Mr. Boulnois' book enters more fully into what are some of the duties of an inspector of nuisances, though he does not describe this as his intention. The way in which scavenging and street cleaning is done clearly comes within the scope of that official. Mr. Boulnois divides his subject into eleven parts. (1) Scavenging under the Public Health Act; (2) house refuse, what is and what is not; (3) the dust-bin, its construction and position, what should and should not go into it, and what should be done with that which is not put into it; (4) collection of house refuse under various systems; (5) the scavenger's cart; (6) the disposal of house refuse—that is, the final disposal to surrounding districts after collection, as tipping into waste holes and pits, by carbonisers or "destructors," or on farms, or to brickmakers; (7) street cleansing as carried out in several towns; (8) snow and its removal—and here some useful notes are given, as, for instance, Sormani and Clericetti's experiments in Milan on the density of snow and cost of its removal. Sormani found that a cubic yard of snow weighed 814 lb. as collected from one fall, while on another occasion it weighed but 71 lb., the densest snow thus weighing about half the same volume of water. In Milan the arrangements for clearing away snow are very complete, but even so, the 40⅝in. which fell in the winter 1874-5 cost over £8400 to remove. A curious fact with reference to the Paris arrangements is mentioned, namely, that the General Omnibus Company is bound by its concession to furnish fifty wagons and carts to help in the removal of snow; (10) contracts and administration by local authority; (11) cost of scavenging and cleansing. The book contains a good deal of information only otherwise to be found scattered in sanitary works and "Transactions" of societies, and is useful to town surveyors.

Mr. Banner's book is a very full description of his own system of sanitary and ventilating arrangements for houses and buildings, and of the various apparatus employed, and the reasons for employing different arrangements under different circumstances. That the book is devoted almost entirely to his own system as employed in houses, public buildings, and railway carriages, is, perhaps, a matter for complaint, as the title of the book does suggest a general treatment of the subject, but Mr. Banner's success in ventilating buildings, and in their sanitary appliances, is sufficiently well known to enable us to forgive this to a considerable extent, and to make it unnecessary to say more of his book.

TANGYE'S VERTICAL ENGINE FOR ELECTRIC LIGHT PURPOSES.

THE extension of electric lighting, even where the necessary power must be obtained by means of steam, has stimulated many engine makers to make engines more or less specially suited to this requirement, although many that have been brought out and said to be for that purpose differ in no respect from the engines previously sent out by the same people. We illustrate herewith an engine which has been lately designed by Messrs. Tangye Bros. for this purpose, and it will be seen to differ from those commonly made by this well-known firm. In our engravings, Fig. 1 shows front elevation, Fig. 2 side elevation, and Fig. 3 plan of this vertical engine. The steam cylinder is 12in. diameter, with a stroke of 18in., steam jacketted, and fitted with Meyer's expansion plates made adjustable outside the cylinder from nothing to three-fourths of the stroke. The cylinder is bolted to a massive standard secured to bed-plate, and to secure complete rigidity there are also two bright wrought iron columns in the front to prevent vibration. The crosshead is of wrought iron of the slipper form, with gun-metal shoe. The connecting rod is of the marine engine type, with large lubricators cast on the brasses.

The crank shaft is of wrought iron, with bearings 4½in. diameter by 10in. long fitted in blocks cast on the bed-plate. The feed pump is placed on the side and worked by a separate excentric. The governor is shown in Figs. 4 and 5. It is constructed in accordance with Messrs. Tangye's patent, and is made to ensure the steadiness and accuracy so necessary for dynamo machines. The spring for the counterbalance is placed in tension instead of compression as formerly done, so that any friction that might be caused by the spring rubbing against the sides of the sleeve is avoided. The stuffing-box for the valve spindle is now entirely dispensed with, and in its place there is a brass box screwed in, Figs. 6 and 7, through the lower part of which the valve spindle A fits in, and is raised or lowered by the lever A' working in the bush B. This is made an accurate fit, and the steam joint is made by a V on the spindle working against the bush. For altering the speed of the engine whilst running—see Fig. 1—a wrought iron lever C is fitted, with one end attached to a revolving collar on the governor spindle, and on the other end an adjustable weight D is fixed. A still further alteration in speed can be obtained by altering the tension of the spring E, Fig. 4. The cylinder is lagged with sheet steel. One of these engines has just been sent to Ragoon for working machines for electric light, and for this purpose they seem to be specially designed and well adapted.

TENDERS.

ERDINGTON SEWERAGE WORKS.

E. PRITCHARD, engineer, 27, Great George-street, Westminster, S.W., and 37, Waterloo-street, Birmingham. Quantities by E. J. Purnell, Coventry.

CONTRACT NO. 1.—CAST IRON, EARTHENWARE AND BRICK SEWERS, AND OTHER WORKS.

	£	s.	d.
Nelson and Co., York	15,144	0	0
Smith, J. M., Westminster	14,600	0	0
Cowdery, G., and Sons, Newent, Gloucester	14,401	7	0
Fotherby and Son, Burnley	13,996	3	10
Hill Bros., Beckenham	13,405	0	0
Jevons, John, Dudley	13,284	6	7
Pickthall, J. M., Bromsgrove	13,110	0	0
Fell, John, Leamington	12,900	0	0
Holland, W. M., Leicester	12,822	0	0
Hilton, H., Birmingham	12,730	0	0
Currall and Lewis, Birmingham	12,378	0	0
Palmer, A., Birmingham	12,194	0	0
Law, G., Kidderminster—accepted	11,993	0	0
Engineer's estimate	13,000	0	0

TRIAL OF THE S.S. SAINT RONANS.—This vessel, which hast just been completed by Earle's Shipbuilding and Engineering Company, Limited, Hull, for Messrs. Rankin, Gilmour, and Co., of Liverpool, left Hull on Saturday last for London. She is 4484 tons gross, and 2951 tons net. Her length over all is 416ft., and she has a total carrying capacity of 5100 tons. The engines, which were also constructed by Earle's Company, are 500 nominal horse-power, and steam is supplied, at a working pressure of 90 lb., by three double-ended steel boilers, each having four furnaces, 4ft. diameter. The vessel was put on the measured mile at Withernsea, and the average speed was 12½ knots, with fifty-six revolutions, and an indicated horse-power of 2400.

THE INTERNATIONAL ELECTRIC EXHIBITION.—The directors of the Crystal Palace have appointed the following twenty-one British jurymen:—Captain F. W. Abney, R.E., F.R.S., Professor W. Grylls Adams, F.R.S., Major R. F. Armstrong, R.E., Professor W. E. Ayrton, F.R.S., Mr. Shelford Bidwell, Sir S. Canning, Professor R. B. Clifton, M.A., F.R.S., Mr. T. R. Crampton, C.E., Mr. Horace Darwin, Professor G. Carey Foster, F.R.S., Professor E. Frankland, F.R.S., Captain Douglas Galton, C.B., F.R.S., F.R.G.S., F.G.S., F.L.S., D.C.L., Lieutenant-Colonel W. Haywood, Dr. J. Hopkinson, F.R.S., Professor D. E. Hughes, F.R.S., Professor Fleeming Jenkin, F.R.S., S.L. and E., M.I.C.E., Professor J. W. Keats, Mr. W. H. Preece, F.R.S., Professor Silvanus Thompson, B.A., D. Sc., Mr. C. E. Spagnoletti, C.E., and Lieutenant-Colonel Webber, R.E., President Society of Telegraph Engineers. The first meeting of the British section of the jury was held at the Crystal Palace on Tuesday evening, when nearly all the jurymen were present. Some of the foreigners who have been asked to act on the jury have already accepted, and the names of the foreign jurymen will be announced as soon as the list is complete.

SEWERAGE OF NORTHFIELD AND KING'S NORTON.—Mr. J. Thornhill Harrison, C.E., inspector for the Local Government Board, attended on the 14th inst. at the Grand Hotel to hold the adjourned inquiry touching an application by the King's Norton Rural Sanitary Authority, for a Provisional Order to enable them to acquire compulsorily certain lands needed for the purposes of the Northfield sewerage scheme. At the opening of the inquiry on February 24th a scheme was submitted on behalf of the Rural Sanitary Authority providing for the drainage of Northfield only, at a cost of £2910, or £1485 exclusive of the cost of land. It was, however, contended in opposition that the more desirable way of providing for the sewerage of the district was to combine Northfield, King's Norton, and Lifford in one scheme, and eventually the inquiry was adjourned in order that the representatives of the Rural Sanitary Authority might take the alternative scheme into consideration. Mr. Herbert now informed the inspector that since the adjournment his clients had fully considered the alternative scheme prepared by Mr. Edward Pritchard, C.E., and also the suggestions thrown out by him—the inspector—on the previous occasion, and they had come to the conclusion to withdraw their present application to the Local Government Board for a Provisional Order in reference to their original scheme. The alternative scheme provides for the sewerage of Northfield, King's Norton town, King's Norton station district, and Lifford, at a cost, exclusive of the cost of land, of £4000. The piece of land indicated in the plans is stated to be available for purchase without compulsory powers being resorted to. Whilst the original scheme provided for a population of a few hundreds only, the one now described would be sufficient for an ultimate population of 28,000; all that would be necessary to extend its capabilities being the acquirement of additional land at the Lifford outfall as required. Intermittent filtration will be the system adopted. The inspector, before closing the inquiry, said there was no doubt the alternative scheme was the preferable one, and he advised the Rural Sanitary Authority to lose no time in acquiring the land offered for outfall works without compulsory powers.

CRYSTAL PALACE ELECTRICAL EXHIBITION.

No. V.

Among the minor exhibits at the Palace are some very interesting and ingenious contrivances. Thus Mr. Macdonald shows his Holophote Course Indicator, Figs. 1 and 2, which may prove very useful on board ship. It consists of an electric lamp A, Fig. 1, with a reflector B, set on a movable handle C C. This handle is held fast by two detents D D′, while the rudder is amidships. When the helm is put to port, an electric circuit is established through the electro-magnet

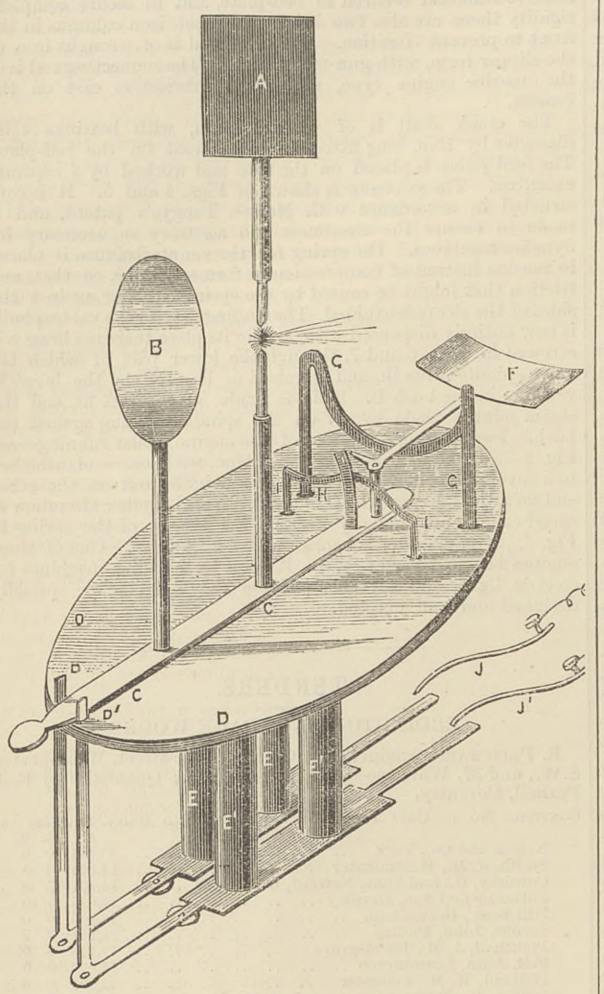


FIG. 1.

E E, by which the detent D is drawn downwards, and the handle C C set free to move, so that the reflector B can swing round, and the light be made to wave to starboard. As the handle swings round, the screen F is forced upwards by the curved bar G G, and the pointed inner end of the arm on which the screen F is pivotted pushes back the spring H, and drops into a slot in the top of

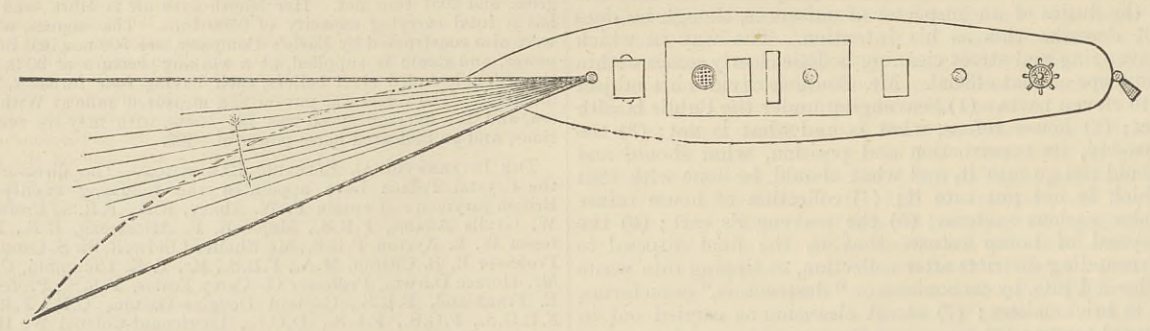


FIG. 2.

the spring, which thus holds the screen upright and shuts out the light. The handle is then moved to its original position, when the spring H being pressed back by the bar I I, the point of the arm carrying the screen F is set free, and F, falling down, exposes the light again. What we have said about the detent D answers also for D′, which is pulled down by the electro-magnets E′ E′. The operation indicated of releasing the detent D and swinging the light to starboard, or releasing D′ and swinging it to the opposite quarter, can be carried on indefinitely. Fig. 2 shows the light streaming in one direction. It will be seen that by such means as is here shown the course of a vessel and every action of her helm can be shown to those who are on the look-out.

The new secondary battery, of which a good deal has been published without stating by whom it was made or invented or what it was like, was exhibited and shown in operation to the Prince and Princess of Wales on Saturday, in the Alhambra Courts of the Crystal Palace, by the Electrical Power Storage Company, of 74, Hatton-garden. The battery is the result of the labours of several inventors, amongst whom are Mr. E. Volckmar, Mr. Sellon, and Mr. Swan, and it is, it need hardly be said, entirely different in construction from the Faure battery, of which so much has been heard and comparatively little seen. For the purpose of the display, the Alhambra Court is richly furnished in the Moorish style, and electric chandeliers or candelabra have been specially designed by Mr. Johnson, a pupil of the late Owen Jones. Of the design of these fixtures and fittings we can only say that they must be seen to be appreciated. Altogether they carry 201 incandescent lamps, all of which are connected up to 33 of the new batteries out of 38 at present in an enclosed space next the engine and machine shed of the Brush Corporation. The 33 are connected up to a switch-board in such a way that the current from any number from about 10 to 33 may be put in circuit by simply turning the switch handle, and thus anything from a very dim to a very bright light may be used as required.

The cells each contain twelve elements, each about 20in. by 15in., and about $\frac{5}{16}$in. in thickness, and placed in a box of about 25in. by 16in. by 7in., the whole weighing about 370 lb., and containing about 295 lb. of metallic material. Each cell stores electric energy equivalent to about 5-horse power for one hour, which can be used at the rate of fully 40 ampéres per horse-power, or say 200 ampéres. The plates are closely perforated with holes about $\frac{1}{2}$in. diameter, the holes being afterwards filled with a composition, the exact nature of which we are not yet at liberty to make known, further than to say that it is such that it expands when the plates are first polarised, and thus finds itself under a pressure sufficient to cause a considerable superficial extension of the positive plate. Perfect metallic contact between the composition and the material of the plates is thus permanently ensured, so that the plates cannot become inactive by local action or by deposit of a salt of lead between the composition and the walls of its containing holes forming a solid mass of alloy. The plates are strong and are maintained at a very short distance apart by splines of wood, and stand with their longest dimension vertical. They are connected up to a plate on the top of the cell in a very simple way, the whole producing a perfectly satisfactory, efficient, and practical battery, having neither of the chief faults of the Faure battery.

From the figures we have given, and to which we shall add on an early occasion, it will be seen that the weight of the battery per one hour horse-power is about 60 lb. of metallic composition. To give off 400-horse power for one hour or 200-horse power for two hours would thus require about 10 tons of batteries, and for the 201 Lane-Fox lights in circuit on Saturday, a little over $4\frac{1}{2}$ tons were coupled up.

The Lane-Fox lamps are 20-candle power pushed to 30-candle power, so that the weight of battery coupled up was 1·65 lb. per candle, or 50·14 lb. per 30-hour candles.

It is generally acknowledged by electricians that without a satisfactory secondary battery domestic electric lighting cannot become general. This is not, however, confined to domestic lighting, but applies to lighting public buildings and to many other applications of electricity. Something must be had which in an electric lighting system, or in an electromotive power system, will take the place represented by the gasometer in the gas-lighting system and by the accumulator in a hydraulic power system. The battery which will do this is now provided, and the application of electric currents will probably make more rapid advance from this time than it has done even within the past three years. The new battery may be made to meet any requirements. It may be of small size to go into the place of the gas meter in a house, or in large masonry tanks for extensive public buildings; and it will probably be made to fill very large tanks at central electric lighting and power-generating stations, so that smaller engines running continually may take the place of large engines running as at present only during the hours that lights are required. It will be possible to obtain a light or work an electric motor at any time by one movement of a handle, and the batteries will probably, in some cases, constitute the moter for domestic lighting. One of each pair of the elements or plates will last almost indefinitely, while the other will only require renewal when constantly in use about once in, say, fifteen months, as far as can at present be seen, and they may turn out to be made more durable. They are easily renewed, and the batteries require no attention whatever, except for a little filling up at long intervals of the acidulated water in which the plates are immersed.

The lamps were nominally 20-candle power, pushed to 30-candle power, the total candle power being 6030 candles.

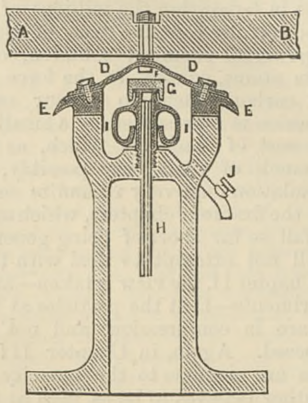
The following approximate particulars may be given of these lamps:—

No. of lamp.	Luminous surface, square inches.	Candle-power.	Resistance, hot, ohms.	Current, ampéres.
A	0·157	20	38·2	1·6
B	0·102	12	38·0	1·2
C	0·157	20	20·5	2·25
D	0·102	12	62·0	1·00

ELECTRIC RAILWAYS.

ON Friday, the 24th inst., Professor W. E. Ayrton, F.R.S., gave a lecture on electric railways. He briefly reviewed the history of the various modes of propulsion on railways down to Colonel Beaumont's air engines and Siemens' and Edison's electric engines. He then gave a full account of the electric railway system devised by Professor Perry and himself, to overcome the objections particularly as to conductors which belong to the hitherto tried systems. Instead of supplying electricity to one very long, perhaps imperfectly insulated rail, they lay by the side of the railway line a well insulated cable, which conveys the main current. The rail, which is rubbed by the moving train, and which supplies it with electric energy, is divided into a number of sections, each fairly well insulated from its neighbour and from the ground; but at any moment only that section or sections, which is in the immediate neighbourhood of the train is connected with the main cable, the connection being made automatically with the moving train. The loss of power by leakage is very much lessened. For the purpose of automatically making connection between the main well-insulated cable and the rubbed rail in the neighbourhood of the moving train they have devised the apparatus shown in the following figure.

FIG. 1

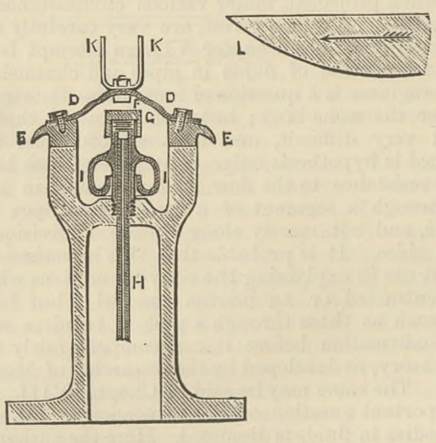


A B is a copper or other metallic rod resting on the top of and fastened to a corrugated tempered steel disc, D D—of the nature of, but of course immensely stronger than, the corrugated top of the vacuum box of an aneroid barometer—and which is carried by and fastened to a thick ring, E E, made of ebonite or other insulating material. The ebonite ring is itself screwed to the circular cast iron box, which latter is fastened to the ordinary railway sleepers or buried with only the top above ground. The auxiliary rail A B and the corrugated steel discs D D have sufficient flexibility that two or more of the latter are simultaneously depressed by an insulated collecting brush or roller carried by one or by all of the carriages. Depressing any of the corrugated steel discs brings the stud F, which is electrically connected with the rod A B, into contacct with the stud G, electrically connected with the well-insulated cable.

As only a short piece of the auxiliary rail A D is at any moment in connection with the main cable, the insulation of the ebonite ring E E will be sufficient even in wet weather, but the insulation of G, which is permanently in connection with the main cable, must be far better. The gutta-percha or india-rubber covered wire coming from the main cable, is led through the centre of a specially-formed telegraph insulator, and causes it to adhere to the inside of the earthenware tube forming the stalk; and as the inside of each contact box is dry, a very perfect insulation is maintained.

The existence of these contact boxes at every 20ft. to 50ft. also enables the train to record its position graphically at any moment on a map hanging up at the terminus, or in a signal-box or elsewhere, by a shadow which creeps along the map of the line as the train advances, stops when the train stops, and backs when the train backs. This is effected thus:—As the train passes along, not only is the main contact between F and G automatically made, as already described, but an auxiliary contact is also completed by the depression of the lid of the contact box, and which has the effect of putting, at each contact box in succession, an earth fault on an insulated thin auxiliary wire running by the side of the line. And thus the moving position of the earth fault—that is, the position of the train itself—is automatically recorded by the pointer of a galvanometer moving behind a screen or map, in which is cut out a slit representing by its shape and length the section of the line on which the train is, as shown in Fig. 2. In addition, then, to the small sections of 20ft. or

FIG. 2

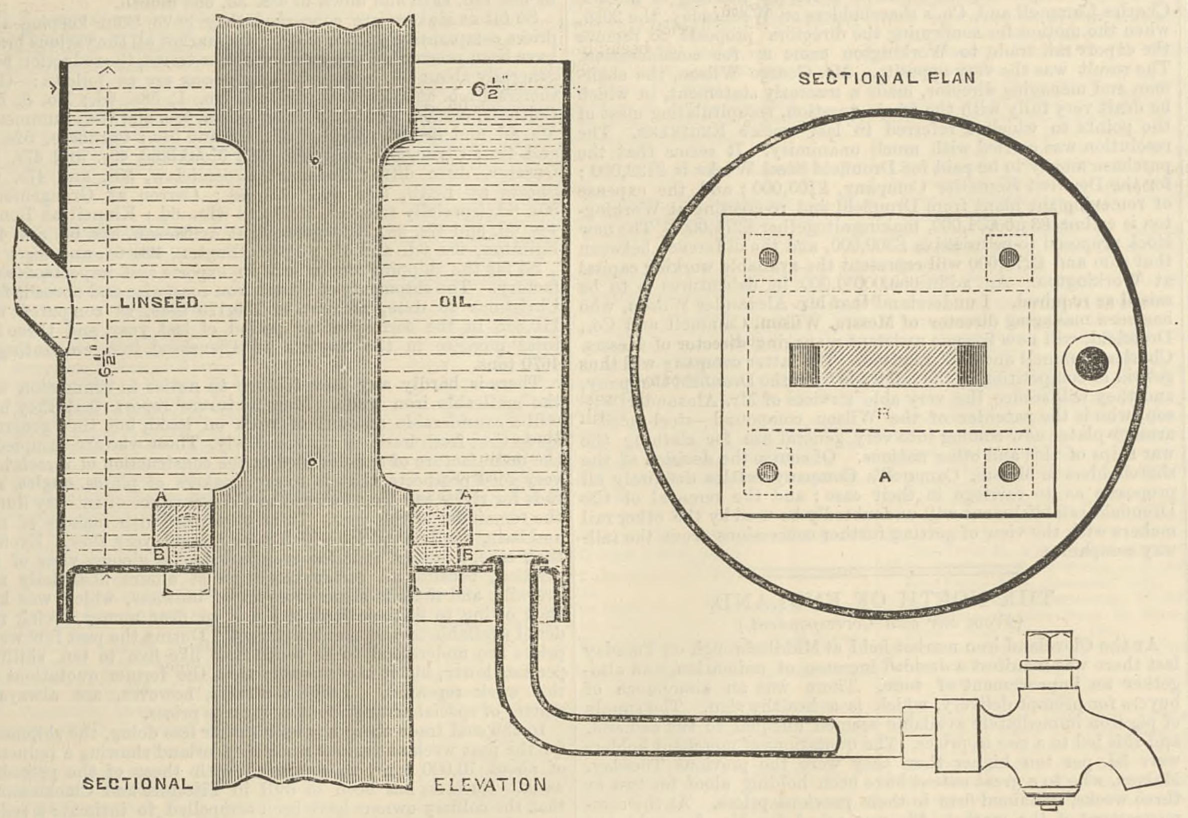


more into which the auxiliary rubbed rail is electrically divided, there would be certain long blocked sections one mile or several miles in length, for each of which on the map a separate galvanometer and pointer would be provided.

A model was exhibited divided into four sections, and it was shown by current detectors that as the train runs either way it puts current into the section just entered, and takes off current from ths section just left. The train not only takes off current from the section A when it is just leaving it, and entering section B, but no following train entering section A can receive current or motive power until the preceding train has entered section C. When a train runs on to a blocked section it is quickly pulled up, because it is not only deprived of all motive power, but is powerfully braked, and when the current is cut off from a section the insulated and non-insulated rail of that section are automatically connected together, so that when the train runs on to a blocked section the electromotor becomes a generator short circuited on itself, producing, therefore, a powerful current which rapidly pulls up the dynamo-electric engine.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending March 25th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9332; mercantile marine, building materials, and other collections, 3091. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 5 p.m., Museum, 1455; mercantile marine, building materials, and other collections, 255. Total, 14,133. Average of corresponding week in former years, 16,212. Total from the opening of the Museum, 20,809,782.

APPARATUS FOR TESTING HEATED STEEL.



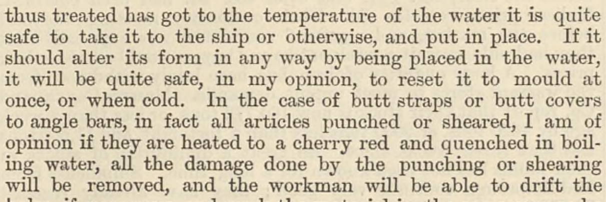
SOME very important experiments on the influence of temperature on iron and steel have been carried out by the Admiralty at the Cyclops Works, Sheffield, and Mr. T. F. Barnaby's report to the Controller of the Navy on these experiments has just been issued. The testing apparatus is illustrated by the accompanying engraving, which explains itself. Mr. Barnaby says :—By the kind permission of Messrs. C. Cammell and Co., John Brown and Co., and the Bolton Iron and Steel Co., I have been able to make tests on steel made both by the Siemens and Bessemer processes, and on iron of B. B. Boiler and Bowling quality. I have enclosed a sketch to show how the samples were heated and broken in oil or sand at the Bolton Works. I have endeavoured to be as accurate as possible in determining the various temperatures, and when not able to do so with a Fahrenheit thermometer which registered to 600 deg., I have taken the colour visible on the fractures of the samples as a means of determining temperatures in accordance with tables given by Mr. J. S. Jeans in his work "On Steel," *vide* page 615 ; and by Mr. D. K. Clark, in his "Tables for Engineers ;" and others. The tests, &c., which I have made, although done with care, are only comparative, and I am of opinion that with specially designed apparatus much valuable information may be obtained by further experiments and tests, which I think would quite dispel any fear that may exist in the minds of engineers and others as to the use of—properly manipulated—mild steel for boilers, &c.—*vide* page 41 of "Experiments on Steel" issued for the information of Board of Trade surveyors, with the remarks of the engineer surveyor-in-chief and his assistants. "The plates of superheaters, when enclosed wholly or partly in the uptakes, are often heated to a temperature equal or exceeding that which has been found to affect the steel so prejudicially, and in the absence of a full series of experiments to ascertain the exact loss of the tensile or crushing resistance it is prudent either to dispense with such structures, or efficiently protect them by shield plates from the contact of flame or hot gases." I beg further to state that I have other tests in hand which will range from the ordinary temperature of the atmosphere up to 400 deg. or 430 deg., as most of the samples shown are above these temperatures. I am, therefore, of opinion that, from the nature of the results of these experiments, there need be no fear with respect to the use of steel for boilers, or where it may be affected by heat, but that it can be used with all confidence, as the tests, so far as I have been able to go, prove that Bessemer steel heated to about 400 deg. is about 10 tons per square inch stronger than when in its normal state, while but one-third only of its ductility is lost, heat does not seem to affect steel made by the Siemens process to the same extent in tensile strength as it does Bessemer, but the elongation is affected to a like degree. This increase in strain and decrease in ductility is maintained more or less up to 600 deg.; beyond this temperature it requires further experiments before any conclusions can be arrived at, as at 880 deg. or at a very dark red only visible in the dark there is a great drop in tensile strength, but the ductility is still above the percentage required. With respect to B. B. iron or that of Bowling quality it will be seen that there is a rise of about three to four tons per square inch in the tensile strain, and a loss of one-fourth to one-half the ductility. This report is dated October 1st, 1881, and is accompanied by several tables.

On Oct. 13th, Mr. Barnaby reported again to the Controller on a series of tests he had made upon mild steel of the quality supplied to the dockyards by Messrs. Charles Cammell and Co., John Brown and Co., and the Bolton Iron and Steel Company. "I have made," he writes, "these experiments and tests to ascertain if possible the quickest and best method of treating steel after it has been in the hands of the shipwright or smith and has been heated any number of times, to work the material to the forms required, as well as to show what in my opinion is a safe and quick method of dealing with butt straps and butt covers to angles which have been punched, and, in fact, in all small jobs done to steel by the shipwright or smith at the fire or punching machine, and beg most respectfully to state that from the nature of the tests I have made, and the results obtained, I am of opinion that it is quite safe in all cases after the steel has been punched, sheared, or heated and worked to forms such as joggles and corners for watertight work, &c., for the workman to heat it gently over the part he has been working to a bright cherry-red heat, and then quench it in boiling water or oil, which has the effect of toughening the material, and does not make it in any way brittle or unsafe, while at the same time the ductility is only affected to a very slight degree, and further the quenching in boiling water has the effect of removing all scale from the material. As soon as the article or material thus treated has got to the temperature of the water it is quite safe to take it to the ship or otherwise, and put in place. If it should alter its form in any way by being placed in the water, it will be quite safe, in my opinion, to reset it to mould at once, or when cold. In the case of butt straps or butt covers to angle bars, in fact all articles punched or sheared, I am of opinion if they are heated to a cherry red and quenched in boiling water, all the damage done by the punching or shearing will be removed, and the workman will be able to drift the holes, if necessary, and work the material in the same way as he would if it had been annealed. The samples tested prove that the material is not much injured by the heating and working, providing it be done with ordinary care. In one case I have taken a soft Bessemer plate, and in the other a Siemens just above the prescribed strain, and find that the samples after all the work described has been put on them, and they have been broken in the testing machine, that the pieces may be punched and will stand bending, even across the parts which have been worked, to the extent required for plates of their thickness, and at the same time will stand punching and bending across the holes in a satisfactory manner. All samples which have been quenched in boiling water after the holes have been punched, have been closed, or bent to 180 deg. across the holes without a sign of fracture ; others have stood drifting cold (after being drilled) to twice the size of the original holes before fracture. I have also made tests on angle bars, beams, &c., and find that forge tests made after quenching in boiling water are equal to those made after annealing. I beg further to state it is my experience after bending over 100,000 shearings that even the quenching in cold water removes the damage done in shearing, and pieces which would not bend cold without planing have bent freely to the required curves after being quenched in cold water, but by the use of boiling water far better results are obtained. It will be seen that if the material can be treated in this way, there is a great gain both in time, labour, and expense, at the same time the scale is removed, and the material retains its good properties, viz., strength and ductility."

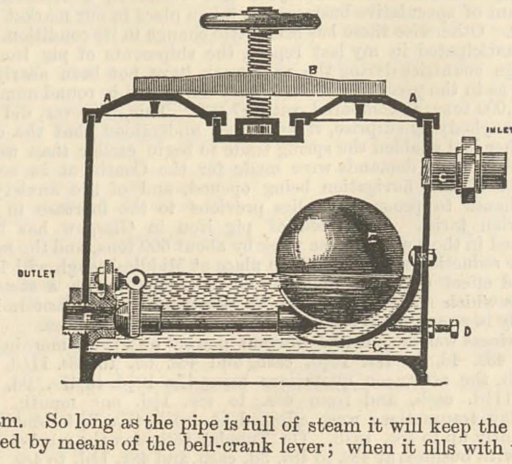
It will be seen that these experiments contradict a Government report issued last year which went to show that comparatively low temperatures steel became quite brittle and unsafe. How the two reports are to be reconciled it is for the authorities to say.

THE "LANCASTER" EXPANSION TRAP.

WE illustrate below an expansion trap for getting rid of condensed steam, patented by Messrs. Lancaster and Tonge, Pendleton, Manchester. The first trap is based upon the fact that



metals under the influence of heat or cold expand or contract. The water of condensation is colder than the steam, therefore a pipe containing condensed water is shorter than when filled with



steam. So long as the pipe is full of steam it will keep the valve closed by means of the bell-crank lever; when it fills with water which is colder than the steam it contracts in length, and the valve opens. The second engraving explains itself. These are excellent traps.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—An exceedingly quiet tone has prevailed all through the week in the iron market here. To some extent no doubt operations are being restricted, owing to the close of the quarter, but a more substantial reason for the present absence of inquiry is to be found in the fact that many of the consumers have iron still to come in, which will see them over the next three months, and there is no disposition to speculate forward at current prices. Makers, both of pig and finished iron, although mostly still well employed, are working off old orders much more rapidly than they are being replaced, and the prospect of a large portion of the output having to come upon the market before long is encouraging "bear" operations to a considerable extent.

There was a very flat market at Manchester on Tuesday, and so far as prices could be tested by the limited amount of business doing, the tendency was decidedly in a downward direction. There were a few orders stirring, but these had to be taken at very low figures, and district brands of pig iron especially were to be bought at figures very much under those which were being asked a short time back. Lancashire makers were more open to offers, and would now sell readily at 48s. to 49s., less 2½ for forge and foundry qualities delivered equal to Manchester, but they can do comparatively little or no new business, and stocks are beginning to accumulate at the works. In Lincolnshire iron there have been sellers at under 47s. per ton, less 2½, and of Derbyshire at as low as 47s. 6d. to 48s., less 2½ delivered equal to Manchester, but makers who have fair deliveries yet in hand are asking considerably above these figures. Middlesbrough iron is nominally quoted at about 51s. 4d. per ton net cash, delivered equal to Manchester, but merchants are open to book at 1s. per ton under this figure.

For finished iron there is only a limited amount of inquiry at present coming into the market, and it seems to be a matter of waiting on the part of makers who are working off orders before giving way in their quotations on the one side, and merchants who are holding back their orders for shipment next month with a view of breaking down prices on the other. The local forges, as a rule, are still kept well employed, and the quotations of the leading makers remain at £7 per ton for bars delivered equal to Manchester, but it would be difficult to secure new orders at a higher figure than £6 12s. 6d., and in some cases local makers are quoting as low as £6 15s. per ton.

There is no material change to notice in the condition of the engineering branches of trade, which continue mostly well employed, all departments connected with iron shipbuilding being still very busy. Wheelwrights have plenty of work in hand, and merchants report an improvement in the number of local orders giving out, which is due, no doubt, to orders for machinery required for filling the new mills in course of erection in the district, now being placed in the market.

The Manchester Smoke Abatement Exhibition may now be considered to have got fairly into full working order, and so far it has had a very fair number of visitors. The collection of mechanical stokers and the various types of fire-bars, most of which, however, were shown in London, is the chief feature of the industrial section, and the general impression they give is that great improvement, both as regards strength of construction and adaptability to the purpose for which they are designed, has been effected since the last exhibition of similar apparatus in Manchester. It is, of course, unnecessary to go into details with regard to the great bulk of the exhibits, and I can only select out one or two here and there which are actual novelties, or are being shown for the first time in public. Amongst these are a couple of exhibits by Messrs. W. H. Bailey and Co., of Salford, which have attracted some attention. One is an adaptation of the Lakeman vertical hot-air engine, to be worked by a Bunsen gas burner, and which they term their "Bee" motor. The engine in its construction consists of an open cylinder passing through an outer casing containing cold water, whilst the bottom of the cylinder is kept constantly heated by the burner underneath. Within the cylinder is a double piston with alternate action, one piston rising whilst the other acts as a plunger, driving the air, after being cooled by coming in contact with the jacket of cold water, back to the bottom hot-plate, where it is again heated, and this alternate expansion and contraction of the air gives the motive power to the engine. The one shown is only a small engine of 1000ft. lbs. power, consuming 4ft. of gas per hour, but larger engines are made on the same principle up to 5 and 6-horse power. The other exhibit is a new filter, specially designed for boilers, which is termed the "Nile" high-pressure, horizontal, adjustable, self-cleansing filter. This consists of a cylinder containing two filters, which are composed of coarse grain animal charcoal, compressed together between two perforated iron plates. The water is admitted through a branch at the back of the filter, and comes out between the two filters. The self-cleansing is effected by the pressure of the pump, which injects the water into the boiler, and which, when the plates become clogged with dirt, forces open a valve and drives the water across the plates. The filter can also be cleaned at any moment by opening a valve. I shall refer briefly to one or two other specialities in the exhibition in the course of my future "Notes."

The coal trade continues as depressed as ever, and the short spell of cold weather has had no very appreciable effect upon the market. With the exception of the best qualities of slack, all descriptions of fuel are more or less of a drug in the market, and very few of the Lancashire collieries are running more than three to four days a week. Although nominally no announced reduction in prices is being made with the close of the month, there is so much stock lying under load in wagons which is being forced for sale at under current rates, that prices are to a large extent regulated more by what buyers are prepared to offer than by the list rates. At the pit mouth the average quoted prices remain at about 8s. 6d. to 9s. for best coals, 6s. to 7s. for seconds, 5s. to 5s. 6d. for common coal, 3s. 9d. to 4s. 3d. for good slack, and 3s. to 3s. 3d. for inferior sorts.

The shipping trade is extremely dull, and there are very heavy stocks lying at both the Garston Docks and at the high level, Liverpool. To secure orders sellers have to quote exceedingly low, and delivered either at Garston or Liverpool, common Lancashire steam coal can be bought at 6s. 6d. to 6s. 9d., and best sorts 7s. to 7s. 3d. per ton.

The demand for local-made coke for iron making and other manufacturing purposes continues fairly good at about 9s. to 10s. for common up to 12s. 6d. and 13s. for best qualities at the ovens.

Barrow.—The position of the hematite pig iron market, so far as I am able to judge, has not undergone any change for the better, nor are there any signs which can be considered hopeful or as indicating any great renewal in the active demand. In every quarter there is a dull feeling ; and the enquiry on foreign account shows unmistakable signs of being even quieter than has yet been the case. This applies to America particularly, but any energy in the demand from this quarter is out of the question so long as prices remain at the present low rates prevailing there, and which have a tendency to go still lower. On home account the demand, I am afraid, is very unsatisfactory, and shows more weakness than for some time back. Furnaces are actively engaged in a large output of metal, but stocks, which have accumulated somewhat largely of late, have not increased within the past week or so. A larger amount of iron is being shipped, and as the contracts still remaining on makers' books are large, the furnaces are likely to be kept pretty well employed during the greater part of the year. Prices are again down, Nos. 1, 2, and 3 mixed samples being quoted at 56s. 6d. as compared with 57s. 6d. to 58s. last week. Although the steel mills are in full activity, the demand, I believe, is somewhat quieter. Quotations are unchanged. In the Barrow district new machinery has been put down with a view of facilitating and increasing the output of blooms. In the same district, steel for tin-plate purposes is being produced on a pretty large scale. Iron shipbuilders are in a slightly better position, having booked one or two orders. Other industries unchanged. Iron ore in good demand at from 14s. to 16s. per ton at the mines. Shipping fairly active.

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

(*From our own Correspondent.*)

MOST finished ironmakers on 'Change in Birmingham to-day—Thursday—and in Wolverhampton yesterday were open to accept orders with the condition of immediate delivery. Such work might have been placed at less money than for some time past; but there was only little of it to be secured. Most local consumers have supplied their needs to cover the quarterly meetings which begin in Wolverhampton on the 12th April. No one, except a few buyers in the London market, seems to think that the marked bar firms will at these me tings take off the 10s. per ton which was last put on. The leading firms stoutly demanded £7 10s. for marked bars, while Earl Dudley still quoted £8 2s. 6d. for his lowest quality, £9 10s. for his best, £11 for his double best, and £13 for his treble best.

For the bars of Messrs. John Bagnall and Sons, Limited, £7 10s. was required to-day. Turning and shoeing bars were the same figure, but plating and angle bars were £8, and best rivet iron was £9. As much as £8 was asked for this company's hoops up to 19 w.g. Their singles were named as high as £9; doubles, £10 10s.; and latens, £12; but at these figures nothing was done in either hoops or sheets.

Sheets suitable for galvanising were not difficult to buy from the majority of the firms at from £8 5s. down to £8 for singles, £9 10s. for doubles, and within £11 for trebles.

There is a new local demand for sheets, intended for export to the United States. The Anglo-American Company, which is making roofing shingles in Wolverhampton, has now introduced to that town machinery for cutting out sheets into shapes suitable for use in the making of coal vases, pails, and stove shovels. Thus outlined, the sheets have not to pay the duty on the other side which would be carried by the scrap inseparable from the cutting up of a sheet as it leaves the mill, while from the scrap the ears of the pails are shaped and the holes punched at the same operation. The saving of duty and the much lower original cost of the iron on this side makes it much more profitable for the company to carry on in England that part of its operations described than in the United States. It has therefore sent over all its shaping machinery, and quite apart from its shingle branch it will use up 25 tons of sheets per week.

Galvanised sheets were offered in Wolverhampton and Birmingham under the association price of £15 for 24 w g. in bundles in London; but some makers still refused to sell at less than that figure.

Hoops were in slack request, whether for home or for export, and prices favoured buyers.

A slightly better demand was experienced for some boiler-plates in preparation for the activity in boiler-mending during the Easter holidays.

Angles and girder bridge plates were selling a little, and there were inquiries by engineers who desire to tender for contracts that are open. Makers would not, however, quote long forward.

For iron roof work leading engineers were asking £12 per ton and upwards, and for iron rivetted girders £12 10s. per ton on to truck at the makers' yards.

Galvanised roofing work is in fair request for London and the provinces, for Australia and for India, and the prospects are encouraging.

Nail strip is doing a little better. Some mills have got back orders that had left this part of the kingdom. The strips are for shipment to the East.

A steady adoption of the Casson gas-heating furnace is noticeable.

Pigs are quiet, most consumers having bought forward. Prices are no stronger on the week. They are unfavourably affected by the attempts by middle-men to realise. This is most seen in respect of hematites, which by the agents were, both yesterday and to-day, quoted firm at nothing under 70s. for Barrow, and 72s. 6d. for Tredegar samples. To-day consumers withdrew offers they made a week ago. Derbyshire pigs were quoted 52s. 6d. for Stanton and 50s, for Staveley. All-mine was quoted £3 7s. 6d. to £3 10s.; and part-mine £2 17s. 6d. to £3; but transactions were few.

The important question of Government contracts has been again debated, with prospective advantage as well to the Government as to the manufacturers of South Staffordshire, who will not now find it necessary to go to Birmingham to inspect samples. Mr. Collett has promised to have samples of Admiralty requirements deposited in Wolverhampton.

Coal keeps abundant and cheap, but large lots cannot be got at current rates.

There is no diminution in the prospects affecting the development of thick coal beneath the new red sandstone, between the edge of the old Staffordshire district and the Warwickshire coalfield. The Hamstead Colliery Company, which is working the adjoining property to the Sandwell Park Company, is still sinking its second shaft. At its seventh annual meeting just held, it was announced that the second shaft has now reached a depth of 418 yards, but it has yet to go 193 yards before it reaches the top of the thick coal. Whilst the company has been taking down its second—or No. 2—shaft, it has been working out of its No. 1 shaft; and it announces that the north-east road has been continued for a distance of 432 yards, and a new parallel road driven 310 yards. The coal is throughout regular, of good quality, and a uniform thickness of 24ft.

The Corporation of Walsall are contemplating an expenditure of some £65,000 for certain public improvements. Sewage purification works have been planned which will cost £50,000, and a stone-yard is required, the erection of which will consume some £2000. The rateable value of the district affected by these improvements is a little over £150,000. A Local Government inquiry is being held on application for the necessary loans.

The Corporation of Saltley has just increased the loan for sewage works to nearly £26,000, by obtaining a grant of £8500.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE directors of the Midland Ra.lway Company, I hear, are now trying to meet the Dronfield Steel Works proprietors—Messrs. Wilson, Cammell, and Co., Limited—in the matter of carriage. They may well do so, for the loss, even to a company of such proportions as the Midland Company, must be serious. I am told that for the six months ending February last there were 63,000 tons of rails sent from Dronfield station, and 60,000 tons of pig iron brought to Dronfield by rail. The carriage of rails to the coast is about 10s. per ton, which accounts for £31,500 in one sum; the raw material is about 8s. per ton, which makes another £24,000—£55,500 in all. These figures allow nothing for coals and other items. It is admitted, however, on all hands that the railway companies, in all such cases, cannot possibly reduce the carriage sufficiently low to compensate for the disadvantage of producing rails at Sheffield, instead of at the coast. The removal of the Dronfield establishment to Workington is inevitable; the point is whether this migration of the rail trade will stop here. The fear is generally expressed that firms who remain in the Sheffield district must generally relinquish the export rail trade, and devote themselves to the home business. The difference of 18s. per ton in carriage both ways is regarded as insurmountable in many quarters, though, to tell the truth, several rail makers with whom I have spoken do not think so, and deprecate the present movement coastwards.

It was anticipated there would be a stormy meeting of Messrs. Charles Cammell and Co.'s shareholders on Wednesday, the 29th, when the motion for confirming the directors' proposal to remove the export rail trade to Workington came up for consideration. The result was the very opposite. Mr. George Wilson, the chairman and managing director, made a masterly statement, in which he dealt very fully with the whole question, recapitulating most of the points to which I referred in last week's ENGINEER. The resolution was carried with much unanimity. It seems that the purchase money to be paid for Dronfield Steel Works is £132,000; for the Derwent Hematite Company, £105,000; and the expense of removing the plant from Dronfield and re-erecting at Workington is estimated at £34,000, making altogether £271,000. The new stock proposed to be raised is £300,000, and the difference between that sum and £271,000 will represent the available working capital at Workington. An additional £50,000 in debentures is to be raised as required. I understand that Mr. Alexander Wilson, who has been managing director of Messrs. Wilson, Cammell and Co., Dronfield, will now become assistant managing director of Messrs. Charles Cammell and Co., Limited. The latter company will thus get rid of competition in the rail trade from the Dronfield Company, and they will secure the very able services of Mr. Alexander Wilson, who is the patentee of the Wilson compound—steel-faced—armour plates now coming into very general use for clothing the war ships of this and other nations. Of course the decision of the shareholders in Messrs. Cammell's Company settles definitely all proposals as to carriage in their case; and the removal of the Dronfield establishment will undoubtedly be used by the other rail makers with the view of getting further concessions from the railway companies.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

AT the Cleveland iron market held at Middlesbrough on Tuesday last there was manifest a decided increase of animation, and altogether an improvement of tone. There was an abundance of buyers for prompt delivery, which is a healthy sign. The supply of pig iron immediately available seemed unequal to the demand, and this led to a rise in prices. The quotations of merchant holders were 3d. per ton higher than they were the previous Tuesday. Makers, who to a great extent have been holding aloof for two or three weeks, remained firm to their previous prices. At the commencement of the market, 43s. was asked for No. 3 g.m.b., but before the close, 43s. 1½d. and even 43s. 3d. had been obtained. Makers' prices were 43s. 6d. Their customary meeting was held before the market, and a general confidence was expressed that they had only to wait a week or two and buyers would come to their prices. A large quantity of iron has been lately withdrawn from the warrant stores to meet urgent demands. Messrs. Connal and Co. report that their stock is now 160,772 tons, or less than a week ago by 4620 tons, or 9000 tons less than a fortnight, and 11,000 tons less than three weeks since. So great a diminution of stocks in their hands has not been known for a long time. Shipments from Middlesbrough continue very good; they have already reached 78,377 tons since the commencement of the month, and will probably amount to 90,000 tons before the termination thereof. A very heavy diminution of stocks is expected by the 1st of April, and a further stiffening in prices will be the almost certain result. Smelters are beginning at last to see that they have been making a great mistake in recent times, in selling to merchants rather than consumers. It is true that cash, paid weekly, and delivery taken in trucks at the works, are tempting terms and conditions. But they are not obtained for nothing. Ordinary consumers cannot do business in such summary style, and if sellers insist upon extreme rigidity, they find their customers reduced to a very few opulent and powerful merchants. These have no sooner firmly established themselves between producers and consumers than they begin to tyrannise over both. The "bearing" operations against which the smelters have recently been calling out so lustily, are one result of this policy. At last their eyes are becoming opened, and they are finding out with sadness that they had better take ordinary pains and run ordinary risks, and sell to those who buy their products to use them and work them up, than to those who simply buy for purposes of manœuvring and speculation.

The manufactured iron trade is partaking of the better feeling in pig iron. A large order of 3000 tons of plates for the manufacture of wrought iron sleepers has been placed at one of the works in the district, and other large orders are likely to follow. The plates are placed, when red-hot, upon cast iron blocks, and stamped into the form of a trough. Ordinary ship-plate quality is found to answer the purpose. So heavy a demand for a new purpose is extremely welcome to Cleveland manufacturers. Ship-plates are quoted at £7 5s., and bars and angles at £6 10s., free in trucks Middlesbrough, less 2½ per cent.

The North Yorkshire Iron Company, at South Stockton, has just started operations, after remaining idle for some years. The specialities manufactured will be bars and angles. The directors are Messrs. Joseph Richardson, C. A. Head, W. Anderson, and Mark Robinson; the secretary is Mr. Smith; and the consulting engineer, Mr. E. Hutchinson, of Bishop Auckland.

The arbitration as to ironworkers' wages is to take place before Mr. J. W. Pease, M.P., during the first week in April. The workmen are claiming a further 7½ per cent. advance, and still another 7½ per cent. in certain cases, viz., in those of mill rollers, shearers and heaters, and forge rollers and shinglers. Some of the men claiming this special advance are already earning from £2 to £4 per day clear of all expenses, and yet they want more. There is no scarcity of applicants for such positions. There is, however, a great demand at Middlesbrough for puddlers, under hands, mill heaters, and capable ironworkers generally, and all strong, active young men can find ready employment at good wages.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE warrant market was very languid at the close of last week, but an improvement took place on Monday afternoon and was continued on Tuesday as a result mainly of a probable dispute in the mining trade in Durham. On the strength of the differences prevailing there between employers and workmen, a considerable amount of speculative business has taken place in our market this week. Otherwise there has been little change in its condition. As was anticipated in my last report, the shipments of pig iron to foreign countries during the past week have not been nearly so large as in the preceding week. They amounted in round numbers to 12,000 tons, as compared with 17,000. This, however, did not take anybody by surprise, it being well understood that the open weather had enabled the spring trade to begin earlier than usual, and that larger demands were made for the Continent in consequence of the navigation being opened, and of the anxiety of merchants to procure supplies previous to the increase in the Austrian tariff. The stock of pig iron in Glasgow has been reduced in the course of the week by about 600 tons, and the much larger reduction which has taken place at Middlesbrough will have a good effect upon our market and serve to prolong a state of things which makes it possible to substitute No. 3 Scotch iron largely in our manufacturing works for Cleveland pig iron.

Business was done in the warrant market on Friday morning at from 48s. 4d. to 47s. 10½d. cash, and 48s. 6d. to 48s. 11½d. one month, the afternoon quotations being 47s. 10½d. to 47s. 9d. and 47s. 11½d. cash, and from 48s. to 48s. 1½d. one month. On Monday transactions were effected at from 47s. 7½d. and subsequently up to 48s. cash. On Tuesday forenoon the market was firm with business at 48s. to 48s. 3d. cash, and 48s. 1½d. to 48s. 4½d. one month; in the afternoon transactions were effected at 48s. 3d. to 48s. 5½d. cash, and 48s. 5d. to 58s. 6d. one month. On Wednesday the market was firm, with business at 48s. 5½d. to 48s. 7½d. cash. To-day—Thursday—the market was rather flat, at 48s. 7½d. to 48s. 1½d. cash and down to 48s. 3d. one month.

So far as makers are concerned they have been keeping their prices comparatively firm, but in the market all the various brands have been procurable this week on easier terms, the reduction being generally about 6d. per ton. Quotations are as follows:—Gartsherrie f.o.b. at Glasgow, per ton, No. 1, 58s. 6d.; No. 3, 51s.; Coltness, 58s. 6d. and 52s. 6d.; Langloan, 59s. and 53s.; Summerlee, 57s. 6d. and 49s. 6d.; Calder, 57s. 6d. and 51s.; Carnbroe, 52s. 6d. and 49s.; Clyde, 51s. and 48s. 6d.; Monkland 49s. and 47s. 6d.; Quarter, ditto ditto; Govan at Broomielaw, 50s. and 47s. 6d.; Shotts at Leith, 59s. and 53s. 6d.; Carron at Grangemouth, 50s. 6d. (specially selected, 53s.) and 49s. 6d.; Kinneil at Boness, 48s. 6d. and 47s. 6d.; Glengarnock at Ardrossan, 52s. 6d. and 49s.; Eglinton, 49s. 6d. and 47s.; Dalmellington, 49s. 6d. and 48s.

So far the shipping trade, both in exports and imports, is satisfactory. The shipments of Scotch iron coastwise and abroad, from Christmas to date, amount to 135,170 tons, as compared with 110,888 in the corresponding period of last year, and there is a total increase in the imports of Cleveland iron amounting to 4670 tons.

There is hardly any new feature to notice in connection with the malleable iron trade. Manufacturers report that they have still a considerable amount of work on hand, but they generally agree that fresh business arrives slowly. Those who are occupied in the manufacture of articles used in the construction of vessels have very good prospects, that is to say, makers of plates, angles, and rods for rivets can look forward to a continuance of activity during the remainder of the year. It is otherwise with makers of rails and bars, the demand for which is at present very slow. Even in their case, however, it is too soon to adopt a gloomy view of the position, because an easier condition of affairs financially now prevails, and there is some prospect of business, which was kept back owing to financial troubles and to dear money, being rendered available to the manufacturers. During the past few weeks prices are understood to be something like five to ten shillings per ton lower, but it is observable that the former quotations are this week repeated. Large contracts, however, are always a matter of special arrangement as regards prices.

In the coal trade there has been rather less doing, the shipments for the past week at various ports in Scotland showing a reduction of about 10,000 tons, as compared with those of the preceding week. Business has been so dull in Fifeshire and Clackmannan that the colliery owners have been compelled to intimate a reduction of wages, and at a meeting with the representatives of the men, held a few days ago, it appeared to be admitted by the latter that to some extent the action of the employers was justifiable. The proposal is to reduce wages by 12½ per cent. during the next two months, at the end of which time the employers will be glad to return the amount, should the state of trade by that time have improved. The coalmasters of mid and east Lothian have likewise issued an intimation that wages will be reduced after Wednesday first. The coalmasters of the western district met at Glasgow with the view of adopting measures towards the same end. The meeting took place on Wednesday afternoon, but no resolution was adopted.

The Clyde shipwrights have obtained an advance of ½d. per hour in their wages.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

I DID not anticipate the non-success of the Taff Vale Railway with its Bill for a new line in connection with Cyfarthfa and Merthyr, but as it has running powers over the proposed Rhymney line, its position is not very unsatisfactory. The London and North-Western and Great Western, too, have running powers. The line will be a great help to the Rhymney Co. in the development of its system. Some of the principal shareholders entertain the idea of some day carrying out another section, viz., changing from the western side of the Taff to the eastern, and so running down through a now undeveloped coalfield to Cardiff. But this field is an untried one, and, so far, experiments have not been satisfactory. The underground disturbances on that side are very marked, and even at Treharris, the Deep Navigation pit, the top is a very bad one, and gives a good deal of trouble.

The new Rhymney line will take some time to make, as a large viaduct constitutes one important work. I commend the example of the contractors of the Newport, Caerphilly, and Pontypridd line to contractors generally. This line is in a fine state of forwardness, and will be opened this year.

Coal still languishes, collieries are not working fully, and sidings are blocked. Yet over 150,000 tons left the various ports last week, and there is not so much cause for complaint as some allege. The fact is the flush in the trade was so great, and continuous, that when a slight lull took place people became surprised and annoyed. I have not heard of any change in prices except for forward, and that slightly, and until this occurs shall believe the present depression to be only of temporary character. The evidence of coalowners and mining agents before the House of Lords Committee on the two Swansea Bills is of highest interest as shadowing the future of the Welsh coal trade, and there is a great deal of hopeful import to be derived from it. The Rhondda contains at present great tracts of best coal yet untouched, and whichever line is granted will open out more and greater fields. The various industries that skirt the sea-shore from Maesteg to Neath will be materially benefitted by the granting of one of the two lines. Mr. Vivian could not see why both might not be granted. The evidence of Mr. W. T. Lewis, Mr. Shaw, Mr. T. Joseph, and others was most telling and important. With respect to the Rhymney Railway, connected with Quakers'-yard, &c., the success in a great measure is due to Mr. W. T. Lewis. Though he did not figure before the scenes, those in the secret knew that his powerful influence and great practical ability were at work. Another point is worthy to quote in connection with the various railway bills. I refer to the persistence with which the Aberdare and Plymouth representatives defended their right. They possess a tramway eight miles in length, which is freehold and a valuable property. This lies on the east of the Taff, and some day will be utilised.

Patent fuel is in good demand, and there is a fair inquiry for best samples of Rhondda coke.

In the dispute waging between Mr. Thos. Jones, of the Havad, and the Coedcae Colliery, Mr. Jones has gained, I hear, an important point relative to the valuation of his colliery.

There has been a good deal of discussion in the local papers with regard to the "nursing" of coal tips. It is stated that a good deal of demurrage is incurred by this practice, and that if more coal trimmers were engaged a large proportion of cost would be avoided. I commend the idea to those interested. Two new coal tips on the river Taff, at Cardiff, were opened on Saturday by the shipment of a quantity of coal. They promised to do good work. Both tips were erected by Messrs. Brown Bros., of Edinburgh, on the hydraulic principle. They form two of a series of six, and together will ship one million tons annually. There has been a failure in the negotiations between the men of the Ocean collieries and the manager, Mr. Jenkins. A mass meeting is to be held, when it is expected that some definite line of policy will be pursued. There is little to note in connection with the iron and steel trades. All the works are tolerably busy. Tin-plate is dull.

I hear alarming news of Mr. Menelaus. He has had another severe attack, and is now lying in a most critical, if not hopeless condition at Tenby. It was thought at one time that he might recover sufficiently well to resume his old post, but it is evident that even should he rally, his practical connection with Dowlais works is at an end.

Rhymney Railway shares are waking up well, and Great Westerns are promising.]

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

21*st March*, 1882.

1355. Packing Case, A. H. Lowe, Brixton.
1356. Telephones, R. and M. Theiler, London.
1357. Securing Knobs, J. Thom, Wolverhampton.
1358. Cutting Holes, J. and W. Hall, Nottingham.
1359. Brakes, H. Ivey and J. H. Craddock, London.
1360. Gas Motor Engines, H. Sumner, Manchester.
1361. Small-arms, J. Rigby and L. F. Banks, Dublin.
1362. Permanent Way, A. Riche, Brixton.
1363. Secondary Batteries, F. Maxwell-Lyte, London.
1364. Wheels, J. Taylor, Wigan.
1365. Moving Rollers by Belts, F. Asthöwer and T. Bicheroux, Annin, Germany.
1366. Telephonic Apparatus, A. E. Dolbear, London.
1367. Electrical Connections, A. E. Dolbear, London.
1368. Electrical Cables, A E. Dolbear, London.
1369. Metal Drums, H. D. B. Wall, Liverpool.
1370. Spinning Machinery, J. Howson, Drighlington.
1371. Taking Measurements, J. Baier, London.
1372. Coffins, H. R. Allen, Indianapolis, U.S.
1373. Railway Chairs, H. Bridgewater, Watford.
1374. Looms, J. Stansfield, Colne.
1375. Locks, J. H. Black, London.
1376. Spile Holes, W. W. Watts, London.
1377. Producing Ammonia from Shale, &c., W. Young, Peebles, and G. T. Beilby, Midcalder.

22*nd March*, 1882.

1378. Waterproof Capes, G. and S. Maleberg,nd and H. L. Rothband, Manchester.
1379. Fire Buckets, J. M. B. Baker, London.
1380. Raising Water, B. J. Mills.—(*J. Fangeat, Paris.*)
1381. Marine Governor, J. J. Tyler, Bromley-by-Bow.
1380. Drawing off Water, C. Fisher, Loughborough.
1383. Healds, J. Green, Blackburn.
1384. Tip-wagons, W. March, London.
1385. Thermometers, J. Formby, Formby.
1386. Separating Cream, G. M. Allender, Bayswater, and W. E. Crossby, Chelmsford.
1387. Valves, W. Teague, Illogan.
1388. Chimney Tops, G. Ashdowne & G. Kent, Portsea.
1389. Filtering Water, F. A. Bonnefin, London.
1390. Driving Dynamo Machines, J. Rogers, London.
1391. Printing Tablets, F. Rath.—(*M. Komáromy, Budapest.*)
1392. Electric Lamps, D. Graham & H. Smith, Glasgow.
1393. Obtaining Sulphur, F. B. Rawes, Stratford.
1394. Chest Expanding Corset, H. Knight, London.
1395. Lamps, J. Lucas, Birmingham.
1396. Purifying Sewage, G. J. Andrews and F. H. Parker, London.
1397. Flower-pot Stand, J. F. Grimmo, Leyton.
1398. Crimping Machine, H. H. Lake.—(*G. P. E. Lenormand-Carpentier, Amiens.*)
1399. Furnaces, J. Burch, Stockport, and W. Evans, Manchester.

23*rd March*, 1882.

1400. Electric Lamps, T. E. Gatehouse, Camberwell.
1401. Locking Devices, J. M. Main, Cumberland.
1402. Tubular Boilers, J. Imray.—(*F. Deloye and A. Guebbard, Paris.*)
1403. Gas Burners, J. Lewis, Stepney.
1404. Manure, E. Fisher, Beverley.
1405. Igniting Apparatus, J. W. Urquhart, London.
1406. Corkscrews, W. J. Holroyde, Manchester.
1407. Preventing Overwinding, W. T. Lewis, Aberdare, and W. H. Massey, Henley-on-Thames.
1408. Administering Fluids, F. Kingston, St. John's.
1409. Armour Plates, H. Reusch, Prussia.
1410. Ingress to Theatres, U. Scott, London.
1411. Flyers, R. C. Sykes, Cleckheaton.
1412. Electric Lighting, O. E. Woodhouse and F. L. Rawson, London.
1413. Umbrellas, J. Willis, Rosendale.
1414. Pulleys, G. W. Beynon, Reading.
1415. Ships' Rudders, J. E. Commerell, London.

24*th March*, 1882.

1416. Binnacles, W. R. and C. A. Williams, Newport.
1417. Excavating, W. Smith, Aberdeen.
1418. Looms, A. Rollason, Lowell, U.S.
1419. Spinning Fibres, F. Ripley & T. Briggs, Bradford.
1420. Ice, R. P. Pictet, Geneva.
1421. Nail Cutter, J. P. Jones, London.
1422. Umbrellas, J. Minière, Paris.
1423. Cooking, A. J. Boult.—(*J. Dudley, Liége.*)
1424. Heels of Boots, W. R. Lake.—(*Tyler Manufacturing Company, Portland, U.S.*)
1425. Velocipedes, A. Pengelly & R. Day, Highbridge.
1426. Valves, W. Jones, Glasgow, and J. MacLeod, Birkenhead.
1427. Variable Expansion Gear, T. English, Hawley.
1428. Steeping Tanks, R. Free, Mistley.
1429. Raising Acids, &c., C. T. Wordsworth, Leeds, and J. Wolstenholme, Radcliffe.
1430. Obtaining Power, A. Clark.—(*K. Anunsen, U.S.*)
1431. Grinding Plates, T. Smith, Stoke-on-Trent.
1432. Flushing Tanks, W. Bartholomew, London.
1433. Rollers, J. Lewthwaite, Halifax.
1434. Sewers, E. G. Banner, London.

25*th March*, 1882.

1435. Chimney Flues, B. Finch, Westminster.
1436. Saving Life, J. Z. Cressy, Glasgow.
1437. Electric Accumulator, S. Cohne, London.
1438. Stoppers for Bottles, H. Barrett, London.
1439. Punching, &c., J. Fielding, Gloucester.
1440. Spreading Manure, R. G. Garvie and H. Skinner, Glasgow.
1441. Exhausting Air, E. Edwards.—(*P. Clerc and A. Hémot, Paris.*)
1442. Beater Bars, C. Green, Lincoln.
1443. Measuring Speed, J. Armstrong, New Swindon.
1444. Electric Lighting, R. Werdermann, London.
1445. Separating Cellulose, W. Springer, London.
1446. Mules, J. Wain, Manchester.
1447. Dyeing Fabrics, J. W. Hepworth, Churwell.
1448. Plaiting Machines, J. Dowling, London.
1549. Smoking Cigarettes, W. Boggett, Chelsea.
1450. Syphon Bottles, H. H. Lake.—(*E. Musitzky, Budapestk.*)
1451. Cigarette Papers, A. G. Goodes, London.

27*th March*, 1882.

1452. Chucks, J. M. Alling.—(*A. Y. Alling, U.S.*)
1453. Colouring Matters, J. A. Dixon.—(*C. Kœnig, Germany.*)
1454. Raising Water, G. Macaulay-Cruikshank.—(*M. E. B. du Marais and P. D. de la Grée, Algiers.*)
1455. Secondary Batteries, G. Molloy, Dublin.
1456. Tanning Hides, A. C. Henderson.—(*C. Bez and Sons, Béran.*)
1457. Looms, L. A. Groth.—(*H. Vogt, Berlin.*)
1458. Rendering Tissues Uninflammable, L. A. Groth.—(*H. R. P. Hoseman, Berlin.*)
1459. Forges, L. A. Groth.—(*A. F. Hammell, Denmark.*)
1460. Producing Ice, C. D. Young, London.
1461. Explosive Compounds, E. Turpin, Paris.
1462. Electric Lamps, S. Waters, London.
1463. Divers' Dresses, W. H. Skipper, London.
1464. Electric Piles, F. de Lalande.—(*G. Chaperon, Huelva, Spain.*)
1465. Carbons, A. Smith, Brockley.
1466. Perforated Tiles, W. L. Fison, Stowmarket.
1467. Lubricants, F. Field, Beckenham.
1468. Fire-proof Plates, C. Abel.—(*J. Nagel, Galgócz.*)
1469. Tube Beaders, J. A. Frieake and T. McCormick, London.
1470. Furnaces, J. Hodgkinson, Bolton.
1471. Metallic Packing, W. V. Ley, Liverpool.
1472. Governors, W. Lyon, Sheffield.
1473. Moreen Fabrics, E. H. Wade, Bradford.
1474. Steam Engines, W. R. Lake.—(*E. Farcot, Paris.*)
1475. Utilising Pneumatic Pressure, W. R. Lake.—(*G. V. Sheffield, New York.*)
1476. Ornamenting China, H. Doulton, Lambeth, and J. Slater, Burslem.
1477. Harvesting Machines, B. Samuelson and W. G. Manwaring.—(*C. W. Marsh, Sycamore, U.S.*)
1478. Sugar, J. H. Johnson.—(*M. Weinrich, Vienna.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

1333. Receptacles for Ink Holders, E. G. Brewer, Chancery-lane, London.—A communication from C. S. Bleton and A. Maleville, Paris.—18*th March*, 1882.
1337. Twisted and Woven Fabrics, A. M. Clark, Chancery-lane, London.—A communication from A. Urbahn, Paterson, and A. G Jennings, Brooklyn, U.S.—18*th March*, 1882.
1343. Dust Collectors for Flour Mills, L. Varicas, Montague-place, London.—A communication from S. L. Bean, Washington, U.S.—20*th March*, 1882.
1422. Umbrellas, J. Minière, Boulevard de Strasbourg, Paris.—24*th March*, 1882.

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

1123. Steel Pinned Coverings, T. W. Harding, Leeds.—20*th March*, 1879.
1154. Fastenings for Bags, &c., J. B. Brooks, Birmingham.—22*nd March*, 1879.
1155. Springs, G. W. Willford, London.—22*nd March*, 1879.
1176. Refrigerating, W. R. Lake, London.—25*th March*, 1879.
1200. Compressing Air, W. H. Northcott, London.—26*th March*, 1879.
1217. Woven Fabrics, A. Topp, Farnworth.—27*th March*, 1879.
1167. Regulating Cut-off of Steam Engines, E. T. Hughes, London.—24*th March*, 1879.
1179. Scotch Bonnets, W. and T. Wild, Stewarton.—25*th March*, 1879.
1246. Thermometers, C. Milton, London.—28*th March*, 1879.
1322. Converting Striking Clocks into Chime Clocks, A. N. Cornu, London. -3*rd April*, 1879.
1308. Safety Valves, W. Eaves, Sheffield.—2*nd April*, 1879.
1547. Playing Wind Musical Instruments, E. Hunt, Glasgow.—19*th April*, 1879.
1252. Looms for Weaving, C. Hughes and W. H. Bairstow, Kidderminster.—29*th March*, 1879.
1274. Bicycles, E. C. F. Otto, Peckham.—31*st March*, 1879.
1280. Dress Suspenders, L. von Hoven, London.—31*st March*, 1879.
1330. Propelling Ships, J. I. Thornycroft, Chiswick.—3*rd April*, 1879.

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

984. Water-closets, W. Phillips, Sheffield.—17*th March*, 1879.
1117. Tawing Hides, W. E. Gedge, London.—27*th March*, 1879.
1142. Forming Crucibles, T. V. Morgan, Battersea.—27*th March*, 1875.
1207. Steam Generators, J. Blake, Manchester.—3*rd April*, 1875.
1539. Steam Generators, G. Plant, Miles Platting.—27*th April*, 1875.
2514. Steam Boilers, C. J. Galloway and C. H. Holt, Manchester.—13*th July*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 14*th April*, 1882.

5057. Sheet Iron, &c., W. Morgan-Brown, London.—Com. from E. Schroeder.—18*th November*, 1881.
5059. Carding Apparatus, E. Edwards, London.—A com. from P. Fleury.—18*th November*, 1881.
5060. Hoists, S. Empsall, Halifax.—19*th November*, 1881.
5062. Pistons, J. Hopkinson, Sheffield.—19*th November*, 1881.
5070. Telephonic Repeater, C. Moseley, Manchester.—19*th November*, 1881.
5072. Grinding Mills, E. Phillips, London.—19*th November*, 1881.
5086. Knitting Machines, H. M. Mellor, Nottingham.—21*st November*, 1881.
5087. Cutting Horn, W. Hughes, London.—21*st November*, 1881
5089. Combing Wool, A. Smith and M. Firth, Bradford.—21*st November*, 1881.
5090. Bottles, &c., E. Edwards, London.—A communication from A. M. Hurel.—21*st November*, 1881.
5106. Velocipedes, W. E. Price and W. D. Overton, Hampton Wick.—22*nd November*, 1881.
5107. Horseshoes, E. Kimber, West Dulwich.—Com. from L. H. Bellamy.—22*nd November*, 1881.
5125. Screw Spanners, H. Waters and A. Vickerstaff, Birmingham.—23*rd November*, 1881.
5138. Tram-cars, H. Betteley, London.—24*th November*, 1881.
5141. Hatching Eggs, C. E. Hearson, London.—24*th November*, 1881.
5143. Fire-arms, T. W. and H. Webley, Birmingham.—24*th November*, 1881.
5158. Indicating Apparatus, A. Turner, Worcester.—25*th November*, 1881.
5161. Ribbed Hose, W. Raven, Leicester.—25*th November*, 1881.
5189. Burning Potteryware, J. Roberton, Glasgow.—28*th November*, 1881.
5197. Malleable Iron, W. R. Lake, London.—Com. from G. Beals.—28*th November*, 1881.
5225. Extinguishing Fire, W. H. Phillips, Nunhead.—29*th November*, 1881.
5248. Ornamental Glass, H. H. Lake, London.—Com. from J. Budd and J. Grant.—30*th November*, 1881.
5253. Tricycles, I. T. Townsend, Coventry.—1*st December*, 1881.
5271. Purifying Copper, F. Claudet, London.—2*nd December*, 1881.
5321. Printing Machinery, J. Salmon, M. Smith, and J. Hamilton, Manchester.—6*th December*, 1881.
5514. Driving Tricycles, W. P. Thompson, London.—Com. from N. Merrill.—16*th December*, 1881.
5573. Telephones, W. R. Lake, London.—A communication from J. H. Rogers.—20*th December*, 1881.
5668. Dynamo-electric Machines, W. Thomson, Glasgow.—26*th December*, 1881.
5685. Gores, W. R. Lake, London.—A communication from S. Florsheim.—27*th December*, 1881.
323. Spinning, B. A. Dobson, E. Gillow and D. Davies, Bolton.—23*rd January*, 1882.
391. Writing Materials, W. P. Thompson, London.—Com. from G. W. Carleton, E. Coffin, jun., and A. S. French.—26*th January*, 1882.
465. Knitting Machines, J. Byfield, Canada.—31*st January*, 1882.
543. Throstle Frames, A. M. Fletcher, Oldham.—4*th February*, 1882.
913. Rolling Mills, P. Kirk, Workington.—25*th February*, 1882.
923. Filter Presses, H. E. Newton, London.—Com. from A. L. G. Dehne.—25*th February*, 1882.
924. Valve Cases, H. E. Newton, London.—Com. from A. L. G. Dehne.—25*th February*, 1882.
973. Compensating Apparatus, F. W. and W. W. Brierley, London.—28*th February*, 1882.
1006. Draw-off Cocks, S. B. Goslin, London.—2*nd March*, 1882.
1010. Railways, G. M. Minchin and L. H. Despeissis, Staines.—2*nd March*, 1882.
1051. Armour Plates, J. D. Ellis, Sheffield.—4*th March*, 1882.
1085. Electro-magnets, W. P. Thompson, London.—Com. from G. Smith.—7*th March*, 1882.
1126. Steam Engine Indicator, H. J. Haddan, London.—Com. from G. H. Crosby.—8*th March*, 1882.
1300. Wall Paper, A. M. Clark, London.—Com. from E. Leissner.—17*th March*, 1882.
1337. Woven Fabrics, A. M. Clark, London.—Com. from A. Urbahn and A. G. Jennings.—18*th March*, 1882.
1343. Dust Collectors, L. Varicas, London.—Com. from S. L. Bean.—20*th March*, 1882.

Last day for filing opposition, 18*th April*, 1882.

5110. Generating Motive Power, R. Hallewell, Blackburn.—23*rd November*, 1881.
5113. Velocipedes, W. T. Eades, Birmingham.—23*rd November*, 1881.
5114. Jacquard Machines, A. Place, Macclesfield.—23*rd November*, 1881.
5118. Roads, H. J. Haddan, London.—A communication from J. Salvat.—23*rd November*, 1881.
5122. Iron and Steel, J. C. Bromfield, Brighton.—23*rd November*, 1881.
5123. Vacuum Brake, J. A. F. Aspinall, Dublin.—23*rd November*, 1881.
5129. Umbrellas, &c., R. H. Brandon, Paris.—Com. from J. P. d'Aragon.—24*th November*, 1881.
5134. Spinning Wool, W. T. Emmott, Manchester.—Com. from E. Appenzeller.—24*th November*, 1881.
5135. Spinning Machinery, F. Ripley and T. H. Brigg, Bradford.—24*th November*, 1881.
5144. Explosive Substances, E Edwards, London.—A communication from E. Wickersheimer and L. Pech.—24*th November*, 1881.
5148. Perambulators, T. Steen, Ripley.—25*th November*, 1881.
5152. Bobbins, &c., J. H. and L. Wilson, Todmorden.—25*th November*, 1881.
5153. Slipways, J. Thompson, Newcastle-on-Tyne, and G. Cooper, Penarth.—25*th November*, 1881.
5155. Mineral White Substances, T. H. Cobley, Dunstable.—25*th November*, 1881.
5160. Coal Cutting Machinery, J. R. Bower, J. F. A. Pflaum, and J. T. Tannett, Leeds.—25*th November*, 1881.
5165. Dislodging Germs, T. H. D. Voss, London.—26*th November*, 1881.
5178. Gas Motor Engines, J. Shaw, Liversedge.—26*th November*, 1881.
5180. Washing, &c., Machines, T. Bradford, Manchester.—28*th November*, 1881.
5185. Electric Lamps, E. G. Brewer, London.—Com. from A. G. Waterhouse.—28*th November*, 1881.
5200. Gas Burners, W. Snelgrove, Melksham.—28*th November*, 1881.
5207. Utilising Waste, E. L. Ransome, San Francisco, U.S.—29*th November*, 1881.
5209. Coating Tin-plate, A. N. Hopkins, Birmingham.—29*th November*, 1881.
5218. Spinning, &c., F. W. Fox, Windhill.—29*th November*, 1881.
5219. Nippers, F. J. Cheesbrough, Liverpool.—Com. from T. G. Hall.—29*th November*, 1881.
5236. Steering Apparatus, J. N. Holliday, Sunderland.—30*th November*, 1881.
5246. Sorting Ores, F. C. Glaser, Berlin.—A communication from F. Büttgenbach.—30*th November*, 1881.
5252. Clothes Dryer, H. J. Haddan, London.—Com. from J. H. D. Everett.—1*st December*, 1881.
5258. Spinning Wool, J. W. Menall, Morton.—1*st December*, 1881.
5291. Yellow, &c., Chrome, W. Spence, London.—Com. from E. Werner.—3*rd December*, 1881.
5297. Blacking Leather, H. H. Lake, London.—Com. from J. Nicolet.—3*rd December*, 1881.
5305. Saddles, C. R. B. Hamilton, Greenwich.—5*th December*, 1881.
5323. Cutting Machines, W. Lorenz, Carlsruhe.—6*th December*, 1881.
5337. Clip, &c., R. Burgess, London.—6*th December*, 1881.
5351. Warming Apparatus, T. Rowan, London.—7*th December*, 1881.
5372. Paper Bags, F. D. Bumsted, Hednesford.—8*th December*, 1881.
5377. Water-closets, D. G. Cameron, Lambeth.—8*th December*, 1881.
5378. Looms, W. H., E. and J. Smith, Kidderminster.—Com. from W. Talbot.—9*th December*, 1881.
5601. Electrical Brushes, &c., J. N. Aronson, London.—21*st December*, 1881.
5691. Trueing Apparatus, C. A. Barlow, Manchester.—Com. from J. Tolra.—28*th December*, 1881.
5706. Lubricating Bearings, H. Reisert, Cologne.—29*th December*, 1881.
5707. Rose Cutters, C. D. Abel, London.—Com. from W. Lorenz.—29*th December*, 1881.
60. Railway Signals, S. S. Allin, London.—5*th January*, 1882.
258. Stoves, R. G. Greig, London.—A communication from The Detroit Stove Works Company.—18*th January*, 1882.
358. Sounding Apparatus, C. A. McEvoy, London.—24*th January*, 1882.
607. Telephone Transmitters, R. and M. Theiler, London.—8*th February*, 1882.
788. Hoops, &c., T. Brown, Sheffield.—18*th February*, 1882.
886. Spinning Fibres, F. Ripley and T. H. Brigg, Bradford.—23*rd February*, 1882.
894. Tin-plate, A. J. Maskrey, Coatbridge.—24*th February*, 1882.
983. Scouring Wool, J. and W. McNaught, Rochdale.—1*st March*, 1882.
1044. Telephone Transmitters, R. and M. Theiler, London.—4*th March*, 1882.
1086. Furnaces, A. Mellor, Nottingham.—7*th March*, 1882.
1105. Chains, W. Penman, Gateshead-on-Tyne.—7*th March*, 1882.
1106. Grain, &c., W. R. Lake, London.—Com. from E. H. Farrar.—7*th March*, 1882.
1137. Telegraphic Apparatus, W. H. Davies and F. H. W. Higgins, London.—8*th March*, 1882.
1141. Carding Machinery, J. Dobson, Galashiels.—9*th March*, 1882.
1157. Spindles, R. B. Thomson, Dundee.—10*th March*, 1882.
1205. Feeding Apparatus, C. W. Wardle, Leeds.—13*th March*, 1882.
1213. Fire-grates, R. Wright, Richmond.—13*th March*, 1882.
1246. Musical Instruments, H. H. Lake, London.—Com. from G. W. Turner.—14*th March*, 1882.

Patents Sealed.

(*List of Patent Letters which passed the Great Seal on the* 24*th March*, 1882.)

4136. Heating Appliances, W. Truswell, Sheffield.—26*th September*, 1881.
4138. Filling Bottles, A. M. Davis and H. des Forges, London.—26*th September*, 1881.
4143. Embroidery, J. Renals, London.—26*th September*, 1881.
4153. Stop-cocks, H. Hughes, Loughborough.—27*th September*, 1881.
4182. Making Paper, G. Tidcombe, jun., Watford.—28*th September*, 1881.
4183. Bricks, &c., R. Stone, London.—28*th September*, 1881.
4184. Printers' Type, W. R. Lake, London.—28*th September*, 1881.
4185. Calcareous Bricks, F. H. F. Engel, Hamburg.—28*th September*, 1881.
4186. German Yeast, G. W. von Nawrocki, Berlin.—28*th September*, 1881.
4187. Heating Water, G. W. Wigner and R. H. Harland, London.—28*th September*, 1881.
4195. Coating Mixture, C. J. Davidson, Wolverhampton.—29*th September*, 1881.
4208. Frames, &c., J. Meeson, Sheffield.—29*th September*, 1881.
4209. Cutlery, L. Meyer, Sheffield.—29*th September*, 1881.
4230. Carding Cans, H. J. Haddan, London.—30*th September*, 1881.
4231. Feeding Bottles, H. J. Haddan, London.—30*th September*, 1881.
4232. Watch Winders, H. J. Haddan, London.—30*th September*, 1881.
4237. Mixing Flour, H. J. Haddan, London.—30*th September*, 1881.
4272. Scouring Wool, J. and W. McNaught, Rochdale.—3*rd October*, 1881.
4290. Printing Floorcloth, W. R. Lake, London.—3*rd October*, 1881.
4356. Shelling Rice, A. G. Frazer, G. Smith and L. W. Harvey, London.—6*th October*, 1881.
4360. Snow, F. N. Mackay, Liverpool.—7*th October*, 1881.
4375. Timekeepers, H. B. James, New York, U.S.—8*th October*, 1881.
4400. Pads, W. Reynolds, London.—10*th October*, 1881.
4424. Fasteners, E. Gilbert and D. Sinclair, Dundee.—11*th October*, 1881.
4426. Knitting Machines, H. J. Haddan, London.—11*th October*, 1881.
4484. Sledges, W. B. L. de Blaquière, Crawley.—14*th October*, 1881.
4510. Governors, P. Turner, Ipswich.—15*th October*, 1881.
5170. Drawing Frames, R. Andrews, Bessbrook.—26*th November*, 1881.
5397. Heating Air, W. Whitwell, Stockton-on-Tees.—9*th December*, 1881.
5432. Telephones, A. W. Rose, London.—12*th December*, 1881.
5716. Roasting Coffee, M. Robinson, Manchester.—30*th December*, 1881.
5730. Brushes, G. J. Beissbarth, London.—30*th December*, 1881.
157. Electric Lighting, G. Hawkes, London.—11*th January*, 1882.
335. Vacuum Pan Apparatus, H. H. Lake, London.—23*rd January*, 1882.

(*List of Letters Patent which passed the Great Seal on the* 28*th March*, 1882.)

4151. Fireplaces, W. P. Thompson, Liverpool.—27*th September*, 1881.
4223. Gas Motor Engines, C. W. King, Manchester.—30*th September*, 1881.
4225. Colliery Corves, J. Trippett and F. Hallam, Sheffield.—30*th September*, 1881.
4238. Protecting Engines, C. Colwell, Southtown.—30*th September*, 1881.
4243. Generating Steam, G. W. Wigner and J. Dixon, London.—30*th September*, 1881.
4244. Motor Engines, C. D. Abel, London.—30*th September* 1881.
4252. Ornamenting Tin-plate, A. N. Hopkins, Birmingham, and G. Hatton, Kidderminster.—1*st October*, 1881.
4255. Secondary Batteries, A. Watt, Liverpool.—1*st October*, 1881.
4266. Furniture Cord, L. A. Walters and A. George, London.—1*st October*, 1881.
4292. Malt Liquors, A. E. Wood, Wavertree.—4*th October*, 1881.
4294. Electric Lamps, A. G. Schaeffer, Newcastle-on-Tyne.—4*th October*, 1881.
4317. Bicycles, &c., T. Warwick, Aston.—4*th October*, 1881.
4324. Fluid Meters, A. Wightman, Sheffield.—5*th October*, 1881.
4326. Stop Valves, &c., J. Margerison, Preston.—5*th October*, 1881.
4334. Lamps, A. W. Calvert, Leeds.—5*th October*, 1881.
4339. Achromatic Lenses, N. Lazarus, London.—5*th October*, 1881.
4361. Studs, P. F. Allen, London.—7*th October*, 1881.
4384. Basic Bricks, S. G. Thomas, London.—8*th October*, 1881.
4404. Bessemer Converter, A. L. Holley, Brooklyn.—10*th October*, 1881.
4453. Locks, J. M. Bibbins, Williams Port, U.S.—12*th October*, 1881.
4525. Locomotive Engines, A. W. L. Reddie, London.—17*th October*, 1881.
4708. Screw Propellers, J. M. Leishman, London.—27*th October*, 1881.
4941. Ventilating Apparatus, W. Cunningham, Dundee.—11*th November*, 1881.
4942. Electric Currents, S. Pitt, Sutton.—11*th November*, 1881.
5315. Fixing Window Glass, W. Clark, London.—5*th December*, 1881.
109. Soda, W. Weldon, Burstow.—9*th January*, 1882.
152. Dyeing Yarn, E. Boden, Manchester.—11*th January*, 1882.
191. Pneumatic Brake, C. D. Abel, London.—13*th January*, 1882.
202. Treating Solutions, A. McDougall, Penrith.—14*th January*, 1882.
448. Screw Nails, H. H. Lake, London.—28*th January*, 1882.
479. Feed Apparatus, J. Hayes, London.—31*st January*, 1882.

List of Specifications published during the week ending March 25th, 1882.

2749, 6d.; 3193, 1s. 2d.; 3196, 4d.; 3279, 8d.; 3328, 6d.; 3352, 6d.; 3360, 6d.; 3369, 6d.; 3518, 6d.; 3425, 6d.; 3428, 10d.; 3430, 6d.; 3438, 6d.; 3441, 8d.; 3445, 6d.; 3446, 6d.; 3447, 6d. 3448, 6d.; 3452, 4d.; 3457, 6d.;; 3460, 6d.; 3461, 6d.; 3462, 6d.; 3464, 6d.; 3469, 1s. 4d.; 3472, 8d.; 3475, 6d.; 3480, 6d.; 3483, 6d.; 3486, 6d.; 3487, 1s. 4d.; 3490, 6d.; 3495, 6d.; 3502, 6d.; 3507, 6d.; 3509, 6d.; 3512, 6d.; 3513, 6d.; 3515, 6d.; 3522, 1s. 4d.; 3525, 1s. 2d.; 3534, 6d.; 3540, 6d.; 3541, 6d.; 3544, 6d.; 3546, 6d.; 3547, 6d.; 3554, 6d.; 3555, 6d.; 3557, 6d.; 3561, 10d.; 3563, 6d.; 3566, 6d.; 3567, 8d.; 3576, 6d.; 3581, 6d.; 3582, 6d.; 3583, 6d.; 3590, 6d.; 3599, 8d.; 3600, 6d.; 3615, 6d.; 3616, 10d.; 3618, 4d.; 3620, 6d.; 3626, 2d.; 3628, 2d.; 3631, 2d.; 3632, 2d.; 3633, 2d.; 3634, 2d.; 3635, 2d.; 3638, 2d.; 3639, 2d.; 3640, 2d.; 3641, 2d.; 3642 2d.; 3643, 2d.; 3644, 2d ; 3646, 4d.; 3650, 2d.; 3651, 2d.; 3556, 2d.; 3657, 4d.; 3660, 6d.; 3661, 8d.; 3662, 6d.; 3664, 6d.; 3671, 2d.; 3672, 2d.; 3673, 2d.; 3630, 2d.; 3621, 2d.; 3684, 2d.; 3685, 2d.; 3686, 2d.; 3689, 2d.; 3690, 2d.; 3692, 2d.; 3695, 2d.; 3697, 6d.; 3702, 2d.; 3705, 2d.; 3708, 2d.; 3710, 2d.; 3711, 2d.; 3712, 4d ; 3718, 4d.; 3722, 2d.; 3727, 2d.; 3730, 2d.; 3731, 4d.; 3735, 2d.; 3745, 2d.; 3751, 4d.; 3944, 6d.; 4588, 6d.; 5309, 4d.; 5590, 6d.

*** 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.

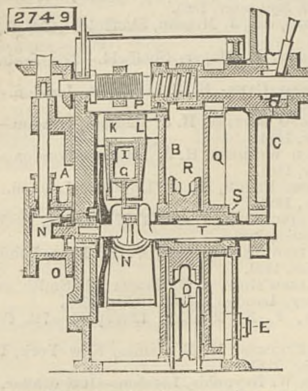
ABSTRACTS OF SPECIFICATIONS.

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

2749. Steam and Hand Steering Gear, *A. Higginson, Liverpool.*—23*rd June*, 1881. 6*d.*

In the drawing A B and C are three vertical frames; the frames A and C are arranged to bolt directly to the deck without a sole plate, D are the leading wheels working on the screw bolts E. The pistons G of the steam engine are made hollow, and formed each with an aperture I in their outer ends. Steam or exhaust passages are formed in the upright frame A, and leading from the passages K K1 in the

2749



trunnion L, past a circular valve to an annular chamber N. O is an exhaust passage leading from the annular chamber N to any desired position. The main spur wheel Q is secured to the chain wheel R, and is fitted on the sleeve S surrounding the crank shaft T carried by the frames B and C.

3059. Conveying Goods from Railways or Tramways into Ships, *J. Ingleby, Manchester.—13th July*, 1881.—(*Provisional protection not allowed.*)—(*A communication from J. Pechar, Germany.*) 2d.

The trucks containing the goods are run on to rails placed on the deck of a lighter moored alongside a pier, and the lighter is then conveyed to the ship and the goods transferred thereto, the empty trucks being brought back by the lighter.

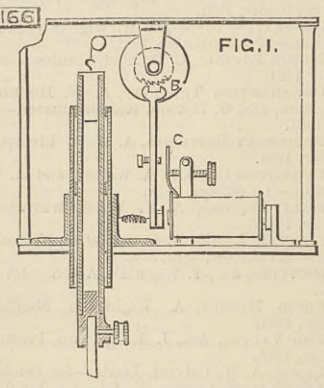
3145. Producing Heating Gases, &c., *H. Haug, Strassburg.—19th July*, 1881. 1s. 2d.

This relates to a method of and apparatus for generating combustible gases from crude carbonaceous materials. The converting materials, which may be steam or carbonic acid, or mixtures of them with air or with combustible gas, are superheated to a high degree in a separate apparatus heated by the gas produced in the converting chamber.

3166. Electric Lamps, *W. Morgan-Brown, London.—20th July*, 1881.—(*A communication from G. P. Harding, Paris.*) 6d.

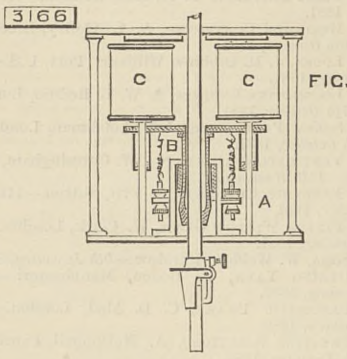
In one form of lamp, to regulate the arc the inventor uses an escapement B actuated by a shunt brake C, the escapement being arranged with a recoil

3166 FIG. 1.



action giving falls of precise measure to the carbon. A second form is a modified clutch lamp, in which a

3166 FIG. 2

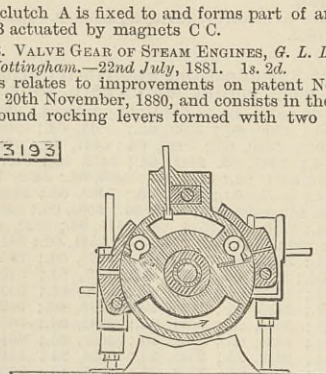


cone clutch A is fixed to and forms part of an armature B actuated by magnets C C.

3193. Valve Gear of Steam Engines, *G. L. Lambert, Nottingham.—22nd July*, 1881. 1s. 2d.

This relates to improvements on patent No. 4340, dated 20th November, 1880, and consists in the use of compound rocking levers formed with two double-

3193



sided arms capable of independent motion, having bosses grasping each other upon the exhaust valve spindles, and with the detent rocking discs, bell cranks, or quadrants, so arranged as to encircle and interlock and work compactly within the said double sides of the levers. Modifications are described.

3196. Pianoforte Actions, *J. Browne, London.—22nd July*, 1881.—(*Not proceeded with.*) 4d.

This relates to improvements in the pianoforte action known as the "sticker action," producing a check action, escapement, and back touch.

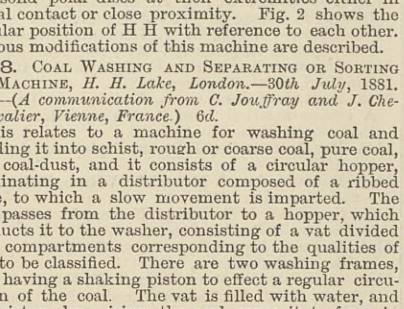
3279. Brakes for Wheeled Vehicles, *W. R. Mortimer, Sussex.—26th July*, 1881. 8d.

This consists in arranging a brake strap or ring to act, by means of a lever connected to one end of it, on the interior of a ring projecting inward from the nave of the wheel.

3283. Improvements in Electric Generators, *S. Pitt, Sutton.—26th July*, 1881.—(*A communication from S. J. M. Bear, Mitchell, Iowa, U.S.A.*) 8d.

The object of this invention is to construct a machine in which the poles of the armature and the field magnets may be brought into the closest proximity, or even absolute contact with each other, without lessening its efficiency. Figs. 1 and 2 show a

3283 FIG. 2. FIG. 1.



machine of this kind. The three straight electro-magnets, having theircores parallel. These cores are provided with polar extensions H H. The spaces between H H are filled with non-magnetic material I I to complete a solid disc at each end of each of the magnets. The magnets are assumed to be mounted in a frame, so as to allow the revolution of each magnet about an axis concentric with its core, with the solid polar discs at their extremities either in actual contact or close proximity. Fig. 2 shows the angular position of H H with reference to each other. Various modifications of this machine are described.

3328. Coal Washing and Separating or Sorting Machine, *H. H. Lake, London.—30th July*, 1881.—(*A communication from C. Jouffray and J. Chevalier, Vienne, France.*) 6d.

This relates to a machine for washing coal and dividing it into schist, rough or coarse coal, pure coal, and coal-dust, and it consists of a circular hopper, terminating in a distributor composed of a ribbed plate, to which a slow movement is imparted. The coal passes from the distributor to a hopper, which conducts it to the washer, consisting of a vat divided into compartments corresponding to the qualities of coal to be classified. There are two washing frames, each having a shaking piston to effect a regular circulation of the coal. The vat is filled with water, and the pistons by raising the coal cause it to form in layers according to the density.

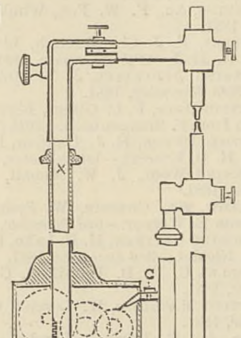
3346. Electric Signalling Apparatus, *J. U. Mackenzie, New York.—2nd August*, 1881. 6d.

This invention refers more to fire alarms, and allows all call-boxes to be constructed alike and set to a number, instead of as now each being made different.

3349. Improvements in Electric Lamps, *A. W. L. Reddie, London.—2nd August*, 1881.—(*A communication from D. A. Chertemps, Paris.*) 6d.

The construction of the lamp will be seen from the figure. The arc is formed by the lower carbon holder being drawn down by a solenoid not shown; spring

3349



pawl G will then arrest the motion of the clockwork until again set free, when the rack rod X will be free to descend and bring the carbons into contact. The two screws shown permit of the adjustment of the upper carbon sideways, and also of the regulation of the arc.

3352. Extracting Copper and other Metals from their Ores, &c., *W. W. Hughes, London.—2nd August*, 1881. 6d.

For this purpose a reducing and desulphurising furnace is employed, consisting of a rectangular chamber longer than it is broad, and having at one end a fireplace as in a reverberatory furnace. The furnace has three tap holes, one at bottom to run the metal clean out from the bottom when required for repairs or otherwise; the second higher up, to run the metal off until it is level with the bottom part of the lowest line of tuyeres, so that it shall not stop up the nozzles should the engine break down; and the third or top hole for running the metal off when the operation is completed to a level a little above the nozzles of the lower line of tuyeres. There are five rabble doors, two at different heights above the bottom of the furnace, and three a little above the line of upper tuyeres.

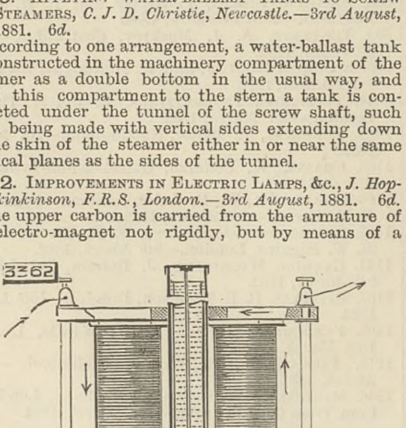
3360. Applying Water-ballast Tanks to Screw Steamers, *C. J. D. Christie, Newcastle.—3rd August*, 1881. 6d.

According to one arrangement, a water-ballast tank is constructed in the machinery compartment of the steamer as a double bottom in the usual way, and from this compartment to the stern a tank is constructed under the tunnel of the screw shaft, such tank being made with vertical sides extending down to the skin of the steamer either in or near the same vertical planes as the sides of the tunnel.

3362. Improvements in Electric Lamps, &c., *J. Hopkinkinson, F.R.S., London.—3rd August*, 1881. 6d.

The upper carbon is carried from the armature of an electro-magnet not rigidly, but by means of a

3362



catch, which when the arc becomes too long is liberated by the action of the armature. The motion of the carbon is controlled by the fluid contained in the upper carbon holder. Fig. 1 explains the construction of the lamp, the arrows representing the direction of the current. The inventor also regulates the current supplied to any lamps by an adjustable self-induction coil. Fig. 2 shows one form of this coil. A ribbon of thin sheet iron is coiled into an annular form, there being a layer of insulating material between the overlapping portions or layers. Round this ring copper wire is coiled as shown. These coils are connected with plates, into which contact plugs connected with the main wires can be inserted, so as to place one or more coils in circuit. The ring

3362 FIG. 2

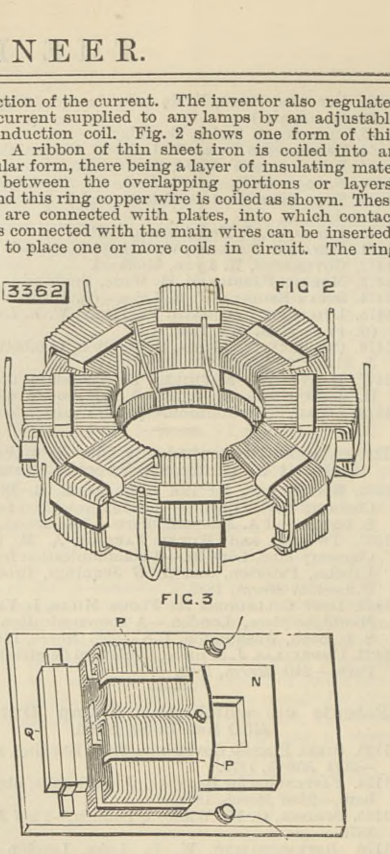


FIG. 3

may be cut in half in order to be able to place the copper coils in it, and subsequently joined. Fig. 3 shows another form of this current regulator. The action is as follows:—When electro-magnet N is drawn from coils P and is at a distance from armature Q, the coefficient of self-induction is small, and as it is thrust in and approaches the armature the said coefficient increases. If a lamp be in circuit the current through lamp is diminished as N is thrust into the coils of P.

3369. Working Gear and Appliances used in Electric Lighting, *K. W. Hedges, Westminster.—23rd August*, 1881. 6d.

This invention relates to such things as switches and driving gear. The switch, Fig. 1, is fitted between the contact pieces by insulating material A A, and from the end of the lever a loose contact piece D,

3369 FIG. 1.

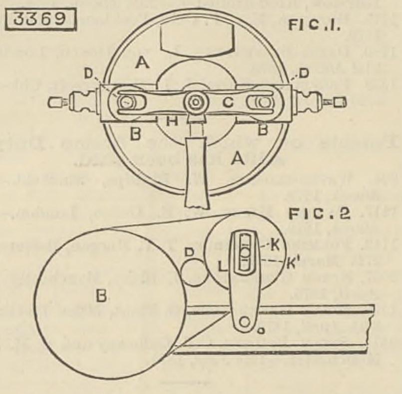


FIG. 2

which can be moved as it wears the contact piece B. Fig. 2 shows the arrangement for driving the shaft of machines, where B is driving pulley, D that on machine, and L an idle pulley on spindle K1 on block K.

3370. Brake, *W. Walton, Romiley, Chester.—3rd August*, 1881. 4d.

The object is to produce a brake applicable to rotating parts of machinery which shall give a uniform resistance, and it consists of a hollow drum fixed on a shaft, and provided inside near the periphery with a number of buckets extending a certain distance towards the centre of the drum. Shot or bullets are placed in the drum, and are carried up by the buckets, falling down again to the bottom of the drum when the buckets arrive at a certain height.

3371. Velocipedes, &c., *F. Wirth, Frankfort-on-the-Main.—3rd August*, 1881.—(*A communication from P. Praechter, Heidelberg.*) 6d.

This relates, First, to the driving mechanism; Secondly, to the steering gear; and Thirdly, to a special form of tricycle.

3372. Ships' Sleeping Berths, *W. R. Lake, London.—3rd August*, 1881.—(*A communication from J. H. Laskey, Boston, U.S.*) 6d.

A frame is suspended centrally at one side of the state room by strong bearings formed in a transverse supporting rod at each side of and somewhat beyond the edges of the frame and berths. The double bearings cause the frame to move laterally with the walls of the room when the vessel rolls, and it swings fore and aft freely at all times on the bearings, so that its horizontal position is not affected by pitching. Berths are suspended one above the other on trunnions at the ends of the frame.

3374. Winding Machines, *H. J. Crawford and J. Lees, Belfast.—4th August*, 1881. 6d.

This relates to means for lifting and stopping the spindles of winding machines on pirns or bobbins becoming filled, or on the breaking of the threads. A slide wedge is introduced horizontally between the frame and the collar which bears the pirn or bobbin, and is actuated by a vertical lever attached at the lower end to the wedge, and made to operate thereon by a stud on the cup covering the pirn or bobbin. To stop the pirn or bobbin on the breaking of the thread, a guide is connected with the wedge, and its weight is borne by a thread, but which, when the thread breaks, acts on the wedge by the aid of a lever, and drives it forward, thus stopping the spindle.

3384. Improvements in Electrically-actuated Indicators, and in Transmitters for Controlling the Operation of the Same, *J. C. Mewburn, London.—4th August*, 1881.—(*A communication from C. H. Pond, New York.*) 8d.

This invention consists in improvements in the construction and operation of the electrical indicator invented by C. H. Pond, which was patented on the 28th August, 1880 (No. 3505), by W. Clark as a communication from J. Van Dussen Reed. It also consists in an improved transmitter for use with the indicator by means of which special calls may be sent. The improvements dispense with all but one of the actuating electro-magnets, and a great many switches and other apparatus, besides rendering an indicator of two or more indicating systems capable of working in the line circuit, thereby dispensing with the local battery and relay.

3386. An Electric Organ, *W. F. Schmoele and A. Mols, Antwerp.—4th August*, 1881. 8d.

This invention relates to improvements on a previous patent dated 27th July, 1881, No. 3294, and also to a means whereby drums, cymbals, &c., can be played at the same time as the organ. The improvements consist in the method of adapting the levers to operate these instruments.

3418. Indicating Depth of Water in and Nature or Character of the Ground for Preparing Sections or Diagrams of Watercourses, Rivers, Harbours, &c., *J. Dillon, Dublin.—8th August*, 1881. 6d.

Across the stern of a boat is mounted an axle movable in bearings and projecting on both sides, and through a hole in this axle passes a bar of suitable length, with a roller at its bottom end to run on the bottom of the watercourse. The axle carries a pointer moving over a dial on the sides of the boat, and also a pencil which marks the movements of the pointer on cylinders caused to revolve by clockwork or other means.

3425. Clocks, *H. J. Haddan, Kensington.—8th August*, 1881.—(*A communication from A. Dardenne, Belgium.*) 6d.

This relates to means for automatically winding up clocks by means of a current of air acting on a helix, the current of air being produced by the draught of a chimney or tube.

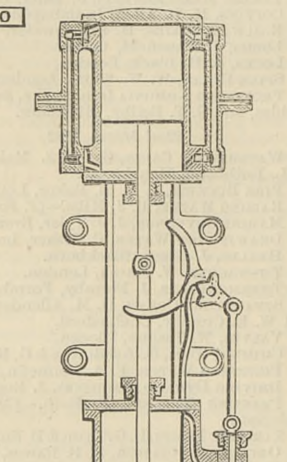
3428. Roof Principals, *F. H. Beattie, near Birmingham.—8th August*, 1881. 10d.

This relates to the use of clipping pieces to grip the rafters or compression booms and connect them to the accessory parts, and also of abutment pieces held against the rafters or compression booms by the tie bars, and which are so constructed as to assist in binding together various members of such structures without the aid of bolts passing through holes.

3430. Pumping Apparatus for Beer, &c., *A. Stierlin, Manchester.—8th August*, 1881.—(*A communication from Schläpfer and Sonderegger, Lausanne Switzerland.*) 6d.

The drawing represents a longitudinal section of a beer pumping or forcing apparatus actuated by water pressure, and in which the required movements of the

3430

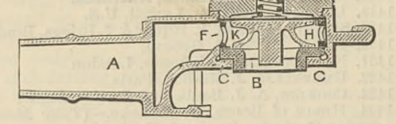


slide valve are obtained from a cam formed with projections actuated by means of a projection on the piston rod and spring.

3434. Working Railway Brakes by Fluid Pressure, *G. Westinghouse, jun., London.—8th August*, 1881. 6d.

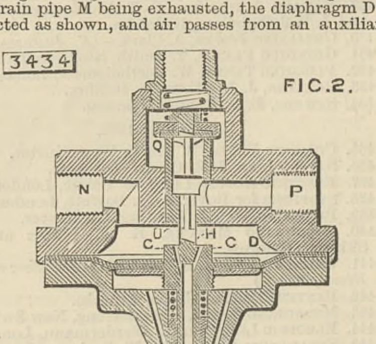
This relates to a coupling for pipes, so as to render them available both when air above atmospheric pressure is employed, and also when the air is rarefied and the atmosphere operates by its excess of pressure over that of the rarefied air; and further to a valve arrangement for use with brakes worked by rarefied air, but which if forming part of a train with brakes worked by compressed air will not interfere with the working of such brakes. Fig. 1 illustrates the pipe coupling. A is the nozzle to receive the flexible hose connecting the half coupling to the carriage pipe, and the passage from it turns at a right angle to the lateral aperture B. Within the coupling is a cylindrical cage F with lateral apertures, and which on screwing down cap G presses on the edge of packing ring C, and also on that of a flexible diaphragm H secured between

3434 FIG. 1.



the cap and the cage. Under the diaphragm, and between it and the packing, is an inner cage K, also having lateral apertures. The cap has an opening to the outer air, and in it is a spring L pressing on the diaphragm. Fig. 2 shows the valve arrangement. The train pipe M being exhausted, the diaphragm D is deflected as shown, and air passes from an auxiliary

3434 FIG. 2.



reservoir and back of brake cylinder by N, and from front of brake cylinder P past the ports of stem H, and through holes G and G1, and the valve Q being closed, the brake cylinder is equally exhausted at both ends. If the pressure in the brake cylinder be increased the diaphragm D is pressed upwards, closing the hole G1 and also the ports in the stem H, which moving upwards open valve Q, and air flows by D so as to act on the brake piston. With compressed air the pressure communicated through M raises the diaphragm till the upper face of G is pressed against O, thus closing the passage.

3438. Self-levelling Berths, &c., *B. J. B. Mills, London.—8th August*, 1881.—(*A communication from J. C. Thompson, Brooklyn, U.S.*) 6d.

This relates to means for preventing self-levelling berths being deflected from the horizontal by a person getting on to or off the same, and consists in the use of an automatic locking arrangement.

3445. PREPARATION OF TEA, *J. P. Brougham, Inverness.—9th August*, 1881. 6*d.*
This relates to a machine for rolling and preparing tea leaves after usual curling, the object being to prevent fermentation in the early stages of the preparation, and to accelerate, the manufacture and improve the quality of the tea. The machine consists of a revolving cylinder with a shifting rotating roller mounted within it for acting on the tea leaves.

3446. TREATING EXCRETA, BLOOD, FISH, &c., *J. Haresceugh, Rochdale.—9th August*, 1881. 6*d.*
The object is to dry and deodorise the substance under treatment, and also to destroy or fix the gases given off and rendering them innoxious. The substance is placed in a rotating cylinder, and heat is supplied at one end from a furnace and drawn off with the moisture at the other end. A scraper keeps the substance from adhering to the cylinder.

3447. ATTACHING KNOBS AND HANDLES TO THEIR SPINDLES, *W. G. Macvitie, near Birmingham.—9th August*, 1881. 6*d.*
On one face of the spindle ratchet teeth are formed, and it is surrounded by a square tube with a flange to secure it to the door knob. In the tube opposite the teeth is a hole to allow the passage of a catch, which being acted upon by a spring secured to the tube presses it into gear with the teeth of the spindle. A hole is formed in the tube flange for the passage of a tool to force up to the catch when required to withdraw the spindle.

3448. AXLE OR GREASE BOXES, &c., *J. Hooley, Macclesfield.—9th August*, 1881. 6*d.*
This consists in dividing the axle or grease-box into two parts, detachably connected together by a tongue and groove connection, and provided with passages for the grease, the object being to afford ready access to the interior for examining the brasses and cleaning the bearing.

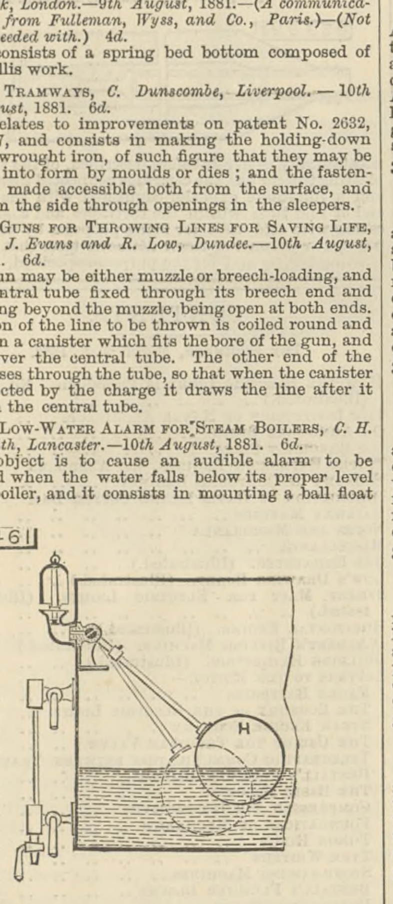
3452. BED BOTTOMS, SPRING MATTRESSES, &c., *W. Clark, London.—9th August*, 1881.—(*A communication from Fulleman, Wyss, and Co., Paris.*)—(*Not proceeded with.*) 4*d.*
This consists of a spring bed bottom composed of wire trellis work.

3457. TRAMWAYS, *C. Dunscombe, Liverpool.—10th August*, 1881. 6*d.*
This relates to improvements on patent No. 2632, A.D. 1877, and consists in making the holding-down jaws of wrought iron, of such figure that they may be pressed into form by moulds or dies; and the fastenings are made accessible both from the surface, and also from the side through openings in the sleepers.

3460. GUNS FOR THROWING LINES FOR SAVING LIFE, &c., *J. Evans and R. Low, Dundee.—10th August*, 1881. 6*d.*
The gun may be either muzzle or breech-loading, and has a central tube fixed through its breech end and projecting beyond the muzzle, being open at both ends. A portion of the line to be thrown is coiled round and placed in a canister which fits the bore of the gun, and passes over the central tube. The other end of the line passes through the tube, so that when the canister is projected by the charge it draws the line after it through the central tube.

3461. LOW-WATER ALARM FOR STEAM BOILERS, *C. H. Smith, Lancaster.—10th August*, 1881. 6*d.*
The object is to cause an audible alarm to be sounded when the water falls below its proper level in the boiler, and it consists in mounting a ball float

3461



H so as to float on the water in the boiler, and the pivot on which its lever turns forms the plug of a valve with a passage through it, which when the float falls coincides with a passage through the shell of the valve, and which leads to a steam whistle placed outside the boiler.

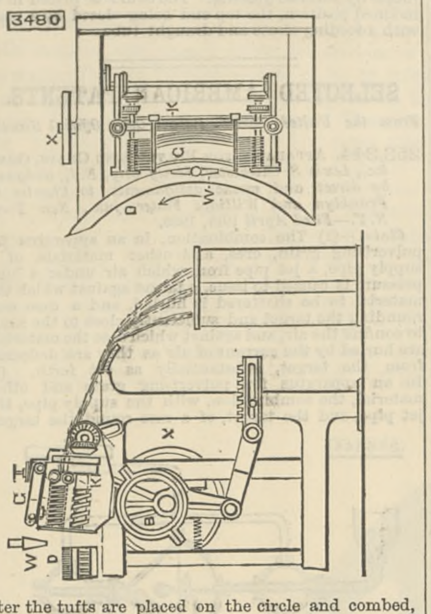
3462. BEETLING, CALENDERING, OR FINISHING WOVEN FABRICS, FELT, PAPER, &c., *D. Stewart, Glasgow.—10th August*, 1881. 6*d.*
The beetler consists of a shaft having on it a number of bands of steel bent into spiral coils, fixed to the shaft at their inner ends, their outer ends being free and formed into small loops. The bands are preferably placed so that their several ends are at different parts of the circle, and the shaft being rotated in the direction which would coil up the bands if their ends were held, causes such ends to fly out by centrifugal action, and in passing round strike the goods, which are made to travel over a roller in close proximity to the ends of the bands.

3469. SELF-ACTING RAILWAY BRAKES, *A. M. Clark, London.—10th August*, 1881.—(*A communication from J. Van Dussen Reed, New York.*) 1*s.* 4*d.*
The improvements are applicable in great measure to automatic brakes in general, but are described as adapted to the automatic double-acting system set forth in patent No. 3305, A.D. 1880, and they consist, First, in providing a spring to act upon the automatic brake shaft, and cause the chain to be unwound whenever the brake is released, without interfering in any way with the action of the hand brake; and Secondly, in providing means for limiting the amount of brake power that is automatically applied, and consisting in combining with the brake-applying mechanism a spring, which when the strain upon the brakes exceeds a certain limit will yield to permit the separation of the communicating parts of the mechanism far enough to prevent the transmission of further power to the brakes, while at the same time keeping them applied.

3475. UMBRELLAS, &c., *E. Posselt, Bradford.—11th August*, 1881.—(*A communication from F. Leitner, Milan.*) 6*d.*
This relates to a means of strengthening the framework of umbrellas, &c., preventing them being upset or losing their shape by the action of wind, and also means for automatically closing them. The ribs are fitted with flat steel stretchers secured one on each side of the clasp, and each connected to the stretcher of the next rib, the inner ends being secured to the runner. The catch to hold the runner is formed on one end of a rod passing down the stick and connected to a ring near the handle, by moving which the catch is withdrawn from the runner, and the stretchers cause the ribs to close on to the stick.

3480. COMBING WOOL, &c., *J. Heaton, Bradford.—11th August*, 1881. 6*d.*
This relates especially to "Holden" or square motion combs, and the object is to lessen the quantity of "robbins." The operation of the apparatus is as follows:—The fibre is fed to the fallers by fluted rollers K, and is carried forward by the fallers, so that at each forward motion of the gill head and excentric B, a tuft of wool is left on the combing circle D, the overhanging fringe being combed by the pins in the curved fallers G as the gill-head recedes, the "robbins" belonging to such fringe being left in the pins of the fallers, but at the next forward motion of the gill-head another tuft is left on the circle with the noil end placed beyond or at the other side of the pins, the overhanging fringe being combed as before.

3480



After the tufts are placed on the circle and combed, the circle travels forward to the ordinary drawing-off apparatus, where it is drawn off, the noil also being carried forward to be drawn off by its own apparatus. A blow-pipe W serves to sever the sliver as the gill-head recedes. To counterbalance the weight of the gill-head the driving pulley X is weighted on one side.

3486. MARKING AND COUNTING CORKS, *W. R. Lake, London.—11th August*, 1881.—(*A communication from G. E. Boëthius, Stockholm.*) 6*d.*
This consists of two dies bearing the name or mark, and each secured to the end of a separate horizontal shaft so as to face each other, and are forced inwards by springs and caused to separate by cams acting on rollers on their shafts. The corks are presented to the dies by a holder with six recesses, each holding a cork, and which is caused to revolve intermittently so as to present the corks in succession. Suitable counting mechanism is fitted to the machine.

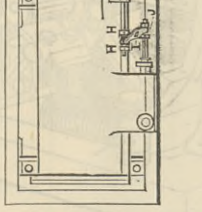
3487. PRINTING AND PAPER FOLDING AND PASTING MACHINERY, *W. R. Lake, London.—11th August*, 1881.—(*A communication from W. Scott, New Jersey, U.S.*) 1*s.* 4*d.*
This relates to web printing machines with a folding attachment, the object being to print from two rolls on the same press, and then associate the two printed webs so that they may be folded together; or to print from a single roll, the web being divided longitudinally, and the two parts being associated before delivery to the folding mechanism.

3490. TELL-TALE APPARATUS FOR REGISTERING THE TRAVEL PERFORMED BY POLICEMEN, &c., *L. Van Bunnen, Brussels.—12th August*, 1881. 6*d.*
This consists of apparatus to be carried by policemen, and which encloses a paper tell-tale showing how many times a certain distance has been traversed; and also apparatus consisting of a pocket box of punches to control the action of superintendents charged with overseeing the individuals who use the controller proper.

3495. METALLIC SPRING MATTRESSES FOR BEDSTEADS, &c., *S. Knowles, Manchester.—12th August*, 1881. 6*d.*
This consists of a combination of laths and springs, suspended lengthwise between the head and foot of the bedstead. The laths are fastened to one end of the bedstead, and their opposite ends are connected to spiral springs attached to the other end of the bedstead.

3502. DIFFERENTIAL VALVE GEAR, *H. W. Pendred, Manchester.—12th August*, 1881. 6*d.*
The piston rod is continued, and works a pump at one end of the cylinder. On the piston rod, between the cylinder and the pump, is fixed an arm A, which can be adjusted in any required position. The outer end of this is forked, and embraces a nut B which rides on a screwed rod C^1,

3502



having a screw of one or more threads. On this rod two collars H are fixed, so as to be adjustable, and between them the forked end of a lever I engages, the other end of which lever acts at J on the spindle of the slide valve of the cylinder. The screw is revolved by an independent motor alternating in opposite directions for each stroke, thereby shifting the slide valve.

3507. PLASTERING AND PLASTERERS' MOULDS, *E. G. Brewer, London.—12th August*, 1881.—(*A communication from D. W. Stockstill, T. J. McGeary, and E. W. Anderson, Washington.*) 6*d.*
This relates to means whereby centres, cornices, and ornaments of any character can be produced by the direct application of newly mixed or soft plaster or composition to the wall under a moulding pressure.

3512. STOVES AND FIREPLACES, *T. Redmayne, Sheffield.—12th August*, 1881. 6*d.*
As applied to a close stove in which the fuel is to be slowly burned with only a small and regulated admission of air, it consists of a hollow base mounted upon feet and carrying a vertical chamber, on each side of which is a vertical pipe connected at the bottom to the base. From the back of the base a passage rises and communicates with a chimney. The top of the vertical chamber and the two side pipes are all connected by a hollow top.

3513. STEAM ENGINES, &c., *M. Lowe, Wigan.—12th August*, 1881. 6*d.*
The cylinder is not rigidly fixed, but is able to reciprocate or oscillate in a curved path under the influence of the actuating fluid exercised alternately on its opposite ends or covers. The cylinder is coupled to the crank or other device, by which its reciprocating or oscillating motion is to be transformed into a rotary motion by means of a connecting

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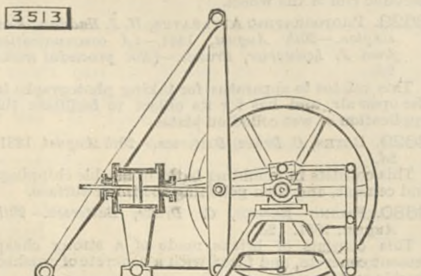

rod or of connecting rods in any suitable manner. The piston is also connected by a system of links and levers to the same crank or other device.

3515. DOWNCAST VENTILATING COWLS FOR SHIPS, *J. W. Gibbs, Liverpool.—13th August*, 1881. 6*d.*
The object is to prevent waves and spray passing down the cowl, and consists in carrying the shaft up to the top of the cowl, and making the opening for the admission of air, on the side of shaft furthest from the mouth of the cowl.

3516. RAILWAY CHAIRS, *J. Barlow, Nottingham.—13th August*, 1881.—(*Not proceeded with.*) 2*d.*
Each chair consists of a base plate with a jaw on its upper side to clip one side of the rail, and a slot to receive a movable jaw to clip the other side of the rail, and which is secured in position by wedging.

3518. EQUESTRIAN'S WATERPROOF CLOTHING, *W. Abbot, Devon.—13th August*, 1881.—(*Not proceeded with.*) 2*d.*
This relates to a covering to protect the rider's legs and feet from rain and snow.

3519. IMPROVEMENTS IN MEANS OR APPARATUS EMPLOYED IN LIGHTING GAS BY ELECTRICITY, *B. J. B. Mills, London.—13th August*, 1881.—(*A communication from L. A. W. Desruelles and G. J. A. Bourdoncle, Paris.*)—(*Not proceeded with.*) 2*d.*
The lighting of the gas is effected by a carrier of wood, in which is mounted a platinum coil heated to incandescence by an electric current. The carrier and coil are made to traverse the orifices of the gas burners.

3520. WATCHES, *A. L. G. Buys, Geneva.—13th August*, 1881.—(*Not proceeded with.*) 2*d.*
This consists in the application of a combined click-spring, which unites in a single piece the click-spring and the click usually applied to the mechanism of keyless watches.

3521. METAL PLATES, TIRES, BARS, &c., *F. Reynolds, Worcester.—13th August*, 1881.—(*Not proceeded with.*) 2*d.*
This relates to the production of rods, &c., of combined steel and iron, or hard steel and mild steel, and it consists in so building up the articles that any holes that may be required to be drilled through them may pass through the softer metal only.

3522. KNITTING MACHINERY, *A. Paget, Loughborough.—13th August*, 1881. 1*s.* 4*d.*
This relates, First, to an arrangement of a thread-layer slide hanging on or gripping a tube caused to traverse to and fro and carry with it the slide which passes across the needles; Secondly, to a method of arranging two or more sets of thread-layer slides, so as to permit of their being turned round a tube in or out of action when required for making the heels; Thirdly, to the construction of the drawing across pulleys; Fourthly, to the use of bob lifters for lifting the drawing across bobs off the periphery of the pulleys to prevent them being carried round; Fifthly, to an arrangement of locking latch pivotted on the incline-slide bar. Several other improvements are described.

3523. VENETIAN BLINDS, *W. Brierley, Halifax.—13th August*, 1881.—(*A communication from F. Rühr, Teplitz, Austro-Hungary.*) 6*d.*
This relates to means for adjusting the laths of Venetian blinds, the object being to combine the, adjuster with a device for raising and lowering the blind; and it consists of an arbor turning in bearings in an outer frame. The bands passing through the laths are attached to the lowest lath and wound round the arbor, which is actuated by pulling a cord wound round it in the opposite direction. A hollow cover surrounds the arbor and oscillates on the pivots, and to its edges broader bands are secured and connected by strings supporting the laths.

3524. LOOMS FOR WEAVING, *T. Sutcliffe, Lancaster.—13th August*, 1881.—(*Not proceeded with.*) 2*d.*
This relates to the picking motion of looms, the object being to check the action of the picking stick and take the strain off the picking band.

3525. REAPING MACHINES, *P. C. Evans, Brimscombe, and H. J. King, Newmarket.—13th August*, 1881. 1*s.* 2*d.*
So as to make a narrower and more convenient machine the sheaf binding or delivering parts are arranged at the back of the machine, and the cut grain is laid with the stalks parallel to the cutter bar (that is at right angles to the travel of the machine), and is carried back by an inclined apron which delivers it to the binding apparatus.

3526. WASHING OR PURIFYING AIR OR GAS FOR RAISING BEER, &c., *W. H. Beck, London.—13th August*, 1881.—(*A communication from J. C. A. Béliard, fils, France.*—(*Not proceeded with.*) 2*d.*
The air passes through an obturator or check valve and is disinfected and rendered inodorous by a washing apparatus placed between the obturator and the piping, which distributes the air under pressure to the barrels of beer.

3534. HORSESHOES, &c., *E. G. Brewer, London.—15th August*, 1881.—(*A communication from E. Schneider, Berlin.*) 6*d.*
The shoes are made with heel calks of india-rubber, leather, or other analogous substance, instead of iron or steel.

3540. MATCH BOXES, *R. H. Thompson, Islington.—15th August*, 1881. 6*d.*
This relates to a box for holding and igniting matches as they are projected therefrom, in which box the matches are delivered in succession into a groove combined with a self-acting sliding shield and a false bottom to isolate each match as it is being projected from the box by a traverser and ignited by an igniter.

3541. APPLYING GROUND COLOUR TO PAPER HANGINGS, *W. Clark, London.—15th August*, 1881.—(*A communication from T. Smith, New York.*) 6*d.*
This consists of a grounding machine in which the rotary brushes that distribute the colour receive a longitudinal movement by excentrics and levers to ensure a uniform application of the colour to the paper; and also in attaching the fulcrum studs of the levers to the bearings of the brushes, so that the latter can be adjusted without disturbing the connection between the levers and brushes.

3544. EFFECTING THE DISPOSAL OF SLAG FROM FURNACES, *E. F. Jones, Middlesbrough-on-Tees.—16th August*, 1881. 6*d.*
This relates to the disposal of slag by carrying it to sea in barges with hopper bottoms, and then sinking it; and it consists in running the slag into thin cakes of large area, so that it may cool quickly, when it is carried to a shoot fitted with knife-edged castings serving to break up the cakes. From the lower end of the shoot the slag is shot into the barge and conveyed to sea.

3546. PRODUCING AND DIFFUSING SPRAY OR MIST FROM WATER, &c., UNDER PRESSURE, *G. W. von Nawrocki, Berlin.—16th August*, 1881.—(*A communication from H. Mestern, Berlin.*) 6*d.*
The apparatus consists of a valve-box screwed to the end of the pressure pipe, and which, narrowing at its end, forms a seat for a valve having radial guide arms and a central bore, through which passes a screwed adjusting valve formed with wings at its upper end secured in the valve-box, while its lower end projects beyond the valve and is screw-threaded. An adjusting screw socket is fitted to this thread, and serves to open and close the valve. A revolving socket is fitted on the pin and is formed with vanes, against which the water as it issues strikes and causes it to revolve, and so diffuse the water in a spray.

3547. SEWING MACHINES, *A. Francois, Douai, France.—16th August*, 1881. 6*d.*
The object is to make twice as many stitches as hitherto with the same number of revolutions of the main shaft, and it consists, First, in the employment of a shuttle with two points and one spool, such shuttle being caused to pass through the loop formed by the upper thread both at its forward and at its backward movements; Secondly, in the arrangement of a disc having a peculiarly formed groove, by means of which the needle rises and descends twice whilst the shaft makes one revolution and the shuttle one to-and-fro movement.

3554. TOBACCO PIPES, *H. Woodward, Shepherd's Bush.—16th August*, 1881. 6*d.*
This consists in the use of a bowl closed at top by the stem from which it depends, and provided at its lower part with an orifice serving as an entrance for the igniting flame, and for the passage of air to the kindled tobacco.

3555. CONVEYING MESSAGES AND PROPERTY FROM SHIPS, *H. Redknap, Twickenham.—16th August*, 1881. 6*d.*
This consists in the use of a vessel covered with an exterior coating of waterproof and buoyant material for conveying messages and articles of property from ships, the bottom of the vessel being weighted to keep it in an upright position, and a flag being secured to a small rod at the top so as to render it more easy to be seen.

3557. CHECK-ACTION AND LEVERAGE SOUNDING BOARD FOR PIANOFORTES, *J. Brinsmead, London.—16th August*, 1881. 6*d.*
The First part consists in centreing a lever to the back end of the butt fork, with a large hole bored through the opposite end about half an inch deep, in which the leather patch of the escapement button works freely; the same being attached to the sticker by the screw pin guides the sticker both sideways and upwards until its button reaches the bottom of the hole. The lever comes forward by the upward motion of the sticker and presses it free of its notch, thereby causing the hammer to drop and to bring it into check. The Second part relates to a system of fixing the sounding board by the addition of a leverage arrangement, whereby the bridges and centre portion of the sounding board can be raised or lowered at pleasure by a screw appliance passed through the projecting portion of same.

3563. UTILISING THE POWER OF THE WAVES FOR DRIVING MACHINERY, *W. Clark, London.—16th August*, 1881.—(*A communication from J. L. Roberts, Jacksonville, U.S.*) 6*d.*
The waves are caused to act on a number of buoys with a rod fixed to the upper end of each, such rod having a rack to gear with a pinion on the driving shaft. The action of the waves in raising the floats disengages the racks from the pinions, while in falling again they are brought into gear and cause the driving shaft to revolve always in the same direction.

3566. REDUCING OR PULVERISING CLAY, ROCK, &c., *J. C. Anderson, Chicago.—16th August*, 1881. 6*d.*
This consists in the use of a machine composed of two upright cylinders fitted with arms acting in conjunction with each other within a shell, also fitted with arms, and made to conform to the outer periphery of the cylinders, which are caused to rotate at a high speed, so that the material to be pulverised is caused to pass through the machine by its own gravity, and to rotate in opposing currents at a great velocity, and is thereby thoroughly pulverised.

3567. TUNNELLING AND EXCAVATING APPARATUS, *A. L. Blackman, Nashville, U.S.—16th August*, 1881. 8*d.*
This relates to a machine for tunnelling, fitted with a conical-shaped boring head, with cutting blades secured by arms to a hollow shaft supported in bearings on a bed-plate. Within the hollow shaft revolves a shaft carrying a screw conveyer to carry the excavated material to the rear of the machine, both shafts being driven from a steam or other engine by means of suitable gearing.

3570. PREPARING DRAWING OR TRANSFER PAPER WITH A TINTED AND EMBOSSED SURFACE FOR USE IN LITHOGRAPHY, &c., *D. Bogue and B. C. Le Moussu, Strand.—17th August*, 1881. 4*d.*
Tinted and embossed paper is prepared by coating the surface with a composition which may be easily scraped, and over it a ruled tint is printed, and it is then finished with a dry embossed block pressed across the tint, the pressure causing the ink to be pressed in at the points of intersection of the lines, points, or dots, leaving the relief lines, on which the pencil will produce squares of graduated intensity up to perfect black. The printed tint will remain intermediate between the added work and the graduation to be obtained by a scraper, by means of which the printed tint being taken off, the points or dots will remain, which in turn may be removed at will when the full or high lights are required.

3576. VELOCIPEDES, *M. A. Weir, London.—17th August* 1881. 6*d.*
This consists, First, in the combination with a tricycle of a driving rack chain with a rocking pedal and lever, which, under the action of the foot, engages at pleasure into either the forward or rearward portion of the driving chain; Secondly, in the use of a telescopic axle so as to lessen the width of the tricycle when necessary; Thirdly, in the combination in a tricycle of a third movable spurred wheel with the driving pedal gear first described.

3579. PROTECTING SHIPS OR VESSELS, &c., *B. L. Thomson, London.—17th August*, 1881. 4*d.*
The surface to be protected is covered with plates of copper or zinc, coated with silica or glass.

3581. ASCERTAINING AND INDICATING WEIGHT, *T. H. Ward, Stafford.—17th August*, 1881. 6*d.*
This relates to improvements on patent No. 3700, A.D. 1877, and consists, First, in forming the loader frame of two side links secured by a crosshead carrying its knife edge top and bottom threaded through the top and bottom shackles or hooks; Secondly in securing all the working parts to one of the side links; Thirdly in the formation ef the dial; Fourthly, to an arrangement to keep the links central with the machine, and yet avoid having any rubbing surface on the knife edges; Fifthly, in fixing the lever-shaped bearing and fulcrum body between two side levers; and Sixthly, in inverting the apparatus so that the tumbler or rocker is placed in the bottom link, and the bottom sheave of an ordinary crane chain is pinned between the two side frames, so as to combine the lifting gear with the weighing machine.

3582. WATER-WASTE PREVENTERS, *C. Winn, Birmingham.—17th August*, 1881. 6*d.*
A syphon tube is placed within the cistern, and is fitted with a vertically-guided cylindrical cap connected to one end of a centred lever, to the other end of which the pull is connected. When the cap is raised a partial vacuum is created under it, and the

atmospheric pressure on the water in the cistern causes it to rise within the cap and pass into the syphon tube.

3583. SUGAR CANE MILLS, *D. Stewart, Glasgow.—17th August*, 1881. 6*d*.

This relates to a three-roller mill, the bearings of the upper or middle roll being held down in the usual way, while those of the two lower rolls are pressed horizontally inwards by the rams of hydraulic cylinders. The returner is connected to the bearing blocks of one of the lower rolls by links jointed to the ends of the returner, and to half rings passing partly round the roll journals and fixed to the bearing blocks.

3590. MACHINE EMBROIDERY, &c., *C. A. Barlow, Manchester.—17th August*, 1881.—(*A communication from J. Halter, Switzerland.*) 6*d*.

A piece of paper is placed in the embroidery machine and under stitches are first made on it where the figures are to be embroidered, the thread being continuous from one figure to another. The figures are then connected by strong thread that is made to pass below the under stitches of one figure, then drawn out at the front, and passed below the under stitches of the next figure and drawn out at the front, and so on till all the figures are connected. The figures are then embroidered in the usual manner and the paper removed by immersion in water.

3600. TAKING-OFF APPARATUS FOR PRINTING MACHINES, *H. T. L. Wilkinson, Clerkenwell.—18th August*, 1881. 6*d*.

This relates to taking-off sheets from single-cylinder printing machines without the aid of a fly, and it consists of a rock shaft A mounted in bearings in the brackets, carrying the receiving board B and extending across from side to side. A lever C is keyed on the shaft at one side and a similar one at the other side of the board, and to each free end is pivotted a

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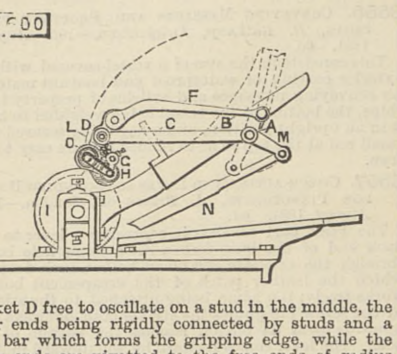

bracket D free to oscillate on a stud in the middle, the lower ends being rigidly connected by studs and a cross bar which forms the gripping edge, while the upper ends are pivotted to the free ends of radius rods F. G is a cross shaft mounted to turn in extensions of the lower ends of brackets D, and on it are fixed the gripping fingers by means of set screws. On shaft G is a short arm H with a stud at its extremity carrying a friction roller in contact with the plain part of the impression cylinder I, which is provided with ordinary grippers to seize and release the sheets, a depression being formed in its plain part to allow the friction roller on arm H to enter the same and cause the gripping fingers on shaft G to seize the sheet between them and the cross bar. An arm L on the shaft G has a stud in its end, which comes in contact with rod F and turns the shaft so as to open the gripping fingers and deposit the sheet on the receiving board. An arm M is keyed to shaft A, and is connected to rod N worked from the main shaft. The roller G is in contact with impression cylinder, and serves to steady the take-off apparatus.

3615. SELF-ACTING BOTTLE-STOPPING MACHINES, *C. M. Sombart, Magdeburg.—19th August*, 1881.—(*A communication from O. Hassmann, Holland.*) 6*d*.

This consists in automatically-feeding bottles under the piston of the machine by a revolving disc with tongs attached thereto, one branch of the tongs being movable, and the other immovable, and being actuated by a curved rail and edged tappet. The corks are automatically fed to the bottles, means being provided to prevent their being fed when no bottle is under the piston.

3616. MANUFACTURE OF FORKS, SCREW BOLTS, RIVETS, &c., *G. R. Postlethwaite, Aston.—19th August*, 1881. 10*d*.

The lower slide F of the machine is adjusted by a gauge screw to fall only so far as just to allow sufficient room between the tools to take in the heated iron or steel to be operated upon. The said heated metal having been placed between the faces of the tools, the foot lever I is pressed down. The lower slide rises and brings the metal under the action of the upper vibrating slide E, by the action of which the required shape is rapidly given to the metal under

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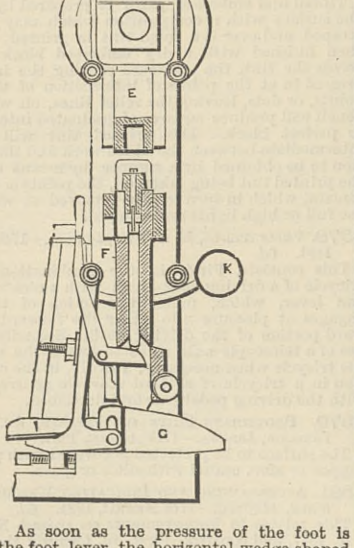

operation. As soon as the pressure of the foot is taken off the foot lever, the horizontal wedge-shaped slide G makes its return motion by the action of the counterbalance weight K, and at the same time the tools separate and liberate the article which has been shaped, and are again in their places ready for repeating the operation.

3618. CRICKET BATS, *G. W. Frowd, Newington Causeway.—19th August*, 1881. 4*d*.

This consists in forming the bat handle of a strip or strips of cork combined with the pieces of cane usually employed.

3620. DRESSING ENAMELLED BRICKS, &c., *J. Craig, Kilmarnock, N.B.—19th August*, 1881. 6*d*.

This relates to means for removing surplus enamelling or glazing composition from the edges or sides and ends of enamelled or glazed bricks, &c., and it consists in forming the rubbing surfaces for such purpose of travelling endless band, or of the flat sides or circular edge of revolving discs or drums covered with wire cards or carding cloth, or with hard fibre or similar material.

3626. WHEELS FOR PERAMBULATORS, BATH CHAIRS, &c., *J. Mansell, Birmingham.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to a method of fixing spokes of metallic wheels by constructing the hub of a special form; and also to the means for securing an elastic tire to the metallic rim of the wheel.

3628. PHOTOGRAPHIC APPARATUS, *H. J. Haddan, Kensington.—20th August*, 1881.—(*A communication from J. Lejéuvrier, France.*—(*Not proceeded with.*) 2*d*.

This relates to apparatus for taking photographs in the open air, and has for its object to facilitate the application of wet collodion plates.

3629. BATHS, *C. Drake, Battersea.—20th August*, 1881. 2*d*.

This consists in moulding baths of marble chippings and cement, and then polishing the inner surface.

3630. FACING BRICKS, *C. Drake, Battersea.—20th August*, 1881. 2*d*.

This consists of bricks made of a strong cheap cement concrete, and faced with a concrete of crushed marble and cement.

3631. SIZEING OR DRESSING YARNS OR THREADS, *F. Goldie, Airdrie, N.B.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

The object is to prevent the communication of colour from yarns of one colour to those of another colour, when sizeing or dressing yarns of different colours.

3632. TREATING MAIZE, *J. Muir, Edinburgh.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

The maize is broken by rollers or stones and the husks separated by sifting or fanning, after which it is placed in a pan mill, in which a grinding or rubbing action detaches the germs.

3633. ADJUSTING ACTION FOR TOILET GLASSES, SWING SASHES, &c., *S. Mead and J. W. Tiptaft, Birmingham.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

On the standard is fixed a bracket carrying a stud with a toothed disc at the end, and on the glass frame is fixed a plate with a spring bolt engaging with the disc.

3634. ELEVATING AND CONVEYING APPARATUS FOR DISCHARGING GRAIN FROM SHIPS, *H. Garland, Liverpool.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

The main elevator is fitted with a series of auxiliary elevators extending down into the grain and on each side of the screw shaft tunnel, such auxiliary elevators being hinged to the main elevator.

3635. IMPROVEMENTS IN THE PRODUCTION OF THE ELECTRIC LIGHT, *T. Tubini, London.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

The inventor makes the carbons of an arc lamp hollow, and causes gas or oil yielding carbonic atoms to pass through them, thereby augmenting the light, &c.

3638. CORE BARS FOR PIPE CASTING, *H. H. Stewart, Westminster.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in forming the core bar in four segments capable of collapsing so as to be readily removable.

3639. STREET OR ROAD TRAMWAYS, *C. A. Edge, Birmingham.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in forming a wedge-shaped projection on the underside of the rail, to fit into a corresponding recess formed between the cheeks of the chairs, which are supported on wrought iron sleepers of inverted trough form.

3640. CLIP FOR HOLDING UP THE LOWER EDGES OF TROUSERS TO PREVENT SOILING, *H. C. Noble, Connecticut, U.S.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

The clip is secured to the boot and prevents the edges of trousers legs trailing in the dirt.

3641. PUDDLING FURNACES AND MILL FURNACES FOR THE MANUFACTURE OF IRON AND STEEL, *J. Lones, C. Vernon, E. Holden, and R. Bennett, Stafford.—20th August*, 1881.—(*Not proceeded with.*) 2*d*.

The fireplace is provided with ordinary horizontal bars, and also inclined bars in the lower half of the front of the furnace. The bridge is made hollow, and the air entering the fireplace from the bridge is caused to pass through openings in the front of same. The sides and arched top are hollow, and air is heated therein and passes to the fireplace.

3642. FIRE-BARS, *T. Nash, Sheffield.—22nd August*, 1881.—(*Not proceeded with.*) 2*d*.

The bars are made of perforated plates strengthened by longitudinal and transverse ribs, the upper surface being corrugated to admit air to circulate under and through the fuel.

3643. GAS-BURNERS, *C. W. Morley, London.—22nd August*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in the application to burners of a bar or rod with a conical end actuated from the outside, so as to cause such end to more or less close the opening for the passage of the gas.

3644. CAPSULING JARS, BOTTLES, &c., *G. H. Butchings, London.—22nd August*, 1881.—(*Not proceeded with.*) 2*d*.

This machine consists of four plates, four grippers, and lever, all of metal, and four india-rubbers.

3646. PROCESS FOR THE WET EXTRACTION OF LEAD, SILVER, &c., *H. J. Haddan, Kensington.—22nd August*, 1881.—(*A communication from A. Drouin, Paris.*) 4*d*.

This consists, First, in the treatment of minerals and matts containing lead, silver, copper, nickel, or cobalt with an acidulated hot or cold solution of a soluble chloride, with or without previous roasting of the minerals or matts, for the purpose of binding the metals with chlorine; Secondly, in the repeated use of the same dissolving liquid after the precipitation of the dissolved metals.

3650. IMPROVEMENTS IN OR CONNECTED WITH ELECTRIC LAMPS, *G. Pfannkuche, London.—22nd August*, 1881.—(*Not proceeded with.*) 2*d*.

Instead of enclosing the carbons of incandescent lamps in a vacuous globe, the inventor proposes to envelope them in a transparent body, such as glass.

3651. DEPHOSPHORISATION OF IRON IN BLAST FURNACES, *C. D. Abel, London.—22nd August*, 1881.—(*A communication from H. J. B. Pellet and J. Cahen, Paris.*)—(*Not proceeded with.*) 2*d*.

This consists in adding magnesia in certain proportions to the charge in the blast furnace in order to act upon the phosphatic earths contained in the iron ores, so as to produce phosphate of magnesia.

3656. GLASS REFLECTORS FOR GAS LIGHTS, &c., *F. H. F. Engel, Hamburg.—22nd August*, 1381.—(*A communication from G. Franke, Hamburg.*)—(*Not proceeded with.*) 2*d*.

This relates to the construction of a single walled glass reflector, and consists in protecting the silver covering with a varnish of shellac, sandarac, mastic, Venetian turpentine, and alcohol, and when dry a mineral coating of amber varnish is applied.

3657. CASTS, COPIES, OR IMPRESSIONS OF PATTERNS, DEVICES, OR DESIGNS, *J. J. Sachs, Sunbury.—22nd August*, 1881. 4*d*.

A layer of some substance, such as chromo-gelatine, which is acted upon by light, is covered with a suitable varnish, such as asphaltum dissolved in turpentine, and the like, after which the sensitive layer is exposed to light under the copy or design to be reproduced, and after a sufficient time the parts not acted upon are removed by washing. A cast is then taken of the layer thus prepared by running Spence's or other similar metal on to it.

3660. DRYING APPARATUS FOR SUGAR, GRAIN, &c., *W. Morgan-Brown, London.—23rd August*, 1881.—(*A communication from C. H. and F. C. Hersey, Boston, U.S.*) 6*d*.

This relates to apparatus for drying sugar &c., and consists in the combination of a drum with buckets with an interior heating cylinder mounted upon independent bearings below the axis of the drum, both the drum and the heating cylinder being caused to rotate by suitable gearing. The drum is placed in an inclined position, the top end being closed by a plate with a feeding chute and draught tube.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

253,344. APPARATUS FOR PULVERISING GRAIN, ORES, &c., *Lewis S. Chichester, Jersey City, N.J., assignor, by direct and mesne assignments, to Charles G. Franklyn and William Foster, jun., New York, N.Y.—Filed April 19th*, 1880.

Claim.—(1) The combination, in an apparatus for pulverising grain, ores, and other materials, of a supply pipe, a jet pipe from which air under a high pressure is caused to issue, a target against which the material to be shattered is hurled, and a case surrounding the target and sufficiently close to the same to confine the air, and against which case the materials are hurled by the current of air as they are deflected from the target, substantially as set forth. (2) In an apparatus for pulverising grain and other material, the combination, with the supply pipe, the jet pipe, and the target, of a case round the target,

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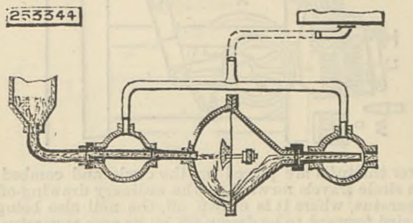

against which the material is hurled as it is deflected from the target, and which case is contracted, and a second pipe, and jet pipe, connected with the case and a second target, substantially as specified, whereby the materials receive two or more shattering impacts in the apparatus, substantially as specified. (3) In an apparatus for pulverising grain and other materials, the combination, with the supply tube and jet tube for air under a high pressure, of a convex target, against which the material is shattered, and from which the said material passes freely as it rebounds, as set forth. (4) The combination, with the ejector and target, in an apparatus for pulverising grain and other materials, of a central support at the back of the target and a cross bar for the same, substantially as set forth.

253,382. MAGNETO-ELECTRIC MACHINE, *Ludwig Herman, Union, N.J., assignor to himself and Julius Jonson, New York, N.Y.—Filed May 13th*, 1880.

Brief.—An armature mounted on an excentric driving shaft is brought in contact with or in close proximity to the field-of-force magnets. The magnets are parallel with the shaft, and the entire body of the armature is wound with conducting wires in the direction of rotation. Pole pieces are provided at the

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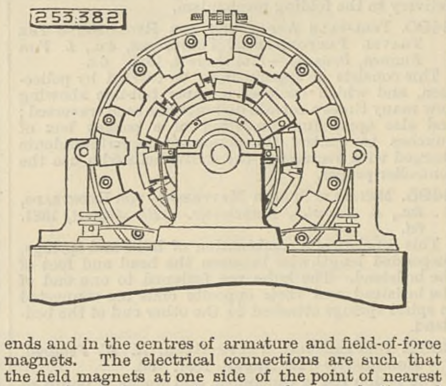

ends and in the centres of armature and field-of-force magnets. The electrical connections are such that the field magnets at one side of the point of nearest approach of the armature are of one polarity and those on the other side of the opposite polarity at all times.

253,387. DYNAMO-ELECTRIC MACHINE, *Chas. A. Hussey, New York, N.Y., assignor to the Hussey Electric Company, same place.—Filed August 13th*, 1880.

Brief.—The field magnet is circular, inclosing the

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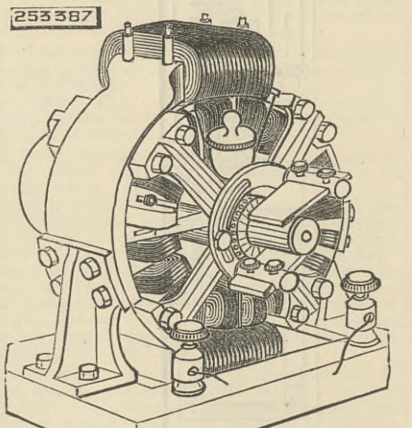

armature, and has the portion upon which the wire is wound offset, so that the inner surface of the coil is flush with the inner surface of the polar portions.

253,567. PRESSURE REGULATOR, *Joseph E. Watts, Larence, Mass.—Filed December 24th*, 1881.

Claim.—In fluid-pressure regulators, a closed parti-

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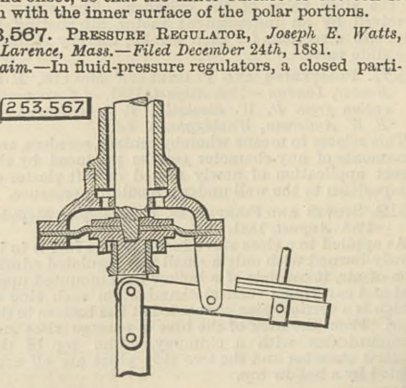

tion in the steam space of the water-well below the mouth of the equilibrium pipe which connects the water well with the delivery pipe of the regulator, this partition having a passage to permit fluctuations in pressure at the point of connection with equalising pipe to be communicated to the column of water in

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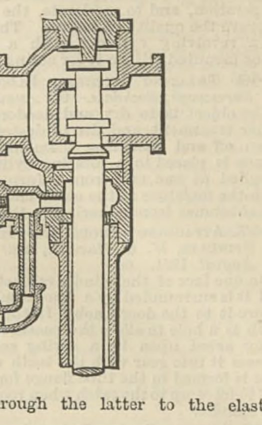

the well, and through the latter to the elastic diaphragm.

253,893. EXPLODER FOR BLASTING CARTRIDGES, *John C. Schrader, Warwick, R.I.—Filed August 11th*, 1881.

Claim.—(1) The combination, substantially as hereinbefore described, of the tubular blasting tube or bar, the cartridge connected therewith, and a fulminate-exploder connected with the blasting tube, located within the cartridge and beyond the end of said tube, as and for the purposes specified. (2) The combination,

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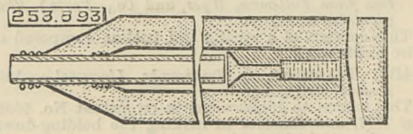

substantially as hereinbefore described, of the tubular blasting tube or bar, the cartridge connected therewith, and a fulminate exploder connected with the inner end of said tube within the cartridge and communicating with said tube for firing purposes by way of a passage or channel of lesser diameter than that of the blasting bar, as and for the purposes specified.

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