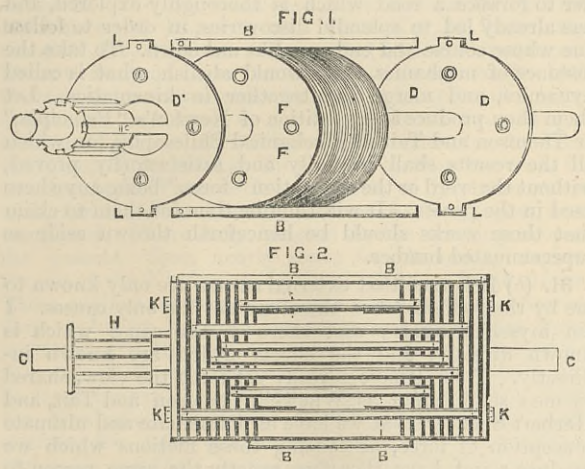
THE PARIS ELECTRICAL EXHIBITION.

No. XII.

We have spoken of the Pacinotti machine as forming the type upon which the more modern machines have been designed, and we have in previous articles described some of the newer forms of these machines, such as that of Dr. Hopkinson and that of Professor Jungerson. Besides these, however, there are several new machines in the Exhibition about which we know very little, and which have never previously been visible to the ordinary public, such as that of Edison, and of Ball, noticed in our last issue—both in the American section—of Gülcher, in the German section, &c. The Edison machine seems to have been designed from the Häfner-Alteneck machine—that is, we presume Mr. Edison studied the faults of the above-named machine and tried to remedy them. Mr. Edison prefers the cylindrical form of coils to his field magnets as shown, with the maximum pole pieces. Professor Rowland maintains that this form is preferable to the flat form of the Siemens or the Bürgin, and it would be interesting if Professor Rowland would give his reasons for this conclusion. One of the defects of the Häfner-Alteneck machine, according to Sawyer, is in the excessive heating of the armature, this being, he says, frequently so great "as to destroy the insulation." Edison's armature consists of the axle passing through a wooden tube, which again is surrounded with a strong iron cylinder composed of a series of very thin discs of iron separated by an insulator in order to render the magnetic inversions more prompt. At the two ends of this iron core, and insulated from it, are copper rings at both ends. These copper rings or discs are joined by bars of copper, which pass over the iron core.

A clearer idea of the Edison armature will, however, be gained by considering the illustrations, Figs. 1 and 2. At the commutator end, Fig. 1, a slightly different form of copper disc is adopted to that at the opposite end. At the latter the discs are perforated for the shaft to pass through, from which, however, they are insulated. On opposite sides of each disc is a lug, to which the connecting bars are fixed. In Fig. 1, C represents the shaft, D the disc just referred to, with the lugs L L, to which the copper bars B B are fixed. The discs D¹ at the commutator end have at the centre two semicircular pieces cut out, leaving the tongue T. This tongue bent outwards forms the metallic connection with the commutator base H. The discs F F are the soft iron core discs insulated like the copper discs from each other, and also insulated from the bars. The commutator H is formed of insulating material, grooved on its face with grooves equal in width to the tongues left on the copper plates. The discs D¹ are so arranged on the shaft that the tongues of the discs come opposite to the corresponding grooves in H, and each tongue is secured in its proper groove as shown at T in Fig. 1. Bolts K K passing through and insulated from the discs serve to connect the whole together. It may be stated that the insulation of the rods from the core is obtained by leaving a little air space. Altogether, then, it will be seen that this armature is built up of the simplest forms—the discs, insulating pieces, bars, &c., can all be stamped out by machinery. No costly process of winding is required, and if any part of the armature meets with a mishap the remedy is simple and the work of repair easily done. The resistance of such an armature is necessarily small, and in this Mr. Edison claims to have accomplished practically the relation of armature resistance to external resistance, which Sir W. Thomson in his paper at the British Association has mathematically demonstrated should hold good.

The smaller machine used at Paris till the arrival of the larger machine, has the appearance shown in Fig. 3. Both machines are similar in principle, and examples of them will be shown at the forthcoming exhibition at the Crystal Palace. Mr. Edison has devoted his attention to the designing a complete system of electric light apparatus, and hence it is not only a machine or a lamp we have to consider in his exhibits. It is well understood that in any system of electric lighting, some arrangement must be made for compensating resistances—that is the resistances in the circuit should be kept as constant as possible. When describing the installation of the Crompton light at Aldersgate-street Station, we stated that if any lamp was cut out of the circuit an equivalent resistance was introduced into the circuit, so that the sum total of the resistances remained fairly constant. Mr. Edison has not adopted this automatic plan, but prefers another method. His system includes photometric apparatus, a Wheatstone bridge arrangement, and a shunt circuit, which latter contains a series of resistance coils having at Paris a total resistance of 180,000 ohms. This arrangement, of course, is only applicable when a number of lights are required, and would ordinarily be placed at the "Central Station" to act the counterpart of the apparatus at the gasworks for increasing or decreasing the pressure of the gas. In the case of the electric light, the attendant observes the candle power of the lamp by means of the photometer, and adds or takes away resistance as required. It means simply the turning of a handle. Besides this compensating arrangement, if the electric current is to be supplied commercially, like gas, from a central station by mains and branches, it is necessary to have some way of determining the quantity used by the householder. Mr. Edison has a webermeter to take the place of the gas-meter. This measurer of electricity, as shown at Paris, is constructed upon principles well understood in electro-metallurgy. An electric current of a given quantity will deposit the same amount of copper. Hence Mr. Edison takes a depositing cell with a metal lining, which forms one electrode; the other electrodes may be obtained in several ways. Thus in one instrument he uses a piece of metal suspended within the cell by a spring so adjusted that when a certain weight of deposit has been made in the metal, the mass sinks down to the bottom of the cell. One form of this meter is shown in Fig. 4. When the metal falls down it causes a reversal of the current, and what was previously the + electrode now becomes the − electrode, and the deposit is transferred to the cell till the action of the spring withdraws the metal to its original position, and again the current is reversed. In the figure C shows the metal lining to the cell, B the piece of metal suspended by spring V. The scale S, in connection with the arm D, shows at any moment the amount of deposition. From D is a contact arm H; on A is also a contact G. An arm X supports a lever Y-shaped at one end, the double ends lying between the contacts H and G; and between the ends is the end of the index arm, so that, as will be seen from the figure, the rise and fall of B causes contact with one arm of the Y-shaped end of the lever at H, or the other arm at G. A reversing and counting apparatus is shown at I, consisting of two magnets, *m*, *n*, between which plays an armature lever L, one end of which actuates the register K, the other controls the reverser O. As a certain definite fraction of the current is sent through the meter, known by measuring the shunt circuit, that is the resistance of the meter, and the resistance of the line, the current dividing inversely as these resistances, the current used can be measured. The connections are made as shown by the dotted lines.. The modifications in the design of apparatus used may be very numerous, but the principle is the same; and we have preferred to illustrate the principle in this case rather than the particular design shown. It may be well to notice another of Edison's meters, as illustrated in Fig. 5. Here the meter is constructed on the principle of showing quantity of work done or resistance overcome. The rapidity with which the motor will accomplish its work with a definite loading is proportioned to the amount of current acting through it, hence if the motor is arranged to have a slow motion with a certain current, its speed will be increased proportionally as the current is increased. The loading, as shown in the figure, is by fan blades or wings, driven in any suitable medium, the shaft being connected with the registering device. In the design shown the coils of F are directly in the line circuit, while the armature A is in a shunt circuit. The shaft of A carries at one end a gear which meshes into a pinion, on whose shaft is the gear D taking into a pinion E on the shaft carrying the fan blades W, which give the load to the engine. Upon the other end of the shaft A is the pinion F and an index finger, the latter passing over a register face. As the load is constant the rapidity of the work done depends on the current. These ingenious devices will shortly be tested by trial on a large scale, when their exact value will be determined.



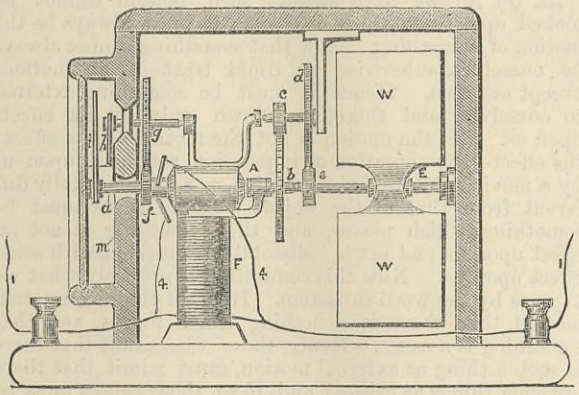


FIG. 5.—EDISON WEBERMETER.

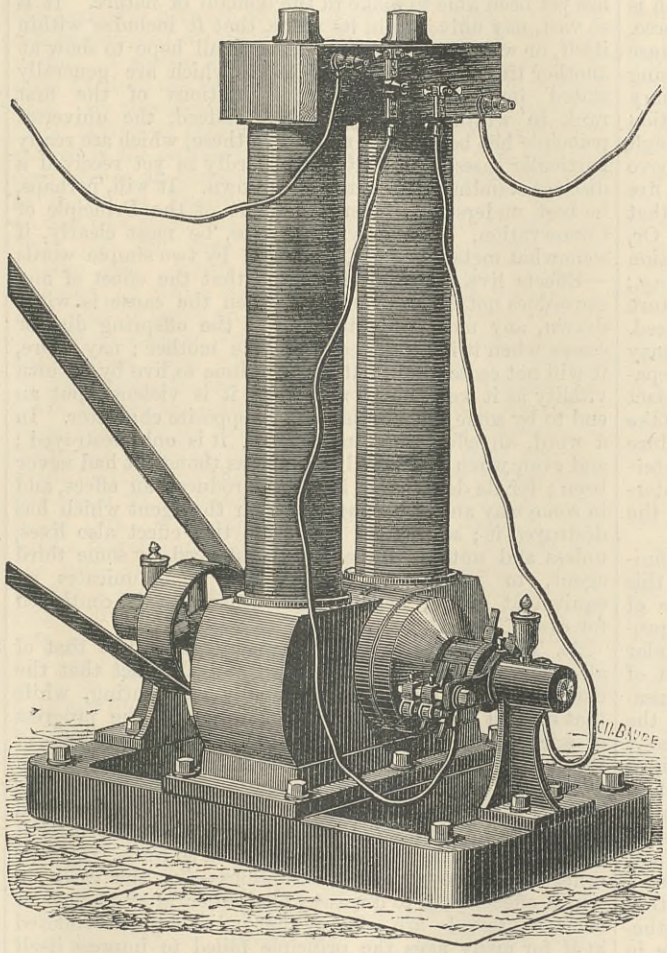


FIG. 3.—EDISON'S DYNAMO MACHINE.

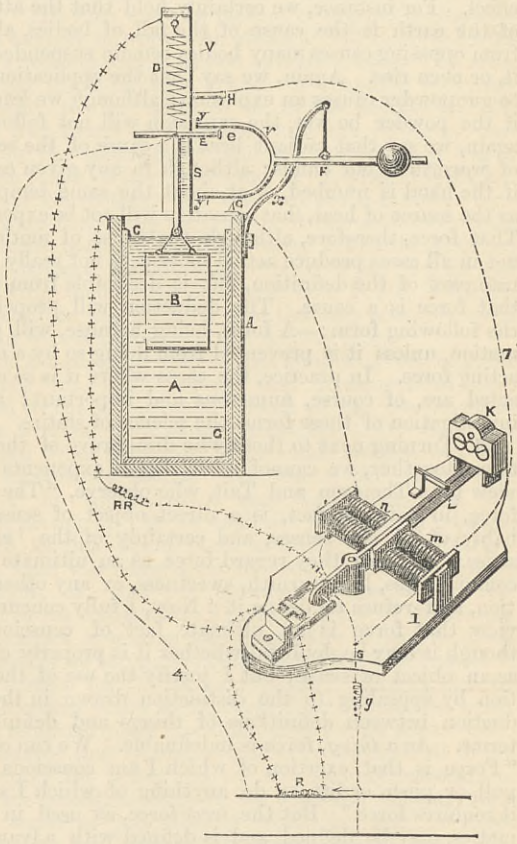


FIG. 4.—EDISON WEBERMETER.

THE FOUNDATIONS OF MECHANICS.

By Walter R. Browne, M.A.

No. II.

15. Motion, then, as regards the observer, is the change of place of the moving thing with reference to some other thing, supposed fixed; as regards the moving thing, it is a condition in which it is changing its place with regard to some other thing. And from these facts—that motion is relative, and that it is a condition—we see at once the error of those who assume that motion is a *thing*, an object with a separate existence of its own, which can be measured, and handed from one to another, and is by nature indestructible. Motion can no more be dissociated from a thing moved than pain from a person pained, or decay from a thing decaying. That this is so is shown in common speech, since we can only speak of a thing being in motion, or the motion of a thing. We cannot speak of a motion without reference to some thing any more than of a pain without reference to some body. Hence it is clearly a mistake in language to speak of a quantity of motion, since quantity implies the measurement of some definite thing; and accordingly the old term "quantity of motion," though only employed in a technical sense, has been properly replaced by "momentum." We cannot speak of the quantity of a pain: we speak of its intensity; and so we might speak of the intensity of a motion were it not that this has a specific name of its own, namely velocity.

16. For the same reason, in using accurate language, we must not say that motion is *transferred* from one body to another. If A, finding himself in a passion with B, uses injurious terms which put B in a passion also, we cannot say that A has transferred his passion to B, even if his own anger has been somewhat relieved by the explosion. Similarly, if a body A strikes against a body B, and puts it in motion whilst stopped itself, we must not say, speaking scientifically, that A has transferred its motion to B. It has only put B into a like state—with reference to some assumed fixed point, be it remembered—to that in which it had previously been itself. This may appear an unnecessary strictness of language; but there seems reason to think that the frequent use of the word transference, as applied to motion, is one of the causes which have led men to consider motion as a thing instead of merely a condition.

17. The above does not, of course, imply that there is no such thing as absolute motion, or that, practically, there are any bodies which are not in a state of absolute motion; but only that the direction and the intensity of absolute motion are for us impossible alike to recognise and to measure, and therefore that no conclusions can properly be drawn from it.

18. *Force.*—We have now defined mechanics as the science of force and motion, and we have explained, in the impossibility of defining, the sense of the word motion. We must next define, or explain, the sense of the word force. The definition we shall give is a very brief one, and is this:—*A force is a cause of motion.*

19. This definition is substantially that given by most writers on mechanics; but by those who approve it, it is usually expressed in an expanded form, while it is disapproved altogether by others. It is therefore necessary to defend it on both these sides.

20. The expanded definition is that given by Newton, "Principia" Def. v.,* and is nowhere put more clearly than in the "Course of Mathematics" by the present Bishop of Carlisle, where it appears as follows:—"Force is any cause which changes, or tends to change, a body's state of rest or motion." The object of this expansion is of course to bring out the fact that forces may act in many cases without causing motion, *e.g.*, when a weight rests upon a table. But the fact in such cases is not that force, as a cause of motion, ceases to operate, but that its operation is exactly balanced by an opposite or counteracting force. Now we are perfectly familiar with the idea that a cause may exist, and yet may be prevented by an opposing cause from producing the whole or any part of its ordinary effect. For instance, we certainly hold that the attraction of the earth is the cause of the fall of bodies, although from opposing causes many bodies remain suspended above it, or even rise. Again, we say that the application of fire to gunpowder causes an explosion; although we know that if the powder be wet, the explosion will not follow. Or, again, we say that radiant heat is a cause of the sensation of warmth in our hands; although in any given case, *e.g.*, if the hand is numbed, or at about the same temperature as the source of heat, that sensation will not be experienced. That force, therefore, although the cause of motion, may not in all cases produce actual motion, is not really a separate part of the definition, but is deducible from the fact that force is a cause. The deduction will properly take the following form:—A force, being a cause, will produce motion, unless it is prevented from doing so by a counteracting force. In practice, the cases where it is so counteracted are, of course, numerous and important; and the investigation of these forms the science of statics.

21. Turning next to those who disapprove of the definition altogether, we cannot select better exponents of this view than Thomson and Tait, who observe, "The idea of force, in point of fact, is a direct object of sense; probably of all our senses, and certainly of the 'muscular sense.'" Hence they regard force as an ultimate fact of consciousness, like warmth, sweetness, or any other sensation, and refuse to define it. Now, I fully concur in the view that force is an ultimate fact of consciousness,† though it may be doubtful whether it is properly classified as an object of sense; but I justify the use of the definition by appealing to the distinction drawn in the introduction between definitions of things and definitions of terms. As a *thing*, force is indefinable. We can only say, "Force is that exertion of which I am conscious when I pull or push or lift, or do anything of which I say that it requires force." But the *term* force, as used in mathematics, may be defined, and is defined with advantage in the words here given. The advantage is two-fold. In the first place, by means of this definition, we can exclude from mechanics a number of questions which might otherwise be asked, and would have to be answered, although the answer has nothing to do with the science. For instance, we get rid of the complaint which is sometimes made that writers on mechanics do not, after all, tell us what force is, in its essence and real nature. For answer, we only reply that we define force as a *term*, and that, as pointed out in the introduction, the definition of a term does not imply or require any other statement whatever as to the various objects in nature to which that term may be applied. For instance, we do not assert that what we call gravitation, and what we call magnetism, have any connection whatever, except the fact that they produce motion, and are therefore forces; while still less do we assert that we may not, in the further progress of this or other sciences, be able to trace out some further connection between them.

22. In the second place, we are able to show that certain principles, which must otherwise be laid down as separate and independent axioms, flow in reality from the definition, either directly, or by the aid of general principles, which do not belong to one science only, but are common to all. This is of great importance, inasmuch as the structure is thus shown to rest not on so many separate props, but on a stable and connected wall. One instance of this we have given already, in showing that the definition of force as a cause leads at once to the principle that forces may be counteracted by other forces, and that an expansion of the definition to include this fact is not therefore necessary. And we will now give two others, which are perhaps still more important.

23. It is sufficiently clear that all causes external to myself can only be known to me by their effects, direct or indirect, upon myself. For instance, if I am eating my dinner in a room in London, I may be receiving from external objects impressions of sight, hearing, smell, taste, and touch, all of which have no existence for my neighbour, only a few feet distant, but on the other side of a thick party-wall. The causes are there, in his immediate neighbourhood; but he knows nothing of them, because they produce no effect upon him; and if causes are only known by their effects, it follows that they can only be estimated or measured by their effects. In such measurement, however, we must take care to begin by examining the effects of the causes on one and the same object—since different objects may produce a specific difference in the effect—and also during the same times. Now apply this to the case of force, defined as the cause of motion. Then it follows that we can properly measure a force—or in other words, we can properly compare the intensities of two forces—only by comparing the intensity of the effects, that is the intensity of the motions, which they produce in one and the same object. But the intensity of motion is velocity, and hence we have the principle, that when forces are applied to the same object—or to objects in all respects equal—they are measured by the velocities which they generate in a given time.

24. The second principle referred to is derived from our definition by the help of an axiom, which is perhaps the widest and most important generalisation which science has yet been able to make in the domain of nature. It is so vast, nay universal in its scope, that it includes within itself, or within its converse—as I shall hope to show at another time—many other principles which are generally stated independently, as generalisations of the first rank in width and importance. Indeed, the universal principle has been so far merged in these, which are really particular cases of it, that it has hardly as yet received a distinct standing and name of its own. It will, perhaps, be best understood under the name of the Principle of Conservation. And it will, perhaps, be most clearly, if somewhat metaphorically, expressed by two simple words—Effects live. By this is meant that the effect of any cause does not die away or cease when the cause is withdrawn, any more than the life of the offspring dies or ceases when it is separated from the mother; nay, more, it will not cease at all, but will continue to live by its own vitality as it were, unless and until it is violently put an end to by some other action of the opposite character. In a word, an effect does not cease; it is only destroyed; and even when destroyed it is not as though it had never been; for its destruction in itself produces an effect, and in some way an equivalent effect, on the agent which has destroyed it; and by the same law this effect also lives, unless and until it likewise is destroyed by some third agent, to which in turn it also communicates an equivalent effect; and so the generation is continued for ever.

25. The proof of this great generalisation, like that of all other generalisations, lies mainly in the fact that the evidence in its favour is continually augmenting, while that against it is continually diminishing, as the progress of science reveals to us more and more of the workings of the universe. That it is true to some extent is shown by such every-day facts as that a stone continues to fly after it has left the hand, that waves continue to roll after the wind has dropped, that the horseshoe continues to glow after it has been withdrawn from the fire, and so forth. On the other hand the apparent exceptions—*i.e.*, the cases in which effects seem to die away altogether, after a longer or shorter interval—are so many that it is not to be wondered at if for many ages the principle failed to impress itself on the human mind. But the progress of modern science has shown so many of the exceptions to be apparent only, not real, and has at the same time brought to light so many additional instances of the rule, that the current of thought has changed; and the danger is now lest men should follow the rule too blindly and implicitly, and extend it to regions where it has not been shown to hold. Among the exceptions explained, may be mentioned as a signal instance the discovery that where mechanical work disappears it is always converted into some equivalent, such as heat; and among the new illustrations of the rule, the noblest is, perhaps, that furnished by astronomy, which teaches us that the majestic sweep of the planets through space is due to their having once for all been set in motion by something beyond themselves, somewhere, somewhen, somehow.

26. Without dwelling further on the proof of this great principle, we may proceed to apply it to our definition of force. If force is the cause of motion, and if effects live, then the particular effect called motion lives. In other words, a body once acted on by a force will retain precisely that intensity and direction of motion which the force has left it with, unless and until some other force supervenes to cause a change. In more definite language, *a body, under the action of no external force, will remain at rest, or move uniformly in a straight line.*

27. This is Newton's first law of motion, which is usually stated as an independent principle of dynamics, but which is thus seen to flow from the definition of force by the simple application of the universal principle of conservation. It is a well-known fact that the want of appreciation of this principle delayed for ages the progress of dynamics; because men thought themselves bound to look for the force which kept up the motion of a body, instead of simply looking for the force that had started it. This fact may at least teach us not to fall into the opposite error of regarding the principle of conservation as a necessary truth. There is no *à priori* reason to be given why effects should not die away of themselves, either at once or by degrees. Looking to the continual instances of decay around us, this seems to me even now the easier and more natural supposition; and I only accept the opposite because the facts of the universe force it upon me.

28. There are other fundamental principles, besides the first law of motion, which may be deduced in the same way from the definition; but it will be better to postpone these to a later stage.

29. *Cause.*—We must not leave the definition of force without saying something about the other essential word which it contains, namely, cause. To discuss this word thoroughly in the light, or shall I rather say in the obscurity, of all that has been written upon it, would fill a volume, and would take us off the solid ground of science into the confused and misty limbo of metaphysics. But there are some few at the present day who appear to disapprove of the word altogether, and to imagine that it may and should be done away with. Recognising the fact that external causes are only known to us through their effects, they apparently infer that we do not know them at all, and have no right or need to suppose their existence. Thus in mechanics they would eliminate force altogether, and pursue the science with the conceptions of motion alone. In answer to this it might be thought sufficient to appeal to the universal acceptation of the reality of causation; to the fact that even sceptical writers like J. S. Mill and Herbert Spencer found their theories of things upon it, and regard the existence of an effect without a cause as absolutely impossible either to credit or to conceive. I am not myself, however, disposed to adopt this position, and would rather urge upon these despisers of causes the following more practical considerations.

30. (*a*) The history of science is the history of the discovery of causes; her advances have been made on the single plan of studying events with a view to determine the causes of them. Thus the objectors are urging her to forsake a road which is thoroughly explored, and has already led to splendid discoveries, in order to follow one whose course and end are alike unknown. To take the instance of mechanics, they would abolish what is called dynamics, and merge it altogether in kinematics. Let them then produce a new edition of Newton's "Principia," or Thomson and Tait's "Mechanical Philosophy," in which all the results shall be fully and satisfactorily proved, without the word or the conception "force" being anywhere used in the proofs. It will then be time for them to claim that these works should be henceforth thrown aside as superannuated lumber.

31. (*b*) It is true that external causes are only known to me by their effects; but these are not the only causes. I am myself a cause; and there is the cause which is known directly, and the effects which are known indirectly. Thus I have already set forth the view, shared by men so different as Whewell, Thomson and Tait, and Herbert Spencer, that we have an immediate and ultimate conception of force, as causing those motions which we produce; and have therefore exactly the same reason to assume its reality as to assume the reality of thought, of sensation, of space, or of anything else which forms a primary fact of consciousness.

32. (*c*) As we have already seen, motion cannot be looked upon as a thing in itself; it must always be the motion of something. Now that something cannot always be ourselves, otherwise we could treat of no motions except our own. Hence it must be something external to ourselves, and therefore known only by its effects upon us. But the motion is not the motion of the effect: the effect—the sensation or impression produced upon us by a moving object—has no motion, or a motion wholly different from that of the object. Hence there must be something which moves, and this something is not an effect upon us, and yet is indissolubly connected with some effect upon us. Now this connection is precisely what we express by the word causation. Hence if there is external motion, then there is something which moves, and that something is a cause. Hence those who admit that there is such a thing as external motion, must admit that there are such things as causes; and, if so, those causes must be worth investigation, and science cannot be complete unless it investigates them. Moreover, if there are causes for impressions in general, it becomes probable that there are causes for motion also, and this probability becomes almost certainty when we remember, first, that we are directly conscious of ourselves as causing motion by exerting force; and, secondly, that science strengthens daily the proof that all impressions made upon us are due to motions of some kind or other.

* The literal translation of Newton's wording is:—"Impressed force is an action exercised on a body, tending to change its state either of rest or uniform motion in one direction."

† This view of force is also taken by Mr. Herbert Spencer, in his "First Principles;" but I altogether dissent from his further statement, that the idea is given by the impressions—of resistance, &c.—made on us by external objects. Let the reader rest his hand on the table with a book upon it, and then let him begin slowly to exert and to increase force until the book is just lifted. The sensation produced by the book upon the hand does not alter. What supervenes is a sensation, if it can be called so, in the muscles of the arm, accompanied by an involuntary inspiration, and general feeling of tension throughout the body. The idea of force is given by what we exert ourselves, not what other bodies exert upon us. Of course, it does not follow but that there must be a resisting body to give us the feeling. The difference is like that between an idea and a thought—we may not be able to think without an idea to think of; but idea and thought are not the same things.

Wind and Water Power.—A second edition of a pamphlet by Mr. S. B. Gaslin has recently been published by Messrs. John Warner and Sons, of the Crescent Foundry, Cripplegate, entitled, "The Relative Advantages of Wind, Water, and Steam as Motive Powers, Compared with Each Other, and a Description of the Motors Most Suited for Utilising Them." The larger part of the pamphlet is occupied in showing that wind and water power may be cheaply utilised in many situations, and that windmills may be employed to do work in very many cases where steam is now employed, simply because the steam-engine has become so universally looked to as the best motor, whenever any power is required. Instances are given of this, and an interesting though brief historical notice of windmills accompanies the part dealing specially with these motors. There is no doubt that windmills have been very much lost sight of during the past quarter century by numbers who have wanted a small motor, and in cases where some irregularity in the quantity of power would be of no importance. For village water supply, for irrigation, on farms and sheep runs, plantations, and very numerous places for raising water and doing occasional work, windmills may be usefully and cheaply employed where steam power costs too much to enable operations to be profitably carried on. An example of the employment of these motors for pumping purposes is the use of one at the Faversham Waterworks. This wheel is of 15-horse power, and this, the engineer of the works says, raised twenty-one millions of gallons of water in ten months from a depth of 109ft. from the bottom of the suction pipe to the reservoir. It is rarely that the mill stands entirely still for two days, and when a stiff breeze blows 10,000 gallons per hour are easily pumped into the reservoir, and as the steam engine at the same works uses 10 lb. of coal to every 1000 gallons raised, the saving by the windmill is often 100 lb. of coal per hour, or, on the above showing, there was a saving of 94 tons of coal or 9·4 tons per month. There are also many situations where water wheels of cheap construction could be employed with very great advantage, and, no doubt, will be more employed now that power can be so easily transmitted by electricity. Mr. Goslin's pamphlet will serve a useful purpose if it renews attention of those who want small motive power to economical wind and water wheels. A new catalogue of the annular wind wheels and of the water wheels made by Messrs. Warner has also been sent us. It contains illustrations and some particulars of these, but it does not give the average horse-power of any of the wind wheels.

MESSRS. SIMPSON AND CO.'S WORKS, PIMLICO.

Among the works thrown open to the members of the Iron and Steel Institution last month, were those of Messrs. Simpson and Co., Grosvenor-road, Pimlico. The firm have been engaged in the manufacture of hydraulic machinery for the past century; also in making mill engines, and waterworks' fittings of all kinds. Amongst the engines built by the firm in its earlier years may be mentioned the compound engines erected for the Lambeth and Chelsea Waterworks, the former being of 1200 and the latter of 600-horse power, and at the time—1849 or 1850—they were the most economical of their type ever turned out. When they were tested by Mr. Thomas Hawkesley, past president of the Institute of Civil Engineers, in 1867, they were found to be capable of lifting nearly 111,000,000 lb. of water 1ft. high with 1 cwt. of coal. Since that time the firm have made many pumping engines, both for use at home and for export, the foreign work being principally for Berlin, where the engines supplied by this firm were found capable of lifting 117,000,000 lb. of water 1ft. high, by consuming 1 cwt. of Welsh coal, when tested, in 1869, by Mr. Gill, the engineer of the waterworks in that city. Pumping engines have also been shipped to Copenhagen, Cairo and Ramlé in Egypt, and Odessa and Kharkoff in Russia; and three compound pumping engines, each of 100-horse power, are now at work at Herr Krupp's works at Essen. The last-mentioned have been tested by Prof. Rühlmann, of Hanover, and Herr Key, of Bonn, and raised 97,000,000 lb. of water with 1 cwt. of German coal. Messrs. Simpson have from time to time made both Cornish and rotary engines for nearly all the London water companies, and have at present in hand two pairs of compound engines, of 150-horse power each, for the West Middlesex Waterworks. Two, of 110-horse power each, for the Lambeth Waterworks, and two, of 105-horse power each, for the East London Waterworks, have just been completed. There may be seen in the erecting shop at the present time, nearly ready for shipment, engines for use at the Kimberley diamond mines in South Africa. These engines are compound, and fitted with an intermediate re-heater between the cylinders, which are steam jacketted, and lagged with mahogany. Some notion of the resources of Messrs. Simpson and Co.'s establishment may be formed when it is stated that the whole of the work for Kimberley, consisting of five pairs of compound engines, has been got to its present forward condition within six months. In making these engines every possible economical contrivance has been applied with a view to reducing the consumption of fuel to a minimum, for in that part of the world the coal, which has to be carried some 500 miles up the country, costs no less than from £20 to £30 per ton. The boilers were designed by Mr. E. A. Cowper, the president of the Institution of Mechanical Engineers, and have been built in sections with a view to facilitating the transport. During the last few years Messrs. Simpson and Co. have paid great attention to the improvement of their works, and have altered and remodelled their foundry, putting up in it a 30-ton power traveller, worked by a square shaft, made by Messrs. James Taylor and Co., of Liverpool. The foundry has also been furnished with three cupolas, and the largest castings that have been made here were some cylinders for marine engines which weighed 18 tons each. Morgan's plumbago crucibles are used in this foundry. Messrs. Simpson have made, amongst other machinery, a large quantity of mill engines, and have just completed one which will work up to 350 indicated horse-power, for Mr. Mumford, of the Royal Flour Mills, Vauxhall, where, in addition to the ordinary stones, a number of chilled rollers for crushing wheat by the new system are being driven.

In the turning shop Messrs. Simpson and Co. have put down a quantity of new lathes and other machinery, amongst the novelties being a very heavy lathe made by Messrs. Craven, of Manchester, which will turn objects up to 25ft. diameter and carry 25 tons on the mandril. The shop where the water valves are made has been specially designed and remodelled, the demand for these valves having largely increased during the past few years. The valves are all tested up to 1200ft. head of water without the glands being packed, the spindles being so arranged that the joint is made perfect without packing. This is a great advantage to the water companies, who are thereby enabled to repack their glands while their mains are fully charged with water. Those conversant with the matter will know the trouble and annoyance that is caused to the public by the draining of the water mains for the purpose of re-packing the valves, and will at once recognise the value of Messrs. Simpson's practice in cases where constant service mains are in use.

THE INSTITUTION OF MECHANICAL ENGINEERS.

The usual autumn meeting of the Institution of Mechanical Engineers at Manchester took place in the Memorial Hall, Albert-square, on the 28th ult. Mr. E. A. Cowper president, occupied the chair, and after the reading of the minutes of the proceedings of the last meeting, and announcements of election of new members and of nomination of new members of council and president, it was stated that the local committee for the summer meeting at Leeds in 1882 had been formed, and arrangements for that meeting were proceeding. The following is an abstract of a paper which was then read by Mr. C. J. Copeland, of Barrow-in-Furness, on

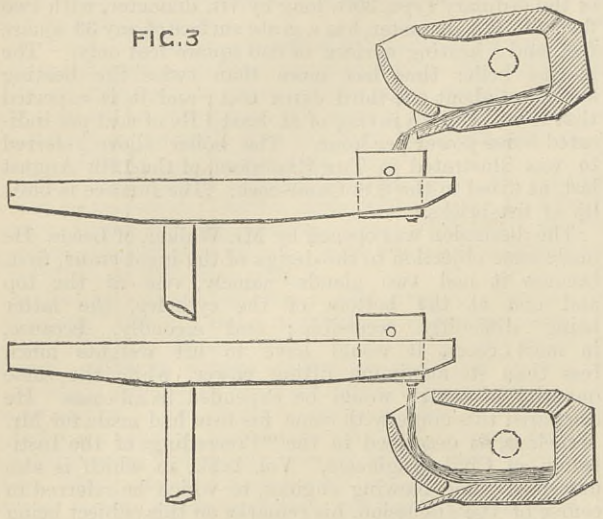
Bessemer Steel Plant, with Special Reference to the Erimus Works.

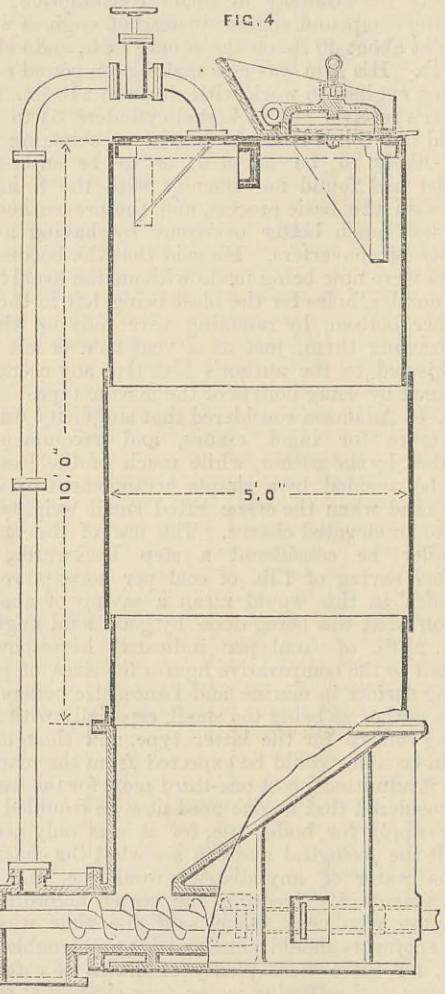
The paper described the steel making plant, into which the plant at the Erimus Works, constructed for the Danks process, had been converted from the designs of Mr. Godfrey. The cupolas, as constructed for the Danks process, not being high enough to run the metal direct into the converter, it is run into a receiver, and from thence tapped into the ladle M, see page 328, on the table of the lift C, Figure 1. This lift has a ram 14in. diameter and 21ft. 6in. stroke. The lift is worked by an ordinary slide valve, levers for which are placed both on the platform and floor level; and there is a knock-off arrangement at the top and bottom of the stroke. The metal ladles M have a capacity of six tons, with an ample allowance for slag, and being made to tap have no tipping gear attached to them. They are supported on the carriage by an angle iron belt, and are easily removed for relining and repairs. The metal runner E is suspended in a movable sling at the outer end, and supported on wheels at the back. The spiegel cupolas B are 4ft. 4in. diameter inside the shell, and are placed on the platform one on each side of the lift. The spiegel is run into small ladles V, which are lifted by the hydraulic crane D, attached to the wall of the house; it is weighed, in the act of running from the cupolas, by one of Duckham's patent machines suspended to the jib. The metal in the ladles is then tipped into the runner E. The valve gear for the crane D is fixed on the platform. The converters, two in number, have wrought iron shells, 8ft. diameter outside, and ⅞in. thick. The length from the centre of the trunnion to the top of the nose is 8ft. 8in., and to the bottom, exclusive of blast box, 5ft. 10in. The shells are carried by a strong cast iron belt, 3ft. deep, a portion of which is used for conveying the blast. The trunnions are 19in. diameter, and are cast on the belt, which is made in segments, and fitted to the converter between strong angle iron rings, so that it can be removed without damaging the shell of the converter. A special feature of the converter is the cast iron hood fixed on the back above the belt, to form a tapping hole. By this means, should any difficulty arise from the metal taking up phosphorus from the slag, when it is being poured in the ordinary way, it can be tapped out, with the converter in an horizontal position, from beneath the slag, as shown in Figure 3. The converters are carried on cast iron standards, the bases of which are on the floor level, 15ft. 6in. from the centre of the trunnions. The tipping gear consists of movable horizontal hydraulic cylinders, on which are fixed cast steel racks, working in steel pinions keyed on the trunnions. The piston-rods are of tubular steel, to conduct the pressure to each side of the pistons. The outer ends of the rods are secured to the standards, and the cylinders have sufficient traverse to turn the converters three-fourths of a revolution. Hand-cranes G are fixed on each side of the platform for lifting the blast-box covers, &c., and jack rams are provided for changing the bottoms. The centre casting crane has a ram 2ft. diameter and 36ft. long, the working stroke being 19ft. The extreme radius of the ladle is 17ft., with a traverse inwards of 18in. The jib is turned, and the ladle traversed, by hand-gear; the centre casting having a steel pivot at the top, and being fitted with a ring of live rollers at the bottom. The great length of lift was arranged specially for the dephosphorising process, and the proposed operations with that process are indicated in Figure 2. The crane is there shown at its extreme lift, transferring the desiliconised metal to the second converter; which may be found necessary, if the operation cannot be completed in the ordinary way. The ingot cranes, lift five tons, two in number, are of the ordinary type, having rams 10in. and 16in. diameter, and a working radius of 18ft., with a lift of 7ft. 6in. The objection urged against this kind of crane is that the weight of the ram and jib are greater than the weight the crane will lift; but, having regard to the great desiratum of all steel plant, namely, simplicity, the author thinks that this objection may be disregarded. The accumulator has a ram 2ft. diameter, with a stroke of 20ft., and is weighted to give a pressure of 600 lb. per square inch. The blast and water pressure are led to a distributing box, over which there is a platform, on which is arranged a series of levers for working the valves. The blast is carried to the lime-infuser in a single 18in. main; although there are two blast valves on the distributing box, one for each converter. On the other side of the lime-infuser the main is divided into two 12in. pipes, on each side of which there is a sluice valve. To prevent the possibility of the converters being turned up with these sluice valves shut, there is a small hydraulic cylinder fixed over each of them, the valves for working which are on the distributing box. The levers for working these valves are arranged so that the act of opening the blast valve would work the hydraulic valve, should the attendant forget to do so. The lime-infuser consists of a wrought iron casing, 5ft. diameter and 10ft. high, placed on a cast iron base or hopper, Fig. 4. The charging door on the top is on a level with the converter platform, and there is also a blast connection on the top for admitting the pressure when the infuser is charged. At the bottom of the hopper there is a cylinder containing a worm, which is driven by a small pair of engines, and this conveys the lime to the blast main. The author then described some recent modifications in steel making plant. The first of these is Holley's system of changing the converters without disturbing the belt or trunnions, as shown in Fig. 5. It consists in lowering the converter out of the belt by means of a hydraulic lift, on which there is a bogie. The shell is secured to the belt by wrought iron knees and cotters, which are slacked back when it is to be changed. This method of removing the converters obviates the necessity for an overhead crane. Messrs. Thomas and Gilchrist propose to overcome the necessity for removing the converters by means of a special mixture for relining, which is thrown or poured round a collapsible iron shell or mould fixed inside the converter. Cooper's method of utilising the waste heat from the converters, where the direct process is not in use, and in which the flame from the mouth of the converter passes into a chamber filled with pipes, through which the blast of the cupolas passes, was next referred to. The temperature of the blast is raised by this means to between 400 deg. and 500 deg. Fah. At Messrs. Brown, Bayley, and Dixon's Works it effected a saving of 25 per cent. in the quantity of coke used for melting the pig iron. At the conclusion of the paper the author suggested the adoption of a marine type of boiler, as a means of effecting a saving both in the space occupied and in economy of fuel. The author's firm are now making such a boiler for the Barrow Steel Company, and on their recommendation Turner's system has been adopted. This boiler, occupying a space of 9ft. by 21ft., has a grate surface of 33 square feet, and a total heating surface of 1275 square feet. A Lancashire boiler of the ordinary type, 30ft. long by 7ft. diameter, with two flues 2ft. 9in. diameter, has a grate surface of, say 33 square feet, and a heating surface of 840 square feet only. The marine boiler thus has more than twice the heating surface at about one-third extra cost; and it is expected that it will effect a saving of at least 1 lb. of coal per indicated horse-power per hour. The boiler above referred to was illustrated in The Engineer, of the 12th August last, as fitted in the S.S. Game-cock. The furnace is built up of fire-bricks.

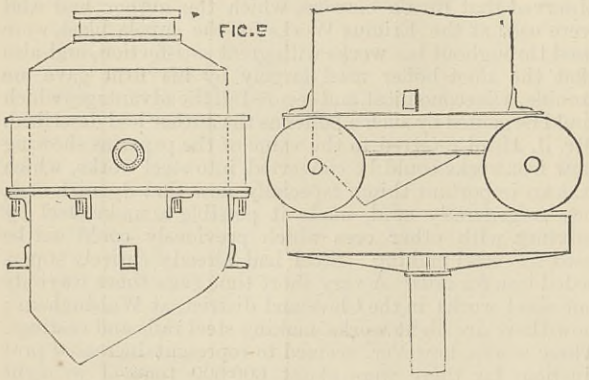
The discussion was opened by Mr. Walker, of Leeds. He made some objection to the design of the ingot-crane, first, because it had two glands—namely, one at the top and one at the bottom of the cylinder, the latter being difficultly accessible; and secondly, because, in most cases, it would have to lift weights much less than its maximum lifting power, while the same quantity of water would be expended in all cases. He compared this crane with some his firm had made for Mr. Menelaus, as described in the "Proceedings of the Institution of Civil Engineers," Vol. lxiii., in which is also described some blowing engines, to which he referred in course of the discussion, his remarks on this subject being to the effect that iron and steel-masters now saw the necessity for economy in steam consumption, and were adopting compound engines instead of engines which used steam at about 40 lb. on the square inch, and exhausted it at 20 lb. His firm was now making compound condensing blowing engines to work with steam at 110 lb., fitted with Cowper's receiver and jacketted cylinders, 3½ to 1 in area. He did not think Holley's system of changing converter parts likely to be adopted, or to be successful. M. Wendel had found no difficulty with the lining of converters in the basic process, and the prevention of loss of time was much better overcome by having a sufficient number of converters. He said that the bottoms of converters were now being made without the usual terra-cotta blast nozzles, holes for the blast being left in the ganister, or other bottom, by ramming wire rods up therein and withdrawing them, just as a vent-hole is left in a core. He objected to the author's idea that any economy could be gained by using boilers of the marine type.

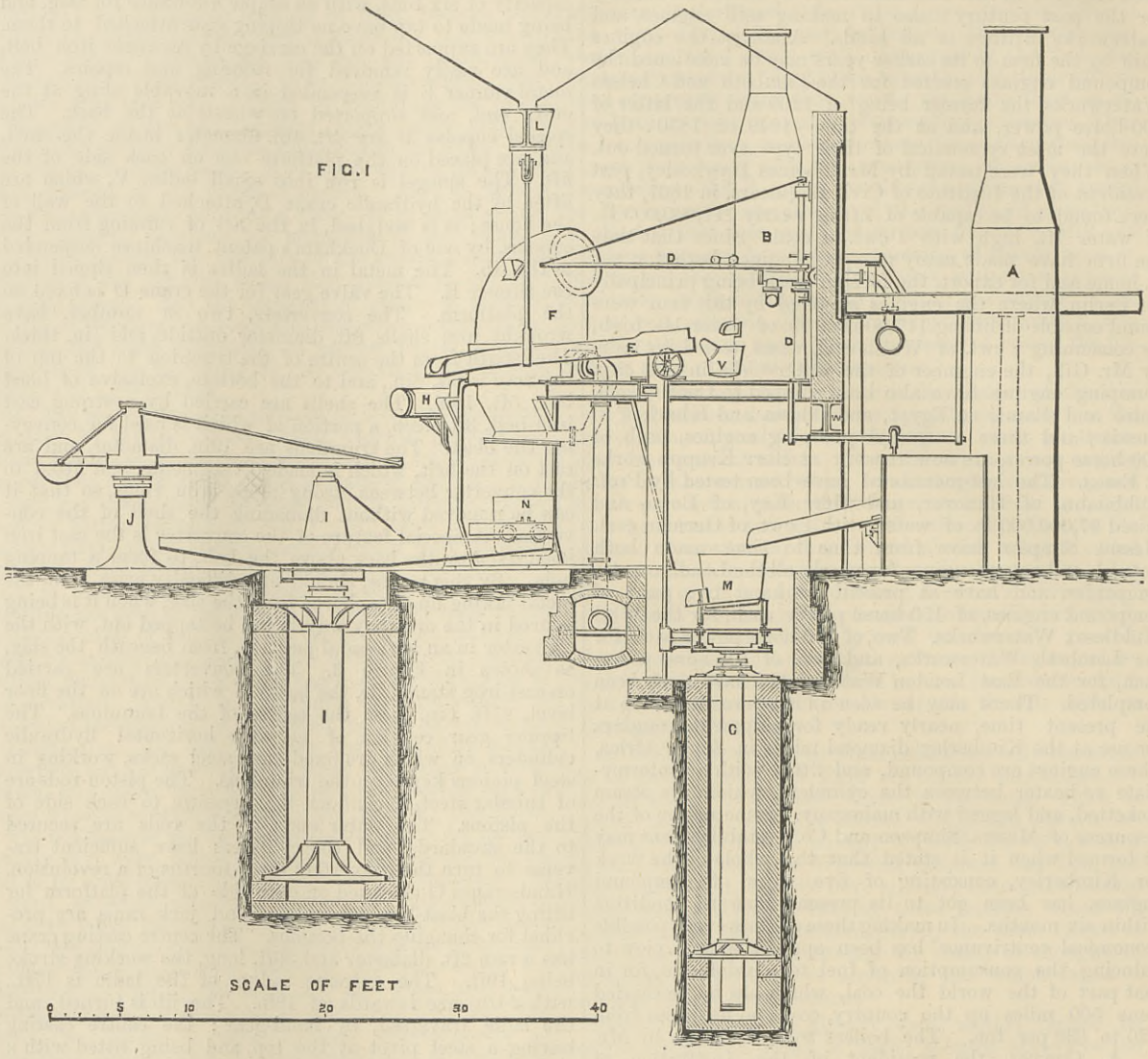
Mr. D. Adamson considered that simplicity was of great importance for ingot cranes, and recommended that described by the author, while much of the loss of water could be avoided by a simple arrangement by which the water used when the crane lifted small weights was sent back to an elevated cistern. The use of the marine type of boiler he considered a step backwards, and the supposed saving of 1 lb. of coal per horse-power absurd, inasmuch as this would mean a saving of about 50 per cent. on what was being done by good land engines using about 2½ lb. of coal per indicated horse-power. He objected to the comparative figures for sizes of grates and heating surface in marine and Lancashire boilers as given by the author as being too small, especially with respect to heating surface for the latter type, and thought that no gain in economy could be expected from the marine boiler while it admittedly cost one-third more for the same power. He considered that no one need now be troubled as to the water supply for boiler use, for it was only necessary to consult the geological maps to see what the characteristics of the water of any district would be, and to make arrangements for treating the water accordingly. Mr. Crampton, who next spoke, said the time was gone by when engineers should acknowledge any trouble with the water, for there were plenty of means of softening and purifying, and softening water very cheaply at command; and Mr. Cochran said that Strong's purifier lately described to the Institution was one of these. Mr. Cochran also observed that Root's blowers, which the author had said were used at the Erimus Works for the cupola blast, were used throughout his works with great satisfaction, and also that the Root boiler used largely by his firm gave no trouble, was economical, and secured all the advantages which could be gained by such a boiler as the author had described. Mr. J. Head referred to the value of the paper as showing how ironworks could be converted into steel works, which was an important thing, especially now that Spanish ores, now so generally used, made it possible to make steel by mixture with other ores which previously could not be used for steel making. Steel had already entirely superseded iron for rails. A very short time since there was only one steel works in the Cleveland district, at Walsingham; now there are eight works making steel rails and castings. These works, however, seemed to represent increased production, for there were about 600,000 tons of wrought iron still made as previously to the production of these steel works. He seemed to think that ironworks could in many cases be converted into steel works, but in Cleveland this would have to be by the basic process, using Cleveland ores. Mr. I. L. Bell did not think that many ironworks could be so converted; for the plant which was strong enough for rolling iron could not stand steel work, and he mentioned a case where the conversion of an iron into a steel works had been disastrous from this cause. The adoption of the basic process depended entirely upon the relative cost of hematites and the less pure ores. When hematite or similar pure ore could be obtained at a low price, it would not pay to use the basic process and sulphurous ores, and hence in Germany, with ores in which phosphorus was the chief impurity, the basic process would be used because pure ores could not be cheaply obtained, but in this country this was not the case, and he thought Mr. Head took rather too sanguine a view of the steel making probabilities of Cleveland. Referring to the boilers, he said that egg-ended externally-fired boilers, 75ft. in length, and with a U-shaped connection in the centre of their length, were used in his works with great economy, due he considered, to the fact that the heated gases passed over so large a surface that they had time to give up their heat before passing to the chimney. The

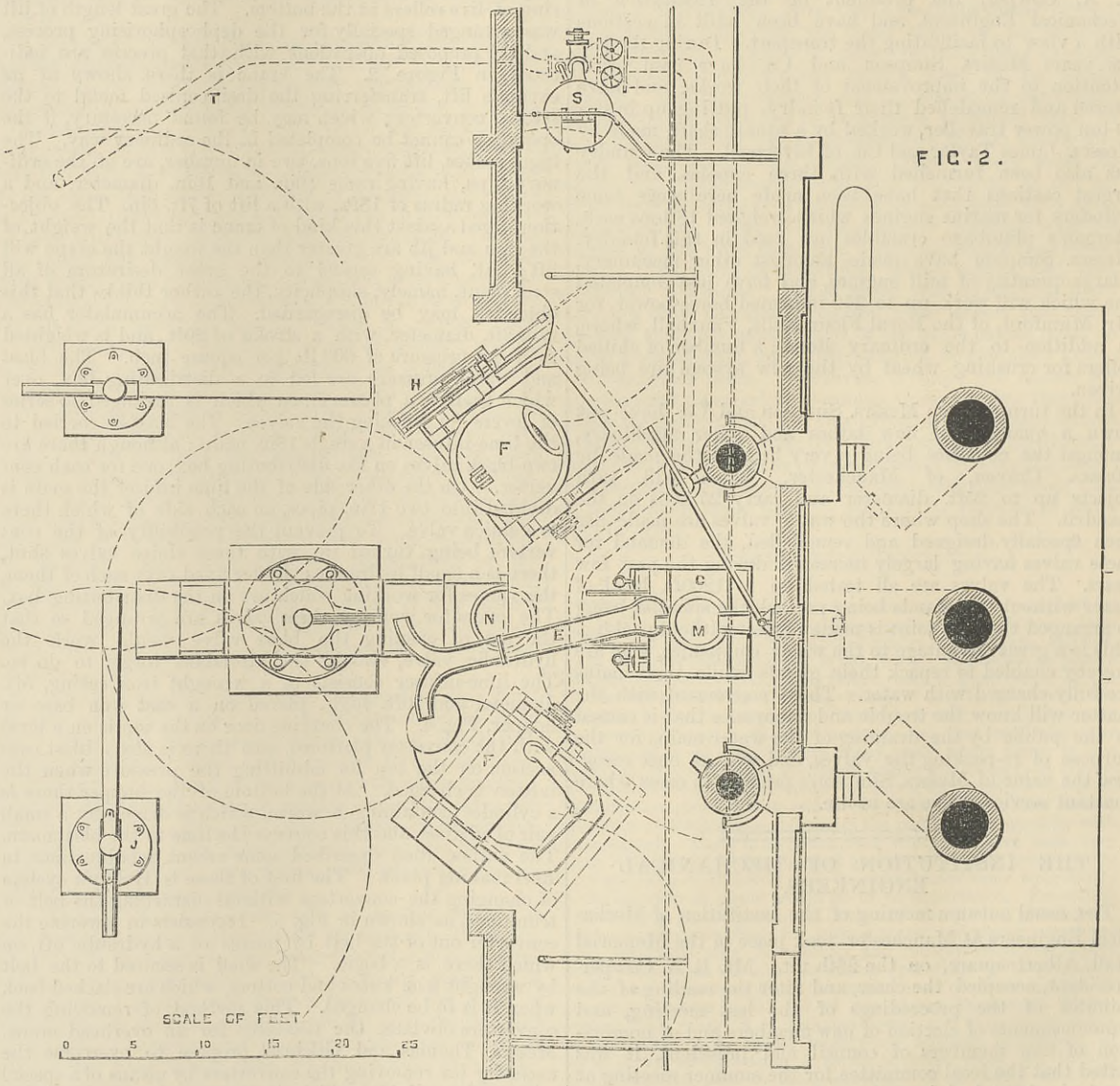
BESSEMER STEEL-MAKING PLANT AT THE ERIMUS WORKS.











temperature of these escaping gases, when the boiler was clean, was only about 500 deg., which had been shown to be the most economical temperature, but this rose to about 800 deg. when the boiler surfaces had got coated with soot, &c.

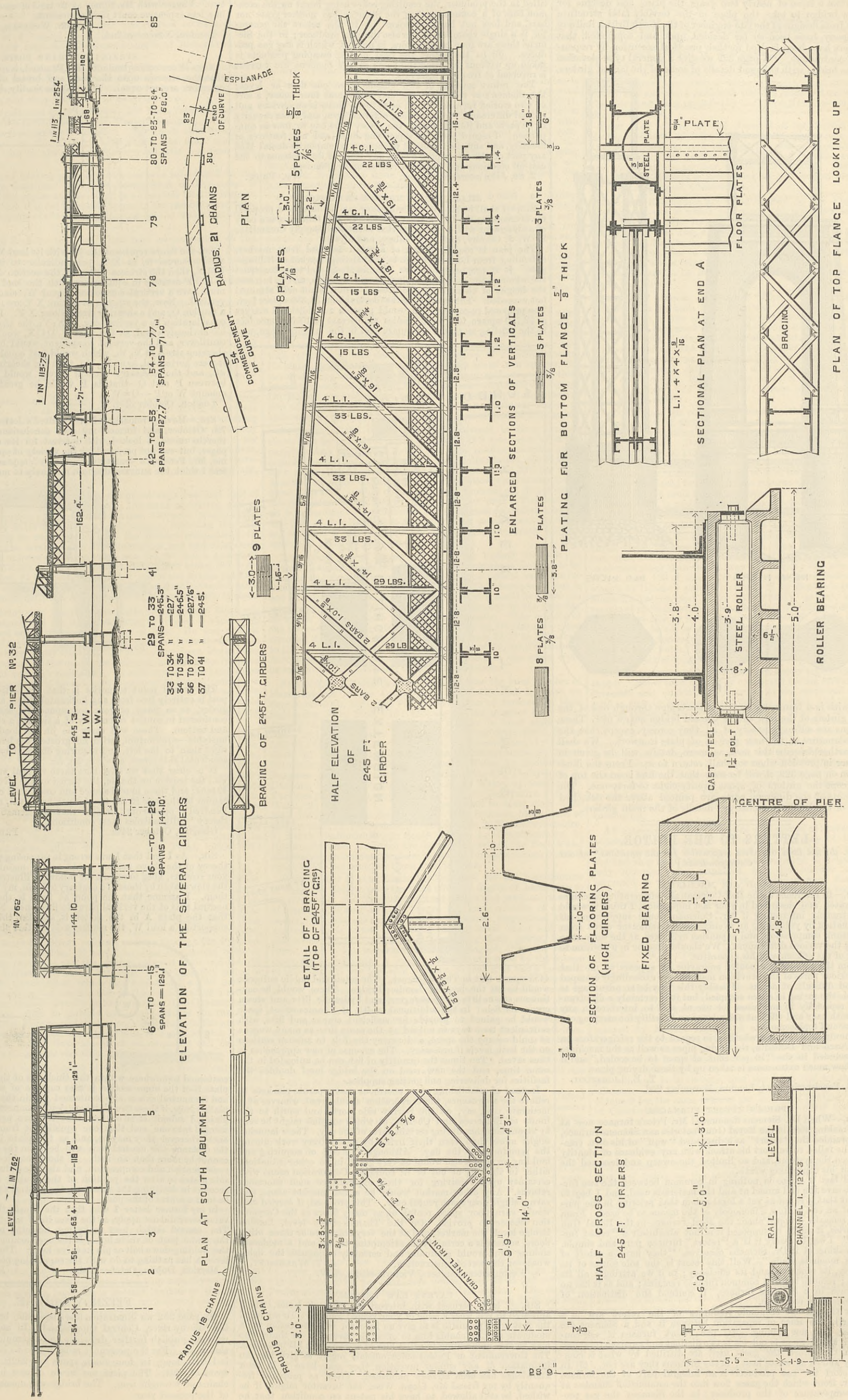
In the blowing engines referred to by Mr. Walker, and illustrated in the Proc. Inst. C.E., the jacket was made in two lengths to reduce liabilities to cracking, and Mr. Walker explained, in reply to some remarks by Mr. Bennett, that, though best iron was employed whenever a difficult casting had to be made, and where cracking by contraction was probable, that his firm used fo such purposes a mixture of Blaenavon, Pontypool, and cold blast Stafford iron, and that they had succeeded, where a single high-class hard iron had failed, in making some large valves, with a mixture of three soft Scotch pigs. It was often specified that the best iron should be used for rather large and complicated castings; but very close iron could not be used for the purpose, because of its inability to accommodate itself to the strains attendant upon contraction—contraction being of itself greater with the harder iron than with soft iron. For these reasons his firm made the bore only of the cylinders with close or hard best iron, and the jackets were made of softer iron, and in two lengths. Mr. E. A. Cowper mentioned that it had been shown by a German experimenter that steel took three times more power than iron in the rolling mill. Mr. Copeland, in reply, said that the crane described was worked with water at a pressure of only 400 lb. per square inch, and hence the cylinder was larger than usual. With reference to the paragraph which was somewhat curiously thrown into the end of his paper, and which caused much discussion, he said that some marine engines worked with fully 1 lb. less coal than land engines, and there was reason to think this was largely due to the use of the marine type of boiler. He was quite prepared to find that his statement would meet with a good deal of unfavourable criticism; but all the truth was not always urged in discussions, and he was convinced that a very important economy would be secured with the use of the type of boiler he described. The Barrow Company had saved 30 per cent. by the use of some boilers of this class, but he admitted that the Barrow Company had ordered the boiler he had referred to to fit into the place of a water tube boiler, about to be removed.

The next paper read was by Mr. W. D. Scott-Moncrieff, of London, on "Compressed Air on Tramways." This paper and the discussion upon it will be given in our next impression.

THE NEW TAY BRIDGE.

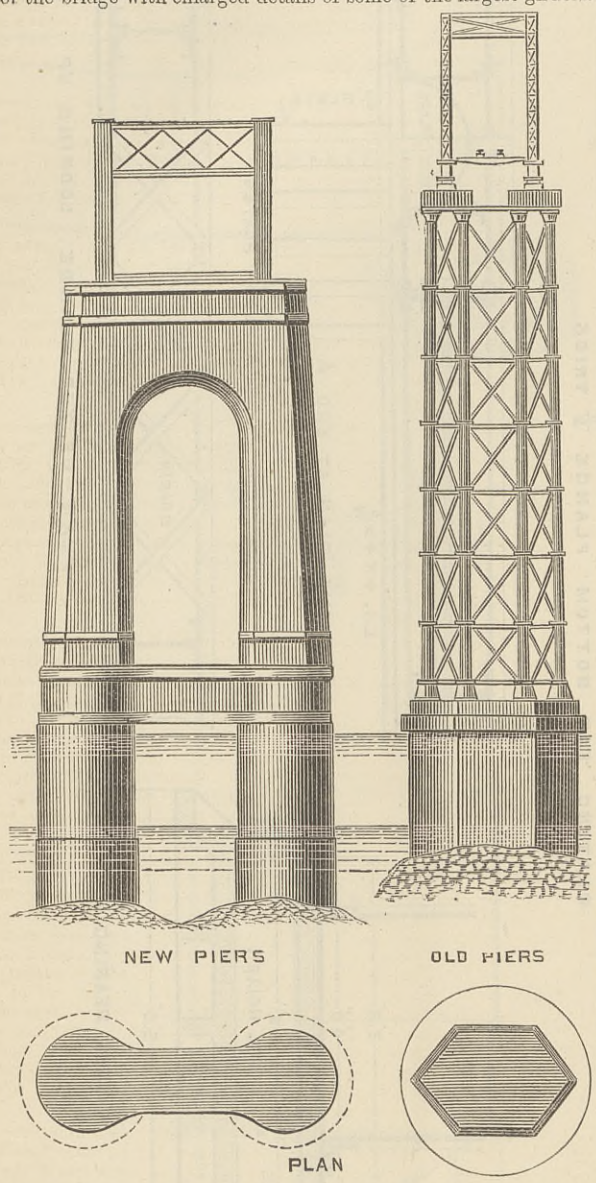
MR. W. H. BARLOW, F.R.S., ENGINEER.

(For description see page 330.)



THE NEW TAY BRIDGE.

After a lapse of nearly two years, the plans and designs for a new bridge to take the place of the terribly fatal structure built from designs of the late engineer of the North British Railway Company, have been so far decided upon and completed, that tenders have been invited for their practical execution by responsible contractors. On page 329 we give a general type elevation of the bridge with enlarged details of some of the largest girders.



Herewith is a transverse section of the bridge through one of the main girders of the new and of the old bridge near a pier. These sections are self-explanatory of all they convey, except that the superstructure of the new pier is of plate ironwork. We shall not further describe this now, as more details will be given in another impression when we shall return to it. From the illustration on page 329, it will be seen that the line is on the top of all except the girders of spans twenty-eight to forty-one. The gradients at the different parts are printed above the detached parts of the bridge and enlarged details of the main girders.

LETTERS TO THE EDITOR.

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

COLD AIR MACHINES.

Sir,—In reference to the Bell-Coleman air refrigerating machines illustrated and described in your last impression, I think it would be extremely interesting if Mr. Coleman would supplement his information by publishing an average set of indicator cards from the steam, compression, and expansion cylinders, at the same time giving the various dimensions. We should then be in a position to judge of the efficiency of his apparatus.

From the admirably executed engraving, it appears to me that the various parts of the provision machine are exceedingly cramped up and difficult of access. Possibly this may be an advantage as regards the saving in space occupied, but it is certainly a disadvantage, especially in machines for use at sea, to interfere in any way with easy and efficient attendance and facility for carrying out repairs and replacements.

I should like to know whether, in regard to the refrigerators on the Cuzco and Dunedin, the drying pipes as well as the machines are included in the "10 per cent. of space to be cooled," and if not, how much extra room is taken up by these drying pipes.

T. B. Lightfoot.

116, Fenchurch-street, London, November 2nd.

PRICE'S RETORT FURNACES.

Sir,—When Dr. Siemens denounced Mr. Price's furnace now at work making steel in the Royal Gun Factories as a Siemens furnace, and branded the "retort" as a discarded "waif" of his own creation, he failed to support his attack with any evidence of identity between the systems, and so limited the sweep and lessened the fury of his consuming wrath.

The fact is there is nothing in common between the two furnaces, save the end aimed at and the materials used, and I beg to submit that it is not as yet a legal axiom that priority in the pursuit of an end confers a monopoly of the means to be used. From some remarks dropped about the steel furnace in the Royal Gun Factories, it might be supposed it is not absolutely a "retort furnace." I beg to assert it is a "retort" furnace pure and simple. In speaking of it Dr. Siemens observes, "they have a retort of which much is made." Well this retort is the sole source of its novelty, its economy, and its efficiency; to it we attribute all its merit; remove it and a common furnace remains; and as it has no existence in a Siemens furnace, I contend the distinction of the systems is complete.

But though the economic resources of the retort are in a nutshell, the lines of separation between it and a Siemens are neither few nor trifling. (1) The retort furnace is self-contained, the Siemens is not—it is two distinct and separate furnaces. (2) In the retort the gases used are distilled by what is commonly known as waste heat; in the Siemens they are not. (3) In the retort the gas producer is an integral part of the furnace proper, from which the gases flow into the combustion chamber at the temperature of the producer; in the Siemens the gas producer is separated from the furnace proper, and the gapes are cooled in their transit. (4) In the retort the fuel is only partially distilled in the producer, the resulting cokes being burnt on the common bars of a common grate; the Siemens has neither grate nor bars, and does not burn any coke. (5) In the retort the generator is a single chamber, and is also the gas producer; in the Siemens there are four regenerators, in none of which is any gas producer. (6) In the retort the heat of the escaping products is taken up without diverting the flow; in the Siemens the current is reversed at frequent intervals.

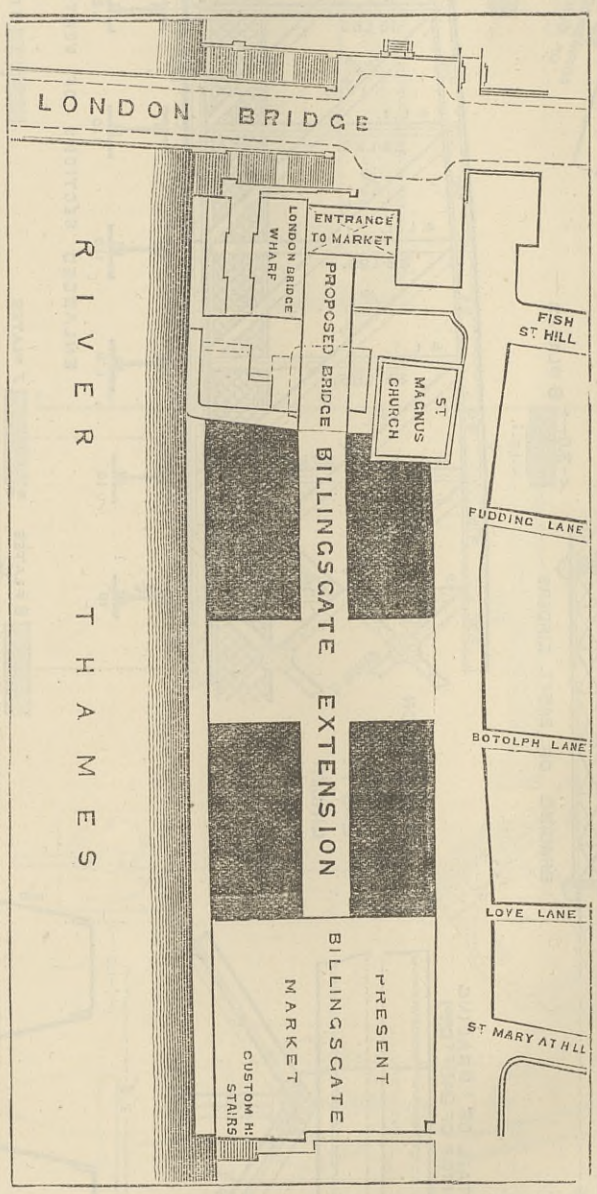
The retort consists of two chambers on one floor or level; the Siemen's of five chambers, one above and four below, a sort of two storied furnace. Then as to form, there is an obvious and radical difference. In substance, external area, and cubic capacity of its parts and its prime cost, the retort is as one to four in comparison. I regard these as separating lines and not features of identity, and sufficiently broad to support an emphatic denial that any part of the retort plan owned any trace of its existence to the cast-off creations and discarded fancies of Dr. Siemens.

2, St. John's-terrace, Jarrow. Wm. Price.

BILLINGSGATE MARKET EXTENSION.

Sir,—I shall be glad if you will allow me to describe a proposal for overcoming the fish market difficulty. The following is a copy of a statement with plans submitted to the Fish Supply Committee by W. J. Glenny, of King's College, and myself.

The plan is roughly shown of a retail fish and fruit market, extending from London Bridge to the existing market at Billingsgate. It is proposed to widen Thames-street and to re-construct the whole of the existing warehouses and wharves, and to increase the height of them until the present rental is not only attained but exceeded. The existing market covers about 31,350 square feet. The proposed re-construction would provide an additional market of 72,710 square feet area, besides an increase of 1000 square feet in the existing market, 7200 square feet in the landing stage, and



4455 square feet in Thames-street. The retail and public entrance would be on the level of London Bridge. There would be continuous steam lifts for passengers, and hydraulic lifts and steam cranes for fish. In the additional width of Thames-street, space would be gained to provide for sufficient cranes and lifts, with convenient tramways to unload at the same time as many wagons as could occupy the space, and convey the fish to auction stations on the both levels if necessary. The expense of new approaches is thus saved. Ten times the quantity of fish can be unloaded in the same time, and the new road on the bridge level doubles the facilities for delivering and getting supplies.

Instead of establishing at an enormous cost separate markets to relieve the approaches, the Corporation should rent wharves at a moderate cost, say, on the Surrey side north and south to the limits of Battersea and Chelsea, to which supplies might be sent by steam launches during certain parts of the day. These launches might more than earn their living by zigzag ferry work during the remainder of the day. Although the cost of acquiring and building on such a site would be very great, in no other situation, either in the City or out of it, could the Corporation count with certainty upon receiving for their expenditure such enormous returns. Any other market would be a fish market alone, and earn a single floor space rental only. This proposal, if carried out, would earn floor space rental on as many floors as the Corporation choose to provide. On the Thames-street level, London Bridge level, the market, and at the very least two or three other floors, success is a certainty in attempting to let, and a moderate sinking fund would gradually and certainly extinguish the debt, whatever the cost of construction. A. T. Walmisley.

5, Westminster-chambers, Victoria-street, S.W.

PATENT LAW REFORM.

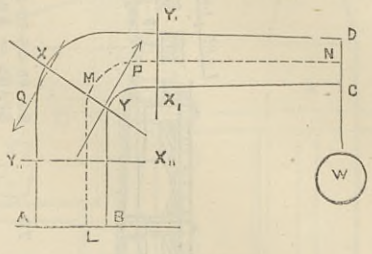
Sir,—I have perused with interest Mr. Simey's letter, which appeared in last week's issue of your valued journal. To my mind the first great requisite is to give an inventor real protection for a moderate sum, to enable him to offer his invention to those who may be able and willing to assist him in working out his invention. The Government or Patent-office officials ought to give him an intimation of any similar invention they may have it in their knowledge has been already published. Then, as proposed frequently by my friend Mr. Lloyd Wise, the inventor might, if he wished, be still allowed to have his patent on condition that he alluded in his specification to the prior invention, at the same time distinctly stating what he claimed as new and different between the two. I agree with Mr. Simey as to trial of cases of infringement in a less expensive court than at present.

Samuel Worssam, A.M. Inst. C.E.

London, November 2nd.

STRAINS ON CRANE POSTS.

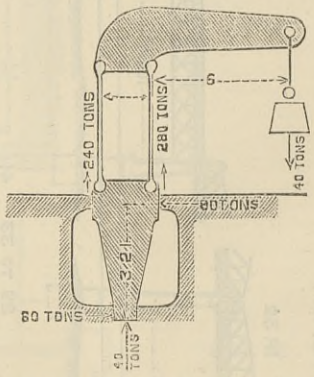
Sir,—Your correspondent, Mr. Pendred, is quite right in saying that the stresses upon the back and breast of the crane jib he describes are not equal. This may be readily shown as follows:—



Let the figure represent the jib with its load W. If we take any section across it, as X Y, perpendicular to its neutral surface L M N, then the stresses acting at the section X Y upon the part X D C Y must be in equilibrium with the load W, and therefore must have a vertical component equal W, since W is of course vertical. Now, the stresses at section X Y are: A compression P, a tension Q, and a shearing stress along X Y. If the plane under consideration be a vertical one, as $X_1 Y_1$, the stresses P and Q will be obviously equal, as the part Y, D C X, would act as a simple cantilever, and the vertical component would be supplied by the shearing stress at $X_1 Y_1$, which would just equal W. If, however, it were horizontal, as at $X_{11} Y_{11}$, then the shearing stress would be *nil*, and the necessary vertical stress would be the difference between P and Q—that is, P would be greater than Q by the amount W or P — Q = W. W. M.

London, October 31st.

Sir,—Having remarked Mr. Pendred's letter in your issue of 7th October, and formed my own conclusions on the question therein raised, I looked with interest for its discussion in your pages, but was not prepared for the variety of opinion evoked. To me, Mr. Pendred's "safety valve theory" appears the correct one, and I think the annexed diagram may help to make this plain.

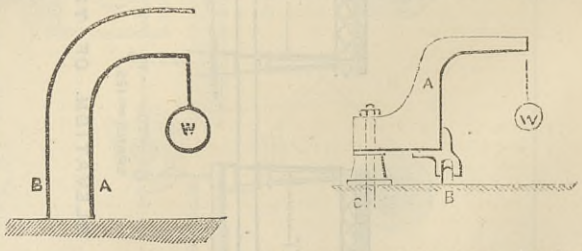


The special point to notice is that the vertical portion of the post is entirely free from any horizontal stress, and therefore not a girder, as so many of your correspondents assume, but may be considered to consist essentially of a tie and a strut hinged at top and bottom. These will carry the jib and load in a position of—unstable—equilibrium, with no greater tendency to fall to the right than to the left, and requiring diagonal bracing only against accidental side stress, as wind, &c. &c.

It is clear that we have here three vertical stresses to consider, viz., the tension on the tie, the thrust on the strut, and the load of 40 tons; and these must balance and counteract one another, which cannot be the case if the two former are equal, as claimed by Mr. Pendred's opponents; whilst that gentleman's "safety valve theory" fully satisfies these conditions.

Glasgow, October 24th. Parallel Motion.

Sir,—As I find that I was wrong in supposing that Mr. Pendred's theory of the above matter would not be maintained by others of your readers, I beg to submit the following illustration in support of the views taken by those of a contrary opinion, my humble self among them. I assume that the point at issue is the position of the neutral axis of the vertical part of a jib crane. Now let us suppose that the plate A in the sketch is, say, 1in. thick and capable of supporting a load W, the neutral axis of this plate would then be



contained somewhere within the thickness of the plate. Another plate B of the same section is also capable of supporting a load, and its neutral axis is also contained within the thickness of the plate. Now, if these two plates are rigidly connected by a web or side plates, I submit it is obvious that the two neutral axes will be merged into one, and that one equidistant from the two former ones wherever they may be, and as the plate is one inch thick, the distance the neutral axis will be from the centre of the post cannot be more than an inch. If the strength of the material to resist tension and compression, and also the influence of the web or side plates to alter the position of the neutral axis, is taken into account in designing the structure, the neutral axis can and should be in the centre of the post.

In my former letter I said that the illustration of the safety valve lever did not apply, as the lever itself was the crane post, &c. The second sketch may make my meaning more clear. A is the crane post or valve lever, B the overturning point or valve, C the holding-down bolt or pin in valve lever. The strength of the lever A has nothing to do with the supporting points C and B.

Merrion, Dublin, October 25th. H. W. Glasier.

FITZROY BRIDGE.

On page 332 we illustrate a fine suspension bridge erected over the Fitzroy river, Central Queensland. In another impression we shall publish further drawings and a complete description of this work. For the present it must suffice to say that the bridge is 1104ft. long, in four main spans of 232ft., and two end spans of 88ft. The piers are made of cast iron columns, the chains of wrought iron. The bridge was opened on the first day of the present year.

RAILWAY MATTERS.

THE plans and models of the Vienna Elevated Railway were submitted to the Emperor of Austria, by the Handels minister on the 26th ult., and warmly approved.

THE Mersey Railway Tunnel was inaugurated on Saturday by the Mayor of Liverpool and the Mayor of Birkenhead, who started the new engines at the tunnel shafts at Birkenhead and Liverpool.

A TRAMWAY is being laid in Chicago with central sunk tube for the wire cable for hauling by fixed steam engines—a system which has been in successful use for over three years on straight and curved lines, and steep gradients, in San Francisco.

GOODS are collected in Manchester, 188 miles from London, up to 8 p.m. by the London and North-Western Company, when their express goods train leaves for London. The goods thus forwarded are delivered in the City by nine o'clock the next morning, being thus done in about twelve hours, or little less time than letter service.

A METHOD of heating passenger cars has been introduced in the States by Mr. Graydon. The chief feature in it is that steam is taken from the engine and is stored in a reservoir in the luggage van, from which it is fed to heating pipes in the passenger carriage, making the circuit of the train, returning to the water tender of the engine.

THE second Fontaine locomotive has been reconstructed at the Erie repair shops, by its builders of the Grant Works, and placed on the Pennsylvania Railroad. It will be used on the fast trains between New York and Philadelphia. Fontaine No. 1 is still on the Canada Southern Railroad, running between Amhertsberg and St. Thomas, and is reported as doing first-class work.

ON the 27th ult. a special meeting of the Batley Corporation was held at the Town Hall, when the Town Clerk read a letter from Messrs. Nelson, Barr, and Nelson, solicitors to the Great Northern Railway Company, stating that the various memorials forwarded by the corporation, inhabitants, and Tradesmen's Association of Batley had been carefully considered by the board of directors, who had given instructions to their engineers to ascertain the best practicable route for a railway to Heckmondwike and Cleckheaton.

THE Swansea and Mumbles Railway prospects are not very encouraging. With an authorised capital of £120,000, there was a profit of only £561 for the past half-year, and the undertaking is said to be unpopular in the town. The affairs of the Tramway Company, which has had a most troubled and litigious history, are hardly less satisfactory. A dividend of 2 per cent. has, however, been paid for the last half year, which is the first which the shareholders have received. The prospects of the undertaking are, however, now decidedly brighter.

OF the 291 axles which failed on our railways the first half of this year, 149 were engine-axles, viz., 138 crank or driving, and 11 leading or trailing; 23 were tender-axles, 109 were wagon-axles, and 10 were axles of salt vans. 52 wagons, including the salt vans, belonged to owners other than the railway companies. Of the 138 crank or driving-axles, 87 were made of iron and 51 of steel. The average mileage of 80 iron axles was 181,988 miles, and of 47 steel axles 172,328 miles. Of the 381 rails which broke, 307 were double-headed, 71 were single-headed, 1 was of the bridge pattern, and 2 were of the Vignoles' section; of the double-headed rails, 221 had been turned; 221 rails were made of iron and 160 of steel.

A CORRESPONDENT describes the scene at the recent fatal collision at Pannal, and the fearful suffering of several of those who were jammed under wreckage by arms or legs. He was himself unhurt, and says that with a pinch-bar or hand-lever these people might have been easily released. As it was one poor wretch was jammed the more as the other was relieved in the endeavours to help without any such assistance. In accidents of this kind there is nothing more useful than a good iron-mounted wood hand-lever or two and a small pinch-bar, and surely these would cost so little that the companies, for their own benefit, might allow, say, a couple of each to form part of the outfit of every guard's van, where they would take but little room.

ALTOGETHER, the number of persons killed and injured on railways in the United Kingdom in the course of public traffic, during the six months ending 30th June 1881, as reported to the Board of Trade, was as follows:—Passengers: from accidents to trains, rolling-stock, permanent way, &c., killed, 2; injured, 339; by accidents from other causes, killed, 32; injured, 371. Servants of companies or contractors: from accidents to trains, rolling-stock, permanent way, &c., killed, 4; injured, 75; by accidents from other causes, killed, 226; injured, 1092. Persons passing over railways at level crossings, killed, 37; injured, 14. Trespassers (including suicides), killed, 168; injured, 63. Other persons not coming in above classification, killed, 28; injured, 55. Total, killed, 497; injured, 2009.

A TUNNEL under the Pyrenees to join France and Spain at a point as nearly as possible equidistant from the Atlantic and Mediterranean is under consideration. The great natural barrier between the two countries has, up to the present, only been surmounted by the iron road at the two extremities of the range near Bayonne and Perpignan. Both these routes necessitate a long detour for traffic between the South of France and the North of Spain, The advantages of a direct railroad midway through the Pyrenees would be unquestionable. It would develope intercourse between neighbouring provinces, and the journey between Paris and Madrid would be shortened by about 100 kilos. The initiative is due to the Spanish Government, which has introduced a Bill into the Cortes authorising the construction of the tunnel and of a railway leading from Madrid directly to its entrance. The Government of King Alfonso offers to provide half the funds for the tunnel on condition that France undertakes an equal share in the expense. If voted by the Cortes, the scheme will, it is said, at once be submitted to the French Government, on whose part it will doubtless meet with a favourable reception. Spain is looking up.

ACCORDING to an abstract of a report on the French railways in 1880-81, the total number of miles open was 14,750, an increase of 4·3 per cent., of which 14,343 miles were worked, and earned on an average £2868 12s. per mile, which is an improvement of 9·4 per cent. on the previous year 1879-80. The railways are divided into five different classes, three of which belong to the six great companies—the "old system," with average earnings of £4849 per mile of road; the "new system," with earnings of £1457 6s. per mile; and the "special system," with £3294 per mile. Then come the State lines—recently acquired, and including, at the end of 1880, 1400 miles of road—whose earnings per mile are but £611 16s. These roads, in most cases, were taken by the State because it did not pay to work them. There remain "various companies," owning 529 miles of road, earning an average of £1099 8s. per mile. The *Railroad Gazette* gives the average earning per mile of American roads at the same time as £1461 8s. against £2868 12s. by the French roads. The average increase on American roads over 1879 was 17 per cent. against 9·4 per cent. on the French roads, which are considered extremely prosperous. If says the *Gazette*, our railroads had earned as much per mile as the French line, their gross receipts would have been £118,400,000—but it probably means £118,400—greater than they actually were in 1880. The French system, however, is strictly limited to the needs of the country. It is probably the richest agricultural country in the world, and one of the most prosperous industrially, but with an area about the same as that of New York, Pennsylvania, Ohio, Indiana, and Illinois together, and with 37,000,000 inhabitants against 17,600,000 in those States, it has 14,750 miles of railroad against their 30,583. In France there are 2500 people and 13·84 square miles of land to support one mile of railroad; in the five States named there are 575 people and 7·1 square miles of land to every mile of railroad

NOTES AND MEMORANDA.

THE total product of pig in France in 1879 was 1,400,000 tons, which is the smallest quantity which has been turned out since 1874. The reduction is to some extent due to the falling of in the demand for charcoal pig, which in 1879 was only 47,000 tons, against 145,000 tons in 1874. In the former year, according to *La Metallurgie*, there were 127 blast furnace works in operation, against 149 in 1878. The total quantity of finished iron—bars, sheets, and rails—turned out in 1876 was 857,000 tons. Rails showed a reduction of over 23 per cent. on the preceding year.

THE total annual production of timber in British Columbia is stated to be about 200,000,000ft., of which 25,000,000ft. is exported to other countries, 25,000,000ft. used at home, and 150,000,000ft. sent to California. Professor Dawson estimates that 110,000,000 acres—or two-thirds of the whole province—are covered with timber. The Douglas fir or Oregon pine is the most valuable commercial tree. It frequently exeeeds 8ft. in diameter above the ground, and rises to a height of from 200ft. to 300ft., forming large and dark forests. The western hemlock and red cedar are the other important trees of the province, both of which, the latter especially, grow to a great size.

COTTONSEED oil at 0 deg. has the sp. gr. 0·9406; at 30 deg. it is only 0·9206. With oil of vitriol it takes a violet tint, which increases on stirring. At the end of twenty-four hours the mixture becomes thick and deep brown. With sulphuric acid and potassium bichromate there is a violent reaction; sulphurous acid evolved, and the oil takes a blood-red colour. At the end of twenty-four hours it has become a black solid mass. With caustic alkalies—sp. gr. 1·24—the oil thickens, becomes a straw colour, while the alkaline solution separates, and takes a deeper colour. If the mixture is stirred with a glass rod the upper layers take a blue colour, which gradually passes into a violet.

DR. HAHN, of Tübingen, has recently given the results of some researches which he has made into the nature of aërolites, which he examines by splitting some specimens into sections, thus rendering them transparent, as described in this column some time ago, with reference to the discovery of evidences of organic remains. He states that generally speaking aërolites are of two species, the one containing iron only, and the other iron and stone together. In a few instances, however, stone is the sole component substance. Dr. Hahn's researches tend to confirm the accuracy of the observation of Wochler as to the existence in these meteoric stones of hydrocarbon produced by the decomposition of organic substances.

ANALYSIS of the crude paraffine discovered in New Zealand shows that by treatment with hot water 21·5 per cent. of crude paraffine may be melted out of it. The residue contains some organic matter, and on being subjected to distillation, yields 9 per cent. more oils and paraffine, making the total yield 30·5 per cent. A sample of crude oil submitted to distillation without any treatment with acid or other chemicals gave: Burning oil, 60 per cent.; intermediate, 20 per cent.; heavy, 20 per cent. The burning oil is, according to the *Chemical Review*, almost colourless, and the first part of the distillate to about half the original was perfectly so, and had a rather agreeable odour, while the heavy oil was semi-solid from the presence of paraffine.

AN average crop of spring wheat in the United States is put down at 14½ bushels to the acre, and this estimate is thought to be founded on tolerably accurate data, but the official estimate for this year brings it down to 11·74 per acre. This decrease, which is but a bushel less to the acre than last year, if it could be relied on, would aggregate 41,000,000 bushels. The decline in the quantity of winter wheat is made to appear still greater. This in spite of the increase of acreage from 21,892,000 to 24,149,000 acres; the assumed difference being in the reduction from 13·72 to 12 bushels to the acre, and amounting to an aggregate of 25,000,000 bushels. According to these figures, the total decrease in the wheat crop, as compared with last year, is 93,000,000 bushels.

ACCORDING to Ryland's *Iron Trade Circular* the total number of blast furnaces in the United Kingdom, built and in blast on September 30th, 1881, was 946; total number of furnaces in blast September 30th, 1881, 548; decrease in the number built since June 30th, 1881, 5; increase in the number in blast since June 30th, 1881, 6; furnaces blown-in since June 30th, 1881, 21; as follows: Cumberland, 4; Derbyshire, 3; Lincolnshire, 1; Lancashire, 2; Northamptonshire, 2; South Staffordshire, 2; North Staffordshire, 1; Yorkshire, 1; South Wales, 3; Scotland, 2. Furnaces blown out since June 30th, 1881, 15; Derbyshire, 3; Durham, 1; South Staffordshire, 3; South Wales, 6; Scotland, 2. Furnaces pulled down since June 30th, 1881, 6: Derbyshire, 3; South Wales, 2; Scotland, 1. Furnaces built and in blast since June 30th, 1881, 1; viz., in South Wales. New furnaces being built at present time, 11: Derbyshire, 1; Lincolnshire, 2; Northamptonshire, 3; North Staffordshire, 2; South Wales, 1; Gloucestershire, 1; Northumberland, 1. Since the date of this return the Scotch and Middlesbrough ironmasters have blown out furnaces in both districts equal to 12½ per cent. on those then in blast.

WITH a view to ascertaining the best steel for the manufacture of magnets, determining the most effective degree of hardening to be given to it, and choosing the most simple and practical method of rendering it magnetic, M. Trouvé has made a series of experiments. He has cut bars of steel lengthwise, magnetised them, measured their power, and then has hardened them and again magnetised them. After again measuring their power, he has found that it was increased, so that a magnet, after the second magnetising, will bear a weight which is expressed by the square of the weight it was first able to carry, so that if it had a power of 2, 3, or 4 after the first operation, its capacity would be increased to 4, 9, or 16 respectively after the second. Hardening must be very regular, and manufacturers of steel for this purpose should do the heating in a muffle heated by gas. In order to magnetise, M. Trouvé places the steel bars into two solenoids in juxtaposition, closing the magnetic circuit by means of two plates of soft iron. For generating the current, he employs a battery of six Wollaston cells. In this way M. Trouvé has obtained magnets having a uniform power, his rod magnets carrying as high as 12 and even 14 times their own weight, while with horseshoe magnets it will rise to 48 or 56 times the weight.

THERE are some rather remarkable copper mines in the United States. One of these mines in the Keweenan Peninsular of Michigan, which projects into Lake Superior, is so exceptional in its wealth of product, that it disturbs all averages and relative comparisons, for the general copper mining of the country. To produce a pound of copper a year requires 62c. capital. The value of the annual product is nearly 28 per cent. of the total capital. Since 1870 the product has increased 116·41 per cent. in weight, and 70·25 per cent. in value. The number of workmen and servants has increased 13·7 per cent., the capital 303 per cent., the horse-power 119 per cent., and material 136·5. The Lake Superior region has grown from 83 per cent. of the entire product in 1870 to 89·71 per cent. in 1880. The gain of product per hand is 90 per cent., due, according to the *American* census returns, first to the wonderful productiveness of the mine before indicated, and second to improved machinery, especially the diamond drill and the percussion drill driven by compressed air. Copper mining requires higher skilled labour than iron mining. It employs 80·53 per cent. less hands, uses 50·61 per cent. less value of material, and represents 48·61 less capital. The copper is worth 38·19 per cent. of the iron mined, but costs 39·92 per cent. as much labour to raise it. The Western district yet to be reported will give near six million pounds product. Michigan ranks first in products of ingot copper—45,830,262. Then Vermont, 24,037 lb.; North Carolina, 24,680 lb.; Missouri, 1051 lb.; Tennessee, 294 lb.; Pennsylvania, 289 lb.; Maryland, 82 lb.; Wisconsin, 62 lb.; a total of 61,091,188 lb., valued at 8,842,961 dols. The wages amounted to 2,915,103 dols., and 6116 persons were employed. The total capital used is 31,675,096 dols.

MISCELLANEA.

THAT strange craft, the Livadia, is, it is said, to be taken to pieces, and the materials with which she is constructed and fitted to be otherwise employed.

THE directors of Messrs. Newton, Chambers, and Co., Limited, have given notice that no further application for shares in the new company will be received after Thursday next, the 10th inst.

THE Town Council of Accrington have decided to apply to Parliament in the ensuing session for powers to construct about seven and a-half miles of tramways, extensive intercepting and outfall sewers, precipitation works, a branch canal about a mile in length, and new store yard with stabling sheds and railway sidings. The plans are being prepared by the borough engineer and surveyor, Mr. E. Knowles.

PART 4 of vol. vi. of the *Journal* of the British Society of Mining Students contains papers on the St. John's Ambulance Association, and its work amongst the mining population, by Mr. P. M. Chester; and another on a method of working two seams of coal lying near one another, by Mr. J. J. Jordan. Notice is given that Mr. W. Howard is now acting as secretary of the society at 13, Cavendish-street, Chesterfield.

TWO iron lighthouses are being erected by the United States Government, one of which, just completed, is situated at the White Rock, Narragansett Bay, where the steamer Rhode Island was lost. It is of cast iron, and consists of the foundation pier in three sections, 8ft. high each, and with 40 pieces in each section. Upon the top of the pier is a four-section lighthouse, crowned by the lantern, the whole being 69ft. above the water line. Other iron lighthouses are to be built for Connecticut and also for Border Flats, Fall River.

THE total number of English ships which appear to have foundered or to have been otherwise totally lost on our shores, from defects in the ships or their equipments during 1879-80, is 30; while 68 happened through the errors, &c., of masters, officers, crews, or pilots, 97 through stress of weather, and 42 from other or unknown causes. The number of casualties arising from the same causes during the year, and resulting in serious damage, is as follows:—Through defects, 45; errors, 115; stress of weather, 213; other causes, 126; and the cases of minor damage were, through defects, 62; errors, 132; stress of weather, 581; and other causes, 163.

ACCORDING to the returns just made by the Roman municipality, the population of the city numbered on the 30th of September 311,674 souls, showing an increase of 1943 inhabitants since the 30th of June last. During the three months the births, 2118, exceeded the deaths, 1474, by 644. The immigrants, 1878, exceeded the emigrants, 404, by 1474, exactly counterbalancing the number of deaths. The military garrison of 5791 men on the 30th of June, has been decreased by 175. These returns show, therefore, an increase of 66,844 souls in the population of Rome since the 1st of January, 1872, in addition to the great influx of Italians between the 20th of September, 1870, and that date.

OF the 780 tires which failed on the railways of the United Kingdom during the six months ending 30th June last, 47 were engine-tires, 23 were tender-tires, 5 were carriage-tires, 35 were van-tires, and 670 were wagon-tires; of the wagons, 551 belonged to owners other than the railway companies; 581 tires were made of iron, and 199 of steel; 28 of the tires were fastened to their wheels by Gibson's patent method, 18 by Beattie's patent, 10 by Mansell's patent, and 27 by Drummond's patent, all of which remained on their wheels when they failed; 682 tires were fastened to their wheels by bolts or rivets, of which 5 left their wheels when they failed, and 15 tires were secured to their wheels by various other methods, none of which left their wheels; 109 tires broke at rivet holes, 195 in the solid, 2 at the weld, and 474 split longitudinally or bulged.

THE Corporation of Stafford are not happy regarding their water supply. Some time back they conducted boring operations at considerable cost on Stafford Common, at the north end of the town, with a view to obtain water from the Bunter, and similar water-bearing strata, which were presumed to lie at an immense depth below the Common. The depth it was desired to reach was 1400ft., but after several unsuccessful attempts, the borings were abandoned. They then went to the south side of the town to a point in the parish of Berkswich, which was supposed to supply favourable indications. A well was sunk, and boring was carried down to about 150ft. The permians were then come upon, and Professor Green has expressed the opinion that it is almost hopeless to proceed any further. Yet the Council have just resolved to go down another 50ft., in the hope of something more favourable turning up.

AN extensive shipbuilding yard was opened at Scotwood-on-Tyne adjoining the suspension bridge, in February of this year, by Messrs. Campbell, Macintosh, and Bowstead, and on the 22nd ult. the first ship built above bridge was launched therefrom. At first only 100 men were employed, but the number of workmen increased to nearly 600, and the spacious yard was completely furnished in every department of construction. The keel of this, the first vessel, was laid in the middle of April, and was built to the order of Mr. C. Brown, shipowner, of Havre, for the purpose of general trade. The vessel was constructed under the spar-decked rule; the dimensions being, length, 293ft.; breadth, 36ft. 9in.; depth of hold, 27ft. 6in.; and the vessel will carry 3200 tons dead weight. She is classed 100 A1 at Lloyd's and highest class "Veritas." The engines are by Messrs. Thomas Clark and Co., Elswick, and are of 270 nominal and 1350 indicated horse-power.

THE trials of the "Brush" electric light at Chesterfield have, we are informed, been so successful that the corporation have decided to dispense with gas entirely, as far as public lighting is concerned, and to replace it with the electric light. The contract has been secured by Messrs. Hammond and Co., of 110, Cannon-street, London, the general agents of the Brush Company. The lighting will be done by means of about twenty-two Brush arc lamps, and about seventy Lane Fox incandescent lamps. The annual cost of same is guaranteed by the contractors not to exceed the present gas bill, and it is claimed that the light will be three times as efficient. If it be true that a vastly improved illumination can be obtained for the same price as gas in public lighting, the example of Chesterfield will be rapidly followed by other towns—in fact, we understand that deputations have already visited Chesterfield from Derby, Nottingham, Barnsley, Sheffield, and other towns, who are now in close negotiation with the contractors for a trial of the Brush light.

A REPORT by Major-General Hutchinson has been sent to the Board of Trade, on the accident and collision which occurred on the 11th of August, near Abbey Hill junction, Edinburgh, on the Edinburgh and Berwick section of the North British Railway, when, as the 8.30 p.m. down express East Coast train from King's Cross to Glasgow and the North was starting, after having been stopped by signal, from the west end of the Calton tunnel, near Waverley station, the couplings between the tenth and eleventh vehicles gave way, and the rear seven vehicles ran back for about 1000 yards, when they came into collision with the 6.5 a.m. special passenger train from Musselburgh to Edinburgh and Glasgow. Ten passengers were injured. The report concludes:—"An automatic brake would in this case have been of great service, as the brakes on five of the rear seven vehicles—two not being connected—would have been at once brought into play upon the severance of the couplings taking place, and these vehicles would have been immediately stopped. . . . In consequence of the falling gradient of 1 in 78, which prevails from near Waverley station for a long distance eastwards, it is very desirable that runaway points should be introduced on the down line not less than the longest train's length east of the down home-signal."

FITZROY BRIDGE, ROCKHAMPTON, CENTRAL QUEENSLAND.

MR. F. J. BYNLEY, C.E., QUEENSLAND, ENGINEER.

(*For description see page* 330.)

PUBLISHER'S NOTICE.

*** *With this week's number is issued as a Supplement, Conversion Tables for French and English Measures—No. II., Area. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

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.*

Apprentice.—*We do not understand your question. What do you mean by "condensing steam direct from an engine?"*

J. R. (Poplar)—*The books are published by Carey, Bird, and Co., of Philadelphia. You may apply to Messrs. Trübner and Co., or to Messrs. Sampson Low and Co.*

W. T. and Co.—*The action to which you refer had reference to only one of the patents, and the decision only applies to that one. Moreover, the decision is under appeal.*

Ploughman.—*We are unable to give you any information as to the work done by the machine to which you refer since the Royal Agricultural Society's Show at Derby, but we have no reason to think that it has failed to satisfy the expectations formed concerning it.*

C. G. B.—*The four largest ships of the Italian navy are the Duilio, the Dandolo, the Italia, and the Lepanto. They have been, or are being, built in Italy, at Castellamare, and Spezia. The Duilio and Dandolo have a displacement of* 10,401 *tons each; they are* 341*ft. long by* 64*ft.* 9*in. wide, and draw about* 26*ft. of water.*

T. C.—*We cannot quite understand what you want. For moulding in sand and iron founding see Spretson's "Casting and Founding," published by E. and F. N. Spon; Overman's "Moulders' and Founders' Guide," published by Sampson Low and Co.; and "Treatise on Ironfounding," by C. Wylie, published by E. and F. N. Spon, Simpkin, Marshall, and Co., and Hamilton, Adams, and Co., in London, and Thos. Reed and Co., Sunderland.*

JOINTING CEMENT FOR CAST IRON TANKS.

(*To the Editor of The Engineer.*)

Sir,—I want to know if Vulcan cement is injurious to water. I have some small cast iron tanks to contain water for the purpose of brewing; red lead must not be used, and the flanges are not suitable for rust joints. If Vulcan cement is objectionable, will any of your readers tell me the best material for joints? The tanks are 3ft. 9in. and 2ft. 6in. by 1ft. 3in., with intermediate partitions. Hampshire.

Southampton, November 3rd.

WINDING ENGINES—PROTECTED AND NON-PROTECTED CYLINDERS.

(*To the Editor of The Engineer.*)

Sir,—Will some of your readers say whether it is really a disadvantage not to have colliery winding cylinders' valve boxes protected from the atmosphere by a non-conducting material, and can they furnish a diagram from an engine with the cylinder protected, and one from an engine with cylinder unprotected? I allude mainly to composition covering as a preventive against radiation. Does it really pay for its cost and trouble of putting it on, &c., and does radiation perceptibly affect a diagram? W. D.

Wigan, October 29th.

CUPOLA PRACTICE.

(*To the Editor of The Engineer.*)

Sir,—If "Foundry Manager" would give us the following information it would perhaps be of interest to some of your readers:—He says "it takes so much less power to drive a blower. A No. 3 Root's blower running 380 revolutions per minute will melt 4 tons of iron per hour." I should like to know what is the actual power required to drive this blower, and the inside dimensions of his cupola. My 30in. Schiele's fan has been running regularly for sixteen years without any perceptible wear. I have heard the opinions of ironfounders who use blowers, and I am convinced that there is no advantage to be derived from using a blower instead of a good fan, for a cupola of similar size to mine. Joshua Horne.

Providence Ironworks, Castleford, November 2nd.

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MEETINGS NEXT WEEK.

Society of Engineers.—Monday, Nov. 7th, at 7.30 p.m.: Discussion on Mr. Arthur T. Walmisley's paper on "Iron Roofs."

The Institution of Civil Engineers.—Tuesday, Nov. 8th, at 8 p.m.: Paper on "Iron Permanent Way," by Mr. Charles Wood, M. Inst. C.E.

THE ENGINEER.

NOVEMBER 4, 1881.

ENGLISH AND FOREIGN ARMOURED DEFENCES.

Armour in its various forms has been the subject of investigation and experiment so continually for many years that we can hardly speak of its being brought to notice. From time to time, however, circumstances may call for a general review of the whole state of the question. Without undertaking so formidable a task as this, we propose to call attention to a few facts bearing on the present state of the armour question. Four kinds of armour are now coming in, or already exist in forts and vessels—namely, wrought iron; compound armour, consisting of steel and wrought iron; steel; and chilled cast iron. Wrought iron is carried on all armour-clad ships, except some of those recently built. The most notable exceptions are the Italian vessels Duilio and Dandolo, and the turrets of some of our own ships—such as the Inflexible. Many vessels now building have compound or steel armour. The behaviour of wrought iron is well known—it yields locally to the impact of shot; it is liable to be penetrated, the projectile making a clean hole and passing on into the interior. It is hardly liable to be injured practically, however, by any projectile that fails to penetrate it completely, or, as it is termed, "perforate" it. Short of that, a projectile only buries itself to a certain depth, probably plugging up the hole it makes. Beyond the displacement of bolts, such a projectile is likely to do little harm. The plate holds together under a great number of blows, and in short, is only to be attacked to any purpose by guns of sufficient penetrating power to perforate it.

All our iron protected coast batteries have wrought iron on the plate-upon-plate system. This has the great recommendation that plates may be added when required on the front, so that the defensive power of the fort may be increased to correspond with the growing power of guns liable to be brought against it. All systems do not admit of this, as we shall see presently. Wrought iron, however, from its liability to perforation is specially affected by the introduction of new type guns, which fire projectiles of small diameter in proportion to the stored-up work contained in them. In other words, such projectiles are specially adapted to perforate armour. Thus, a new type 18-ton gun has nearly the same penetration as the 38-ton gun when the projectile of the latter has half again as much stored-up work in it. The special significance of this lies in the fact that steel projectiles can now be made to stand up to their work sufficiently well to carry a bursting charge into the interior of a ship or fort through such armour as they are capable of penetrating. The Krupp 18-ton gun, 9·49in. calibre, drove steel projectiles uninjured through 20in. of iron armour. The weakness of wrought iron then lies in the fact that it is possible to perforate it and carry fire into the work or ship so protected, and that with a projectile whose diameter does not exceed half the thickness of the iron; and it is specially open to injury by brittle chilled iron projectiles which experience little resistance until they get deep enough to receive support from the plate around them. The recommendations of wrought iron are first that it holds well together, and is not liable to be injured by the continuous fire of guns which fail to perforate it. Hence, if sufficiently thick to resist the perforation of the most powerful single shot that can be brought against it, it is practically impregnable; and lastly it admits of receiving additions from time to time. How very suitable this is to the case of forts will be apparent.

Compound iron armour, either Wilson's or Brown's patent, consists of a fairly hard steel "face-plate" united to a wrought iron "foundation-plate," the respective thicknesses being in the proportion of one to three. The object is to oppose so sudden and sharp a resistance to the shot on first impact as to break it up before it can bury itself, and obtain support from the substance it penetrates; while at the same time the plate has the quality of wrought iron in holding together. This kind of armour is specially good against chilled projectiles, which break up against the surface. Speaking generally, it is considered better than wrought iron in the proportion of about three to two. The Inflexible turrets, for example, have 16in. of compound armour, instead of the 24in. of wrought iron they were originally designed to carry. Compound armour appears more liable eventually to break up than soft wrought iron under long-continued fire. It can hardly be said to be liable to perforation, and therefore would keep out the fire and even the dead metal of a projectile capable of perforating even a greater thickness of wrought iron.

Steel armour, first adopted for the Duilio and Dandolo, is capable of stopping a shot containing enough stored-up work to perforate easily the same thickness of wrought iron. At Spezia two 100-ton gun shot, capable of penetrating a solid wrought iron plate about 24½in. thick, were stopped by 22in. steel plates, while similar projectiles twice passed completely through wrought iron plates 22in. thick. The steel, however, was completely broken up and stripped off the backing. It may be said then that steel is admirably suited to resist a single blow and to keep out fire; but it is found that it can be gradually destroyed and broken up by the continuous fire even of comparatively light guns.

Chilled iron armour possesses the qualities of steel in an exaggerated degree. It transmits the shock of impact through its mass, hence it is liable to be shivered to pieces like steel. This class of armour is, however, advocated where it can be used in sufficient masses to absorb the blow thus distributed through it without suffering greatly. Every European Power, except England, may be said to have adopted it in coast defences. It is supposed to be economical, as it is cast in large blocks, and built up without fastenings or backing, beyond the blocks being keyed together by running white metal into grooves made for this purpose. This armour is said to bear a considerable number of blows of shot well. It becomes destroyed eventually by the entire mass cracking and breaking up. It would be very difficult for guns afloat to deliver a sufficient number of shot such as the shield was intended to resist sufficiently near the same spot to effect this object. The question is, however, whether the single shot of a gun enormously outmatching the fort would not wreck the armour on a wholesale scale. The reply may perhaps be made that any armour can only be made to resist a certain blow with success; but our point is that any armour is liable to encounter a much more severe blow than that for which it was originally designed. The rapid growth of guns is liable to bring this about. Clearly it is an advantage for such a blow only to produce a limited amount of damage; and much more, it is an object to have a kind of armour that can receive additions, so as to increase gradually with the power of artillery, as is the the case with the plate-upon-plate system. This, we think, is out of the question with chilled armour, which depends on its rigidity and mass. Nevertheless, it must be admitted that chilled armour possesses the recommendation of freedom from langridge under fire, such as bolt heads, &c., flying in the interior, and of keeping fire out. Unless enormously outmatched, it is excellent armour, and we wish to see it tried in this country, if only to learn what our navy must expect to encounter the first time they engage with an enemy's fort. On the whole, we think it will appear that we may congratulate ourselves on the adoption of compound armour for our ships, and especially on having the plate-upon-plate system of wrought iron on our coast defence shields, with every provision made for the addition of front plates from time to time if found necessary.

DIMINISHED OUTPUT IN THE IRON TRADE.

The blast furnace proprietors of Cleveland and Glasgow recently reduced their output by about 12 per cent. Probably no step was ever taken by the ironmasters of Great Britain which has evoked so much discussion and criticism. On the one hand we are told that a reduction in the production of pig iron was a most prudent policy, while on the other we are assured that the ironmasters in damping down or putting out their furnaces have disregarded all the laws of political economy and made a great mistake. *Martineau and Smith's Hardware Trade Journal* for the 31st of October contains an article on the "Outlook in the Iron Trade," in which we find the following passage, which may be taken as typical of a certain phase of opinion on this subject:—"But there is another point intimately connected with the present state of the trade that cannot be regarded with so much satisfaction, viz., the action of the Glasgow and Cleveland ironmasters in reducing the output of their furnaces to the extent of 12½ per cent. This arrangement, however called for and seemingly justified by circumstances, must be regarded with some misgiving, as a sort of arbitrary meddling with the natural order of things. It is a measure decided upon for the benefit of the ironmasters, just as the 'cotton corner' in Lancashire was decided on by a few speculators for their own benefit, but it is open to serious doubt whether the ultimate consequences of this measure 'in restraint of trade' will be beneficial to the country at large. The policy has only to be carried to extremes to show how mischievous may be the results. If, for instance, instead of reducing the production in two districts 12½ per cent., all the six or eight iron centres had decided to reduce the production by 50 per cent., what would have been the result? Prices would have bounded upwards, there would have been fine times for those ironmasters who kept their fires alight, or who had large stocks to dispose of; but who would have had to bear the brunt of this unnatural prosperity? We answer, the consumer and the country at large. And such, in a limited degree, will be the consequence of this concerted action at Glasgow and Middlesbrough, unless there are the real elements of improved trade to which we have before referred." The journal from which we have quoted is not without influence, and for this reason its statements are worth consideration. Our contemporary has apparently failed to make himself acquainted with all the conditions of the question he deals with so glibly; or else he is determined to see it himself, and to make his readers see it, in one aspect only. Nothing would be easier than to make the whole matter appear very complex. The truth is, however, that it is comparatively simple. The facts can be put before the world in such a way that any reader of ordinary intelligence, and possessed of a little knowledge of the subject, will be able to say for himself whether the action of the Cleveland and Scotch ironmasters has or has not been justifiable.

For many months past much more iron has been made in Great Britain than could be sold at a price which would leave even a small profit. Stocks accumulated for the most part in Connal's stores; but a large quantity of iron is no doubt in existence in private yards, lying about the works, or in the hands of numerous brokers. We shall probably not be far wide of the mark if we say that there is at present one million tons of pig iron in Great Britain which there is no prospect of selling for months, if not for years to come. This iron represents at least two and a-quarter millions of pounds sterling. The ironmasters of Great Britain are reputed to be wealthy men, but they are comparatively few in number, and they certainly could not suffer the whole of the enormous sum we have named to lie idle. Accordingly, what are known as warrants are issued. In other words, the iron in Messrs. Connal's stores is hypothecated. Although the iron cannot be sold, the warrants can, and a very considerable speculative trade is done in them. Within reasonable limits, there can be no objection to making iron for stock. It ought to be evident, however, that there should be bounds to the practice; but a considerable party exists who maintain that there are no limits; at least, they refuse to define them, which is the same thing. They argue that the more iron is made the cheaper it will be, and the better off will be the consumer. A large stock of iron represents, say they, so much national wealth, and the longer the blast furnaces keep going the richer will be the country. Consequently, it is impolitic to diminish output, because, to use the language of our contemporary quoted above, "It is a sort of arbitrary meddling with the natural order of things." To deal with this kind of writing requires some patience. It is very difficult indeed to answer or even comprehend propositions couched in vague terms. For example, we do not in the least know what our contemporary means by the words "natural order of things." It seems that he has

some hazy notion that it is the business of ironmasters to go on making iron whether they can sell it or not, which is simply absurd. The argument that the wealth of the nation is augmented by the continued production of iron even in excess of the demand, deserves more consideration. It has not been quite lost sight of by our contemporary. It is tolerably clear, however, first, that at least 5000 tons more pig iron have been made every week than the consumer wanted; and, secondly, that no one could say when the demand would keep pace with the supply. In other words, to all intents and purposes the iron stored week by week is simply a useless commodity. No one wants it for any purpose of trade; and it is very difficult to see how, under the conditions, its production adds in any way to the wealth of the nation. It may be argued that at some future period it will all be used. But if we admit this, it must be conceded to us that it only possesses now a value in reversion which is very much less than it would possess if it were being employed at once for some useful purpose. Let us assume, however, that every ton of the iron stored really represents £2 5s. in gold. It is evident that none of this, or very little of it, goes into the pocket of the producer. The consumer is the only one who could benefit. But even he is none the better of the pigs in Connal's yard. He is only the better on the assumption that he buys iron cheaper than he could purchase it if stocks were small or non-existent. But if that were the case, the consumer would be really getting something out of the iron maker's pocket, by taking advantage of his imprudence. The consumer, therefore, thus placed in a better position than he would otherwise be, has the producer, in a sense, sacrificed to him. We know that a very large and influential party contend that the consumer is alone to be considered. But sounder political economists see that this view can be, and very often is, pushed too far. A just balance should be observed throughout the community. In the present case, the shipbuilders are perhaps the class most benefitted by obtaining iron very cheaply. If, however, for every fortune made by a shipbuilder an ironmaster is ruined, it will possibly be admitted that the gain to the community is not great. The prosperity of the iron trade is of as much national importance as that of the shipbuilding trade; and it would require some courage to advocate the building of vast numbers of ships to stock on the chance that they would one day be sold, because, forsooth, it would add to the national wealth. We do not think the men of the Tyne and the Clyde would quite see the proposal in that light.

Our contemporary writes, "The policy has only to be carried to extremes to show how mischievous may be its results." Quite so. Just the same thing, however, may be said of any policy. Our contemporary can, we hope, eat and enjoy a good dinner; but he has only to push the policy of eating dinners to extremes to learn how mischievous may be its results. If the ironmasters had been producing just as much iron as was wanted, and no more, none or very little going into stock, and if they had then combined to diminish output to run up prices, it might be very properly said that they were taking an unfair advantage of the community; and it might even be added, with a certain amount of propriety, that they were limiting the growth of national wealth for their own private aggrandisement; but there is no analogy between such a course and that which they have actually adopted. After a long and painful experience they have arrived at the knowledge that they are making iron which the world does not want. Consequently they cease to make it. The same thing is done every day in all trades and businesses. For example, a man starts as an ironmonger in a new district; he does a good business. Encouraged by his success, another and another shop is opened in the same line. Presently it is discovered that there is at least one ironmonger's shop too much in the district; it is not wanted. The goods exposed for sale cannot be sold. Will the *Hardware Journal* assert that when the owner of the shop too many, sells it to a baker or a shoemaker, or throws it upon the landlord's hands, that he is "arbitrarily meddling with the natural order of things?" We think, on the contrary, that our contemporary will regard the abandonment of a business which does not pay as the most natural thing in the world. Let us suppose that, if instead of agreeing together to limit output, the ironmasters had gone on steadily losing money until one by one they resolved that they would lose no more, and put out their furnaces and closed their works, without consulting with their fellows; will it be maintained that in acting thus they would have broken the laws of sound political economy? Scores of furnaces have been so put out and abandoned in the United States. No one ever dreamt of asserting that the owners were not justified in doing this. Will the *Hardware Journal* maintain that they should for the sake of the consumer have kept on making iron at a loss? There is good reason to believe that if the output in Great Britain had not been reduced by a concerted policy, it would ere long have been reduced with a vengeance by individual action.

May we venture to hope that we have put the facts in a new light not only before the *Hardware Journal* but a great many persons whose views it more or less fully represents? The popular idea seems to be that production has been diminished to raise prices. But a little reflection ought to show that no such result could be permanently brought about by what has up to the present, at least, been done. So long as the supply is equal to or slightly in excess of the demand, so long must prices remain unaltered. When it was announced that Cleveland and Glasgow had agreed to diminish output, prices for a moment were run up either as a result of panic or speculation, but the rise was not based on a legitimate increase in demand, and was quite exceptional. The fact that the makers were turning out week by week thousands of tons of iron which nobody wanted could have no effect at all on the true market. To the consumer who buys as he goes, it is of no importance how much iron there is being made over and above the demand. To the speculator the matter has a different aspect. He may, for example, buy 50,000 tons of iron at £2 2s. per ton, and keep it on the chance that he will be able to sell it again for £2 10s. If there was not a superfluity of iron he could not do this. So long as stocks are heavy he can "bear" the market with safety. But with this sort of trading we have nothing to do. We assert—and it is only necessary to look at the price lists of the day to show that we are right—that the policy of the ironmasters in putting out or running more slowly a number of furnaces, has not augmented prices to any appreciable extent. It is possible, however, that if stocking had continued there would have been a great fall in the price of iron, brought about by forced sales. We doubt, however, if any one would be rash enough to maintain that the flooding of the market with cheap iron under such circumstances—great as the advantage might apparently be to the consumer—would be a circumstance to rejoice about, whether it was the consequence or the cause—either of which it could not fail to be—of widespread disaster in our great iron-making centres. The iron trade of this country is at least as important as the shipbuilding trade—to name one of several—and nothing is gained by any nation if the prosperity of any one of its great industries is built up on the ruins of another. Much of what we have said will apply to other businesses than that of the blast furnace owner; and it is, we think, well that we should here state definitely that we do not advocate the reduction of output unless it is actually in excess of the demand. Every case that can arise will present features peculiar to itself, and each must be judged on its own merits. That man will hardly go wrong who masters all the facts and deals with them in a liberal and unprejudiced spirit before he pronounces a verdict, and condemns or justifies the policy he has had under his notice.

THE HEMATITE IRON TRADE.

Despite the success of the basic method of producing steel, there is a very large extension of the hematite iron trade. In the great north-western district, which is the centre of the production of hematite from native ores, and which works under the disadvantage of having to carry its coke from the Durham district, there is now a production, it is believed, of over 16,000,000 tons of Bessemer and hematite iron yearly. Out of 81 furnaces erected from Carnforth along the coast by Barrow, to Maryport, there are 60 blowing, and it is believed that others are being prepared to be blown in. Despite the fact that the Spanish ore delivered in Cumberland is higher in price than that from the local mines, there is a considerable importation; and this shows the largeness of the demand. In the north-east there is a growing production of iron from imported ores, chiefly Spanish or Elban, and when the cheapness of delivery and of fuel is borne in mind, it will be seen that the growth has a solid foundation. In South Wales the manufacture, under similar conditions, is growing, and in Scotland, where it has been more recently introduced, it is also showing signs of vigour. Unquestionably this is in part due to the large demand for steel rails; but it is also contributed to by the fact that there is a growing use for Bessemer steel for purposes daily widening, and in some of which it infringes on the field that had been occupied once exclusively by steel made by some of the older processes, and as with this enlarged production there is greater cheapness—partly because there are improvements and economies in the process, and partly because of the increased competition amongst the makers—it is to be expected that the area of use will continue to be widened, and that though we may not retain all the demand that has recently arisen for steel rails, yet the widening use will give to the producers a full field for the disposal of the produce of their converters. How far the demand for foreign ores may be interfered with by the adoption of the basic process cannot yet be determined, but the figures and facts that were produced at the recent meeting of the Iron and Steel Institute seem to point to the growth of the process, and though, in this country, it has been almost wholly applied to steel used for rails, yet the commencement of the construction of the works of the North-Eastern Steel Company point to an early extension, not only of the production but also of the area of use, and of the class of articles that are to be made from it. As yet the initial difficulties, heavy as they were, have taken much time to overcome; but as the process extends there will also be an attempt to not only improve the process but also to cheapen it; and it will be when this is being attempted that the competition will arise between Bessemer and basic metal. Meantime, the production of hematite increases, and it is likely still further to increase in the immediate future.

THE ELECTRIC LIGHTING OF LIVERPOOL.

Since we drew the attention of our readers to the dangerous condition and unsightly appearance of the posts employed to carry the wires for the electric lamps in the streets of Liverpool, the British Electric Light Company, which had entered into a contract to light a portion of the city by electricity, has applied to the Corporation for permission to abandon the use of the posts and to lay the wires underground, stating also that unless permission to make this alteration was granted it would prefer to retire from the contract. The Corporation has agreed to the proposal, subject to the approval of the plan and particulars showing the mode in which the work is to be carried out, and with the proviso that none of the carriage-ways are to be interfered with, and that the work shall be done at night. Some of the most dangerous posts have already been removed.

LITERATURE.

Mechanical Industries Explained; showing how many Useful Arts are Practised. By Alexander Watt. Edinburgh and London: W. and A. K. Johnston. 1881.

This is a curious little book, and one worth buying. It is a work of small pretension, and the author does not attempt either to exhaust a subject or to treat it with minute scientific accuracy. Sixty subjects are dealt with, beginning with carving Irish bog oak, and ending with jewellery. No attempt has been made to classify the articles, but a very copious index is provided at the end of the volume. The subjects treated are most varied, including, for example, to name but a few, etching, galvanising iron, gold beating, needle making, file cutting, balloons, whitewashing, and so on. It must not be assumed, however, that Mr. Watt has written a kind of "Inquire Within." The volume is made up of sixty separate articles, each of which describes very fairly how a given thing is made or process carried on. The information thus supplied is far more accurate than is usual in works of this kind, and Mr. Watt's style is so good that he succeeds in conveying a great deal in a few words. The amateur will be certain to get many hints, or even something more, from the pages of this volume. Even the practised tradesman may learn a little. But beyond this the work has a distinct educational value. With small modification it would form an admirable school-book, in which answers might be found to a host of questions constantly put by intelligent boys and girls. It would form a useful present for any boy with mechanical tastes, and its price is so moderate that no one of an inquiring mind need be without it. It is very well printed on good paper, and seems likely to do good service in a very modest and unassuming fashion.

THE LATE MR. McDONALD, M.P.

Mr. Alexander McDonald, M.P. for Stafford, died rather suddenly on Monday afternoon, at his residence, Wellhall, Hamilton, Scotland. Mr. McDonald had been in failing health for a series of years. It was known to his acquaintances that he suffered at times very much from rheumatism and bronchitis, but his indomitable spirit carried him through a great deal of labour and suffering. Little more than a week ago, however, whilst engaged in some duties connected with the Miners' Union in Yorkshire, Mr. McDonald was attacked with jaundice. Hurrying home to Hamilton, he procured the best medical advice, but this attack, superadded to his former ailments, proved too much for him, and he died, as we have said, on Monday afternoon. Mr. McDonald was born in the year 1821, and was thus sixty years of age. His father was a miner, and as soon as he was able, when he was little more than seven years of age, he was taken down the pit, as was the general custom then with miners' children, to assist in the laborious operations in which their parents were engaged. In early boyhood he developed strong natural abilities, and he contrived to save as much money as paid for his classes in Glasgow University. The education he there received enabled him to adopt the profession of a schoolmaster, but he was not long in this position. He was induced to devote himself to the improvement of the condition of the mining population of the district He was all the better qualified for this on account of the hardness of his own experiences in his tender years. No doubt his views were considered extreme, and doubtless his expressions and opinion regarding the conduct of employers were not always well considered; but he had the well-being of his class at heart, and he has been heard to boast that he had spent forty years of his life in endeavouring to raise the miners from the condition of degradation and slavery in which they were in his early days. For many years Mr. McDonald occupied the position of secretary to the Scottish miners, who almost invariably accepted his advice on matters of labour and wages. At an early stage in his career, Mr. McDonald became convinced that it was absolutely necessary that the labour laws should be reformed if the position of the working miner was to be materially improved. He strove to influence members of Parliament to endeavour to procure modifications of these laws, and his influence in this way was considerable. He came forward at the General Election in 1874 as a candidate for the representation of Stafford, and was successful at the poll. After entering Parliament, Mr. McDonald assiduously set himself to the task of reforming the labour laws. He gave valuable assistance to different commissions on the subject, and his vote was steadily found on the side of reform. Mr. McDonald was of late years president of the Miners' National Union of England, and his death will create a blank in labour circles it will not be easy to supply.

TENDERS.

SUTTON COLDFIELD SEWERAGE WORKS.

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

Contract No. 1.—Cast Iron, Earthenware, and Brick Sewers, and other Works.

	£	s.	d.
Wilkes and Co., Bishopsgate, S.W.	28,653	0	0
Bottoms Bros., Battersea	21,500	0	0
Scott, W., Newcastle-on-Tyne	20,472	0	0
Hunter, G., London, W.	17,590	8	2
McKenzie, Williams, and Co., Moorgate, E.C.	17,053	0	0
Nelson and Co., York	16,289	0	0
Ford and Everett, Westminster	15,950	0	0
Botterill, W. J., London, E.C.	15,624	0	0
Lean, W., Gloucester	15,283	0	0
Kirk, T., Chester	14,700	0	0
Hill Bros., Beckenham, S.E.	13,941	0	0
Holland, W., Leicester	13,909	0	0
Pickthall, J. W., Bromsgrove	13,699	0	0
Evans, J, Walsall	13,000	0	0
Currall and Lewis, Birmingham	12,989	0	0
Hilton, H., Birmingham	12,985	0	0
Law, T., Kidderminster	12,577	0	0
Smith, J. M., Westminster	12,550	0	0
Palmer, A., Birmingham	11,990	0	0
Fell, J., Leamington—accepted	11,984	0	0
Engineer's estimate	12,896	5	6

Contract No. 2.—Cast Iron Pipes and Special Castings.

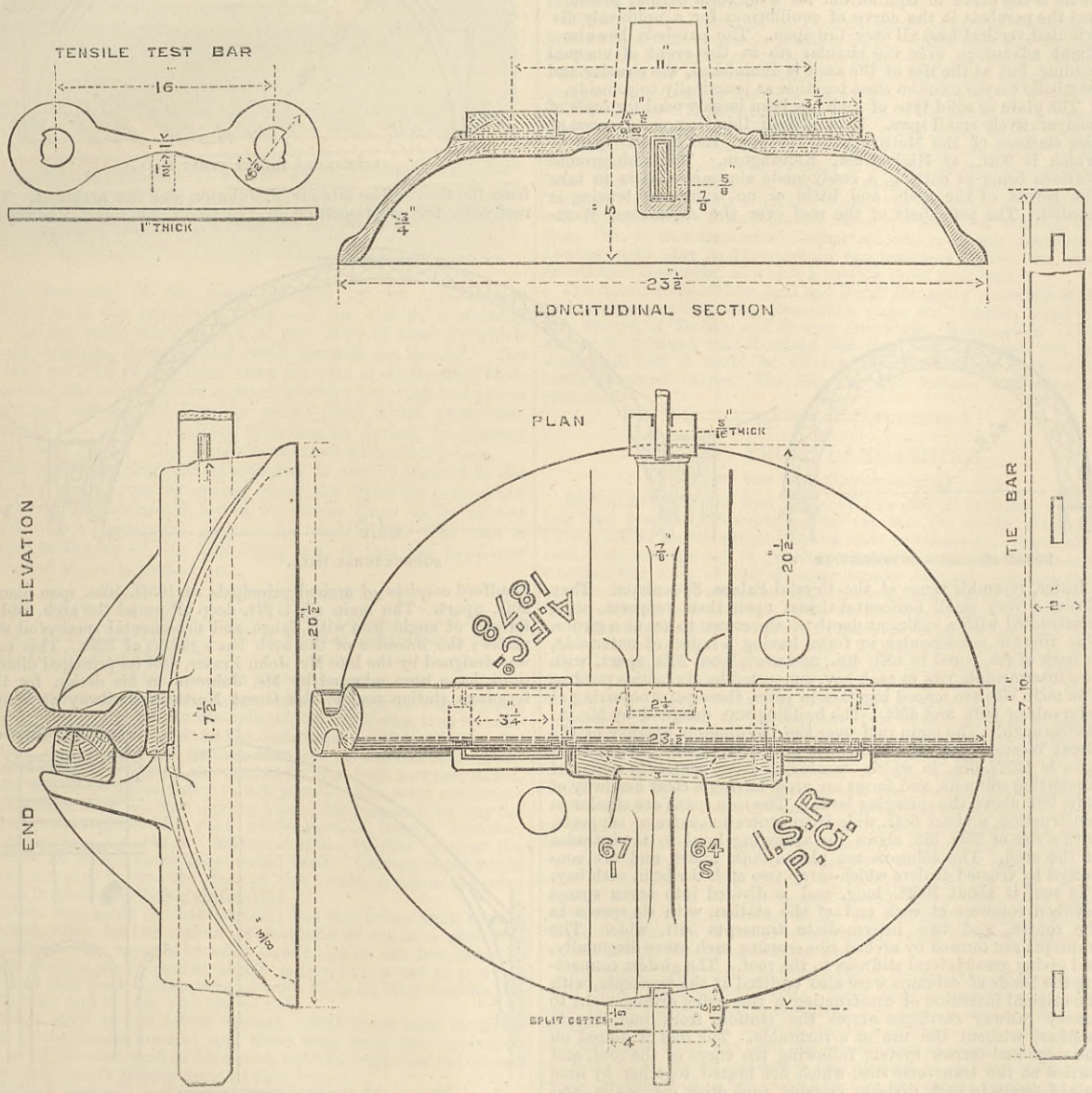
	£	s.	d.
Piggott, T., and Co., Birmingham	1085	0	0
Cochrane and Co., Dudley	1008	0	0
Butterley and Co., Westminster	957	0	0
Staunton Iron Company, near Nottingham	913	11	0
Firmstone, C. E., and Bros., Stourbridge	831	0	0
Roberts, J. and S., West Bromwich—accepted	828	0	0

Paris Electrical Exhibition.—The following are the awards in the British section—Grand Diplôme d'Honneur: Post-office. Diplôme d'Honneur: Society of Telegraph Engineers; Telegraph Construction Company; Eastern Telegraph Company; Submarine Telegraph Company; Professor Hughes, F.R.S.; Sir W. Thomson, F.R.S.; Messrs. Siemens Brothers. Lettres de co-opération: Royal Institution; King's College. Gold Medals; the Anglo-American Brush Company; British Electric Light Company; Messrs. R. E. Crompton and Co.; India-rubber, Gutta-percha Company; Messrs. Clark, Muirhead, and Co.; Mr. Edward Bright; Elliott Brothers; Mr. Swan. Silver Medals: Mr. Apps; Profs. Ayrton and Perry; Mr. Brotherhood; Consolidated Telephone Company; Exchange Telegraph Company; Mr. Fyfe; Messrs. Johnson and Nephew; Messrs. Robey and Co.; Mr. Sabine; Messrs. Saxby and Farmer; Mr. Spagnoletti; Messrs. Thomson and Sterne. Bronze Medals: Messrs. Blakey and Emmott; Mr. Bourne; Mr. Coxeter; Mr. Foxcroft; Mr. Hedges; Mr. O'Lawler; Mr. Patterson; Messrs. Ransome; Mr. Sabel; Mr. Sax; Mr. Smith; Messrs. Stiff and Sons; the Dowson Gas Company; Messrs. Wallis and Steevens; Whitecross Wire Company.

CONTRACTS OPEN.

POT SLEEPERS, INDIAN STATE RAILWAYS.

THE Indian State railways require tenders for pot sleepers for Sonapur-Mugra extension of the Calcutta and South-Eastern Railway, 5ft. 6in. gauge. The work required under this specification consists of the construction, supply, and delivery, at one or more of the ports named in the conditions and tender, of 1130 tons of cast iron pot sleepers, 106½ tons of wrought iron tie-bars, 12 tons of wrought iron gibs and cottars, as shown in detail on the drawing. The whole of the materials and workmanship are to be of the best description and kind specified, and in all respects subject to the approval of the inspecting engineer. The sleepers are to be cast of soft grey all mine irons, and the mixture of the metal is to be such as will produce the strongest and toughest castings, and is to be approved by the inspecting engineer. The contractor must cast twice a day, from the same metal as that used in the sleepers, two duplicate bars, 3ft. 6in. × 2in. × 1in., for test by transverse strain, and two duplicate castings of the form shown on the drawing, and exactly 1in. square for a length of 1½in. in the middle, for test by tensile strain. One of the two bars for test by transverse strain must be tested on edge, on bearings 3ft. apart, and it must bear 30 cwt. in the centre without breaking, and must show a deflection at least 0·29in. before fracture; and one of the two castings for tensile strain must be tested in a suitable machine of approved construction to ascertain the tensile strength of the iron, which must be equal to 11 tons per square inch. The second test casting of each kind is to be marked with the date of casting, and put away for the subsequent inspection of the engineer. All sleepers cast on any day when either of the two bars tested fails to stand the specified tests will be rejected. The wrought iron used for the tie-bars, cottars, and gibs must be equal to a tensional strain of not less than 24 tons per square inch, with a reduction of the tested area of at least 20 per cent. at the point of fracture. Two pieces for testing will be selected by the inspecting engineer from every delivery of iron used for the contract. Should any of the test pieces fail to stand the specified test, the whole of the iron represented by such test will be rejected. Each sleeper is to weigh 86 lb., and no sleeper weighing less than 85 lb, will be taken. Payment will not be made for any weight above 86 lb., and the actual weight only if under 86 lb. will be paid for. The contractor will be required to weigh the whole of the sleepers in the presence of the inspector, and the net weight only will be allowed. All sleepers are to be moulded by machine, no hand moulding will be allowed. Two holes are to be left in the upper part of the sleepers to enable the plate-layers to see whether they be properly packed. Particular attention is to be paid to the size and form of the jaws and of the holes for the tie-bar, also to the tilt or inclination of the rail when keyed up, which must be 1 in 20 from the perpendicular drawn at right angles to the line of cross-tie, and if, on applying a set gauge of that angle, it shall be found that it only touches one of the edges of the rail, and is more than $\frac{1}{16}$in. from the other edge, the sleeper in such case will be rejected. Immediately after every sleeper is cast, it must be protected in such a manner as will satisfy the inspecting engineer that the process of cooling will proceed so slowly that its strength will not in any degree be diminished by too rapid or unequal cooling. Three sleepers will be tested each day by a weight of 3¾ cwt. falling through 2ft., 3ft., 4ft., 5ft., 6ft., 7ft., and 8ft. successively on the head of a piece of rail keyed up in its place with its cushion and key, as if for the road. The sleepers so tested are to be placed on a bed of sand ballast. Whenever any sleeper breaks or shows other signs of failure under these tests, the day's make will be rejected. The sleepers tested will not be taken as part of the contract, but must be broken up immediately after testing. The sand foundation on which the sleepers are tested is to be 2ft. thick, well consolidated before the testing begins, and laid on a cast iron bed plate 8in. thick, weighing 2 tons. The contractor must provide at his own expense all pieces of rail, cushions, and wood keys required for the testing of the sleepers. The tie-bars are to be made of wrought iron 2in. wide by ½in. thick, the holes for the gibs and cottars are to be accurately punched to the required distance to suit a 5ft. 6in. gauge. The angles of the bars are to be cut off as shown on the drawing. All four holes in the tie-bar must be punched cold at one stroke of the machine. Great care must be taken that the tie-bars are perfectly straight after being punched. The gibs and cottars are to be of wrought iron, $\frac{5}{16}$in. thick, and of the form shown on the drawing. The cottars are to be split for a distance of two-thirds of their length. Each day's make of sleepers, gibs, cottars, and tie-bars will also be tested by gauging, cottaring, and keying together as many sleepers as the inspecting engineer may consider necessary. If any further precautions than those adopted by the contractor appear desirable for the completion and delivery of all parts of the work, the inspecting engineer shall have power to direct the same to be done without any additional charge. Four sleepers, with tie-bars, gibs, and cottars, must by submitted to the inspecting engineer at the works for testing and approval within three weeks from the letting of the contract, and none of the work is to be made for delivery under this contract until the inspecting engineer shall have signified his approval of the same in writing. After being inspected, the tie-bars, gibs, and cottars are to be made hot and dipped into boiled linseed-oil. When dry the gibs and cottars are to be packed in cases made of 1¼in. deal board, with elm ends, nailed with 3½in. wire nails, and strengthened by battens and iron hoops, No. 18 B. W. G. The joints of all cases are to be tongued and grooved, and the whole made secure for transit to India. The tie-bars are to be delivered in bundles of sixteen bars, firmly tied together with strong rod iron. The sleepers may be shipped unpacked. Every case is to be branded, not merely painted, and every bundle and sleeper painted, with such descriptive and shipping marks as the inspecting engineer may direct. Tenders are to be delivered at the Store Department in the India-office, Westminster, S.W., on Tuesday, 8th November, 1881, before two p.m., after which hour no tender will be received. They are to be addressed to the Secretary of State for India in Council, with the words "Tenders for Cast Iron Pot Sleepers, &c.," on the left-hand corner of the envelope, and are to be placed in a box provided for that purpose in the Store Department.



POT SLEEPERS—INDIAN STATE RAILWAYS.

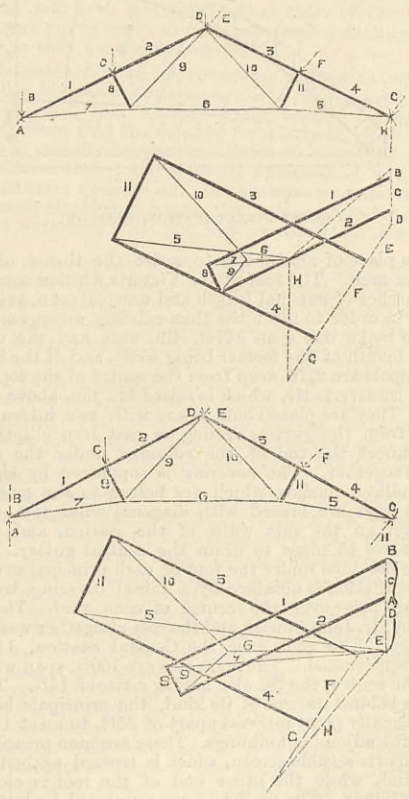
IRON ROOFS.

By Mr. A. T. WALMISLEY, C.E.

[*Continued from page* 309.]

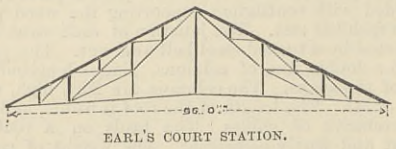
The roof over the City terminus of the South Eastern Railway, at Cannon-street, is trussed in the same way and is divided into nineteen spaces by twenty principals, including gable. The principals have a clear span of 190ft. 4½in., with a rise of curved rib at the centre equal to 60ft. and rise of tie bar 30ft. above the springing level, giving a truss 30ft. deep. The principals are placed 33ft. 6in. apart, and are connected by purlins extending from rib to rib and secured by bolts with holes slotted to provide for expansion and contraction. The purlins are braced by one intermediate rib in each bay and by the sash bars and boarding. The cost was £49 10s. per square. Both roofs are crowned with lanterns fitted with side louvres for ventilation. The main roof of the London Bridge terminus of the London, Brighton and South Coast Railway is another example of this type of truss—No. 5. The span is 88ft. and the depth of truss 18ft., the rise of the top rib being 27ft. and of the tie rod 9ft. above the springing level. The principal trusses are placed 16ft. apart, with a light intermediate rib of trussed angle irons resting on the wrought iron purlins. In the recent competition for the proposed Exchange Station at Liverpool the design which obtained the first prize consisted of three spans each something over 100ft., of the type shown in No. 3—see diagram—with vertical struts. The principal of the main roof over the Blackfriars passenger station is an example of No. 11—see diagram. It is 87ft. 3in. in span and supported on columns 32ft. 3in. apart. The columns are connected longitudinally by a trussed girder which carries two intermediate ribs. The rise of the top curved rib is 22ft. and of the bottom rib forming the tie 9ft. above the springing, giving a depth of truss 13ft. Ventilation is effected through the purlins, which are of cast iron having ornamental perforations for that purpose. The total length is 401ft. 6in., and the whole roof is braced together by diagonal wind ties. The columns are hollow to carry off the rain water. The roof was designed and erected under the direction of Mr. W. H. Thomas. The roofs over the Woodside Station, at Birkenhead, are constructed in a similar manner. There are two spans of 97ft. 11in. and 91ft. respectively, supported on the side walls of the station and meeting in the centre over a longitudinal row of columns placed 25ft. apart. The principals resemble No. 11, and are 10ft. 4in. deep—centres—with a rise of 25ft. from the springing level to the centre of the top rib. They are fixed in the centre to the columns and spandrils, but at the other end the shoes are provided with expansion rollers resting on the wall plates. The roof is divided longitudinally into fifteen spaces by the main ribs, and surmounted by a longitudinal skylight 16ft. wide with side louvre standards. The north-west corner is curved in plan owing to the position of the site. The purlins consist of trussed T. I. and the whole is braced by diagonal wind ties connecting three bays. The roof was built in 1877 and cost about £32 per square.

The roof over the new Lime-street Station, Liverpool, is also composed of trusses framed as shown in No. 11. The main portion erected about ten years ago consisted of principals of varying span, averaging 212ft., with a depth of 22in. 9in., measured from top of arch to arch of tie, which is raised 22ft. above the springing level. The station was enlarged in 1875. The span of the extension measures 191ft., with a height in centre of 71ft. The wrought iron principals are similar in construction, and are placed 32ft. apart, connected by lattice purlins placed over the ribs, and provided with ventilators supporting the wood purlins upon which the sash bar rest. The junction of each strut with the tie bar is effected by a turned steel bolt and nut. The principals are fixed with a double line of columns, placed longitudinally at the junction of the spans. The columns are 20ft. high, with a mean diameter of 3ft. The length of the roof is 645ft., and cost £30 per square, exclusive of gables. The loads on a roof are partly permanent and partly occasional. The weight of snow varies in amount in different countries and in different positions. As in this country snow is not likely, in the presence of a strong wind, to accumulate on a roof more than about 9in. in depth, it is unnecessary to allow for a greater distributed load than 8 lb. per square foot of horizontal surface covered. The pressure of wind is more variable, as it does not always blow in the same direction. In finding the strains on a roof, it is incorrect to assume that the wind force acting vertically is the worst case that could happen. Its pressure depends not only upon its velocity, but also upon the angle of incidence at which it strikes the roof. In this country it is sufficient to allow for a horizontal pressure of 40 lb. or 45 lb. per square foot of surface directly opposed to it, acting broadway on either side of the roof, as representing the equivalent of wind and snow pressure; indeed, it is the opinion of many engineers that this amount is too much. All roofs settle a little, so that it is advisable with large spans to fix the trusses at one end only, and it is found the most economical plan to fix the side opposite to which the heaviest gales are likely to blow. Thus it will be seen that the truss fixed on the leeward side, and left free to expand or contract on the windward side, has the amount of strain in its component parts greatly diminished when compared with the same truss fixed on the windward side, the data in each calculation being alike. The black lines show the members in compression, and the red lines those in tension, while the black dotted lines show the external forces; the greatest stresses being when the leeward foot is free. A simple form of truss has been assumed to illustrate the principle, but the result would be similar in any case, and shows the economy to be effected by observing the direction of the prevailing wind in any situation, and fixing the roof principals as near as possible on the leeward side. For moderate spans bearing surfaces accurately planed are better than small rollers. Roller frames may tend to lessen the racking motion produced by expansion and contraction of an ordinary roof, but do not prevent it. An examination of the Exeter Station roof of 132ft. span, some time after its erection, proved that the rollers which had been provided at the shoes to the principals in the outer wall had not moved, so that they might have been dispensed with. During the Hammersmith Bridge Inquiry in 1869, it was noticed that the rollers under the chain connections in the towers had rusted under their saddles or bearings, there being evidence of the chains having rubbed their under surface upon the rollers, rendering the friction of the rollers so great as to require the tower itself to ease before the rusty rollers would rotate. Mr. Brunel nearly always provided for variations of temperature in his structures; but time and practice have since proved the effect to be much less than was at first supposed. Care should, however, be taken that the wall or other support at the fixed end of a roof of a large span is capable of resisting the outward thrust produced when the wind is blowing on either side of the roof with its full force, and the rollers at the other end are in the point of motion; also that the support at the roller end is capable of resisting the outward thrust produced when the wind is blowing in either direction with its full force, and the roof is in its normal condition as to temperature. The wind pressure may at any moment act in a vertical direction, depressing the main rafters and producing an uneven stress upon the connection at the ends, which causes the roller on the inner side to be more compressed than the others, and tends to crush it. In the Cannon-street roof provision is made to prevent this by attaching the end of the principal to a special casting, which is connected to another casting resting on the rollers by a circular joint secured with a pin, so that whatever the inclination of the main rib may become, the hinging of the joint causes the stress to pass through the centre of the group of rollers, and thus to be evenly distributed over them. It is usual to brace a roof diagonally to enable



STRAINS IN ROOF TRUSSES.

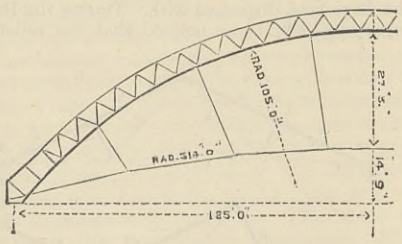
it to resist the effects of winds blowing at an angle with the axis of the roof by iron ties passing up from the springing to the ridge in an oblique direction and attached to the underside of the purlins. In some part of the length of these ties a coupling screw is inserted to admit of proper adjustment. In many roofs these wind ties are spread all over the structure. In the roof over the Drill Hall, Forrest-road, Edinburgh, designed by Mr. R. H. Bow, the wind bracing is confined to two bays. The roof consists of principals similar to No. 12—page 309—with a span of 97ft. 6in. fixed at one end and resting on rollers at the other. There are nine of these trusses 13ft. 6in. deep, which with two stone gables give ten equal bays in a total length of 135ft. The bays next the end bays are braced with diagonal ties fixed throughout at a favourable angle, the lateral stiffness of the six intermediate and of the two end bays being secured by their purlin connections. The radius of the curve of the top flange of the principals is 57ft. 6in., and the rise of the tie bar in the centre is 13ft. 6in. The wind ties are connected to the lower face of the upper angle irons of the arch, underneath the purlins which are attached to the upper face. Besides looking well this disposition offers facilities in the erection. No. 4—see diagram—illustrates a queen post truss derived from the old timber system, but generally modified in its recent application to iron structures. The roof over the Earl's Court Station of



EARL'S COURT STATION.

the Metropolitan District Railway, designed by Mr. John W. Barry, consists of principals formed of two inverted queen post trusses with vertical members braced together and connected by purlins, which are made deeper at their junction with the principals than in the centre, so as to stiffen the ribs longitudinally. The principals are about 96ft. span and are placed 20ft. apart. One end of each principal rests on a single steel roller. The purlins are vertical, and not at right angles to the rafter, it being considered that the fixed load and weight of snow act vertically. There is not wind bracing throughout the roof, but diagonal bracing in the two end bays, which counteracts the endways pressure of the wind. The roof is closed at one end by the booking offices, and at the other end with a gable screen formed by trussing a main rib longitudinally as well as bracing it transversely. Provision is made for ventilation in standards fixed over the purlins. The roof over the Broad-street Station belonging to the London and North-Western Railway is in two spans, of 95ft. each. The principal resembles a queen post truss shown in No. 4, but was originally designed to act as a tied arch braced with tension rods. In each side inclined rafter one vertical strut is inserted to obviate the effects of unequal loading. The principals are placed 36ft. 10in. apart, resting on the outer walls and meeting over a central line of columns which are connected with wrought iron lattice spandril girders. The principals are about 12ft. 6in. deep in the centre, and the rise of the transverse tie rod is about 4ft. 6in. above the springing level. Each span is surmounted in the centre with a cast iron arched spandril ridge, to which are attached side louvres for ventilation. The whole roof is well secured by wind ties, which the construction here adopted renders especially necessary to maintain the structure in position. The roof was erected in 1865. A similar form of principal has been adopted in the roof over the Preston Station, which consists of two spans.

The type of roof adopted at the west-end terminus of the London, Chatham, and Dover Railway—Victoria Station—also at the Central Station, Liverpool, and Queen-street Station, Glasgow, may be described as a tied arch with the tie bar looped up, the tie

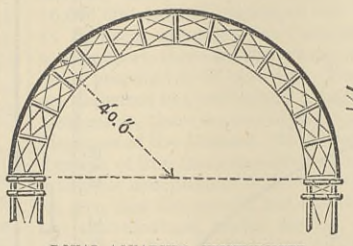


QUEEN STREET STATION, GLASGOW.

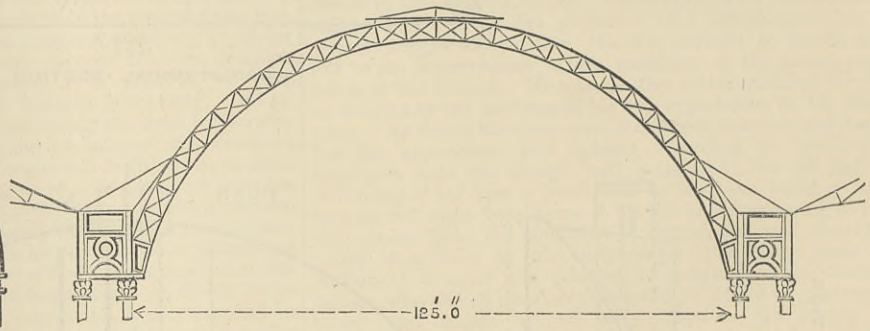
taking the place of abutments to resist the thrust of the upper part of the arch. The roof at the Victoria Station consists of two crescent arches of unequal length and unequal span, as it was found necessary in order to meet the then existing arrangements of the station to make one span 127ft. 4in. wide and the other 129ft. wide, the length of the former being 455ft. and of the latter 385ft. The principals are 21ft. deep from the centre of the top rib to the centre of transverse tie, which is raised 8ft. 6in. above the springing line. They are placed 35ft. apart with two intermediate ribs springing from the gutters resting on cast iron elliptical girders, which connect the top of the columns under the feet of the principals together. The covering is supported by eight trussed and six trellised purlins, which are bolted to the main ribs, and every two bays are braced with diagonal wind ties. The outer gutters rest on the side walls of the station, and the middle columns serve as pipes to drain the central gutter. Expansion rollers are provided under the foot of each principal over each side wall. Ventilation is obtained by a raised covering, trussed as in No. 1—page 309—over the centre of each roof. The work was designed by Mr. John Fowler, and the cost altogether was £27 13s. 4d. per square. The roof over the Central Station, Liverpool, is similarly constructed. The main ribs are 160ft. span with a rise of 40ft. in the centre, the tie also having a rise of 14ft. This roof is one of the boldest designs of its kind, the principals being placed at the unusually great interval apart of 55ft. to meet the requirements of the adjoining buildings. There are nine principals, one of which supports a gable screen, which is trussed against the action of the wind, while the other end of the roof is closed by the station buildings. The main ribs are connected by lattice purlins which support five intermediate ribs. The tie rods are of steel. The roof is 495ft. in length, and is ventilated by open spandrils carrying a raised skylight along the ridge. The roof was designed by Mr. John Fowler, and the cost of the iron and steel was £14 1s. per square.

The roof over the Queen-street Station, Glasgow, belonging to the North British Railway Company, is about 415ft. long and 170ft. span from centre to centre of supporting columns, which are placed at a distance of 41ft. 6in. longitudinally. This roof is the largest span of its kind, and is carried by nine principals in addition to two end gables. The rise of the centre of the top rib of the principal is 43ft. 9in., and the rise of the tie rods 14ft. 9in. above the springing level. The side columns are connected by lattice girders carrying the gutter, and each bay between the main ribs is divided into five spaces by four intermediate ribs supported by lattice purlins placed 27ft. 9¾in. apart with secondary purlins carrying the glass. The tie rods are of steel. The roof cost £15 per square exclusive of foundations and drainage. There is not so much difference now as there used to be between the prices of iron and steel, and hence steel is being rolled into a larger variety of sections than formerly. With roofs of small span the weight of the component parts is not sufficiently great to effect any economy by the substitution of steel for iron, but in large spans the saving of expense is sufficiently great to recommend its use as presenting a much lighter appearance than iron of equal strength. The general adoption of iron roofs of large span is comparatively of recent date. Beyond a span of 50ft. the question arises whether the roof shall be made in one or more spans. The late Professor Rankine held the opinion that the roof should where possible be in a single span over the whole station, but the late Sir Charles Fox preferred roofs of 50ft. or 60ft. spans as being the cheapest. If intermediate pillars are used they should be placed in the middle of broad platforms. A comparison of the two stations at Victoria, London, shows this. In the case of the London, Chatham, and Dover Railway Station, they are in the centre of the narrowest platform, whereas in the London, Brighton, and South Coast Railway Station, they are in the centre of a broad carriage road. Of course, the adoption of very large spans is more expensive than dividing the space into two or three moderate spans, but there are the advantages of (1) freedom from all intermediate supports, giving facilities in laying the space to the greatest advantage, or in subsequently altering the arrangements, and this freedom is especially valuable when it is required to transfer the traffic of the station from one line to another diagonally at the shortest possible intervals; (2) getting rid of annoyance of snow lodging in the valleys; and (3) the grander architectural effect of the structure, whether trussed or arched. The stability of an arch increases with its weight and size. It may, however, be generally accepted, as stated by Mr. Matheson in his useful and practical book entitled "Works in Iron," that an arched roof usually costs more than a trussed roof if the expense of the abutments be included. But if by the position or arrangement of the building, abutments already exist, or if for other reasons they have to be provided, then an arched roof may be better and cheaper than a trussed roof. It is evident that if strength alone be considered the proper form of a roof is that which puts the whole in equilibrium, so that it would stand in that shape, supposing all the joints to be flexible. Any departure from this form necessitates the introduction of braces to maintain it, and the parts are subjected to strain. The circle is the curve of equilibrium for a uniform normal pressure, but the parabola is the curve of equilibrium for a uniformly distributed vertical load all over the span. The parabola has also a slight advantage over the circular rib in the event of unequal loading, but as the rise of the arch is diminished, the circular and parabolic curves come so close together as practically to coincide.

The plate or solid type of arch has been largely used for roofs of comparatively small span. Examples of this form can be seen at the stations of the Metropolitan Railway, the largest span of which is 90ft., at High-street, Kensington. The underground stations being in cutting, a ready-made abutment exists to take the thrust of the arch, and little or no transverse bracing is needed. The principals of the roof over the Aquarium, West-

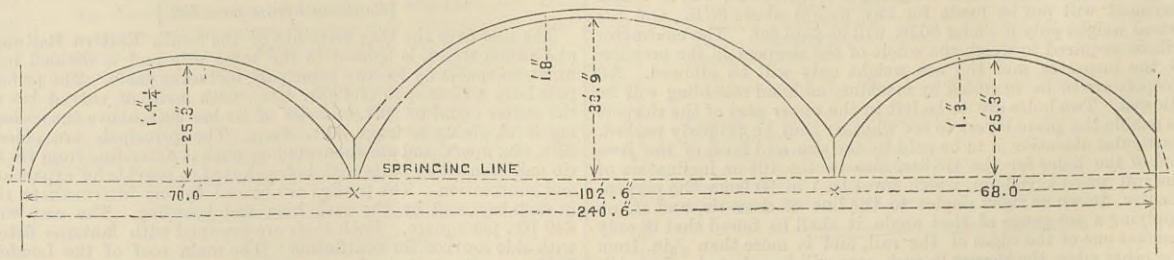


ROYAL AQUARIUM, WESTMINSTER



AGRICULTURAL HALL.

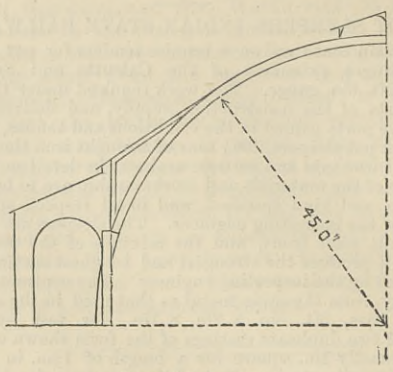
minster, resemble those at the Crystal Palace, Sydenham. They throw a very small horizontal thrust upon their supports, being constructed with a sufficient depth at the crown to act as a girder. The ribs are semicircular in form, having a radius of outer side, or back of rib, equal to 40ft. 4in., and are placed 20ft. apart, with two intermediate ribs in each bay, supported by six lattice purlins. The main ribs are braced together in pairs, these pairs occurring at intervals of 60ft. and 40ft. The building was designed by Mr. A. Bedborough. The main roof over the Paddington Station of the Great Western Railway is divided into three spans. The centre span is 102ft. 6in. in width, measuring from centre to centre of supporting columns, and forms an arch having a clear headway of 33ft. 9in. above the springing level. The side spans are similar in construction, and are 68ft. wide from centre to centre of supports, with a rise of 25ft. 3in. above the springing level to the intrados of the arch. The columns are placed 30ft. apart, and are connected by trussed girders which carry two arched ribs in each bay. The roof is about 700ft. long, and is divided into seven spaces between columns at each end of the station, with six spaces in the centre, and two intermediate transepts 50ft. wide. The transepts are formed by arched ribs crossing each other diagonally, and giving great lateral stiffness to the roof. The girders connecting the heads of columns were also omitted at the transepts, with the original intention of constructing a traversing arrangement to convey railway carriages across the station from one line to another, without the use of a turntable. The roof is glazed on the ridge-and-furrow system following the curve of the roof, and carried on the transverse ribs, which are braced together by nine pair of straps in each division crossing each other diagonally, and connected with the top flange of one principal and the bottom flange of the next. The roof is closed by an ornamental screen at each end. The web of the principals has a neat design of holes punched out of the solid plates. The larger holes were made with a simple screw press, having long levers and heavy weights attached to them. This method seems to be the right way of treating wrought iron plates, the web only remaining where it acts in a similar manner to diagonals, and in the author's opinion produces a much better effect than when raised ornaments are used. The plan has been followed in other roofs. The Paddington roof cost £19 per square, exclusive of columns and girders.



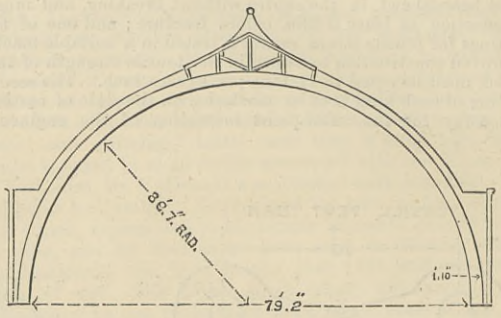
PADDINGTON STATION.

The Agricultural Hall, Islington, was designed by Mr. Frederick Peck, and built in 1862. The span of the central roof is 125ft., with a rise of 70ft. measured from the ground to the crown of the arch. The principals are 24ft. apart, and are connected by longitudinal trussed purlins and wind ties; the main principals rest upon a double row of braced columns, forming a base of sufficient width to resist the thrust which is conveyed through the gallery girders to the outer walls. The roof cost £12 15s. per square, exclusive of erection and covering.

The roof over the Coventry Market Hall, designed by Messrs. Coe and Robinson, is in a single span of 90ft. springing from the ground, and constructed somewhat similarly to the main roof of the Agricultural Hall. The centre of the top of the arch is 45ft. above the ground, and the thrust of the arch is conveyed through a side arch to the main wall of the building. The principals are placed about 8ft. apart and connected by trussed ron purlins. The main ribs of the roof over the Great Hall in the Alexandra Palace are 1ft. 9in. deep, with a radius of 39ft. 7in. They are placed 25ft. apart, and are surmounted with a braced rib giving a straight incline of rafter for the covering; the springing line is 50ft. 6in.

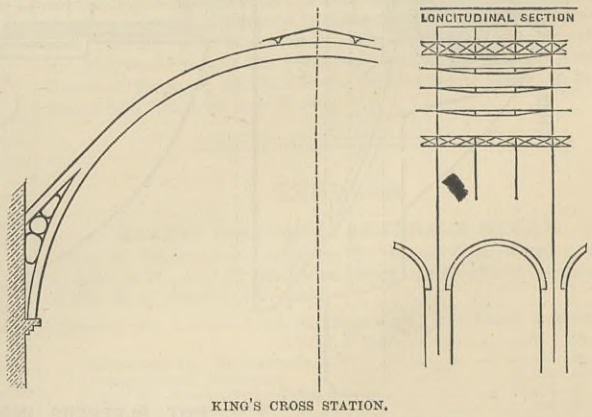


COVENTRY MARKET.



ALEXANDRA PALACE GREAT HALL.

from the floor. The late Mr. J. Johnson was the architect. The roof over the goods station of the Great Northern Railway at Bradford consists of arched principals of 103ft. 10in. span placed 20ft. apart. The main rib is 2ft. deep all round the arch, and is formed of angle iron with flange and ornamental quatrefoil web plates; the intrados of the arch has a radius of 52ft. This roof was designed by the late Mr. John Fraser, and its principal dimensions have been adopted by Mr. Johnson in his design for the terminus station roof of the Great Northern Railway at King's



KING'S CROSS STATION.

Cross. The main ribs are connected by trussed T. I. purlins carrying two intermediate ribs. In the last bay at the north end the purlins are made of a stronger section than the others, and T. I. bracing is introduced to sustain the lateral thrust of the roof.

A good description of the roofs over the Crystal Palace, Sydenham, the Crystal Palace, Amsterdam, the Derby Market Hall, and the Dublin Exhibition, was given by Mr. Wessely, in his paper on "Arched Roofs," read before this Society in March, 1866, and published in the "Transactions." In this paper Mr. Wessely alluded to the St. Pancras Station roof, the drawings for which were at that time being prepared. This roof is the largest single span we have, being 240ft. clear at the springing line. The form differs from both the circle and the parabola, the curve of equilibrium varying but slightly from the neutral line of the arched rib adopted, so that the transverse stresses arising from the weight of the roof itself are small. The arch was made slightly pointed at the top, because it was considered that this form possessed advantages in resisting the lateral pressure of the wind.

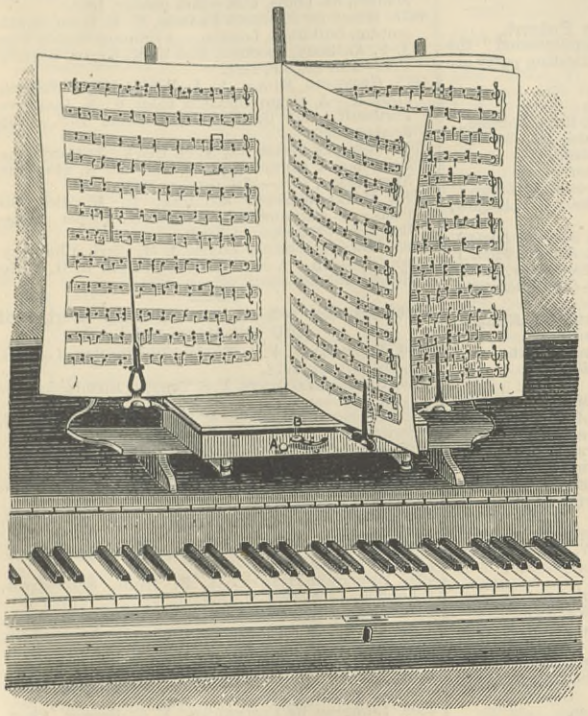
(To be continued.

A GOLD medal has been awarded at the Congress Internationale Phylloxerique de la Gironde, held at Bordeaux, for the Invincible centrifugal pump made by Messrs John and Henry Gwynne.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Richard S. Lee, chief engineer, to the Algerine, commissioned, dated 3rd Nov.; and Robert F. Norman, engineer, to the Warrior, additional, for the Banterer.

APPARATUS FOR TURNING LEAVES OF MUSIC.

We illustrate herewith an apparatus invented and made by Mr. R. H. Padbury, of 24, Mildmay-grove, for turning over leaves of music. This is not the first apparatus made for the purpose, but it has the advantage of being small and compact, folds into small compass, and is not liable to get out of order. The apparatus consists of folding lever arms, which, when in use, whip over page after page as desired, when a little lever arm B in front of the instrument is tapped by the finger. The apparatus is represented in the act of turning a leaf.



The smallness of the space occupied by the apparatus is chiefly due to the horizontal arms and the hollows containing the springs being stamped out of one piece of steel, by which means lightness, strength, and small compass are secured. The vertical portions of the lever arms are also so constructed that, in setting the music in the apparatus before use, each leaf passes easily and without fail into its proper place, which experience shows to be a point requiring attention in devices for turning over music leaves. The design harmonises with most pianos.

The box containing the mechanism is readily secured to the ordinary music rest by spring clips; the flyers or turners are hinged to the horizontal levers, to enable them to be turned down into a horizontal position, for portability. The rest is hinged to the top of the containing box, so that the appliance when not in use is packed up.

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

(*From our own Correspondent.*)

Satisfaction was generally expressed on 'Change in Birmingham to-day—Thursday—and in Wolverhampton yesterday, that November 1st had passed by without the declaration by Earl Dudley of a further rise in coal, for the maintenance of current fuel quotations is further steadying the market for iron both raw and rolled. There was no manifest desire to buy or sell. Yet some consumers of finished iron of medium quality were quite prepared to buy for delivery throughout the next twelvemonth. Rarely, however, would makers consent to deliver over six months even at the advance at which alone they would book. Current rates would not be accepted beyond the close of this month, a rise in the price of coal in December being anticipated.

Sheets were again in brisk request; but the orders were mostly rejected, alike by the makers of first and of medium qualities. Quotations were upon last week's basis; and in the few cases in which makers were open to accept orders buyers had to give the prices of that time, singles ranging from £8 to £8 10s.; doubles, £9 to £9 10s.; and trebles, £10 10s. to £11.

Hoops were in less active request. Still there were inquiries upon United States account, and there were firms who quoted as low as £7 10s. delivered in Liverpool, but the price was not given. Tube strip was in greater demand than supply.

Medium bars sold well in small lots from £6 10s. to £7; and a steady trade was done in marked bars at £7 10s. upwards. Activity continues to distinguish the work doing at establishments of this class.

Plates for boiler work were less neglected, and there was no falling off in the inquiry for tank plates, though girder and gasometer plates were less demanded.

Pig iron is being made to the full capacity of the furnaces blowing, and three more are in blast now than a month ago. The consumption of best iron is equal to the output, and of less valuable sorts more than equal, for where there are stocks they are being steadily reduced. Plants of four furnaces each are being run by Mr. Alfred Hickman, Wolverhampton; and Messrs. Pearson, Netherton; and Messrs. Roberts, Tipton; and Messrs. H. W. Whitehouse are blowing three.

Prices of pig iron do not show the tendency to rise seen three weeks or a month ago; nor is there any reduction upon that time in the open market quotations. Yet there were brands which to-day might have been bought at from 1s. 3d. to 2s. 6d. under the maximum prices demanded at the quarterly meetings. All-mine held their own at £3 5s. upwards, and cinder pigs were quoted but not sold at from £2 2s. 6d. to £2 5s. Wellingborough was quoted firm at £2 15s. for No. 4 forge, and Staveley pigs were held at £2 10s.—both delivered in Staffordshire.

Coal for forge purposes was plentifully offered to-day and yesterday. There were sales at 6s. 9d. to 7s., according to quality. Plus carriage by canal, these prices mean about 8s. per ton, boat weight, at consumers' coal sidings.

A section of the South Staffordshire colliers—those about Netherton—have approached the Coalmasters' Association, asking for a revision of the sliding scale. The employers have responded that they see no good likely to result from such revision, and the men are agitating with a view to joint action throughout the several localities to enforce an alteration. Throughout Cannock Chase the sliding scale arrangement has been abandoned by the men; but the employers are desirous of concluding new terms upon a similar basis. In North Staffordshire, where the men have been demanding a rise of 10 per cent., and will not, some of them, be content with the 5 per cent. which their masters offered, there has been open disaffection at some of the collieries, to the inconvenience of certain of the ironworks. In one or two cases this has led to a provisional acquiescence in the men's demands, but in one or two others the men have resumed on their employers' terms.

At a monthly meeting of the South Staffordshire Mines Drainage Commissioners held in Wolverhampton yesterday, it was announced that the draft of the new Bill seeking additional rating powers was being prepared, and the law clerks will issue the necessary legal notices informing colliery owners and occupiers throughout the whole of South Staffordshire of the intention of the Commissioners. At the same meeting it was resolved to come to an agreement with the Earl of Dudley, which is to operate for twenty-one years, whereby for the payment of £210 yearly the Commissioners acquire the right to pierce any of his lordship's barriers which are in the district surrounding the Tibbington pumping engine of the Commissioners in the Tipton area, for the more effectual conveyance of water from the collieries in the district to the Tibbington pumps. The Commissioners also determined to purchase the Leviathan pumping engine from the Tipton Moat Colliery Company, for which they have hitherto been paying rental.

At the engineering establishments throughout Birmingham, South Staffordshire, East Worcestershire, and Shropshire there is a good business doing in mill castings, in constructive work, in railway fastenings, in engineers' nuts and bolts, in lifting and moving appliances for warehouses and workshops; and the gas and steam wrought iron tube firms are much easier than a year ago; while the makers of gas plumbers' work are busier than usual at this season upon fittings to be set up in factories.

The death this week is announced of one of the largest nail manufacturers in the kingdom—Mr. Wm. Geo. Griffin Walker, of Darby End, Netherton.

The Wolverhampton Town Council, after trying steam traction on one of their lines for some months past, have come to the conclusion that its advantages do not outweigh its inconveniences and dangers. They have therefore resolved to discontinue its use. A resolution will be brought forward at the next meeting for the continuance of the system at least during the winter months when the labour of the horse teams is heaviest, and protests against the decision have been sent in from several of the neighbouring towns, who are either now benefiting, or who hope to benefit, by the extension of the tram lines.

The Midland Association of Gas Managers have had a pleasant time at their last quarterly meeting here. Little time was wasted on the vexed question of the electric light *versus* gas, but attention was directed to the best methods of perfecting the existing gas supply. Chief among the papers read was one by Mr. J. Tindall, of Walsall, on "The Distribution of Gas." It advocated a more effective system of distribution in the street mains, and a proper regulation of the pressure by the governors at the works. The best means to this end was, he said, to divide the district supplied into two or three levels, supply each level separately, and "govern" it separately from the works. Equalisation of pressure and the reduction of leakage to a minimum would be attained by this. Mr. R. O. Paterson, of Chelmsford, was re-elected president. During their stay in Birmingham the members visited the new Smethwick Gasworks, of which I wrote a short time back.

The South Staffordshire Mill and Forge Managers' Association at their meeting on Saturday discussed a paper on "Smoke," read by Mr. Morris, of Dallam and Bewsey Ironworks, Warrington. The author maintained that if smoke was once formed it could not be consumed, but it could be diluted with air admitted through easily-governed valves. Dr. Siemens' gas furnace was warmly praised.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—In the iron trade of this district business, which has been gradually tapering off for the last few weeks, seems to have subsided for the present into a state of inactivity. No doubt consumers who are not in pressing want of iron are waiting to see whether the close of the shipping season will not influence the market in their favour, and as there is a good deal of iron in the hands of speculative holders, some of whom are becoming anxious to realise, odd orders, where they have to be given out, can be placed at under makers' quotations. This applies especially to pig iron; but makers themselves still, for the most part, hold firmly for late rates, as pretty near all the iron they can make for the next two or three months is in many cases already sold.

Lancashire makers of pig iron have this week been open to book orders for delivery over the first month of next year; but although they have very few new inquiries coming in, they are still firm at their full list rates of 48s. for No. 4 forge, and 49s. for No. 3 foundry, less 2½ per cent., delivered into the Manchester district.

Of outside irons the only brands which are at all saleable to any extent to consumers in this district are still in Lincolnshire and Derbyshire makes, and in these prices in some cases are rather easier. One or two of the lower quality brands have been offered at as low as 47s. 6d., but 48s. 6d. up to 50s., less 2½ per cent., still remains about the average figures quoted, and in some cases considerably higher figures than these are nominally being asked. Middlesbrough iron at the prices at present asked by North-country makers has practically no market here.

The finished iron trade continues active, with all the local rolling mills and forges well employed. Work already secured will keep some of them going until next spring, and there is still a very fair inquiry in the market. Foreign inquiries continue numerous, and amongst these there has been one for 300 tons of spike iron all of one size, which would indicate a fair amount of railway work on hand. Sheets both in the plain and the galvanised qualities are also in brisk demand, and bars are in fair request. Makers, however, have not been able to realise to any extent the full price of £7 per ton which was recently being quoted for bar iron delivered into the Manchester district, but they are firm at £6 10s. to £6 15s., and sheets are quoted at £8 10s. to £8 15s., with hoops at £7 to £7 5s. per ton, but in the latter there have been sellers of second-hand lots at 5s. per ton under makers' rates.

Prospects in the engineering, tool-making and machine-making trades generally continue to improve. The inquiries I make all through the districts show a steadily increasing volume of trade coming in. Although work has still to be taken at low prices, the inquiries which for some months past have been growing in number, have now reached the point when they are resulting in actual orders, and with the continuance of the present progressive state of trade there is every reason to look forward to a healthy condition of things next spring, with probably more remunerative prices obtainable than at present. In stating this I am not only speaking from personal observation, but on the authority of one well acquainted with what is going on in the engineering trades throughout the country, and in corroboration I may add from another source that in conversation this week with the secretary of the Amalgamated Society of Engineers, I learned the significant fact that throughout the Manchester district they have not at present a single pattern-maker on their books out of employment. A good deal, I may say a great proportion, of the work at present coming in is on foreign accounts, and this is of a very varied description. France and other parts of the Continent are coming here pretty freely for all kinds of tools, and from so far afield as China important orders are being received, whilst the colonies are fair customers, and one very noticeable feature of late has been the number of American inquiries for tools which have been coming into this district, and it is not only in tools that there is this increasing activity; one of the largest boiler-makers in this district informed me the other day that the inquiries for boilers and engines from all parts were more numerous than he had known for a considerable period back.

By means of a friendly conference between the representatives of the Iron Trades Employers' Association and the Amalgamated Society of Engineers held during the past week, the overtime question has now been uniformly settled throughout this district. Previously it had been practically arranged with the exception of one large firm, and the result of the conference has been that all cause of disagreement has now been amicably removed.

Some time back I referred to the numerous experiments which were being carried out with the view of perfecting some suitable mechanical locomotive power for tramways, and the question was pretty fully discussed at the Manchester meeting of the Institution of Mechanical Engineers last week. I may add as showing the pertinacity with which inventors are still directing their efforts in this direction, that just recently Messrs. Ashbury and Co., the well-known carriage builders, of Manchester, have had inquiries sent in to them with the view of adapting their reversible tram cars so as to be driven both by compressed air and by electricity. The constructive details, should the suggestions be carried into effect, have, I believe, as yet to be worked out, but I understand that in one case it was proposed that the compressed air chambers should be contained in that portion of the car now occupied by the driver, whilst in the other case it was suggested to adapt the car to be driven by electric engines designed by Dr. Siemens.

There is still a brisk demand for all descriptions of round coal, with increasing requirements for the commoner sorts for general trade purposes, which is an indication of a better state of things generally throughout the district. Slack is also in fairly good demand, but owing to the increased quantity of round coal now being screened, it is in some cases at present being placed to stock. The advance in prices announced last week in the Manchester district has been followed more or less generally throughout Lancashire; and as the result of the upward movement which has been going on during the last two months, it may be stated that the prices are now being quoted at 1s. 6d. to 2s. per ton above the lowest figures which were being taken in September. The average prices at the pit mouth for the month are about 9s. 6d. to 10s. for best coal, 8s. to 8s. 6d. for seconds, 6s. 6d. to 7s. for common coal, 4s. 6d. to 5s. for burgy, and 3s. 6d. to 4s. for good slack.

Following the upward movement in prices, there has naturally been an advance in wages. In the Manchester district the rate of wages to the colliers has been advanced 10d. per load and 3d. per yard, and to the underground daymen 1s. per week, which means nearly 15 per cent., and is a return to the wages paid last winter. In other districts advances ranging from 10 to 15 per cent. are announced; but the Wigan district colliery proprietors, many of whom are largely under contract, have not yet conceded an advance, and the result has been that nearly the whole of the collieries throughout West Lancashire have been stopped since the commencement of the week. A meeting of the coalowners, however, is to be held to-day—Friday—at Liverpool, and it is generally expected that a compromise will be effected on the basis of an advance to the men of about 10 per cent., without any recurrence of the union's interruption with work which occurred last winter.

Barrow.—The hematite pig iron trade continues to improve and is gradually though slowly creeping into a position, not only reassuring as to the stability of the movement, but giving good grounds for believing that it will yet improve considerably on its present state. I know that makers in a few cases are very well sold forward, and are asking 2s. per ton more for iron than the quoted prices. No. 1 Bessemer is quoted at makers' works at 62s. per ton, while No. 3 forge changes hands at 60s. The output of metal at the furnaces, although very considerable, is going directly into consumption, and makers do not undertake deliveries this side of the Christmas holidays. Stocks may be said to be *nil*, as the increased demand has put all stocked iron into consumption. Makers anticipate ere long having to increase their output. Steel makers are very busy, the mills being well employed. A good inquiry is experienced for all qualities, more especially rail and plate sections. Iron ore is in good demand; makers are well sold forward. Iron shipbuilders, engineers, and others fairly supplied with orders.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

In some quarters local work has been a good deal disturbed by the municipal contests, which have been more numerous and exciting than for years past. On the whole, however, the Sheffield workman now-a-days is not so prone to fool away his time as he was in 1873, and even electioneering agents can scarcely induce him to leave his work for days to engage in municipal warfare, as was too often the case in bygone years. The severe lesson of the lean years has not been lost by the great mass of the Sheffield artisans, who are not so ready to risk their employment by absence without leave as they were in former days.

The unmistakeable signs of improvement noticed in my former letters are being increased and emphasised. There is no scarcity of orders in the rail, tire, spring, or file trades; indeed, there seems to be no doubt that the demand for nearly all classes of railway material is steadily increasing. Builders of rolling stock of every description are busy, and it is only by reason of what I have heard manufacturers describe as "the insensate competition" of the more recently established houses that better prices for Sheffield goods are not obtained, with the heavier contracts now on the market.

The Colonial Governments of Victoria and New South Wales are inviting tenders for large lots of rails and fittings for the permanent way of their railways, and considerable shipments are also being made to both North and South America. The building of locomotives is not carried on in Sheffield, but the extensive orders which are being carried out in Manchester and Glasgow for the Continent and India favourably affect our large firms, the various metallic portions of the engines being drawn to a great extent from this neighbourhood. The various Scotch railway companies have been replenishing their wagon stores freely, and this with Colonial favours has caused several departments of our local works to be exceedingly active.

Commendatore Beneditti Brin, President of the Council of Construction of the Italian Marine Ministry, with Mr. F. Mattei, late Chief Constructor, Rome (who were the guests of Mr. George Wilson, of Banner Cross), visited last Thursday the Cyclops Works, of which Mr. Wilson is chairman and managing director. They witnessed the processes of manufacturing the "Wilson" compound armour plate, and inspected other portions of this large establishment. A visit was also paid to the neighbouring establishment of Messrs. John Brown and Co., where the visitors witnessed the making of compound plates on the "Ellis" system, and also saw the process of flanging marine boilers and plates.

The Corporation of Chesterfield have finally decided to light the whole town by electricity. The month's trial is considered satisfactory, and Messrs. Hammond and Co. have received instructions to undertake the entire length of the streets. The illumination will be provided from about 22 arc lights, each of 2000-candle power, on the Brush system, and by 70 Lane Fox incandescent lamps. It is believed that the illumination, while superior to gas, will be obtained at no greater cost. The lighting of the various Sheffield establishments, already noted, on the Brush system, continues to give satisfaction.

In the coal trade there is very great briskness, and this week another advance of 5d. to 10d. per ton has been secured in house coal; while locomotive coal is being freely sold out at 6s. 6d., as compared with 5s. 8d. a few weeks ago. If the present wintry weather continues, a further advance may be secured on December 1st.

At Barnsley the checkweighmen employed at the various collieries in South Yorkshire have held a meeting, at which they complained that miners were systematically deprived of the benefits of the Mines Act and Weights and Measures Acts in regard to checkweighmen. It was stated that one Yorkshire firm had in two years confiscated 6000 tons of coal. Resolutions were passed directing the attention of the Home Secretary to the miners' grievances, which were enumerated.

At the Swanwick Colliery, near Alfreton, a diabolical act was discovered in time to prevent a dreadful outrage. An engineman was about to let down the horsekeepers when he discovered that the rope in connection with the drum had been maliciously cut off and tied with a piece of sacking, while the lubricator had been smashed. The horsekeepers, if let down by the engineman, would have been dashed to pieces.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE Glasgow iron market has been comparatively steady during the past week, the fluctuations in prices being confined within much narrower limits than of late. There has, nevertheless, been a fair speculative business doing. The demand for makers' iron has somewhat slackened; but this is not an unusual circumstance at this time of the year. The exports of pig iron to the Continent were placed to some extent in arrear by the recent stormy weather, and it was hoped that large shipments might be got away in the beginning of November; but now the winter has set in with frost and snow, and there is little prospect of this being done. Otherwise the trade is fairly good, the past week's shipments, being upwards of 11,000 tons, show very well compared with those of the same week last year, which amounted to 7556 tons. There is a steady demand for the consumption of pig iron at home in the manufactured iron works. The stock of pig iron has not been growing so rapidly as of late, when it was understood that a large proportion of the additions came from the accumulation at makers' works. Between 3000 and 4000 tons have, however, been added to the stock in Messrs. Connal and Co.'s stores, which now amount to about 600,900 tons. There are 105 furnaces in blast, as compared with 118 at the same date last year.

Business was done in the warrant market on Friday forenoon at from 49s. 10d. to 49s. 8½d., and again up to 50s. 2d. cash, the afternoon quotation being 50s. 1½d. to 49s. 11d. cash, and 50s. 4d. to 50s. 4½d. one month. On Monday the market opened quietly, but became firmer, and prices showed a slight advance. In the forenoon business was done at from 49s. 10d. down to 50s. 3½d. cash, and from 50s. 3d. to 50s. 6d. one month. In the afternoon the transactions noted were at from 50s. 2d. to 50s. 4½d. cash, and 50s. 5d. to 50s. 7½d. one month. On Tuesday the market was steady, with business at 50s. 6d. to 50s. 4½d. and 50s. 7d. cash, and 50s. 7½d. to 50s. 9½d. one month. On Wednesday the market was quiet, with business between 50s. 3½d. to 50s. 7d. cash and 50s. 6d. to 50s. 9d. one month. To-day—Thursday—the market has been steady, with business at 50s. 3½d. to 50s. 4½d. cash and 50s. 7½d. one month.

The demand for makers' iron being rather slower, prices have become easier, and in a number of cases the quotations have declined from 6d. to 1s. per ton on the week. Gartsherrie, f.o.b. at Glasgow, per ton, No. 1 is quoted at 59s.; No. 3, 51s.; Coltness, 59s. 6d. and 52s. 6d.; Langloan, 61s. 6d. and 53s.; Summerlee, 59s. 6d. and 51s.; Calder, 59s. 6d. and 52s. 6d.; Carnbroe, 52s. 6d. and 50s. 6d.; Clyde, 50s. 6d. and 48s.; Monkland, 50s. and 47s. 6d.; Quarter, 50s. and 47s. 6d.; Govan, at Broomielaw, 50s. and 47s. 6d.; Shotts, at Leith, 60s. 6d. and 53s.; Carron, at Grangemouth, 53s. 6d. and (specially selected, 56s.) 52s. 6d.; Kinneil, at Bo'ness, 50s. and 48s.; Glengarnock, at Ardrossan, 52s. 6d. and 50s. 6d.; Eglinton, 50s. and 47s.; Dalmellington, 50s. 6d. and 47s. 6d.

The different branches of the manufactured iron trade continue very well employed, and the slight upward movement in prices has had the effect of bringing forward a number of fresh orders which will still further increase the activity at the works. The locomotive works have received good contracts, and there is a steady flow of new orders in the shipbuilding and marine engineering trades.

The time has now arrived when it is usual for the shipping department of the coal trade to exhibit a large decrease, and the shipments are not now so heavy as they were some weeks ago, yet they compare very favourably with those of this time last year, and the inland demand, both for public works and domestic consumption, is manifestly on the increase. There is no alteration in prices.

It appears doubtful at the moment whether the miners generally throughout Scotland will obtain at this time the advance of 6d. per day which they have sought from their employers. The advance was to come into force on Tuesday last. The week previously a considerable number of the colliery owners in the Hamilton district conceded to the demands of the men, but at a mass meeting of the miners of the Glasgow district held on Monday it was reported by representatives from all the collieries that not a single employer had consented to give an advance. In Ayrshire the masters are expected to adopt the course followed by the employers generally. In the Slamannan district it was agreed to pay the men 6d. extra from the 1st of the present month. In Fife and Clackmannan the advance has been refused in the meantime, and as the men are dissatisfied they adopted a resolution to restrict the hours of labour, but whether they will carry out this resolution into effect or not remains to be seen.

The Singer Manufacturing Company, Limited, has acquired a large portion of ground on the Clyde, near Glasgow, upon which to erect an extensive manufactory for the production of its sewing machines.

The Clyde trustees have contracted with Messrs. Simons and Co., Shipbuilders, Renfrew, to construct four very powerful steam dredgers that will be capable of deepening the channel of the river to 35ft.

During the past month sixteen vessels with a tonnage of 14,890 were launched from the Clyde shipbuilding yards, as compared with fourteen vessels and 16,000 tons in October, 1880. The output of the ten months amounts to 258,889 tons, as compared with 186,830 tons in the corresponding period last year. The trade continues busy.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

Two subjects are coming up to the front amongst the Welsh colliers, and I begin to fear that possibly some interruption to the present tranquil condition of trade is looming. These subjects are: First, an alteration of the sliding scale; and secondly, blasting in mines. Both were fully discussed at a large meeting of colliers at Aberdare a few days ago, and it was evident that both were considered of grave importance. There are three scales at present in operation in South Wales, and the men wish them amalgamated, and so connected and refashioned as to give them a different basis in one distinct scale that may be accepted by all colliers in Wales. The three scales are those of the Coalowners' Association, Ferndale, and Ocean collieries.

The other subject under dispute, blasting in mines, was also discussed. The general opinion seemed to be that in many collieries in Wales the non use of gunpowder would entail a cost on output of 6d. to 9d. per ton, and where the vein was very thin necessitate the abandonment of the colliery altogether. Eventually it was decided to form a "resolution," and wait upon Lord Aberdare in order to get it presented to the Home Secretary.

The colliers are well pleased at the advance of wages which has taken place, and this, by the action of the Coalowners' Association, has been made general, the Ocean having preceded. The amount is 2½ per cent.

The exports maintain their high figures at all the ports, and inquiries are well sustained. Several good contracts have been secured at Cardiff, and an important mail packet arrangement has been completed at satisfactory rates to both parties.

French inquiries are in the market for bituminous or coking coal, and orders to the extent of 150,000 tons are now being placed at Cardiff. Now that Swansea is pressing on with rapid strides to prepare itself for the business which the new dock will bring, attention is being directed towards Newport, which commands a larger area of unworked lower coals than any district. This area I have long pointed out as the future great coal field, and shareholders in the Rhymney Railway may take heart that good times are yet to come. The Rhymney Railway is a favourite route also for foreign ore being conveyed to the Monmouthshire works, and this is an additional security. Few lines have progressed at greater speed than the new line from Pontyfariall to Newport by way of Caerphilly.

I see that the Rhymney line will make another effort next session to get running powers to join Cyfarthfa Works and Merthyr.

The iron and steel trades are in a flourishing state, and a good deal of firmness marks existing business. Dowlais is full of work, and the same fact applies pretty generally to the principal works in Monmouth and Glamorgan. I note a good deal of briskness at Pentyrch this week, and also at Treforest Iron and Steel Works. The brand of pig at the latter place is in good repute.

I regret to note that the Gadlys Tin-plate Works Company has gone into liquidation, but I have long foreseen that the condition of things in the tin-plate trade would drive some to the wall. The wonder is that more are not gazetted. The company in question was an able one, and so fully possessed the confidence of those with whom they are connected that I should think there would be no doubt of an early restart.

The dispute about the liability of miners to be put to ripping the top of collieries has been settled by the Aberdare magistrates in favour of the masters.

THE DRAINAGE OF BARMOUTH.—Barmouth is a watering place which has been growing in favour, and recently it has had a new spring water supply from Ceilwart brought into its houses, under a high gravitation head. The drainage has now been effected by a complete new sewerage system, constructed from the designs and under the superintendence of Mr. T. Roberts, C.E., Portmadoc, who was also engineer for the water supply. These works have been designed to drain the whole of the existing town, and the adjoining district likely to be built upon during the next twenty or thirty years. On account of the levels it was found impossible to convey the sewage to one outfall except at great cost, and therefore two outfalls were adopted. The principal, or north outfall, is situated at low-water mark at Rô Ddu, and the greater part of the town and district is drained to this point. The main sewer commences in the centre of the town, passes along High-street, turning to the left near the Board Schools, passing along the new road along the Cambrian Railway to settling tanks on the land purchased for sewage utilisation on the western side of the railway. The sewers are of glazed earthenware pipes joined in cement, the diameters being 9in., 10in., and 15in., the gradients varying from 1 in 105 to 1 in 610. From the settling tanks the sewage passes into an egg-shaped tank sewer, 3ft. 3in. by 2ft. 2in. by 3ft. 3in. of sufficient capacity to hold the sewage during the time the sewers are tide-locked, then through cast iron pipes 20in. diameter to low water at Rô Ddu. The tank sewer has a gradient of 1 in 420, and the cast iron pipe 1 to 113. Tidal valves are provided to prevent the sewage from backing up into the tanks. The remainder of the town is drained to the centre of the main stream of the river Mawddach to a point 3ft. below low water marks at spring tides; outfall sewer being a 12in. cast iron pipe with a fall of 1 in 60. The main sewers are of glazed earthenware pipes, jointed in cement, the diameters varying from 9in. to 10in. and the gradients from 1 in 10 to 1 in 95. The sewers throughout are laid in straight lines with even gradients, manholes and lampholes being provided at each change of direction, and change of gradient. At the end of each main sewer a flushing chamber is provided with all necessary valves and connections. The whole of the manholes, lampholes, and flushing chambers, are designed to act as ventilators for the main tenders. The outfall sewers will discharge 63,703 cubic feet of sewage per hour. Assuming a population of 3000 and doubling this, would give, say 19,200 cubic feet of sewage to be discharged per day. The outfalls would discharge this in eighteen minutes. In the event of a sudden rain storm of ½in. over the whole area commanded by the sewers (say 160 acres) 290,400 cubic feet of rain water would have to be discharged in addition to the 19,200 cubic feet of sewage. The outfalls would discharge this quantity in 4·85, or say 5 hours. Storm water outlets are provided at convenient points to relieve the sewers during heavy storms. Mr. John Lewis was contractor for waterworks, and Mr. S. P. Owen for the sewerage. The total cost has been £6760.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

25th October, 1881.

4656. Glass Tile Borders, &c., T. H. Rees, London.
4657. Coupling Carriages, S. H. Ward, Manchester.
4658. Watches, S. M. Morgan, Kingsland.
4659. Lighting, R. H. Courtenay, London.
4660. Belt Pulleys, G. Pitt.—(*P. Medart, St. Louis.*)
4661. Attaching Heels to Boots, &c., T. Lithgow, Manchester.
4662. Heating, E. P. Alexander.—(*C. Martin, Paris.*)
4663. Burners, E. P. Alexander.—(*C. Martin, Paris.*)
4664. Electro-meters, J. Imray.—(*J. Sarpentier, Paris.*)
4665. Doors, &c., H. J. Haddan.—(*Favier-Simonet, Paris, France.*)
4666. Mincing Meat, C. M. Sombart.—(*C. Hammer, sen., and H. Perschmann, Germany.*)
4667. Horseshoes, J. Vernon, Newton-Stewart.
4668. Stoves, A. H. Hearington, London.
4669. Brakes, W. H. Marks, London.
4670. Metallic Pillars, R. B. Lee, Manchester.
4671. Rings for Spinning Frames, W. R. Lake.—(*J. Y. Anthony and W. K. Evans, Massachusetts.*)
4672. Steam Pumps, T. H. Ward, Tipton, Stafford.
4673. Mixing and Kneading, J. Melvin, Glasgow.
4674. Steam-boilers, C. Y. C. Dawbarn, Liverpool.
4675. Grinding Mills, A. J. Boult.—(*W. N. Cosgrove and R. Morrell, U.S.*)
4676. Wire Ropes, J. Hodson, Lancaster.
4677. Screw-nuts, W. H. Lewis and W. Clark, Surrey.

26th October, 1881.

4678. Heating Water by Gas, S. Leoni, London.
4679. Lifting Water, J. H. Palmer, Warwick.
4680. Indicating Presence of Fire-damp, W. S. Macdonald, Manchester.
4681. Fastening Scarves, &c., H. Scott, Liverpool.
4682. Locks, J. Jackson, jun., & C. Sheekey, London.
4683. Wagons, R. Hudson, Leeds.
4684. Balloons, F. C. Kinnear, London.
4685. Horseshoes, H. Dyer, London.
4686. Looped Fabrics, J. Imray.—(*O. Viett, Germany.*)
4687. Asbestos, S. Pitt.—(*H. W. Johns, New. York.*)
4688. Castor for Chairs, &c., W. R. Lake.—(*A. F. Mauchain, Geneva, Switzerland.*)
4689. Breech-loading Fire-arms, H. E. Newton.—(*Colts' Patent Fire-arms Manufacturing Company, Incorporated, Connecticut, U.S.*)
4690. Coupling Buffers, G. Turton, London.
4691. Cutting Corks, H. Gardner.—(*I. S. Elkins, and C. G. Clark, New York, and E. C. Hine, Brooklyn.*)

27th October, 1881.

4692. Doors and Windows for Excluding Draughts, J. Benson and T. Wainwright, Lancaster.
4693. Conveying Grain, &c., J. Woodward, Manchester.
4694. Actuating Signalling Apparatus, E. Edwards.—(*E. Lesbros, France.*)
4695. Utilising Electric Circuits, W. F. Barrett, Monkstown, Dublin.
4696. Joints of Pipes, J. A. Eaton, London.
4697. Elastic Cotton, G. G. de Luna Byron, Brighton.
4698. Chimney Caps, R. Brealey, London.
4699. Mashing Maize, &c., W. Apthorpe, Cambridge.
4700. Steam Engines, S. Geoghegan, Dublin, and J. Sturgeon, London.
4701. Fish-hooks, &c., T. Morgan, Redditch.
4792. Sulphate of Lime, J. Young, Kelly, N.B.
4703. Axle-boxes, R. McIntosh & J. Wright, Forfar.
4704. Chandeliers, G. W. von Nawrocki.—(*H. Raupp, Germany.*)
4705. Journal Bearings, A. M. Clark.—(*D. A. Hopkins, New Jersey, U.S.*)
4706. Knife-boards, H. C. de Berenger, London.
4707. Window-sashes, J. H. Miles, Southampton.
4708. Arranging Screw-propellers, J, M. Leishman.—(*E. Cousteau, Bordeaux, France.*)
4709. Stoppering Bottles, G. Kemp, Swinton.
4710. Woven Fabrics, O. Drey, Manchester.
4711. Figured Fabrics, J. Makin and J. Johnson-Ferguson, Bolton, Lancaster.
4712. Ash-pans, C. Ezard, Bradford,
4713. Weaving Fabrics, J. Makin and J. E. Johnson-Ferguson, Bolton, Lancaster.
4714. Spring Mattresses, W. R. Lake.—(*E. Hinckley, San Francisco, U.S.*)
4715. Wax Paper, W. R. Lake.—(*W. B. Dowse, U.S.*)
4716. Labelled Bottles, M. Hardcastle, Hoxton.
4717. Pills, W. R. Lake.—(*J. A. Whitney, New York.*)

28th October, 1881.

4718. Rivetting Machines, G. Edmeston, Manchester.
4719. Beverages, A. and M. Conroy, Liverpool.
4720. Refrigerating, J. Chambers, Manchester.
4721. Loading Ships, W. G. Herbert, Liverpool.
4722. Velocipedes, F. W. Jones, Exeter.
4723. Separating Bodies, H. Smith, Glasgow.
4724. Discharging Water, H. G. Grant.—(*E. Briart, France.*)
4725. Flushing Water-closets, H. Skerrett, Birmingham.
4726. Metal Dressing Machines, R. H. Brandon.—(*H. Pieper, Liege, Belgium.*)
4727. Water Gas, P. Jensen.—(*European Water Gas Company, Limited, Stockholm.*)
4728. Tunnelling, T. R. Crampton, Westminster.
4729. Raising Ships' Boats, A. M. Clark.—(*R. H. Earle, Newfoundland.*)
4730. Locks, &c., T. Galloway, Gateshead-on-Tyne.
4731. Treatment of Stone, &c., J. H. Johnson.—(*G. O. Kramer and Co., Prussia.*)
4732. Merino, &c., J. Kershaw, Macclesfield.

29th October, 1881.

4733. Carriages, J. Hancock & W. Smith, Nottingham.
4734. Combing Cotton, P. C. Marsden and W. Pendlebury, Bolton.
4735. Watches, L. Weill, Holborn-circus, London.
4736. Safety Letter-boxes, A. Little, Twickenham.
4737. Beam Scales, &c., W. B. Avery, Birmingham.
4738. Horseshoe Appliance, G. W. Elliott, Liverpool, and A. E. Stayner, Sheffield.
4739. Violin Pegs, J. Wallis.—(*E. Hamma, Germany.*)
4740. Purifying Wax, A. Boult.—(*D. Gray, New York.*)
4741. Chimney-pieces, J. Thomas, Bangor.
4742. Desks, F. Engel.—(*J. Kuhlmann, Hamburg.*)
4743. Preserving Milk, E. Brewer.—(*L. Scherff, Berlin.*)
4744. Extracting Fat, E. Edwards.—(*E. Pyrkosch, Ratibor, Germany.*)
4745. Heating Water, R. T. Gillibrand, Darwen.
4746. Looms, A. Dickinson and J. Crook, Blackburn.
4747. Wigs, &c., J. H. Johnson.—(*G. Petit, Paris.*)
4748. Electric Batteries, W. R. Lake.—(*J. F. Aymonnet, Grignon, France.*)
4749. Spring Balances, J. Linacre, Brecon.

31st October, 1881.

4750. Horseshoes, J. F. Bell, Fulham, London.
4751. Hand Perforating Machines, L. Cler, Paris.
4752. Weaving, M. Bauer.—(*P. Besté, France.*)
4753. Air Compressor, M. Bauer.—(*C. Mayrhofer, Paris.*)
4754. Fences, &c., D. Rowell, Westminster.
4755. Anchors, F. Engel.—(*A. & A. Aggens, Germany.*)
4756. Drawing-off Bottled Liquids, S. Pitt.—(*P. Hathaway, U.S.*)
4757. Straining Semi-fluids, W. S. Scott, Southwick.
4758. Transmission of Sounds, F. J. Smith, Taunton.
4759. Testing Milk, F. Wolff.—(*Burmeister and Wains Maskin-og Skibsbyggeri, Copenhagen.*)
4760. Removal of Yeast, P. Smith, Sevenoaks.
4761. Spirits, P. Jensen.—(*A. Deininger, Berlin.*)
4762. Enamels, C. W. Heaton, Lessness Heath, and T. Bolas, Chiswick.
4763. Folding Paper, W. Conquest, London.

Inventions Protected for Six Months on deposit of Complete Specifications.

4625. Steam-boiler Furnaces, G. W. Clarke, San Francisco.—*22nd October*, 1881.
4660. Belt Pulleys, G. Pitt, Sutton.—A com. from P. Medart, St. Louis, U.S.—*25th October*, 1881.
4671. Rings for Spinning Frames, W. R. Lake, Southampton-buildings, London.—A communication from J. Y. Anthony, Taunton, and W. K. Evans, Beverly U.S.—*25th October*, 1881.
4675. Grinding Mills, A. J. Boult, High Holborn London.—A communication from W. N. Cosgrove, Faribault, and R. Morrell, Passaic, U.S. — *25th October*, 1881.
4705. Journal Bearings, A. M. Clark, Chancery-lane, London.—A communication from D. A. Hopkins, New Jersey, U.S.—*27th October*, 1881.
4726. Metal-dressing Machine, R. H. Brandon, Paris.—A communication from H. Pieper, Liege, Belgium.—*28th October*, 1881.
4729. Lowering Ships' Boats, A. M. Clark, Chancery-lane, London.—A communication from R. H. Earle, Newfoundland.—*28th October*, 1881.

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

4366. Propellers, F. A. Whelan, Paddington, London.—*29th October*, 1878.
4260. Sewing Machines, T. S. Tongue, Birmingham.—*24th October*, 1878.
4346. Telegraph Cables, E. Berthoud and F. Borel, Switzerland.—*29th October*, 1878.
4428. Buildings, G. E. Pritchett, Bishops Stortford.—*1st November*, 1878.
4652. Steam Pumps, H. J. Haddan, Westminster.—*16th November*, 1878.
4286. Preparing Metallic Sheets, J. H. Johns, Rhymney.—*25th October*, 1878.
4295. Utilising Heat, F. A. T. de Beauregard, Paris.—*25th October*, 1878.
4297. Agglomerating Coal, B. Hunt, Serle-street, London.—*25th October*, 1878.
4298. Supporting Potteryware in Kilns, E. Leak, Longton, & J. Edwards, Fenton.—*25th October*, 1878.
4358. Bells for Bicycles, J. Harrison, Birmingham.—*29th October*, 1878.
4406. New Colouring Matters, C. A. Martius, Berlin.—*31st October*, 1878.
4502. Lighting by Electricity, E. G. Brewer, Chancery-lane, London.—*31st October*, 1878.
4398. Automatic Stoking Furnaces, J. Auld, Glasgow.—*31st October*, 1878.
4321. Making Sand Moulds, W. P. Thompson, Liverpool.—*28th October*, 1878.
4327. Condenser Bobbins, E. Whitwam, Huddersfield.—*28th October*, 1878.
4362. Collecting Solidifiable Portions of Fumes, W. R. Lake, London.—*29th October*, 1878.
4369. Ascertaining Speed of Vessels, T. F. Walker, Birmingham.—*30th October*, 1878.
4377. Shaping Parts of Augers, T. A. Mathieson, Glasgow.—*30th October*, 1878.
4469. Packing Ribbons, F. W. Parker, London, and W. Barber, South Norwood.—*5th November*, 1878.
4546. Cushions, G. Bayliff, Liscard.—*9th November*, 1878.
4944. Vulcanite, W. L. Wise, Adelphi, London.—*3rd December*, 1878.
4320. Folding Paper, J. T. King, Liverpool.—*28th October*, 1878.
4431. Bending Plate Iron, R. T. Morris and J. Williams, Landore.—*2nd November*, 1878.
4345. Forming Glass Bottles, W. Bull, Strand, London.—*29th October*, 1878.
4365. Finishing Nails, W. Morgan-Brown, London.—*29th October*, 1878.
4373. Procuring Rotating Military Guns, J. Watkins, Westminster.—*30th October*, 1878.
4391. Dyeing Hair, J. Frost, Huddersfield.—*31st October*, 1878.

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

3690. Warming Railway Carriages, W. Tice, Worsley.—*26th October*, 1874.
3707. Printing Machines, E. Hely, Dublin.—*27th October*, 1874.
3703. Implement for Planting Potatoes, L. A. Aspinwall, London.—*27th October*, 1874.
3708. Paper Pulp, J. H. Johnson, London.—*27th October*, 1874.
3768. Condensers, S. Holman, Laurence Pountney-lane, London.—*31st October*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, *18th November*, 1881.

2735. Buckles, J. Belicard, Manchester.—*22nd June*, 1881.
2741. Treating Vegetable Substances, A. Gough, Buckingham.—*22nd June*, 1881.
2751. Forming Joints in Pipes, D. Church, Southwark, London.—*23rd June*, 1881.
2756. Steamships, &c., for Storing Fruit. G. A. Cochrane, Liverpool.—*24th June*, 1881.
2761. Electro-magnetic Induction Machine, L. A. Groth, London. — A communication from D. Lachaussée.—*24th June*, 1881.
2775. Gas Apparatus, J. Woodward, Manchester.—*25th June*, 1881.
2781. Soldering Apparatus, E. A. Brydges, Berlin.—Communication from F. Stoll, jun.—*25th June*, 1881.
2782. Secondary Batteries, H. E. Newton, London.—A communication from the Société Universelle d'Electricité Tommasi.—*25th June*, 1881.
2790. Drying Apparatus, G. W. von Nawrocki, Berlin.—A communication from J. Swiecianowski and S. Adamczewski.—*25th June*, 1881.
2794. Looms for Weaving, W. Beck, London.—A communication from J. C. N. Mouret.—*25th June*, 1881.
2800. Reversing Gear, G. P. Renshaw, Nottingham.—*27th June*, 1881.
2831. Lamps, H. J. Haddan, Westminster.—A communication from E. S. Piper.—*28th June*, 1881.
2837. Dyeing, W. E. Gaine, Glendale, London.—*28th June*, 1881.
2843. Indicating Words, J. M. Jones, Battersea Park-road, London.—*29th June*, 1881.
2848. Treatment of Carbon, J. G. Lorraine, Savoy, London.—*29th June*, 1881.
2853. Starting Tram-cars, A. Piffard, Felden, and C. H. Giminghan, London.—*29th June*, 1881.
2869. Railway Carriage Lamps, F. W. Clark, Millbank-street, Westminster.—*1st July*, 1881.
2923. Locomotive Engines, T. Morgan, London.—A com. from D. McIntosh Reid.—*4th July*, 1881.
2972. Looms for Weaving, W. Atherton, Preston.—*7th July*, 1881.
3013. Spring Motors, J. H. Johnson, London.—Com. from J. B. Powell and J. H. Harper.—*8th July*, 1881.
3023. Lathe, J. A. Armstrong, Blackheath, London.—*9th July*, 1881.
3113. Motive-power Engine, E. Etève and C. C. Lallement, Paris.—*16th July*, 1881.
3239. Feed-water Heaters, J. H. Johnson, London.—Com. from G. S. Strong.—*25th July*, 1881.
3268. Breech-loading Fire-arms, H. A. Dufrené, London.—Com. from J. S. Jame.—*26th July*, 1881.
3438. Self-levelling Berths, B. J. B. Mills, London.—A com. from J. C. Thompson.—*8th August*, 1881.
3447. Attaching Door Knobs to Spindles, W. G. Macvitie, Sutton Coldfield.—*9th August*, 1881.

3770. Issuing Tickets, J. P. Power, Mortimer-street, London.—30th *August*, 1881.
3793. India-rubber Articles, B. Mills, London.—Com. from J. Smith and H. Gelpcke.—31st *August*, 1881.
3884. Commutators, P. Jensen, London.—A communication from T. A. Edison.—1st *September*, 1881.
4009. Unhairing Hides, &c., J. W. Janson, St. Mary Axe, London.—23rd *September*, 1881.
4285. Letter-press Printing, W. Conquest, London.—Com. from R. Hoe and Co.—3rd *October*, 1881.
4295. Steam Engines, H. E. Newton, London.—Communication from J. Ericsson.—4th *October*, 1881.
4355. Boots and Shoes, W. H. Stevens, Gopsal-street, Leicester.—6th *October*, 1881.
4373. Grinding Mills, W. R. Lake, London.—Communication from J. FitzGerald.—7th *October*, 1881.
4611. Steam Presses, L. Schmiers, Leipzig, Saxony.—A communication from Schmiers, Werner, and Stein.—21st *October*, 1881.
4612. Steam Presses, L. Schmiers, Leipzig, Saxony.—A communication from Schmiers, Werner, and Stein.—21st *October*, 1881.

Last day for filing opposition, 22nd *November*, 1881.

2808. Fog Signalling, J. G. Jebb, London.—A communication from W. Barker.—27th *June*, 1881.
2812. Sewing Machines, T. J. Denne, Red Hill.—27th *June*, 1881.
2820. Floor Cramp, H. Fabian, Erith.—28th *June*, 1881.
2833. Electric Incandescent Lamps, G. G. André, Dorking, and E. Easton, Westminster.—28th *June*, 1881.
2845. Heating Water, T. Drake, Huddersfield.—29th *June*, 1881.
2846. Transmitting Sounds, E. J. Paterson, London.—29th *June*, 1881.
2849. Purifying Coal Gas, J. G. Hawkins, Wigan.—29th *June*, 1881.
2850. Treating Fish, S. D. Cox, Woolwich.—29th *June*, 1881.
2855. Tenoning Machine, G. H. Couch, Croydon.—30th *June*, 1881.
2861. Steam Boilers, F. H. F. Engel, Hamburg.—Com. from A. Schultze and G. Meyer.—30th *June*, 1881.
2862. Felting Hat Bodies, G. Atherton, Stockport.—Partly a com. from G. Yule.—30th *June*, 1881.
2866. Looms, F. O. Tucker, Huddersfield.—1st *July*, 1881.
2886. Casks, F. McC. Scott, Liverpool.—A communication from J. Stark.—2nd *July*, 1881.
2905. Purifying Feathers, J. Martin, Liverpool.—4th *July*, 1881.
2928. Attaching Harness, C. D. Abel, London.—A com. from H. Fleischhauer.—5th *July*, 1881.
2930. Electric Lamps, E. P. Ward, London.—5th *July*, 1881.
2989. Transmitting Power, J. Hopkinson, London.—7th *July*, 1881.
2996. Propulsion of Vessels, W. Coppin, Londonderry.—7th *July*, 1881.
3040. Softening Water, J. H. Porter, London.—11th *July*, 1881.
3056. Treating Fluid Slag, A. M. Clark, London.—A com. from A. D. Elbers.—12th *July*, 1881.
3304. Protecting Steel, F. S. Barff, Kilburn, and G. and A. S. Bower, St. Neots.—28th *July*, 1881.
3498. Registering Apparatus, J. G. Wilson, London.—A communication from J. Fowler and D. Lewis.—12th *August*, 1881.
3674. Locomotives, C. D. Abel, London.—A communication from A. Estrade.—23rd *August*, 1881.
3716. Chains, J. I. Warman, Warwick.—25th *August*, 1881.
3869. Motive-power Engine, W. Whiteman, London.—A communication from E. Roettger and H. de Bay.—6th *September*, 1881.
3884. Boots and Shoes, T. Laycock, Northampton.—7th *September*, 1881.
3914. Preparing Cotton, W. and W. Lord, Todmorden.—9th *September*, 1881.
3918. Case for Trimmings, E. J. V. Earle, London.—9th *September*, 1881.
3932. Dynamo Machines, P. Jensen, London.—A communication from T. A. Edison.—10th *September*, 1881.
3968. Heating Water, F. T. Bond, Gloucester.—14th *September*, 1881.
3970. Perambulators, G. Asher, Birmingham.—14th *September*, 1881.
3996. Twisting Cotton, A. Yates, Derby.—16th *September*, 1881.
4012. Pulley Blocks, T. H. Ward and E. Howl, Tipton.—17th *September*, 1881.
4020. Smoke-consuming, G. West, New Lenton.—19th *September*, 1881.
4022. Torpedo Boats, A. F. Yarrow, Isle of Dogs.—19th *September*, 1881.
4034. Dynamo Machines, P. Jensen, London.—A com. from T. A. Edison.—19th *September*, 1881.
4058. Electrical Tables, H. Lake, London.—A communication from J. Henck, jun.—20th *September*, 1881.
4141. Supplying Lamps, J. Wilby, Barnsley.—26th *September*, 1881.
4158. Rotary Blowers, F. M. Roots, London.—27th *September*, 1881.
4213. Drying Pile Fabrics, J. Worrall, Salford.—29th *September*, 1881.
4227. Insulators, J. Lyon, St. Helen's.—30th *September*, 1881.
4251. Floorcloth, F. Versmann, New Charlton.—1st *October*, 1881.
4311. Electric Lamps, J. H. Johnson, London.—A com. from C. A. Faure.—4th *October*, 1881.
4349. Strings, &c., J. Turner and C. McBride, Glasgow.—6th *October*, 1881.
4379. Rolling, &c., Wire, J. Westgarth, Warrington.—8th *October*, 1881.
4419. Paper, Pulp, D. O. Francke, Sweden.—11th *October*, 1881.
4573. Life-boats, W. R. Lake, London.—A communication from A. Holmes.—19th *October*, 1881.
4617. Electric Lamps, A. M. Clark, London.—A com. from H. B. Sheridan.—21st *October*, 1881.
4660. Belt Pulleys, G. Pitt, Sutton.—A communication from P. Medart.—25th *October*, 1881.
4705. Journal Bearings, A. M. Clark, London.—A com. from A. Hopkins.—27th *October*, 1881.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the* 28th *October*, 1881.)

1859. Brick-making Machinery, T. C. Fawcett, Leeds.—29th *April*, 1881.
1861. Adhesive Materials from Animal Substances, G. W. von Nawrocki, Berlin.—29th *April*, 1881.
1868. Submarine Torpedoes, W. N. Hutchinson, Bideford.—30th *April*, 1881.
1878. Finishing Woven Fabrics, M. McCallum, Barrhead, N.B.—2nd *May*, 1881.
1879. Balloon, W. N. Hutchinson, Bideford.—2nd *May*, 1881.
1881. India-rubber Driving Belts, W. T. Henley, Plaistow.—2nd *May*, 1881.
1883. Boots and Shoes, A. Greer, Beswick.—2nd *May*, 1881.
1899. Dough-mixing Machine, D. C. McKay, and A. Knox, Glasgow.—3rd *May*, 1881.
1906. Sizing Corks, J. Liston, Glasgow.—3rd *May*, 1881.
1907. Working Pressing Bars, H. J. Haddan, London.—3rd *May*, 1881.
1922. Electric Lamp, J. B. Rogers, London.—3rd *May*, 1881.
1926. Clinometer and Prismatic Compass, P. Barker, London.—4th *May*, 1881.
1927. Paving Flags and Tiles, H. Hill, Macclesfield.—4th *May*, 1881.
1928. Vulcanised Caoutchouc, G. L. Scott, Manchester.—4th *May*, 1881.
1994. Lathes, G. E. Sherwin, Birmingham.—7th *May*, 1881.
2014. Scales, O. Gerike, Berlin, Germany.—9th *May*, 1881.
2048. Artificial Stone, P. Jensen, London.—10th *May*, 1881.
2086. Steam Pumps, F. and S. Pearn and T. Addyman, Manchester.—13th *May*, 1881.
2129. Safety-valve Apparatus, W. R. Lake, London.—16th *May*, 1881.
2147. Water-waste Preventers, W. Bartholomew, London.—17th *May*, 1881.
2203. Angle-bars, J. H. Johnson, London.—19th *May*, 1881.
2276. Kitchen Ranges, J. McIntyre Shaw, Glasgow.—24th *May*, 1881.
2868. Printer's Ink P. Jensen, Chancery-lane, London.—1st *July*, 1881.
3539. Electrical Apparatus, W. R. Lake, London.—15th *August*, 1881.
3679. Electric Light Regulators, S. Pitt, Sutton.—23rd *August*, 1881.

(*List of Letters Patent which passed the Great Seal on the* 1st *November*, 1881.)

1681. Reels, F. Wirth, Frankfort-on-the-Main, Germany.—16th *April*, 1881.
1700. Compartments in Ships, W. R. Lake, London.—19th *April*, 1881.
1877. Wheels of Locomotives, H. Lawrence, Durham.—2nd *May*, 1881.
1892. Fishing Nets, H. and S. Boyce and S. Callaway, Sandown.—2nd *May*, 1881.
1897. Obtaining Gas, W. A. Barlow, London.—2nd *May*, 1881.
1900. Utilising Waste Heat, T. Jackson, Edinburgh.—3rd *May*, 1881.
1902. Tools, W. Maiden, Hyde, and E. F. Cowley, Walsall.—3rd *May*, 1881.
1916. Desulphurising Ores, W. R. Lake, London.—3rd *May*, 1881.
1919. Self-acting Lathes, G. W. von Nawrocki, Berlin.—3rd *May*, 1881.
1921. Reeling &c., Silk, J. H. Johnson, London.—3rd *May*, 1881.
1933. Obtaining Motive-power, D. Woollatt, Burton-on-Trent.—4th *May*, 1881.
1946. Registering Fares, T. Wilson, Pentonville.—4th *May*, 1881.
1951. Sewing Machines, M. C. Denne, Eastbourne, and T. J. Denne, Red Hill.—4th *May*, 1881.
1963. Pencil Cases, G. W. von Nawrocki, Berlin.—5th *May*, 1881.
1978. Sweetmeats, S. P. Wilding, London.—6th *May*, 1881.
1981. Cornice Poles, G. Giles, Birmingham.—7th *May*, 1881.
1984. Cutting Open Tin Cases, H. Knight, Ryde.—7th *May*, 1881.
2004. Treatment of Sewage, H. Collet, Paris.—9th *May*, 1881.
2006. Corking Bottles, J. P. Jackson, Liverpool.—9th *May*, 1881.
2010. Warming Apparatus, H. J. Haddan, London.—9th *May*, 1881.
2026. Separator, H. E. Kratz, London.—10th *May*, 1881
2035. Treating Iridium, W. P. Thompson, London.—19th *May*, 1881.
2038. Electric-lighting Apparatus, H. J. Haddan, London.—10th *May*, 1881.
2063. Tank, H. Kirkhouse, Penarth, and H. W. Lewis, Treherbert.—12th *May*, 1881.
2065. Pianofortes, G. W. von Nawrocki, Berlin.—12th *May*, 1881.
2066. Carburetting Air, W. P. Thompson, London.—12th *May*, 1881.
2085. Obtaining Spaces, S. and J. Chandler, London.—13th *May*, 1881.
2159. Railway Brakes, C. D. Abel, London.—18th *May*, 1881.
2175. Regenerating Energy, W. R. Lake, London.—18th *May*, 1881.
2407. Fire-arms, A. M. Clark, London.—31st *May*, 1881.
2535. Gas Condensers, H. and F. C. Cockey, Frome Selwood, Somerset.—10th *June*, 1881.
2730. Hygienic Sweetmeats, H. Bories and P. Tostain, Paris.—22nd *June*, 1881.
2740. Refrigerating Apparatus, A. S. Haslam, Derby.—22nd *June*, 1881.
2834. Reverberatory Furnaces, G. Fenwick, Gateshead, and B. Cochrane, Durham.—28th *June*, 1881.
2976. Extracting Fatty Matters, W. P. Thompson, London.—7th *July*, 1881.
3445. Machine for Preparing Tea, J. P. Brougham, Inverness.—9th *August*, 1881.
3487. Printing Machinery, W. R. Lake, London.—11th *August*, 1881.
3523. Making Pottery, H. J. Haddan, London.—18th *August*, 1881.
3605. Black Ink, H. S. L. Gurney, Warrington.—19th *August*, 1881.
3683. Winding Gear, J. Craven, Wakefield.—24th *June*, 1881.
3777. Hand Pieces, S. Pitt, Sutton, Surrey.—30th *August*, 1881.
3811. Tiles for Walls, H. Hall, London.—1st *September*, 1881.

List of Specifications published during the week ending October 29th, 1881.

436, 4d.; 802, 2d.; 830, 2d.; 837, 2d.; 930, 2d.; 934, 4d.; 992, 2d.; 1121, 6d.; 1138, 6d.; 1143, 2d.; 1218, 2d.; 1274, 6d.; 1286, 6d.; 1298, 6d.; 1304, 4d.; 1308, 4d.; 1310, 6d.; 1321, 6d.; 1325, 8d.; 1328, 4d.; 1329, 6d.; 1330, 4d.; 1331, 6d.; 1334, 6d.; 1337, 6d.; 1342, 6d., 1343, 6d.; 1345, 10d.; 1346, 2d.; 1347, 4d.; 1348, 2d.; 1350, 6d.; 1351, 4d.; 1352, 4d.; 1353, 6d.; 1355, 2d.; 1356, 6d.; 1357, 8d.; 1358, 6d.; 1359, 8d.; 1360, 2d.; 1361, 2d.; 1363, 6d.; 1366, 4d.; 1367, 6d.; 1368, 6d.; 1369, 2d.; 1370, 8d.; 1371, 2d.; 1372, 8d.; 1373, 4d.; 1374, 2d.; 1375, 6d.; 1376, 2d.; 1377, 6d.; 1378, 2d.; 1381, 4d.; 1382, 2d.; 1384, 6d.; 1385, 4d.; 1386, 6d.; 1387, 6d.; 1388, 6d.; 1391, 2d.; 1392, 2d.; 1393, 2d.; 1394, 8d.; 1396, 4d.; 1398, 4d.; 1400, 4d.; 1402, 6d.; 1403, 2d.; 1404, 2d.; 1405, 6d.; 1408, 2d.; 1409, 4d.; 1412, 2d.; 1431, 4d.; 1414, 2d.; 1415, 2d.; 1417, 2d.; 1418, 6d.; 1419, 6d.; 1420, 6d.; 1421, 2d.; 1422, 4d.; 1424, 4d.; 1427, 6d., 1428, 2d.; 1429, 8d.; 1430, 6d.; 1431, 10d.; 1433, 2d.; 1434, 2d.; 1436, 4d.; 1438, 2d.; 1440, 6d.; 1442, 2d.; 1443, 6d.; 1444, 6d.; 1445, 6d.; 1446, 6d.; 1448, 2d.; 1450, 2d.; 1451, 8d.; 1454, 2d.; 1455, 6d.; 1457, 6d.; 1458, 8d.; 1459, 2d.; 1460, 6d.; 1461, 4d.; 1525, 6d.; 1559, 6d.; 1588, 6d.; 2165, 6d.; 2949, 4d.; 3269, 10d.

*** 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.*

436. Transferring Ornamental and Embroidery Designs to Woven Fabrics, Leather, Wood, &c., *C. Poirson.—2nd February*, 1881. 4*d.*

This consists in the combination of chemical salts and organic bodies, which are to produce a liquid to be used as a printing ink or varnish, and having the property to dissolve in water.

802. Machinery for Cutting Splints, &c., *E. Pace and J. H. Howard.—25th February*, 1881.—(*Void.*) 2*d.*

This relates, First, to apparatus for feeding the wood to the cutters; and Secondly, to means whereby the splints are collected from a vibrating delivery trough and formed into bundles of a given size, and the tying up thereof is facilitated.

830. Tricycles, *H. Kinder.—26th February*, 1881.—(*Void.*) 2*d.*

This consists in providing one or more of the axles of the wheels of the machine with a coiled spring or springs, either fixed directly upon the axles or communicating their power thereto through the intervention of suitable gearing, which can be thrown in and out of operation at the will of the rider.

837. Manufacture of Knitted Fabrics, *F. Caldwell.—28th February*, 1881.—(*Void.*) 2*d.*

This relates to the manufacture of knitted fabrics made on circular machines producing ribbed or plain looped fabrics, especially applicable to goods made in the piece and afterwards cut into short lengths, each length requiring to have a selvage or welt at one end.

930. Preparing Ships or other Steel Structures for Painting or Coating, *A. C. Kirk and R. Sim.—4th March*, 1881.—(*Void.*) 2*d.*

This consists in combining with hydrochloric acid or other suitable acid a suitable thickening substance or combination of substances, which will allow of the compound being applied like a thin plaster to the surface of the ship or other structure.

934. Metallic Chain Lathing for Fireproof Bridges, Buildings, &c., *T. Hyatt.—4th March*, 1881.—(*Void.*) 4*d.*

This consists in uniting a convenient number of metal strips, such as hoop iron, into a plate or sheet, composed of solid parts and spaces, the object of the spaces being to furnish a means of keying the plastic to the metal as a completed sheet when made.

983. Treatment of Cellulose, &c., *A. Parkes.—8th March*, 1881. 4*d.*

This consists in dissolving cellulose in a solution of iodide of zinc, or nitrate of zinc, or other such like solvents or mixtures of them, then moulding the dissolved cellulose to the form required, or spreading it over the surfacing to be coated, then removing the solvent by washing, and finally rolling, pressing, or calendering the articles to consolidate them and improve their surface.

992. Obtaining Motive Power, *H. E. Newton.—8th March*, 1881.—(*A communication from H. G. Hosmer.*)—(*Void.*) 2*d.*

This consists of an apparatus in which the motive power is derived from the oscillation of a pendulum.

1094. Improved System of Automatic Rapid Telegraphy, &c., *B. J. B. Mills.—14th March*, 1881.—(*A communication from W. A. Leggo.*) 8*d.*

The object of this invention is to furnish a system of automatic rapid telegraph transmission, in which one machine may be used both for the preparation for transmission and for the transmission of messages. The method followed is to cause the ordinary manipulations of a peg to be recorded in insulating and conducting spaces on a suitable surface, and then to utilise this record to automatically control the transmitting circuit. The apparatus is fitted with gearing, by means of which its speed can be regulated according to whether it is desired to transmit or receive messages. The dots and dashes, or insulating and conducting spaces, are made on specially prepared paper by means of a pen, made to hold a supply of the painting fluid, and to open and shut as required. The inventor also makes use of a specially designed telegraph peg, the movable contact point of which can be made to move faster than the rate of motion of the actuating power. The details of the apparatus are too lengthy for description here. The specification is accompanied by descriptive drawings.

1121. Cast Iron Pots, *J. V. Hope.—15th March*, 1881. 6*d.*

This consists in the manufacture of cast iron pots with wrought iron or other suitable tough metal legs in a separable piece.

1138. Ornamental Blind, *P. and W. P. Van Wyk.—16th March*, 1881. 6*d.*

This consists in the weaving of two separate pieces of cloth, one being intended to form the body of the blind with stripes lengthwise at the two sides, while the other is intended to be used as the border for the top and bottom of the blind by being sewn across the first piece, thus producing a complete blind.

1143. Door Locks, *W. R. Comings.—16th March*, 1881.—(*Void.*) 2*d.*

This relates to the employment of a straight spring instead of bent springs.

1218. Perforating Paper, *G. W. von Nawrocki.—19th March*, 1881.—(*A communication from N. Heimann.*)—(*Not proceeded with.*) 2*d.*

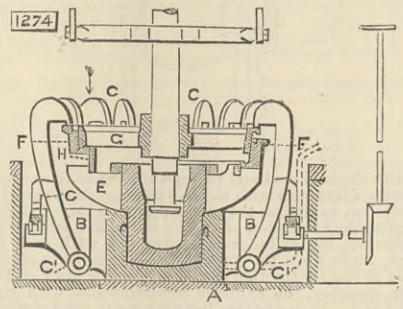
The paper to be perforated is guided in between a steel roller having the required pattern sharply engraved thereon, and another roller having a plain surface and made of a softer material, by preference of a metal composition. A smoothing roller is pressed against the soft roller.

1236. Electric Lamps, Candles, Candle-holders, and Apparatus Connected Therewith, *J. A. Berly.—21st March*, 1881. 8*d.*

The improvements relate to details and combinations. The movable parallel carbons in this system are brought into contact only at the time of lighting, the oscillating electro-magnets and armatures being hinged by strips of flexible material instead of by pins, axles, &c.; the switching from candle to candle being accomplished by fusible plugs or pneumatically.

1274. Fixing Tires on Railway and Tramway Wheels by Hydraulic Pressure, &c., *A. C. Uljée and J. Cleminson.—22nd March*, 1881. 6*d.*

This apparatus is constructed with a cylinder and ram, or a series of cylinders, each provided with a ram, and having connected thereto hooks, claws, or clamps, serving to connect the press cylinder or cylinders with the wheel body or with the tire. The drawing shows an arrangement in which one cylinder A is used. It



is provided with a number of radial arms B, to which the hooks or claws C are hinged or jointed at C¹, and the ram is furnished with a corresponding number of radial arms E that serve to carry the tire F and force it on to the wheel body G whilst the latter is held by the hooks or claws C, or when a tire is to be taken off a wheel body, the radial arms E of the ram D may carry the wheel body G by means of an interposed ring H, the tire F resting against the hooks or claws C, whereby it is held whilst the ram D forces the wheel body out of the tire.

1286. Warmth Reservoirs, *O. Wolff.—23rd March*, 1881.—(*A communication from A. Nieske.*) 6*d.*

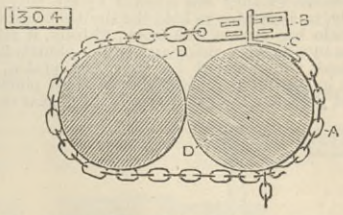
This relates to the application of a mixture of sodaic salts, consisting of acetate of soda and hyposulphite of soda, for filling warmth reservoirs so as to assure the greatest possible duration of the emission of warmth.

1298. Folding Crates or Cases, *J. R. Kelsey.—23rd March*, 1881. 6*d.*

This consists in the construction of folding crates which can, by means of hinges or joints at certain parts of their sides, bottom, top, and end pieces, be caused to fold one upon the other.

1304. Binding for Scaffolding, &c., *J. Rettie.—23rd March*, 1881. 4*d.*

A chain A is employed having at one end a tongue-piece B, and at the other a loop C to slip over same. The tongue-piece is provided with rectangular slots overlapping in the different rows, so as to give varying dimensions from the extremities of the tongue-piece



The chain is passed round the two or more articles to be bound, and the loop is slipped on to the tongue until the chain is very nearly tight, and a wedge is inserted at the back of the loop into one of the slots in the tongue-piece and driven down.

1308. Screws for Horseshoes, *S. Gibbs.—24th March* 1881. 4*d.*

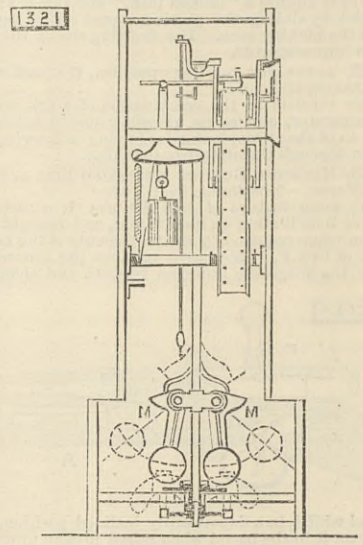
The screws are by preference formed with a long tapered head or neck, in the top of which is cut the groove by which they are turned.

1310. Charcoal Box-irons, *G. Asher.—24th March* 1881. 6*d.*

This relates to making a charcoal box-iron without either the usual chimney in front or ventilator at the back.

1321. Apparatus for Recording the Performance of a Steam Engine, &c., *J. B. Moscrop.—24th March*, 1881. 6*d.*

This relates partly to the peculiar construction of weighted levers M fitted with wings or ears, so formed



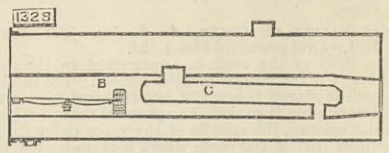
as to operate a pencil or marker in direct or arithmetical proportions with the speed to be recorded.

1325. Indicator Locks, *A. M. Clark.—24th March*, 1881.—(*A communication from the Eagle Lock Company, Incorporated.*) 8*d.*

This relates more particularly to that type of lock in which an annular indicator turns loosely in a peripheral seat in the lock case, and consists, First, in the peculiar construction of the annular indicator wheel; Secondly, in its combination with the bolt mechanism; Thirdly, in the peculiar construction of the bolt mechanism; Fourthly, in the peculiar construction of the case; and Fifthly, in a modified structure of case when made of sheet metal.

1328. Boilers, *W. Arnold.—24th March*, 1881. 4*d.*

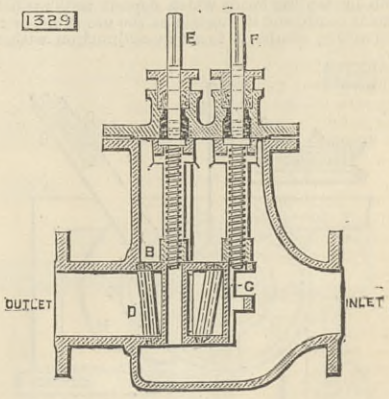
This consists in the use and employment of the



water tube or generator C placed at an angle within the flue B.

1329. Valves, *L. Berry.—25th March*, 1881. 6*d.*

The object is to form a valve that can be easily operated under pressure, thus reducing wear and tear, and in which a clear water-way is obtained from inlet



to outlet. The valve proper B bears against the seating D, and also against a resistance plate C, both the valve and resistance plate being operated separately by screws E and F. The water can circulate freely round the valve, which is thus held in equilibrium, and can be easily raised or lowered.

1330. Couplings for Connecting and Disconnecting Lever Gear, *B. Finch.—25th March*, 1881.—(*Not proceeded with.*) 4*d.*

This relates to means of connecting and disconnecting two levers by means of a lifting clutch, which, when in one position, couples the two levers, and when in another position admits of the levers working independently.

1331. Enriching Gas by Admixture of Hydrocarbon Vapour, *J. Livesey.—25th March*, 1881. 6*d.*

The hydrocarbon is vaporised partly by the heat conducted to the carburetting vessel and partly by the heat of a regulated portion of the gas heated on its way to the carburetting vessel.

1334. Manufacture of Snow, *F. N. Mackay.—25th March*, 1881. 6*d.*

This relates to improvements on patent No. 2706, A.D. 1880, and consists partly in drying the ice frozen on the surface of a drum by means of a wiper before it reaches the cutter.

1337. Looms, *W. Priestley and W. Deighton.—25th March*, 1881. 6*d*.

This relates to looms in which rising and falling shuttle-boxes are employed at each end, and consists, First, in an arrangement for raising and lowering the shuttle-boxes as they are selected by the jacquard; Secondly, in apparatus to hold the shuttle-boxes until the shuttle has crossed the loom; Thirdly, it relates to looms in which the rising and falling shuttle-boxes are raised and lowered by rack and pinion, and consists in apparatus to keep the rack and pinion in gear and yet allow the rack to come out of gear should

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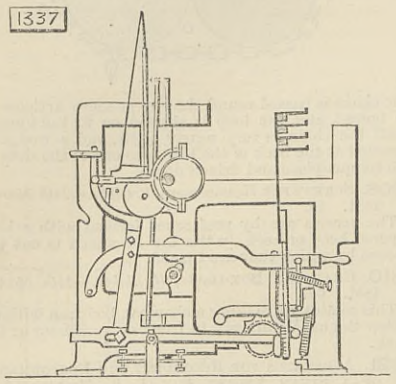

the shuttle become fast in the box; and, Fourthly, to means for keeping the picking stick stationary, and so preventing the movement of the shuttle whilst the weaver is finding a "broken pick," and this is accomplished by sliding the picking tappet out of contact with the picking cone. The drawing shows the first three improvements.

1342. Apparatus for Brewing, &c., *C. Clinch.—25th March*, 1881. 6*d*.

This consists in the combination of a vat, vertical attemperator, and screw propeller placed below the bottom of the attemperator for forcing or drawing the liquor through the attemperator tubes.

1343. Magazine Guns or Repeating Fire-arms, *P. Mauser.—25th March*, 1881. 6*d*.

The main feature of this fire-arm is a cartridge carrier B oscillating on its rear end, and brought into action when required by the movements of the breech piece or lock F. This carrier receives the cartridge A from the magazine arranged beneath and along the

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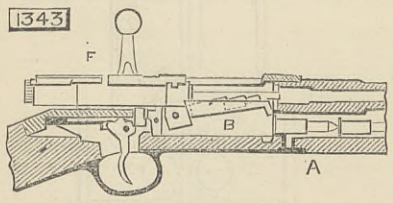

barrel whilst in a downwardly inclined position, and delivers it to the barrel when raised into an upwardly inclined position. The carrier is raised and depressed by the movement of the lock F, the front end of which serves as a breech block, and which contains and operates the firing bolt or pin.

1345. Lamps for Railway Carriage Roofs, *A. E. Ragg.—26th March*, 1881. 10*d*.

This relates, First, to constructing a lamp such that wind or other current of air shall have less deleterious effect than heretofore; Secondly, to means whereby any shadow caused by the oil container may be reduced to a minimum; Thirdly, to means to ensure that the oil in the oil container does not become overheated; Fourthly, to means of excluding outer air; Fifthly, to means for securing the glass chimney in place; Sixthly, to means for raising or lowering the flame from the outside of the lamp; Seventhly, to the construction of gauge whereby the wick may be readily trimmed; Eighthly, to means for extinguishing the flame.

1346. Valves or Cocks, *A. A. Joy.—26th March*, 1881.—(*Not proceeded with.*) 2*d*.

The body of the cock is constructed in the usual manner, but the plug is formed hollow. The inlet to the cock is placed below the outlet therefrom, and in the hollow plug is provided a spherical valve having a tubular seating, the spindle of the valve extending to the upper part of the cock, where it is connected to a flexible diaphragm of suitable material, such diaphragm being fixed in an enlarged chamber at the top of the cock.

1347. Combing Wool, &c., *J. Midgley.—26th March*, 1881. 4*d*.

This relates to what are known as "square motion combs," in which the wool is fed to a large circular comb by feeding heads which deposit tufts upon the circular comb, and it consists in the use of one or two intersecting combs D to act in conjunction with the

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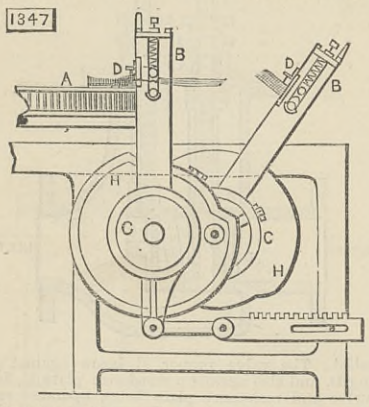

feeding heads B in such a manner that as the latter deposit the tuft upon the circular comb A the intersection combs D shall penetrate the tufts and recede along the feeding heads, thereby combing the overhanging end of the tuft. The combs D are operated by the cams H, and the feeding heads B by the excentrics C.

1348. Cleaning, Blacking, and Polishing Boots, Shoes, &c., *T. Lever.—26th March*, 1881.—(*Not proceeded with.*) 2*d*.

On a frame a set of three brushes are carried on a spindle. The middle brush, being the blacking brush, has a suitable receptacle for the blacking, and a number of holes placed at intervals distributes the blacking, the supply of which can be stopped or regulated by a sheath.

1351. Capsuling Bottles, &c., *J. Dunbar.—26th March*, 1881. 4*d*.

This consists in making the capsules of rubber, which may be vulcanised or otherwise treated in an analogous manner.

1352. Regulating Fanlights, *W. Leggott.—26th March*, 1881. 4*d*.

This consists in opening and closing fanlights by means of a worm and worm wheel.

1350. Machinery for Pickling or Preparing Iron or other Plates Previous to their being Coated with Tin, Terne, &c., *J. Williams and G. L. Morris.—26th March*, 1881. 6*d*.

This consists essentially in the placing of the motive agent centrally of or so as to be surrounded by the

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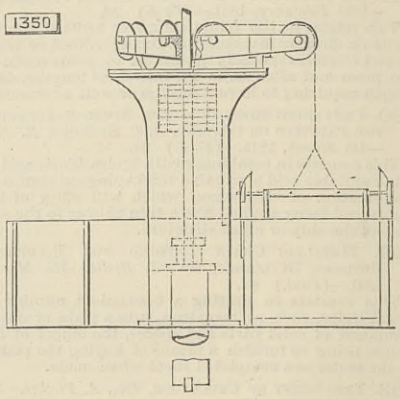

pickling and swilling tanks, and loading and unloading table, whereby the apparatus is rendered self-contained, and independent of exterior actuation or appliances.

1353. System of and Apparatus for Supplying Buildings with Steam, *T. Ritson.—26th March*, 1881.—(*A communication from T. A. Ritson.*) 6*d*.

This consists, First, of a new double system of laying the pipes or mains, two in a trench in each street or road, one for supplying live steam for manufacturing purposes to individual users, and the other pipe being a heating main only for dwellings or other purposes. It relates also to obtaining a more complete combustion of the fuel in the boiler furnaces for generating the steam.

1355. Cocks or Valves, *E. Brice.—26th March*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in forming the face of the valve of a combination of hard and soft metal.

1356. Condensing and Purifying Gas, &c., *T. N. Kirkham, T. Hersey, D. Hulett, S., J., and S. Chandler.—26th March*, 1881. 6*d*.

This relates to improvements on patent No. 4928, A.D. 1877, the object being to increase the frictional

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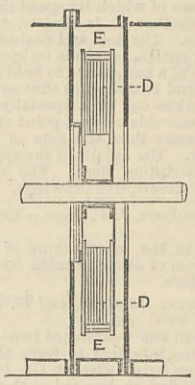

condensing power of the machine, and thereby more effectually arrest the volatile oils carried forward with the gas; and it consists in fixing perforated drums E to the peripheries of the clusters of plates or discs D.

1357. Hot-air Engines, *W. H. Bailey.—26th March*, 1881.—(*A communication from Zipf and Langsdorf, and the Berlin Anhaltische Maschinenbau Actien Gesellschaft.*) 8*d*.

According to one improvement there are provided in the heating chamber two passages, one communicating with the hot end and the other with the cold end of the chamber, which passages lead to ports in a surface against which works a surface on the side of the cylinder, which is an oscillating one. This surface has a port from which a passage leads to the closed end of the cylinder, and by the oscillation of the

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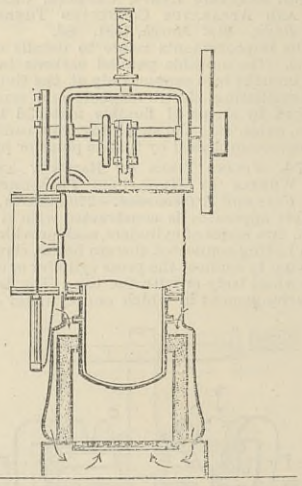

latter the said port and passage are made to communicate alternately with the two passages in the heating chamber, so that as the piston performs its out stroke, due to the expansion of the air in the hot end of the chamber, the cylinder communicates with such hot end, while when the piston is performing its in-stroke, due to the contraction of the air in the cool end of the chamber, the cylinder communicates with such cool end. Various other improvements are described.

1359. Screw Propellers, &c., *N. D. Spartali.—26th March*, 1881. 8*d*.

This relates to improvements on patents No. 3180, A.D. 1875, No. 2906, A.D. 1876, and No. 1670, A.D. 1879,

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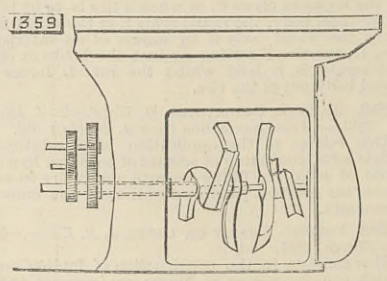

and it consists principally in adding to the breadth of the blades as well as to the pitch, and to the connection of each two blades one to the other, and also in utilising the curvilinear lines of the two centre halves forming the foundation of the blade, and in the connection to the centre and shaft which has the effect of an additional propelling surface, doing the service almost of a third blade; also in the formation of a diagonally triangular recess or chamber in which a great mass of water is contained and bodily displaced, the length of the blades being formed as it were in two and even three sections, united in their breadth to each other diagonally in their thickness. The drawing shows the mode of mounting and working the propellers.

1358. Improvements in Electric Lamps, *R. Harrison and C. Blagburn.—26th March*, 1881. 6*d*.

The lower carbon impinges upon a large block of

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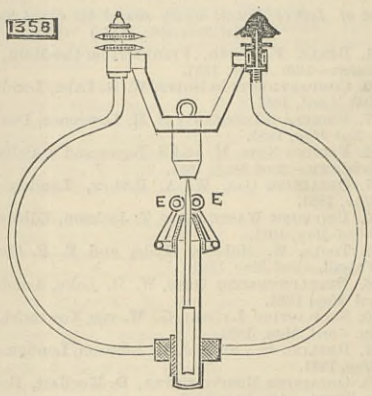

carbon, and as it is consumed is fed by means of the rollers E E, which have a grip on the carbon and are actuated by weights.

1360. Rolling Railway Axles, &c., *J. H. Johnson.—26th March*, 1881.—(*A communication from M. Liogier.*)—(*Not proceeded with.*) 2*d*.

This consists in rolling or compressing the articles between a convex surface and a concave surface.

1361. Iron and Steel, *G. Love and B. Cochrane.—26th March*, 1881.—(*Not proceeded with.*) 2*d*.

Molten iron or steel is caused to be run into moulds formed of mixtures of lime or limestone and peat, or sawdust, or dead leaves, or other carbonaceous material or mixtures of the same.

1363. Gas Motor Engines, *S. and H. N. Bickerton.—28th March*, 1881. 6*d*.

The piston rod is hollow at one end and has openings to allow the products of combustion to pass at the right moment into the atmosphere, being covered and uncovered by the sliding piston G. The front end

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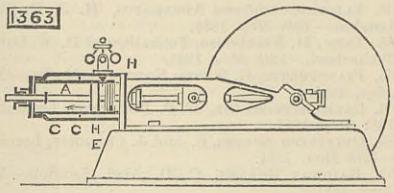

of cylinder A is enlarged and communicates at the front of piston E with the chamber H. Gas is admitted to H and drawn in by piston E as it performs its return stroke.

1366. Trap for Drains and Sewers, *F. W. Hagen and G. C. Akrig.—28th March*, 1881. 4*d*.

The body of the trap A is in the form of a well, and contains an inner removable case E in which all solid materials are retained, the water flowing out through

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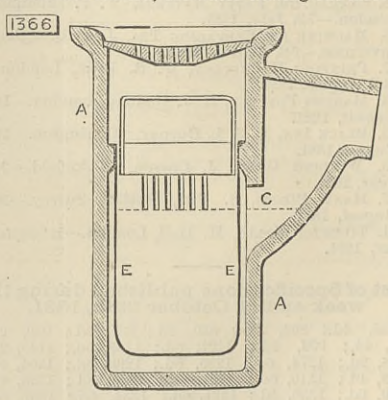

openings near the top, and passes into the side opening C, to which a syphon pipe is attached and forms connection with the drain or sewer.

1367. Construction of Ceilings, *T. Wrigley.—28th March*, 1881.—(*A communication from S. Müeller.*) 6*d*.

To the laths, joists, or other surface to which the plaster is to be fixed are secured a number of discs or buttons resembling in shape the frustrum of a cone, the smaller surface of which when secured by means of tacks, screws, or the like, bed against the laths or other surface forming the foundation of the ceiling.

1368. Manufacture of Gas for Lighting and Heating, *E. P. Alexander.—28th March*, 1881.—(*A communication from E. Mertz.*) 6*d*.

This relates to the construction of apparatus for the production of a rich gas by the distillation of the heavy oils of schist, residues of petroleum, and the like, or from fatty and oleaginous liquid matters by heat.

1369. Wheelbarrows, &c., *W. B. Williamson.—28th March*, 1881.—(*Not proceeded with.*) 2*d*.

The ordinary wheel is dispensed with and a roller or rollers is or are substituted.

1370. Burning Hydrocarbon Oils *A. J. Boult.—28th March*, 1881.—(*A communication from C. Holland.*) 8*d*.

This consists essentially in an apparatus for burning fluid hydrocarbons with steam and air, of the combination of two or more pairs of separate retorts so connected by tubes with a hydrocarbon fluid and water supply, and with jet tubes, from which the resultant gases or vapours and steam are burned, that one retort of each pair shall be supplied with water or steam, and the other retort of each pair shall be supplied with hydrocarbon fluid, and the gas or vapour and steam generated in the other pair or pairs of retorts shall heat the furnace.

1371. Omnibuses, &c., *H. W. Hart.—28th March*, 1881.—(*Not proceeded with.*) 2*d*.

Rows of inside seats are arranged back to back along the centre of the omnibus. The admission to these rows of seats is obtained through separate doors at the end of the omnibus.

1372. Iron and Steel, *W. J. Clapp and T. Griffiths.—28th March*, 1881. 8*d*.

An upright converter formed in three parts A, B, and C, is employed, the upper part forming the stack and being supported on fixed pillars, the intermediate part B forming a bosh or chamber for the circulation of water. The steam and blast pipes D and E are permanently fixed, whilst the lower part C to receive the molten metal to be treated is mounted on a frame capable of being raised and lowered on a second frame having wheels to run on a railway. This lower part has tuyeres F fixed in the side, and a tap hole G at

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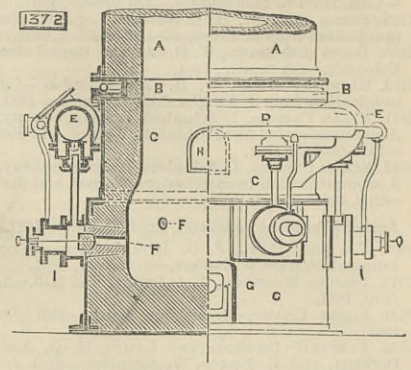

the bottom to allow the metal to run out. Another hole H serves to charge the converter, and also remove slag. Each tuyere has at its rear end a plug to cut off the blast, and is operated by a steam cylinder I.

1373. Colouring Matters, &c., *O. N. Witt and H. Koechlin.—28th March*, 1881. 4*d*.

This consists, First, in the production of new dye stuffs by the action of aromatic nitroso bodies or chloroquinoneimides upon phenols in an alkaline solution, with or without the presence of reducing agents and ammonia; Secondly, in the production of the same dye stuffs by oxidation of alkaline, neutral or feebly acid mixtures of phenols with paramido derivatives, of primary, secondary, or tertiary amines or phenols.

1374. Holding Pressed Goods during Baling, *H. J. Coles.—28th March*, 1881.—(*Not proceeded with.*) 2*d*.

A false top is employed to which are attached links, rods, catches, or hydraulic retaining cylinders provided with catches or otherwise so arranged that when the goods are pressed they may engage with a false bottom placed between the goods and the follower or rising table of the press, and be adjusted to the required length by means of one or more cams, wedges, screws, or hydraulic retaining apparatus.

1375. Regulating Supply of Steam to Marine Engines, *F. W. Eames and J. McIntosh.—28th March*, 1881. 6*d*.

The object is to avoid the "racing" of the engines by the instantaneous stoppage of steam so soon as the speed increases through the propeller being out of the water, and it consists in the use of a pneumatic lever apparatus to work the supply valve. A is the pneumatic lever connected by a pipe with an air-tight cylindrical case, in which the valve is free to slide.

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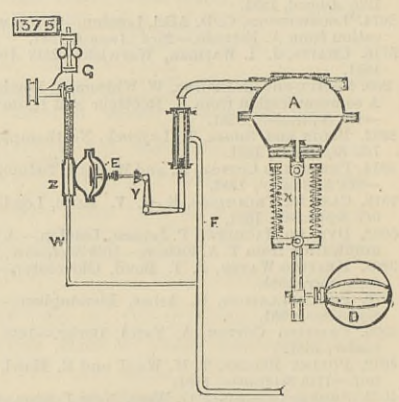


A rod X depends from lever A, and has a cross-bar sliding on guides fitted with stops and surrounded by springs, which yield when there is a vacuum in A. The cross-bar is connected to the throttle valve D. Pendant from the closed end of the valve in the cylindrical crse is a link which connects it to a bell-crank lever Y, one arm of which is connected to a flexible diaphragm E mounted in an air-tight box communicating with a pipe Z having two valve seats and communicating at one end with the pipe W leading from main pipe F. The valve seats are alternately closed and opened by valves connected together by a rod extending up and connected to a governor G, so that when the speed of the engine increases, the governor moves the valves so as to close the air valve and open a passage to the condenser.

1376. Combined Knives and Measuring Instruments, *W. Ritchie.—20th March*, 1881.—(*Not proceeded with.*) 2*d*.

One of the side plates of the knife handle carries an outer plate, which consists of two parts jointed together at one end, and at the other end one of them is jointed to the knife handle plate, so that the two parts of the outer plate may be turned out from off the knife handle plate, and then be turned out from each other, when they will all be in line. The two parts of the outer plate and the side of the knife plate are all divided according to a convenient scale for measurement.

1377. Airing Gussets, Clothes, &c., *W. Sachs.—29th March*, 1881. 6*d*.

This consists in the combination of an impermeable waterproof material perforated by little holes with an absorbing fabric or material, the perforated material being arranged outside or inside of the absorbing material, or between two pieces of the same.

1378. Travelling Trunks, Deed Boxes, &c., *W. H. Jones.—29th March*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to strengthening the top, bottom, sides, and ends of a box made of sheet metal, and consists in employing bars of wood fixed to the surface of the metal, either inside or outside the trunk or box, as may be desired.

1381. Boots, *I. Kay.—29th March*, 1881. 4*d*.

This relates to the construction of boots with the object of excluding wet.

1382. Reversible Rotary Engine, *L. A. Groth.—29th March*, 1881.—(*A communication from H. Schönfeldt and C. F. Höhne.*)—(*Not proceeded with.*) 2*d*.

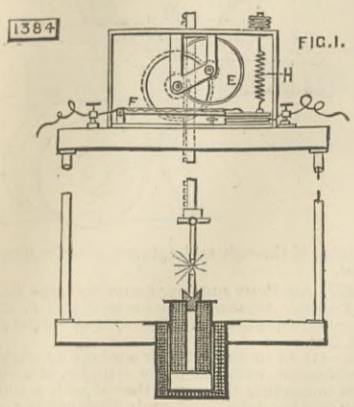
In a cylindrical shell or chamber is placed a shaft on which a drum is keyed, which carries two radial pallets placed diametrically opposite to each other. The space between the inner periphery of the shell or chamber and the outer periphery of the drum, as also two valves contained therein, are so arranged as to be steam-tight. Steam, gas, or other actuating fluid is conducted by a supply pipe into the space between the shell and the drum through one or other of two cocks, according to the direction in which the engine is to be driven, the other cock remaining shut.

1383. Thermometers, *W. B. Fowle.—29th March*, 1881 6*d*.

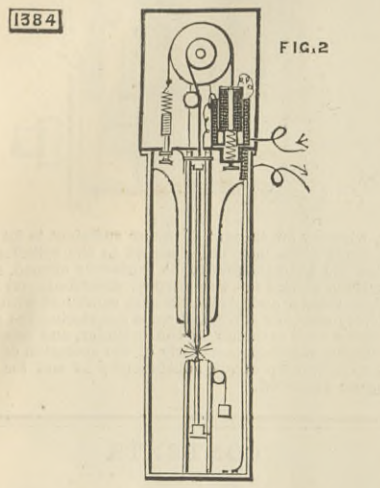
This consists in the combination in a thermometer of two bi-metallic strips, so connected on different sides of the point of rotation of a segment as to act together in operating the indicating hand, and so adjusted as to have a slight tension in respect to each other.

1384. Electric Lighting Apparatus, *W. R. Lake.—29th March*, 1881.—(*A communication from A. G. Holcombe.*) 6*d.*

Fig. 1 shows the arrangement for one form of lamp, the peculiarity of which lies in the feeding parts; E is



the brake wheel, acted on by a shoe carried by the lever pivotted at F. At the end of F is a coil, opposite to which is another coil, with connections as shown. The action of the coils is counterbalanced by the spring H. These parts together give the feeding action. The



lower carbon is fixed to the inside coil of a solenoid as shown. Fig. 2 shows the modified form of lamp when only one lamp is used in the circuit.

1385. Bobbins for Drawing, Finishing, and Roving Frames, *J. Clayton.—29th March*, 1881. 4*d.*

This consists in the manufacture and use of bobbins employed in finishing and roving frames, or of other such-like bobbins made with heads, which are prevented from lifting, opening, warping, or breaking by means of screws or rivets.

1386. Utilising Liquid Fuels, *H. N. Crellin, jun., and C. S. Rolfe.—29th March*, 1881. 6*d.*

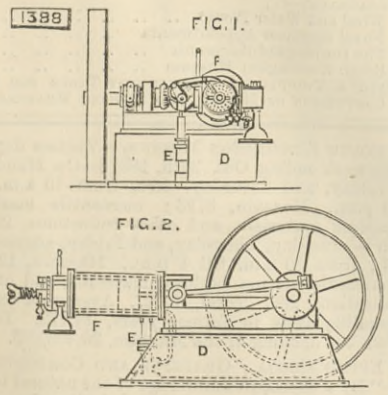
This relates to a method and apparatus or lamp for the combustion of liquid fuels, whereby a nearly perfect and economical form of combustion is secured.

1387. Riddling or Sifting Cinders, &c., *T. Bradford.—29th March*, 1881. 6*d.*

This consists of a combined handle and hand lever or agitator, centred in or carried by a casting affixed to one side of an outer case or box so as to be capable of free vibration, with an inner tray or riddle provided on one side with studs or projections, between which the depending end of the said agitator freely swings, and with which it engages, the tray being freely swung or suspended by supports swinging or depending from opposite sides of the outer case or box, so as to be capable of being freely taken out and placed in position, and so as to receive a rapid to-and-fro or shaking movement when the apparatus is held up or suspended by the said hand lever, and by an outer lifting handle with which the other side of the box is provided upon the hand lever being shaken, and which movement is very efficacious in effecting the separation of the dust or ash from the cinder or other still useful larger parts which it is desired to preserve for still further use.

1388. Gas Engines, *J. A. Ewins and H. Newman.—29th March*, 1881. 6d.

The drawings show the invention as applied to a horizontal engine. Upon the bed is arranged the frame and fly-wheel as usual, a cylinder F fitting in a box containing water to cool the cylinder. At the extreme end or back is a chamber to receive or discharge the gas supplied by a check or trap valve regulated by a rotary plate actuated by a ratchet connected



to the shaft, so as to open and shut a slot to admit the exploding flame. On the chamber is an exhaust valve which continues open during the whole of the back stroke, and is worked by a lever and cam. Under the bed is a cistern, from which the water is drawn by a pump E and circulated round the cylinder.

1391. Incubators, *R. J. Ruymp.—29th March*, 1881.—(*Not proceeded with.*) 2*d.*

The temperature is maintained by means of heaters of any suitable material.

1392. Calculating Machines or Arithmometers, *S. Tate.—29th March*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 13,504, dated 10th February, 1851. The movement which takes place from 0 to 9 or 9 to 0 of the toothed cylinder is effected by means of a double incline formed on a spring fixed on the middle plate of the machine, and an inclined fork, the said double spring acting on the end of the fork, by which the apparatus is simplified.

1393. Improvements in Electric Drills, *J. H. Thomson.—29th March*, 1881.—(*Not proceeded with.*) 2*d.*

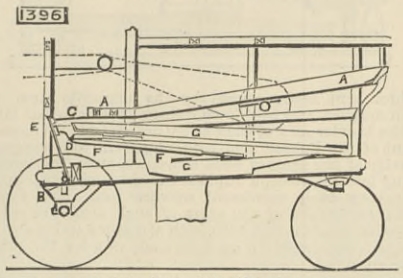
This relates to portable drilling machines operated by electricity, and made for handwork.

1394. Signalling Apparatus, *J. C. Park and H. J. Pryce.—29th March*, 1881. 8*d.*

This relates to improvements in the construction and arrangement of signalling apparatus on railways, for the purpose of controlling one signal by another, the object being to render it impossible for the signalman to admit a train to a section of the line until the signal for clearing that section has been first lowered and then raised again.

1396. Thrashing Machines, *J. Marshall.—29th March*, 1881. 4*d.*

The dressing shoes or riddles G and the shaker-boxes A are operated from the same crank shaft B, which imparts a reciprocating radial motion to the



bars D connected by irons C to the shaker-boxes, and by irons E to rods F connected respectively to the upper and lower shoes or riddles.

1398. Pumps, *G. W. von Nawrocki.—30th March*, 1881.—(*A communication from C. Blasendorf.*)—(*Not proceeded with.*) 4*d.*

An ordinary suction pump without suction valve, but with valved piston or bucket is connected by a pipe with an auxiliary pump with differential pistons. The smaller differential piston is an ordinary suction piston or bucket with a valve, and is connected by a rod with the larger differential piston. The latter piston is larger than the former in proportion to the head or lift.

1400. Treating Biscuits, *F. H. F. Engel.—30th March*, 1881.—(*A communication from W. Gaedke.*) 4*d.*

This consists in the mode of treating biscuits for preventing breakage and cracking thereof in the manufacture by bringing biscuits direct from the oven into the closed boxes, casings, or tubes lined with felt or other bad conductors of heat, such closed boxes, casings, or tubes being furnished with adjustable openings for the purpose of retaining for a longer time the moisture and hot air products of the manufacture, and for regulating the efflux of such air so as to prevent fast external cooling off of the biscuits.

1402. Stands or Supports for Supporting Costumes, *J. Kettle.—30th March*, 1881. 6*d.*

The bust of the stand is supported with capability of being raised or lowered, and of revolving upon a central or other stem carried by a suitable foot or stand.

1403. Substitute for Coffee, *J. Anderson.—30th March*, 1881.—(*Not proceeded with.*) 2*d.*

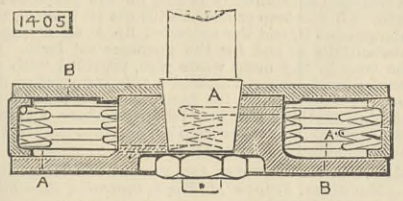
This consists in mixing with coffee a quantity of ground locusts or sweet pods of the carob tree.

1404. Governors for Regulating Speed of Steam Engines, &c., *W. H. and J. Sutcliffe.—30th March*, 1881.—(*Not proceeded with.*) 2*d.*

Two small reservoirs partly filled with mercury or other substance are connected together at the bottom by a horizontal tube; midway between the reservoirs there is a fulcrum or bearing on which the tube carrying the reservoirs rests and is free to rock.

1405. Springs for Pistons, *D. Blackadder.—30th March*, 1881. 6*d.*

The spring is made of a rod or wire of steel, formed with a series of coils or spiral springs at equal distances from each other, and all of equal height and connected by the continuation of the rod or wire.



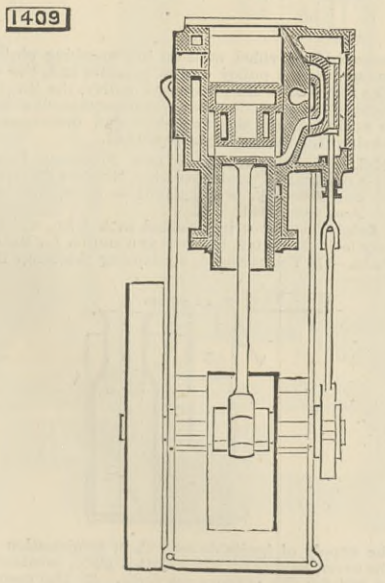
When a sufficient length is formed, the whole is bent into a circle of the desired diameter and the ends secured together. The drawing shows the spring placed in position in the piston ring, A being the coils, and B the rod or wire connecting them together.

1408. Breech-loading Fire-arms, *J. J. Atkinson.—30th March*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to an arrangement of locking projections and movable breech block.

1409. Gas Motor Engines, *J. E. A. Gwynne and W. I. Ellis.—31st March*, 1881. 6*d.*

Each piston is constructed with a trunk on one side of it, or a larger trunk on one side than the other.



The contents of the end of the cylinder which has the greater capacity are partially compressed into the other, so that the mixture of air and gas is then exploded under pressure, and does work by the greater force exerted in the end of greater capacity than is exerted in the smaller end.

1418. Looms for Weaving, *W. Strang.—31st March*, 1881. 6*d.*

Jacquard pattern mechanism and harness are used, together with two or more shuttles, and the arrangements are such that at some parts of the same pattern single shots can be laid of any one of the wefts, whilst at other parts two or more shots of the same weft may follow each other without change.

1419. Reservoir Pen Holders, *T. A. Hearson.—31st March*, 1881. 6*d.*

This consists of an ink holder carrying at one of its ends a pen enclosed within a thin flexible nozzle, with the exception of the point of its ribs, whilst the opposite end of the holder is closed with the exception of a small air tube projecting inwards from it, the inner end of which air tube is or is not fitted into a chamber that is closed, with the exception of a small air hole at the bottom.

1420. Glazing, *J. Russell.—31st March*, 1881. 6*d.*

This consists of a sash bar or rafter grooved or rebated at the sides, in combination with a covering strip of sheet lead or other material applied upon it and folded or doubled under and over the edges of the glass.

1421. Punching or Perforating Cheques, &c., *C. G. Beddoe.—31st March*, 1881—(*Not proceeded with.*) 2*d.*

This consists in the employment of two perforated face-plates or surfaces between which the material to be punched is inserted. The punches correspond with the face-plates.

1422. Production of Electric Light, *W. Crookes.—31st March*, 1881. 4*d.*

This relates to the removal from the carbons as used by Swan, Edison, Maxim, Lane-Fox, &c., of the impurities by means of acids, &c., and thus obtaining pure cellulose.

1424. Manufacture of Acetate of Soda, &c., *W. G. Forster.—31st March*, 1881. 4*d.*

To impure acetate of lime is added a small proportion of water and hydrochloric acid vapour is passed through it. To the solution is added spirit of wine or amylic or methylic alcohols. The solution is then distilled. To acetic ether so obtained is added a caustic alkali, and the mixture is heated in a still. Spirits of wine may be condensed and recovered, and acetate of lime, together with a little acetate of soda, are obtained.

1427. Measuring Contents of Cuttings, Embankments, &c., *J. Imray.—31st March*, 1881.—(*A communication from J. Canale.*) 6*d.*

This relates to the employment of graduated rules by which on a plate or frame a model profile of the cutting or embankment is presented, which by other rules can be divided into triangular or trapezoidal portions, the measurements of which are shown to scale on the graduated guides and rules.

1428. Production of Colouring Matters, *C. D. Abel.—31th March*, 1881.—(*A communication from H. Koechlin and O. Witt.*)—(*Not proceeded with.*) 2*d.*

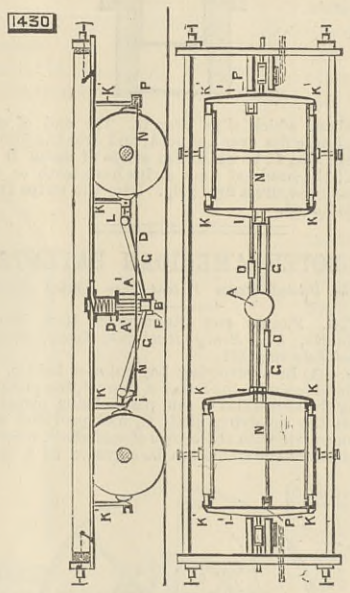
This relates to the production of blue and violet colouring matters of a very pure and inexpensive nature by the utilisation of the reactions that take place when nitrosed derivatives of the tertiary aromatic amines or the phenoles, or the bodies known as chloroquinonimides are put in presence of the alkaline or ammoniacal salts of the phenoles.

1429. Sanitary Receptacles and Appliances, *J. Turner.—31st March*, 1881. 8*d.*

This consists essentially in the combination with a sanitary pail or receptacle of a perforated false bottom, for the purpose of allowing any contained liquid therein to percolate and fall on to the pail bottom.

1430. Railway Brakes, *E. W. Furrell.—1st April*, 1881. 6*d.*

This consists in the mechanical arrangement, taken as a whole, of "knee" levers G formed at their meeting ends with ball-and-socket or other joint B



carried in yoke or head F which works in guide A A^1, in combination with cylinder A and piston D, and in combination with extension bars I I^1, connecting rods N, adjustable nuts O O, springs P, and hangers K K^1, for applying brake blocks to the peripheries of the wheels of a railway carriage or other railway vehicle.

1431. Knitting Machinery, *W. Morgan-Brown.—1st April*, 1881.—(*A communication from H. Schuerer.*) 10*d.*

The object is to enable the production of not only plain, flat, one-coloured web, but also of two or more coloured patterns of all possible shapes. This result is chiefly obtained by peculiarly-formed needle guides, arranged in the bed in rows behind the needles, which are pushed forward by a pushing comb or pushing bar, and which are moved in the required manner by peculiar V-shaped grooves in the cam.

1433. Keyless Watches, *C. H. Errington.—1st April*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the mode of setting the hands, and also of jointing the movement in the case.

1434. Disinfectant and Deodorising Apparatus for Water-closets, *H. Barron.—1st April*, 1881.—(*Not proceeded with.*) 2*d.*

The apparatus consists of a cistern placed above the water-closet pan and filled with any suitable liquid disinfectant or deodoriser. From this cistern two pipes lead, one to the upper rim of the closet pan, and the other to the neck of the syphon under the pan valve, or into the container at the back of the pan valve, down both of which pipes the disinfectant or deodoriser falls by its own gravitation.

1436. Photography, *L. Warnerke.—1st April*, 1881. 4*d.*

This consists in removing by solution the parts of the colloidal body in which silver is not precipitated by the agency combined of light and developer, and by applying solvents to the side of the film opposite to the surface on which the light has acted.

1438. Keyless Puzzle or Permutation Locks, *H. Lunt.—1st April*, 1881.—(*A communication from L. Lunt.*)—(*Not proceeded with.*) 2*d.*

This relates to the construction of keyless puzzle or permutation locks, by which great simplicity of construction is attained.

1440. Preventing the Explosion of Kitchen Boilers, &c., *B. Giles.—1st April*, 1881. 6*d.*

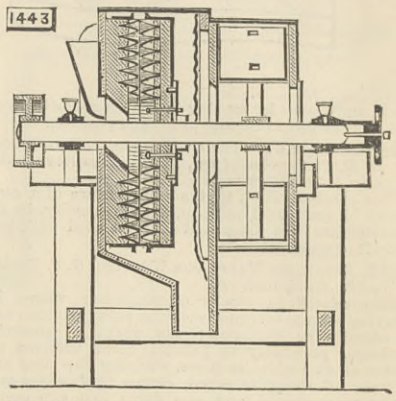
This relates to means for ensuring the rupture of the cover which closes the escape tube for the water from overheated domestic boilers.

1442. Electric Batteries, *F. Rola de Wolski.—1st April*, 1881.—(*Not proceeded with.*) 2*d.*

The object of this invention is to reduce the interna resistance of cells by limiting the electric action to the opposing surfaces of the electrodes, the reverse surface of either or both these being rendered inactive by coating with an insulator or otherwise.

1443. Cleaning or Scouring Grain, *L. Gathmann.—1st April*, 1881. 6*d.*

This consists essentially in setting the bristles or filaments of the brushes at an incline backward with reference to the direction of relative motion of the



brush, and in locating a screen between the brush chamber and the fan chamber, which arrests the grain while allowing the draught to be made so great as to perfectly draw off the dust.

1444. Millstones, *W. R. Lake.—1st April*, 1881.—(*A communication from E. H. Streitz.*) 6*d.*

This consists essentially of a millstone provided with a hardened or chilled cast core or centre piece capable of vertical adjustment within an iron casing, to which the grinding part of the stone formed of French or other suitable buhr is attached.

1445. Machinery for Manufacture of Hair Felt, *J. Erskine.—1st April*, 1881. 6*d.*

This consists in driving the upper and lower plates of the machinery from cranks or excentrics on a shaft arranged and communicating motion to the said plates.

1446. Venetian Blinds, *T. Kauffmann.—1st April*, 1881. 6*d.*

This consists partly in the conical form of the guide for the cords, upon a cylinder in connection with guide rollers to wind up the cords.

1448. Regeneration and Recovery of Hydrochloric Acid Used in Treatment of Bones, *W. R. Lake.—1st April*, 1881.—(*A communication from the Société Coignet Père et Fils et Cie.*—(*Not proceeded with.*) 2*d.*

Sulphuric acid is added to the liquor obtained in the treatment of bones by hydrochloric acid.

1450. Safety and Alarm Apparatus for Kitchen Boilers, *R. McDonald.—2nd April*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a ball float which controls a valve leading to an alarm whistle.

1451. Using a Liquefiable Gas or Vapour at Low Temperature as a Motor Fluid, *J. C. Mewburn.—2nd April*, 1881.—(*A communication from J. Gamgee.*) 8*d.*

This consists essentially in working the vapour or gas in the engine expansively to the extent of more or less complete liquefaction, then exhausting the vapour thus liquefied into a suitable receiver, thence conveying it to a boiler, where it is subjected to the low degree of heat needed to bring it again to the condition of the motor gas or vapour, and thence returning it to the engine to again go through the same cycle of operations.

1454. Dyeing and Printing, *W. and H. W. Brown.—2nd April*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the mode of effecting the more permanent dyeing or fixing of aniline colours upon and on the materials.

1455. Looms, &c., *J. Wood.—2nd April*, 1881. 6*d.*

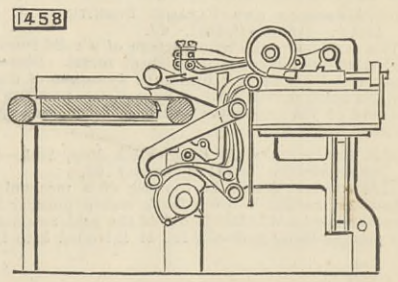
This relates to an apparatus fitted to looms for delivering the warps at any required equal pressure or tension from end to end as the weaving operations continue, by which means the warps are prevented from stretching or twisting.

1457. Ventilating Apparatus, *R. H. Reeves.—2nd April*, 1881. 6*d.*

This consists in the arranging or combining parts with corrugated surfaces forming ventilating apparatus.

1458. Apparatus for Feeding Sheet Paper to Printing Machines, &c., *P. M. Justice.—2nd April*, 1881.—(*A communication from the Sedgwick and Stuart Manufacturing Company, Incorporated.*) 8*d.*

This relates partly to a machine for feeding sheet paper, having a movable table secured to nuts working upon vertical screws, by which the said table is raised or depressed, the said nuts being provided with extensions or guide plates, to each end of which are attached friction rollers, which move in grooves or



passage-ways formed upon the side of the main frames by raised beads, ribs, or equivalent thereof, thereby relieving the vertical screws which operate the table or support for the paper from any undue lateral strain in case a heavy body of wide paper should be piled upon the feed table, and the weight be greater upon one side of the centre of said table than the other. Various other improvements are described. The drawing is a view in section, as seen from the left-hand side of the machine, with left-hand frame removed to show more plainly the cams that actuate the various levers and other operating mechanism.

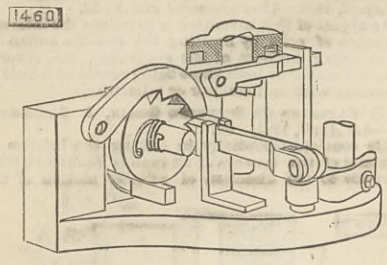
1459. High-pressure Ball Cocks and Air Valves or Air Inlets Combined, *W. Baird.—2nd April*, 1881.—(*Not proceeded with.*) 2*d.*

One valve acts thoroughly for emission of water and inlet of air, when the cistern is either full or partially full. If the stop cock in the lower part of the house is shut, and any of the cocks between aforesaid stop cock and ball cock is opened, the valve at once falls back, admitting air, and consequently the pipe empties and prevents freezing and bursting.

1460. Controlling the Operation of Rakes of Harvesters, &c., *G. E. Vaughan.—2nd April*, 1881.—(*A communication from the Johnston Harvester Company.*)—(*Complete.*) 6*d.*

This relates to a tripping mechanism, and consists partly in the combination with the latch or part to be

tripped of a reciprocating tripping wheel, means for moving the tripping wheel in one direction to trip the



latch, and means for moving it in the opposite direction to return it to its first or normal position.

1461. Condensed Milk having Medicinal Properties, *A. M. Clark.—2nd April*, 1881.—(*A communication from R. Bravais.*) 4*d*.

This consists, First, in the manufacture of a compound of condensed milk and tar; Secondly, in the manufacture of a compound of condensed milk and extract of meat.

1502. Repairing Warps for Weaving, *G. C. Taylor.—6th April*, 1881. 6*d*.

This relates to means of preparing warps for weaving so as to dispense with the sizing process, and it consists in subjecting the warps to powerful pressure, preferably by passing them between the plates of an hydraulic press, whereby the time and expense of sizing is saved, warps that will weave better are produced, and also knots that slip easier through the reed, and dyed warp not liable to fade, besides softer woven fabrics are produced with greater economy.

1519. Cravats and Neckties, &c., *J. Hinkes, T. Hoop, and F. R. Baker.—7th April*, 1881. 6*d*.

The cravat consists of a central part with a pendant end attached to both ends thereof, so that they may be turned down at right angles to the central part, or form one continuous length therewith, metallic bars acted on by springs connecting the whole together, and serving to retain the three parts in the required positions. The invention further relates to improvements in lever fastenings for securing the ends of the bands of cravats.

1525. Fastenings for Boots, Shoes, Gloves, &c., *W. R. Lake.—7th April*, 1881.—(*A communication from T. L. Jacobs.*) 6*d*.

This consists of a tongue provided with loops or divided rings, in combination with a flanged welt or strip, attached to the divided ankle portion of a boot or shoe.

1535. Horseshoes, &c., *J. P. Rothwell.—7th April*, 1881. 6*d*.

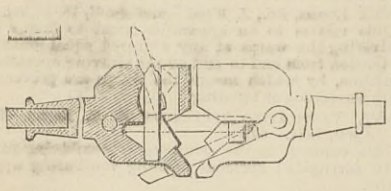
Recesses or slots are formed in the interior rim of the shoes, and into them slide caulks or projections to prevent the horse slipping, such caulks being secured by binding screws. The shoe is made in two parts hinged together, and is secured to the hoof by means of straps instead of nails, the straps passing through the hoof and shoe, and being secured in position by nuts.

1559. Supports for Photographic Films, &c., *A. Pumphrey.—9th April*, 1881. 6*d*.

This consists in pouring upon a sheet of glass or other flat surface plain or uniodised collodion, allowing the collodion to set, removing the marginal portions of the collodion film, and pouring over the collodion film and the marginal portion of the glass or surface from which the collodion film has been removed, a solution of gelatine either with or without chrome, alum or other hardening material, upon which compound film, when dry, the gelatine or collodion emulsion is poured, or other vehicle, either containing the silver compound sensitive to light or charged with the salt, which, in contact with a solution of nitrate of silver, will produce a surface sensitive to light.

1588. Coupling Apparatus for Railway Vehicles, *W. R. Lake.—12th April*, 1881.—(*A communication from W. Scott.*) 6*d*.

This consists essentially in a coupling apparatus for railway vehicles of the draw-heads, each constructed with an upper and a lower jaw, having an opening



between them, and provided with a swinging link hung thereto, in combination with a suitable shackling pin in each head, adapted with the said jaws to hold the shackling link, which is in and between such jaws.

1604. Astral Lanterns, *F. H. Bailey.—12th April*, 1881.—(*Complete.*) 6*d*.

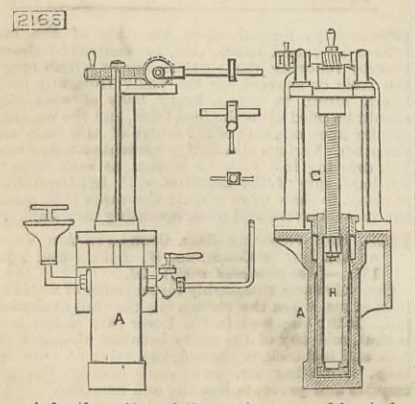
The object is to facilitate the study of astronomy by means of an instrument that will accomplish the work of an atlas of the heavens, celestial globe, planisphere, and lantern for either day or night use.

1610. Umbrella and Parasol Furniture, *G. G. Lusher.—13th April*, 1881. 6*d*.

This consists in the manufacture of a solid runner with a solid notch made from sheet metal. Discs of sheet metal are formed into cups by means of dies, and the notch part is formed by applying pressure to the end of the cup, after which it is grooved and finished in the usual way.

2165. Lubricators, *F. Wolff.—18th May*, 1881.—(*A communication from C. Mollerup.*) 6*d*.

This consists, First, in the use of a mechanical lubricator, having a reservoir A and a plunger H, whereby lubricant is forced out of the said reservoir, the plunger being gradually fed or intruded into the



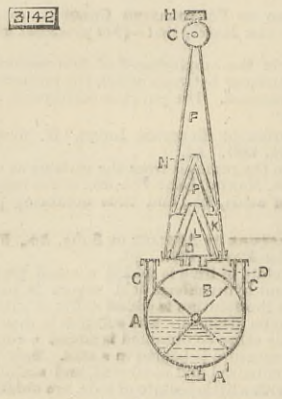
reservoir by the action of the engine or machine to be ubricated. Secondly, in a mechanical lubricator having a reservoir A, whence lubricant is gradually forced by a plunger H, causing the said plunger to be gradually fed or intruded into the said reservoir by a screw G.

2949. Cotton Ropes, *H. Birkmyre.—6th July*, 1881. 4*d*.

This consists in the manufacture of cotton ropes whereby the outer threads in each strand are rendered longer than the inner ones, and the individual threads in the several strands are enabled to bear an equal or approximately equal proportion of any strain to which the ropes may be subjected.

3142. Purifying Alcoholic Liquors, *W. R. Lake.—19th July*, 1881.—(*A communication from the Purifying and Maturing Process Co.*)—(*Complete.*) 6*d*.

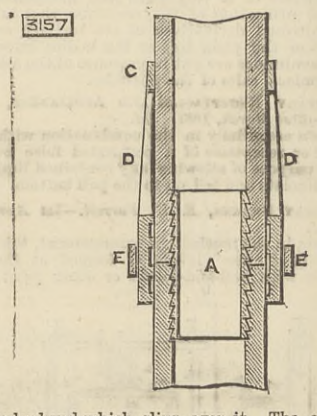
The retort A is kept half full of liquor and at a proper temperature varying from 70 deg. to 264 deg. Fah. At the outlet of retort A is a filter A^1, and one or more escape pipes C with caps. In the retort is a perforated agitator B operated by a hand crank. Into an opening at the top of the retort is set the pan D, which is sunken at its centre, where it is fitted with a pipe D^1 and a perforation. An annular ridge is formed at the edge of the pan, and receives a conductor F sur-



mounted by a barrel-shaped tank or vessel G, with a faucet at each end, and supporting a filter H. On the pan D rests a hollow cone K, within which is a smaller cone L. Over the double cone so formed is a second double cone N and P, the vapours passing between the cones and becoming condensed.

3157. Hose Coupling, *W. E. Gedge.—20th July*, 1881.—(*A communication from D. B. Kendall.*)—(*Complete.*) 4*d*.

This consists of a fastener formed by attaching strips of metal to a ring, so as to form a series of elastic tapering clamps surrounding the hose at its joint, the fastener being capable of compression by a



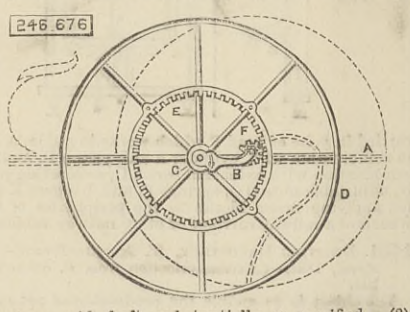
circular band which slips over it. The end of each length of hose fits over a pipe A, and over the joint is passed the ring C, to which the strips of metal D are secured; the heads of such strips have teeth or cerrugations to secure a firm grip. Over the strips D the ring E is forced.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

246,676. Frame for Revolving Hay Rakes, Tedders, &c., *Henry Hitchcock, Lyons, Mich.—Filed July 8th*, 1881.

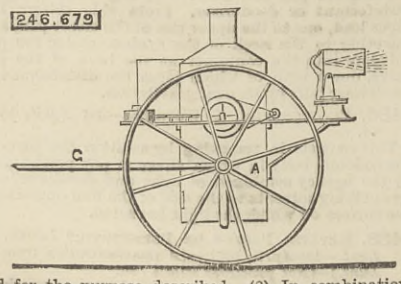
Claim.—(1) In a revolving hay rake or tedder, and in combination with the frame A thereof, the plates B, carrying the stub-axles C, said plates being pivottally hung on the revolving shaft G, and provided with slots concentric with the centre of said shaft, whereby the position of the frame can be adjusted in a radial



line from said shaft, substantially as specified. (2) The frame A, wheels D, and driving gear wheels E of a revolving hay rake or tedder, in combination with the shaft G, pinion F on said shaft, stub-axles C on the plates B, and the plates B, said plates being pivottally hung on the shaft G, and provided with slots concentric with the centre of the same, substantially as and for the purpose specified.

246,679. Light for Life-saving Stations, *Ralph S. Jennings, Baltimore, Md.—Filed May 19th*, 1881.

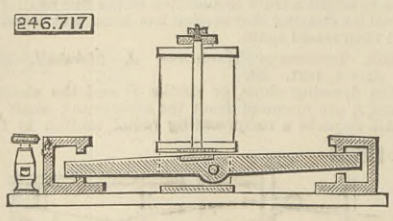
Claim.—(1) In combination with the wheeled vehicle carrying an engine and boiler, as set forth, the dynamo-electric machine, and an electric light pivotted about a horizontal and a vertical axis, as



and for the purpose described. (2) In combination with the wheeled vehicle having tongue or shafts G and boiler A, the dynamo-electric machine and the electric light, mounted, as described, at the rear of the machine, substantially as and for the purpose set forth.

246,717. Telegraph Sounder, *Charles C. Burke, New York, N.Y.—Filed April 23rd*, 1881.

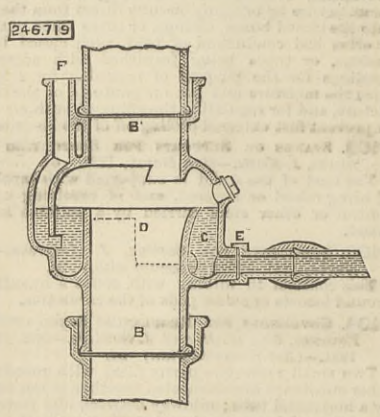
Claim.—A telegraph instrument or sounder, consisting of an inverted impending electro-magnet, in combination with a supporting frame sustaining such magnet over an underlying armature, such armature being so pivotted that an arm will project on each side of such pivot, one arm bearing the usual cross-piece or armature bar, and thereby made heavier than the other, the up movement of the heavier arm of such armature and the downward movement of its



lighter arm being caused by the attractile force of such magnet, and the down return movement or fall of the heavier arm of such armature and the up movement of the lighter arm resulting from the unequal gravity of the arms of such armature, and such arms being but one piece, a duplication of sound being produced by such movement upward and downward from the impact of the arms of such armature with stops, in combination with such armature and electro-magnet, substantially as described, and for the purpose specified.

246,719. Plumber's Trap, *Andrew Campbell, Brooklyn, assignor to Paul P. Todd, New York, N.Y.—Filed January 14th*, 1881.

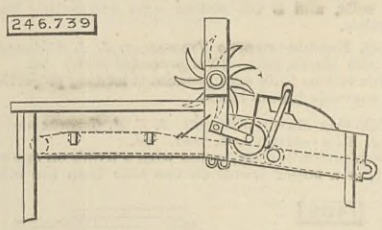
Claim.—(1) A trap for waste pipes, having an air inlet opening into the trap below the overflow lip of the trap and above the waste-inlet from the bowl or sink, and the waste inlet arranged below the normal level of the water in the trap, whereby the waste pipe is kept full of water, substantially as set forth. (2) A trap for waste pipes, arranged in the vertical main waste pipe of a building, and provided with inlets to receive the waste water from the various bowls and sinks, whereby it serves as a trap common to all said bowls and sinks, said inlets being arranged below the normal level of the water in the trap, and said trap having an air inlet opening into the trap below the overflow lip of the same and above the waste inlets, substantially as and for the purposes set forth. (3) A trap for waste pipes, arranged in the main waste pipe



as an annular basin around the tubular overflow lip, and provided with an inlet opening for the waste water arranged tangentially, or substantially at right angles to its radius, as and for the purposes set forth. (4) A trap for waste pipes, consisting of the connecting parts or necks B B^1, the annular basin C, its walls serving to connect the parts B B^1, the tubular overflow lip D, the waste water inlets E, and the air inlet F, all arranged substantially as and for the purposes set forth. (5) The trap provided with the air inlet F, the enlargement B, and the extended lip A, all arranged substantially as and for the purposes set forth. (6) The trap in the main waste pipe, provided with an annular bowl arranged around a tubular overflow lip, and the said tubular lip flared, so as to ensure its catching anything that may fall from above, and prevent such falling matter from getting into the bowl of the trap, substantially as set forth.

246,739. Band Cutter and Feeder for Thrashing Machines, *Francis M. Floyd, Centralia, Ill.—Filed June 11th*, 1881.

Claim.—The combination, in a band cutter and feeder for thrashing machines, of the cog wheel journalled at one side of the frame, with the trans-

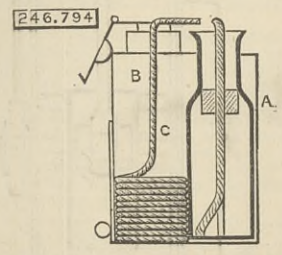


verse shaft provided with an intermeshing pinion at one end and a pulley at the opposite end, the wrist pins attached to the pinion and pulley, the links and vertically reciprocating bar, the fingers loosely attached to said bar, and the rock-shaft and mechanism for moving it, substantially as specified.

246,794. Pocket Lamp and Friction Lighter Combined, *Thomas Lawrence, Absolom C. Stratton, and James M. Wolf, Mountain Home, Ark.—Filed June 22nd*, 1881.

Brief.—The cover is provided with a lip, which not only locks the same, but acts as a snuffer for the cord.

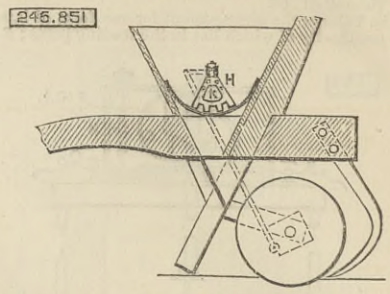
Claim.—(1) The casing A, containing the lamp B and



the supply of ignitable cord C, in combination with the cover, having lip and a slotted plate, substantially as and for the purpose set forth. (2) The casing A, containing the lamp B and the supply of ignitable cord C, in combination with the reel, removable plate, cover, and slotted plate, substantially as and for the purposes specified.

246,851. Fertiliser Distributor, *Lester C. Wofford. Woodruff, S.C.—Filed July 23rd*, 1881.

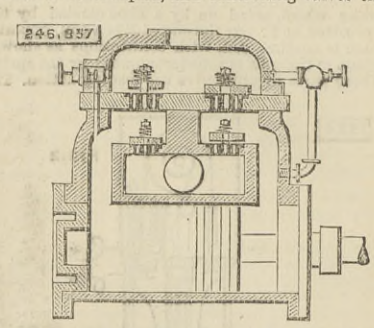
Claim.—In a fertiliser distributor, the combination with the slotted beam and the slotted curved bottom of the hopper arranged on the top of said beam of the vibratory sector-shaped agitator, its lower curved and toothed edge, its laterally projecting studs H, and



the opening K through said agitator, substantially as specified.

246,857. Air Pump for Condensing Engines, *Lucius J. Knowles, Worcester, assignor to George F. Blake Manufacturing Company, Boston, Mass.—Filed July 5th*, 1881.

Claim.—(1) In an air pump for condensing engines, the combination, with the pump cylinder, of ports or passages connecting either end thereof with a supply of water or other liquid, and controlling valves there-



for, whereby an amount of water sufficient to fill the clearance space may be admitted to the cylinder, to cause the pump valves to be positively opened, substantially as and for the purpose described. (2) The pump cylinder and piston therein, combined with the delivery chamber and small ports connecting the said chamber with each end of the cylinder, and adapted to remain open independently of the operation of the piston and pump valves, substantially as and for the purpose described.

CONTENTS.

The Engineer, November 4th, 1881.

South Kensington Museum.—Visitors during the week ending Oct. 29th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 8793; mercantile marine, building materials, and other collections, 2572. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1376; mercantile marine, building materials, and other collections, 286. Total, 13,027. Average of corresponding week in former years, 14,172. Total from the opening of the Museum, 20,456,683.