given. The omissions are nearly as complete in the results given of the tests of the blast fans, but with a fair assumption, a quantitative examination may be made of the work done in Test 10. In the text of the report reference is made to Test 10, pointing out that the energy in the air delivered due to its issuing velocity is equivalent to 3·805-horse power, about 78 per cent. of 4·902, which is supposed to be the total horse-power delivered to the fan. But the air is presumably being delivered with a pressure in excess of the atmospheric pressure, and on account of this work is being done equal to excess pressure per square foot × volume delivered in cubic feet amounting to 1·55-horse power per inch of water. This is in addition to the velocity energy. In Test 8, made half an hour earlier, the conditions are very similar to those of Test 10, and in which the water gauge observation is given as 8in. If this is correct, and we make the natural assumption that the gauge height is proportional to the square of velocity of periphery, 7·6in. will be the height for Test 10, and it would appear that work equivalent to 11·8-horse power is being done in delivering the air with pressure, in addition to 3·8, due to delivering it with velocity. Thus if the observations of the quantity of air and pressure are correct, those of indicated horse-power must be seriously wrong. Probably each of the quantities is in error, for with the given velocity of periphery and delivery, the horse-power delivered to fan would probably amount to 10½ or 11.

The quantities in the tables not being consistent with one another, I retain my faith in the expression $\frac{(\text{velocity of periphery})^2}{g} =$ maximum possible head. In Test 8, with the air density assumed in the report, this is equivalent to 7·1in., and is subject to large deductions in actual experiment. The quoted 8in. is somehow fictitious.

I still withhold my belief that there is any real advantage to be derived from the use of the constricting cylinder in the Capell fan.

THOS. A. HEARSON.

Royal Naval College, Greenwich, March 31st.

THE CREATORS OF THE AGE OF STEEL.

SIR,—Without wishing to be offensive to Mr. W. T. Jeans, I must say that it is useless to continue the attempt to make him see the ground of Mr. Mushet's claim to an important share in the invention of pneumatic steel until he has learnt to distinguish between metals and their oxides. When he has learnt this elementary chemical lesson Mr. Jeans may be convinced that metallic manganese can be made to take up oxygen when the oxide would be quite useless for the purpose. Let him thoroughly understand this fact, and it will surprise me if he does not acknowledge his mistake, and give Mr. Mushet the credit that belongs to that gentleman.

Mr. Mushet has seen well to thank me for the brief notice of his addition to the steel processes contained in the hasty review that constituted my lecture on "The Steel Age." That his work should be so ignored as to impel him to this course on so slight an occasion is a painful reflection on contemporary metallurgical history. When it is considered that Mr. Mushet's process after nearly twenty-eight years is conducted exactly as he patented it, even in the minutest details, and that it is the necessary adjunct to every cheap steel-making process, we may well grieve to think that its inventor should have met with a fate so akin to that of Belisarius.

Landore, March 29th. F. J. R. CARULLA.

SIR,—In your last week's number Mr. W. T. Jeans has brought another of his "inexorable facts" to light in connection with my "manganese incident" and Sir Henry Bessemer's blast incident. No disparagement of the latter intended here. On the 4th January, 1856, Mr. Bessemer, in his patent of that date, proposed to put about 1 or 2 per cent. of oxide of manganese into his converter when he was intending to make steel. I, on the other hand, did not make a similar proposal until 16th September, 1856; therefore clearly for this particular branch of the pneumatic process, Mr., now Sir H. Bessemer, has the very clearest claim for priority over me. The fact is as inexorable as Mr. Jeans himself. But the result of putting 1 or 2 per cent. of oxide of manganese into the Bessemer converter does not steelify the metal, whilst putting in my triple metallic compound of iron, carbon, and manganese does steelify it.

It only remains for Mr. Jeans to demonstrate that oxide of manganese acts like my triple metallic compound, and then his case is fairly made out. "Up," Mr. Jeans, "and at it," paraphrasing the memorable words of Wellington at the fight of Waterloo. Mr. Jeans will then be a steel creator indeed. The spiegel and ferro men will have to close their works, and the triple metallic compound, which is a nuisance as irrepressible and pervading as the somewhat unpleasant thing which used to follow Dr. Faustus about, will be relegated to the abode of the Hartz demon. Nobody puts oxide of manganese into the converter. No one ever made steel by doing so; and if Mr. Bessemer did thus produce steel he was the first and the last man to do so, and the anomalous exception did but confirm the rule. When Mr. Bessemer proposed to put oxide of manganese into the converter, had he said metallic manganese, instead he would have gained the prize; but I happened to know the winning number and he did not. The Americans seem now to hold that I am the chief creator of the age of steel.

April 1st. R. F. MUSHET.

SIR,—If Mr. Jeans had taken the trouble to consult Sir Henry Bessemer, before he wrote the book "The Creators of the Age of Steel," he would have saved those who knew the facts the trouble of correcting him, and would not have appeared before the public as a man who does not know the difference between the oxide of a metal and the metal itself. Sir Henry Bessemer would have told him that the process of steel making, manganese oxide or not, was a complete failure until Mr. Mushet introduced the use of metallic manganese. The history of Mr. Bessemer's struggles to make steel, his abandonment of the whole process after an expenditure of over £10,000, its resumption and its ultimate success, thanks to Mr. Mushet, are so well known that nothing but astonishing ignorance can excuse Mr. Jeans for writing as he has done.

Mr. Jeans can make inquiries if he pleases. Let him cite any instance in which, say, a single ton of good steel rails has been made by the use of oxide of manganese alone, as patented by Bessemer in 1856, and I will admit that some credit may be claimed for the invention; but this does not affect the fact that not an ounce of steel is made under Bessemer's 1856 patent now, while Mushet's process is in use in every steel works in the world.

Mr. Jeans has apparently a great deal to learn. Let me hope that the correspondence which has appeared in your journal will have enlightened him on one point at least. That it can teach him how Bessemer metal is really made would be too much to expect.

SPIEGEL.

London, April 1st.

NEW TRAMWAY RAIL.

SIR,—Please accept my thanks for so readily according me a space in your journal illustrating a section of my new tram rail, and for your remarks thereon.

With regard to your remark, "that the rail may gradually become loose," I agree with you that if the key is put in rather tight, &c., this will not occur. About 1200 tons of this form of rail of my invention, with a steel T-shaped head between angles, secured together with ⅞in. diameter bolts at 16in. centres, were in use on the South-Eastern Railway between Charing-cross and Newcross for about fifteen years, or until the head was worn out, carrying 600 trains per day, and a short length of it is still in use. A similar rail, with a grooved head, is laid entirely on the Deptford, Battersea, and other tramways, the lower rivets of which are ⅞in. at 2ft. centres, and the upper rivets ⅞in. at 6in. centres. This form of rail has been in use for some years without any signs of failure or loosening, either in the jaw or rivets, and the top rivets have to resist a greater strain than the new rail we are discussing. The inclined top and internal face of the jaw of my new rail, as shown, can both be cut in the same roll, which insures absolute similarity of section.

I may here add that my rail, as used on the South-Eastern Railway, when bolted together and cut up in short lengths as samples, was often mistaken as being in one piece, so beautifully true were the parts rolled and fitted.

GEO. P. L. MEAKIN.

Kingston-on-Thames, April 1st.

HILL-CLIMBING TRICYCLES.

SIR,—I think it is useless to reply to Mr. Lawson. His riding upstairs on a tricycle is riding a hobby, and must remain a question of personal choice. I will leave it for your readers to judge of my mechanical knowledge.

Mr. Lawson thinks I have never seen his machine; I can tell him that I have both seen and tried it, and was also an eye witness at the Sportsman's Show; but my opinion is not in the least altered respecting its inferiority to other tricycles, both as regards its safety and propulsion.

Mr. Lawson would have done himself more justice in his last letter had he told us how he gets any approach to vertical position on a 45in. wheel. I make it that with a 32in. or 34in. length of leg, the seat would have to be placed at least 10in. above the wheel, and ask any sane person if that is a safe position on a tricycle. The position of the rider would also require to be brought considerably forward, which would very much reduce the brake power, and add to the danger in the shape of a fall.

Granting the free pedals on the modern machine, it in no way adds to propulsion or its main defect, want of safety. Therefore my contention remains: (1) That it was unfair to test one machine with the dynamometer and publish results, while there were many machines equally good for all-round work; (2) That stair-riding is not a legitimate test, but an abuse rather than use of a tricycle; (3) That the stability and safety of the "Royal National" is worse than any tricycle, including those of narrower gauge, while the power of propulsion remains the same as others. With regard to the challenge, I have said I have no interest to advertise any machine, therefore I do not see why I should contest personally. I have no doubt but that the makers of the "Merlin" would accept the task. At the same time I am willing to show anyone what I can do on the machine if they care to come to me, and we have have some hills around Reading quite as steep as any round Coventry.

My experience is that seven or eight miles per hour is near fair travelling, and in any case of test I should want the maximum pressure as applied to the treadles during an hour's run registered on each machine, otherwise it would be the man tested instead of the tricycle.

H. ALDRIDGE.

Reading, March 31st.

GAS ENGINES.

SIR,—If your correspondent "W." will kindly refer to the second volume of THE ENGINEER for 1864, page 39, he will there find the consumption of gas in the "Lenoir" engines given as stated in my letter to you of the 11th inst.; he will also find at same page and volume the same quantity given by another correspondent, "Progress." As to M. Tresca's experiments in 1861, do not attempt to explain the very different results he obtained from mine. I may, however, presume he operated on an engine of French manufacture, and, as I believe, of inferior workmanship and design. Before commencing the construction of these engines in England in 1863, I went carefully over the details of the French engines and made many alterations and improvements. I found the design of the pistons faulty; they were not tight, and the springs very much too strong, thereby absorbing a large proportion of the power available. These were altered and many other details were improved, so that it is just possible that the decreased consumption of gas in my experiments might, in a great measure, be due to that cause. Then M. Tresca's experiments were doubtless made upon one or two engines alone; mine were conducted over many, for every engine was tested with the dynamometer before it was passed as complete.

Your correspondent "W." very pertinently asks what has become then of all these Lenoir engines? I cannot answer that question, but I dare say since 1864, or twenty years ago, many improvements have been introduced, and one of vital importance, viz., the method of igniting the gas. In the Lenoir engine this was accomplished by an electric spark, generated by a battery and Rhumkorff coil, requiring daily alteration and a replacing of acids. This caused endless trouble, either from carelessness in adding the proper proportion of acids, or, in many instances, the entire neglect of the attendant to this matter. Again, the spark was introduced through the top and bottom covers of the cylinder, and the slightest portion of grease from the oiling of the piston getting on to the point of the inflamers would be sufficient to prevent the explosion. This necessitated the stopping of the engine, withdrawing, wiping, and replacing them in their proper positions, and this perhaps was repeated several times each day. That being so, is it to be wondered at that a certain positive and uniform jet of gas for effecting the explosion should supersede the employment of an uncertain electric spark? This, it appears to me, is a very sufficient reason why the Lenoir engines are displaced by the present improved gas engines.

JOHN PINCHBECK.

9, Victoria-chambers, Victoria-street,
March 31st.

WHAT IS FRICTION?

SIR,—Referring to Mr. Snowdon's letter on the nature of friction, there is no doubt in my mind that his lucid explanation of the oil pressure phenomenon is the correct one. Oil, owing to its viscosity, takes a certain time to be squeezed out from between two surfaces. If one of these surfaces is smeared with oil, and moved past the other surface so as to carry the oil in quicker than it can flow out, the oil is necessarily carried in and is subjected to whatever pressure may exist between the two surfaces. The gradual increase of the pressure no doubt assists, if it is not essential to this action. You will be glad to know that some further experiments with pressure gauges to find the quantity and the number of the distributions of the pressure in a bearing are about to be tried. Many people have expressed great astonishment at the extraordinary low co-efficients of friction given by the late experiments. In engineering text books the co-efficient of friction for lubricated bearings is put down at between $\frac{1}{10}$ and $\frac{1}{70}$, whereas our experiments showed that it is between $\frac{1}{350}$ and $\frac{1}{660}$, and that by the most meagre lubrication possible it could not be reduced much below $\frac{1}{100}$. So that in round numbers the co-efficients given in the text books are from ten to thirty times too high. The heat which would be generated with, say, a co-efficient of $\frac{1}{10}$ would be such as to prevent such a bearing working except at very low speeds, as will be shown by the following calculation. Suppose a bearing running with a surface velocity of 300ft. per minute, and loaded with a pressure of 500 lb. per square inch. Suppose a co-efficient of $\frac{1}{10}$; the amount of work expended per square inch will be 50 × 300 = 15,000 foot-pounds per minute = 1166 units of heat per hour. Now it is said that a square foot of surface of a locomotive firebox will evaporate a cubic foot of water per hour, which is equivalent to 416 units per square inch per hour, so that a co-efficient of friction of $\frac{1}{10}$ gives 2·79 times the heat per unit of surface passing through the plates of a locomotive firebox. A co-efficient of ·03585 would, with a load of 500 lb. and a speed of 300ft. per minute, just give 416 units per hour per square inch.

When we consider the difference of temperature which causes this rate of transference of heat in the locomotive firebox, it seems probable that in order to obtain a similar rate of transference of heat from the bearing to the surrounding air, something like the same difference of temperature would have to exist, or in other words, the bearing would have to be nearly whitehot. Indeed, looking at the matter from this point of view, it seems difficult to understand how a bearing can run with a co-efficient as high as $\frac{1}{10}$. It probably could not if it was not that the square inch which we have been considering is connected to a mass of metal exposing a great many square inches of surface to the air. The explanation of why bearings run without becoming red-hot is to be found in the fact that the co-efficient of friction is in reality more like ·0035 than ·035, and even then the heat generated must be equal to the evaporation of 1·2 cubic inches of water per square inch of bearing per hour.

BEAUCHAMP TOWER.

19, Great George-street, Westminster, S.W., April 2nd.

HIGH SPEED LOCOMOTIVES.

SIR,—I am somewhat surprised that no one has commented on your suggestive articles on this subject, and more particularly on the estimate of resistance, 40 lb. per ton, which you give. My own experience goes to show that at speeds up to 60 miles an hour it is much less than this, possibly not more than 28 lb. per ton, but that at higher speeds it rapidly augments.

As bearing on this, I may say that the Great Britain broad gauge engine has done 53¼ miles in forty-seven minutes. The train weighed, engine and tender included, about 100 tons. Experiments carried out by Babbage with a dynamometer van showed that the gross resistance at 75 miles an hour—the highest speed attained—was 42 lb. per ton on a level. The engine indicated nearly 1000-horse power. I trust these facts may be of interest. I think it will be found that with 9ft. wheels it will be impossible to get the requisite grate surface, but not with 6ft. 6in. wheels. On this point I may have more to say.

J. D.

Swindon, April 2nd.

THE LENOIR GAS ENGINE.

SIR,—Will you kindly allow me to correct an error in my letter, which appeared in your last issue? "670 foot-pounds" should read "670 pound-degrees Fah." W.

Fulham, March 31st.

COAL GRINDING AND CIRCULATING WASHING MACHINERY.

THE accompanying engravings illustrate coal grinding and washing machinery constructed by Mr. E. Hall, of Savile-street, Sheffield. The washing machine works thus:—The wet coal grinding mill, manufactured by Mr. Hall, is shown in Figs. 1 and 2. A is the main framing of cast iron, with a hollow girder passing all round, upon which are cast the main bearings for the beater shaft F running in phosphor bronze half brasses, with caps and bolts and suitable lubricator cups fitted with covers and suitable provisions for carrying needle lubricators and glass bottles. B is a wrought iron cover, to which is attached a suitable wrought iron feed hopper and shuttle. The periphery of the cover has four openings at R, with lids for ventilating the mill casing. C is a wrought iron circular cage, with suitable grooves cut therein for segmental grates of steel with bars of truncated V section, the two plates forming the sides of the cage are held together by suitable distance pieces I with nuts. D are two friction rollers secured to bearings in the main frame A, upon which the cage rotates by means of a turned ring resting thereon on one side; the other side is supported in a bearing on the main frame by a long hollow turned steel flanged boss, upon which is keyed a large spur wheel P for rotating the cage C by means of a pinion and wrought iron pulley O and shaft at the outside. E is the centre boss, with suitable recesses planed out, into which are fitted wrought iron beaters U, steeled on both sides, and hardened wrought iron turned covered plates secured by turned bolts and nuts. F is the steel shaft, upon which is keyed the driving pulley T and beater boss E; H, segmental grates of steel; I, distance pieces or bolts; K, square shaft on which the star wheels L are fixed for clearing and keeping open the interstices of the grates when wet and clogging substances are being ground. These are supported in bearings in two ⊔ brackets N, and a toothed bar passes between the star wheels to clear them. The star wheels are driven round by the cage; O is a driving pulley for rotating the cage by its gear.

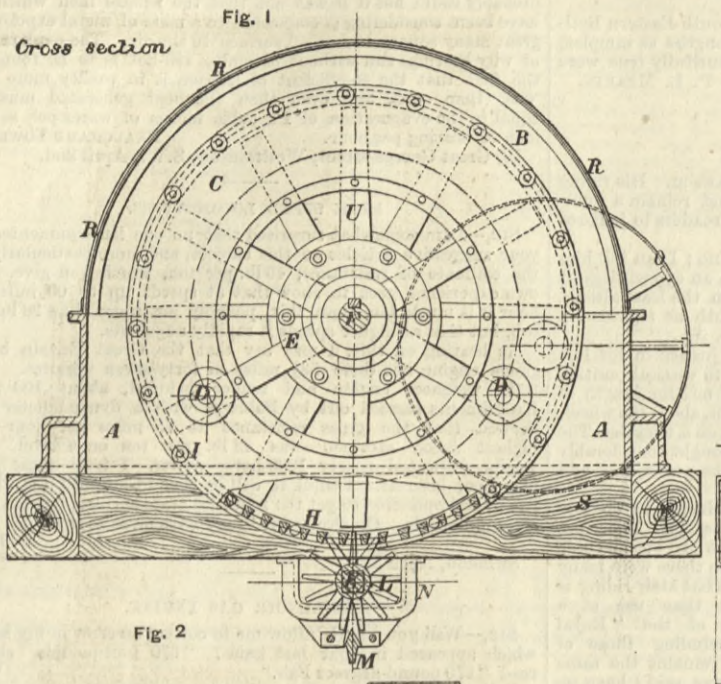
The whole is mounted upon beams 12 by 12 fixed upon concrete or masonry. The beaters rotate at a high speed, the cage at a reduced speed, sufficient only to keep the spaces open. The material fed in is dashed against the steel segments and forced through, the delivery being all round, and aided by the forced current of air raised by the beater. This machine will grind and mix 150 tons of wet coal per day, which produces a very dense and uniform coke. It is the only machine, we believe, which enables the coke-maker to grind and mix the coal after passing from the washing machine.

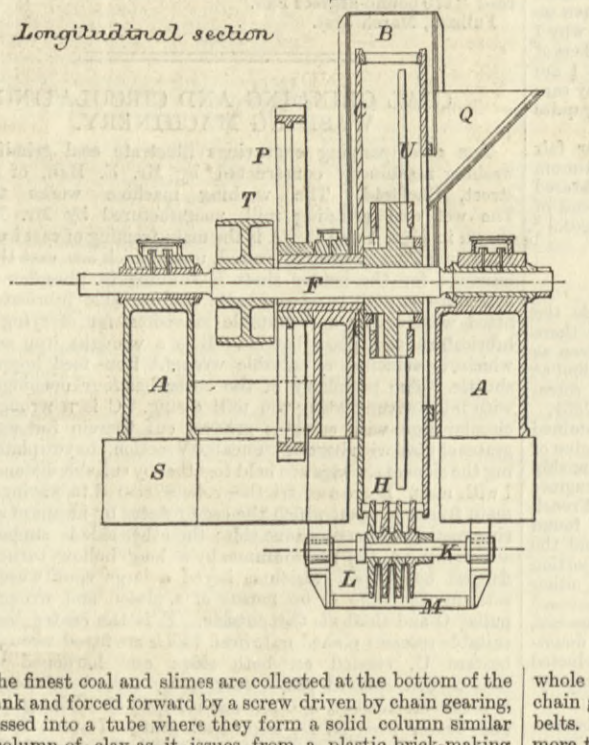
The small coal is placed in a hopper 6, having a square shaft with a suitable horizontal feed worm working the coal forward across the width of the machine and delivering it out through the bottom of the U-shaped trough by means of shuttles or doors fixed in the frame to regulate the quantity supplied to each "bash" marked 5. Water having first been turned on to fill the tanks, as shown, the washer is set in motion by a countershaft and gearing, working a double-throw crank, which reciprocates the two plunger pistons 3 in the cylinders, so that the water is drawn down the outer tank through the foot valves 4 on each side of the pistons; a large delivery valve diaphragm 4 allows the forward stroke of the piston to force the water through the said valves into the inner tank and out through the perforated copper plate, upon which rests the dirty coal, but they close immediately on the return stroke, thus preventing any suction and giving the greatest facility for the lighter portions, *i.e.*, coal to float to the top, whilst all impurities, being heavier than coal, descend rapidly and deposit themselves according to specific gravity nearest the perforated plate. The continued pulsation thus set up, combined with the direction given to the water and the inclined plates, causes the dirt to pass forward without again mixing with the upper strata of clean coal, and when a sufficient quantity of dirt has accumulated a long valve is opened by the bell-cranked lever, it is delivered into the inner tank, where it settles upon the dirt screw 7, and is wormed out in the solid tube at 7 into a dirt truck.

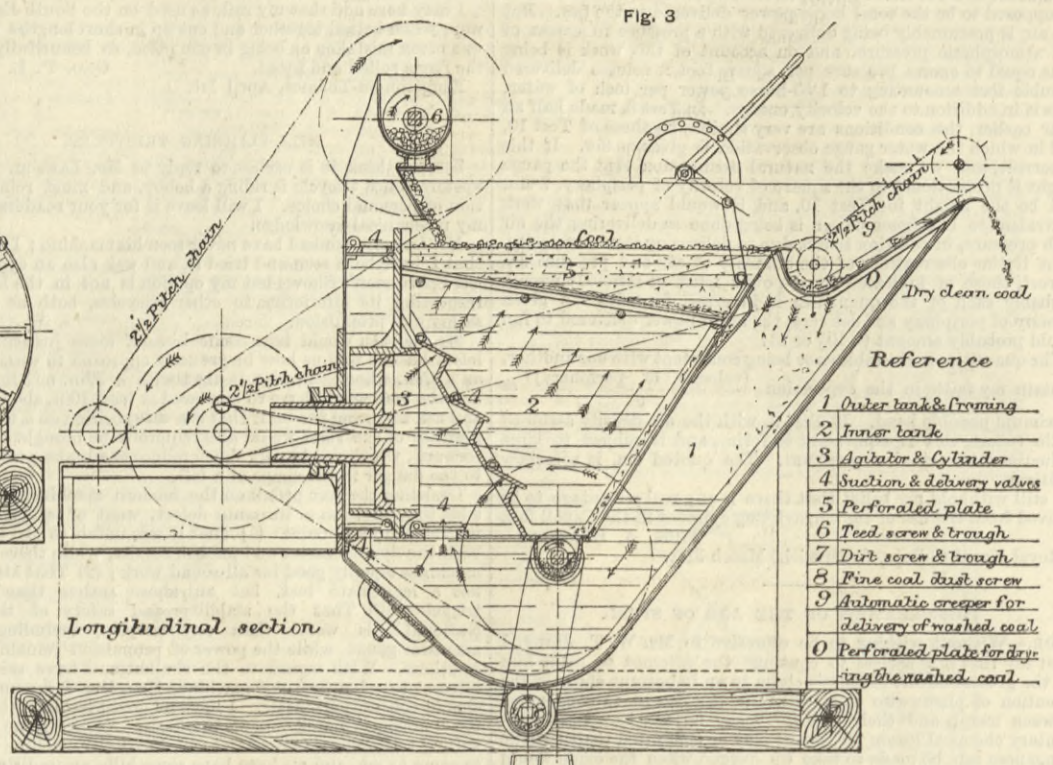
Whilst the above operations are being performed another function is being carried out by the plunger piston and cylinder, and which constitutes the essence of this invention, viz., the piston, in conjunction with the outer and inner tank and suction and delivery valves, maintains a considerable difference of level of water between the two tanks on both strokes, keeping the inner or washing tank full and the outer tank empty, as shown by the lines. The effect of this is to cause a suction under the finely-perforated delivery plate O, which dries the coal instantly, and returns the water thus extracted by the next stroke to the inner tank. Hence the name the "circulation washer." A continuous creeper carries away the dried and washed coal over the lip.

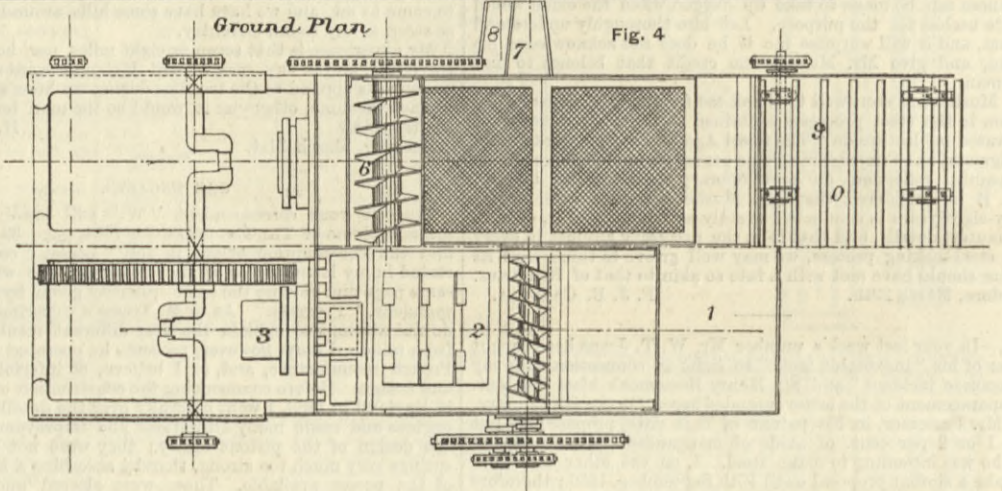
COAL GRINDING AND CIRCULATING WASHING MACHINERY.

MR. C. HALL, SAVILE STREET, SHEFFIELD, ENGINEER.





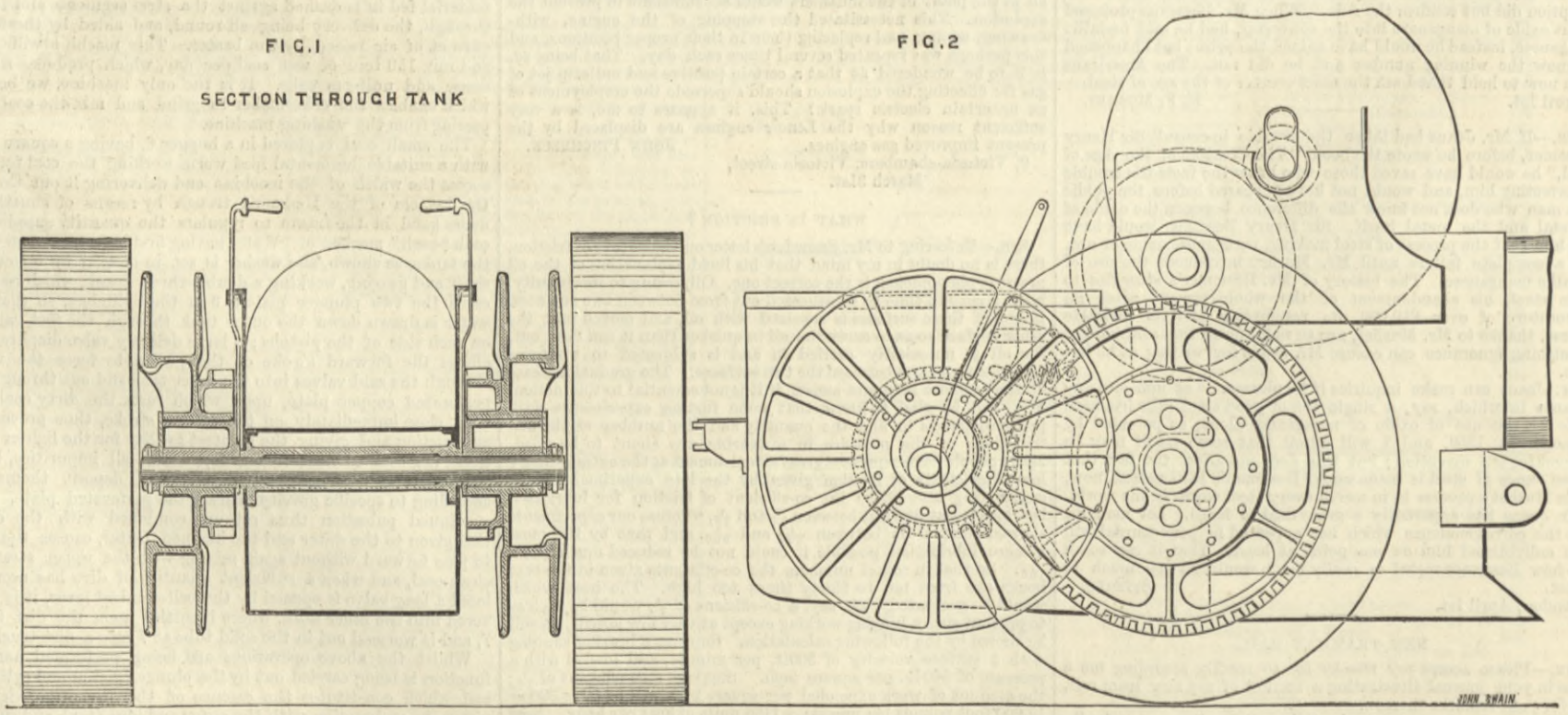




All the finest coal and slimes are collected at the bottom of the outer tank and forced forward by a screw driven by chain gearing, and pressed into a tube where they form a solid column similar to the column of clay as it issues from a plastic brick-making machine. This principle of drying the coal and returning the water has been applied to the common trough washer in a way which could not be explained without the aid of drawings. The whole machine is self-contained and driven entirely by patent chain gearing, also invented by Mr. Hall, thus dispensing with belts. It is claimed that this machine will wash considerably more than any other mechanical washer, because the circulation of water always in one direction is most perfect, and the difference of level between the two tanks allows it to deliver very rapidly. The tanks are of wrought iron, the pistons and cylinders of cast iron truly bored, and with stuffing boxes lined with gun-metal. The delivery screws are on square shafts run in bearings with adjustable glands. The valves are of ample area, hence they open very little and are of the simplest weighted flap kind. The jigger plates are of copper finely perforated and well stayed. These machines are at work, and giving satisfaction.

STEAM PLOUGHING ENGINE.

MR. SAVAGE, KING'S LYNN, ENGINEER.



We illustrate above an engine patented by Messrs. Barford and Perkins, of Peterborough, manufactured by Mr. Savage, of King's Lynn, and exhibited last year at York, which is worth the attention of all interested in steam ploughing. The arrangement is so simple that little or no explanation is required. It is an improvement on Messrs. Barford and Perkins' original ploughing engine. In the engine we illustrate, instead of packing up the engine and causing the road wheels to revolve and act as wire rope winding drums, a pair of winding drums are driven direct from the road gearing, and are hung on the engine tender by means of a parallel shaft passing from side to side of the tank, just underneath the foot plate; this gives a very rigid base for taking the strain when ploughing. The brakes on these drums are perfectly automatic, and they are always in action when the drums are out of gear, so that the rope cannot be accidentally given off. This is frequently the case in other arrangements, causing great injury to the ropes and much delay in working. On the other hand, when these drums are in gear they are quite free from brake pressure. The drums are mounted excentrically and are thrown in and out of gear by powerful levers conveniently placed for the driver to operate. This engine dispenses entirely with the separate windlass and double snatch block. As soon as it is steamed into the field it is ready for ploughing without any fixing whatever, and the tackle can be set down for work in half the time usually necessary. The drums can be taken off in a very few minutes, and the engine then becomes an ordinary agricultural locomotive.

THREE-CYLINDER COMPOUND ENGINE.

MESSRS. WILLANS AND ROBINSON, THAMES DITTON, ENGINEERS.

Fig. 4

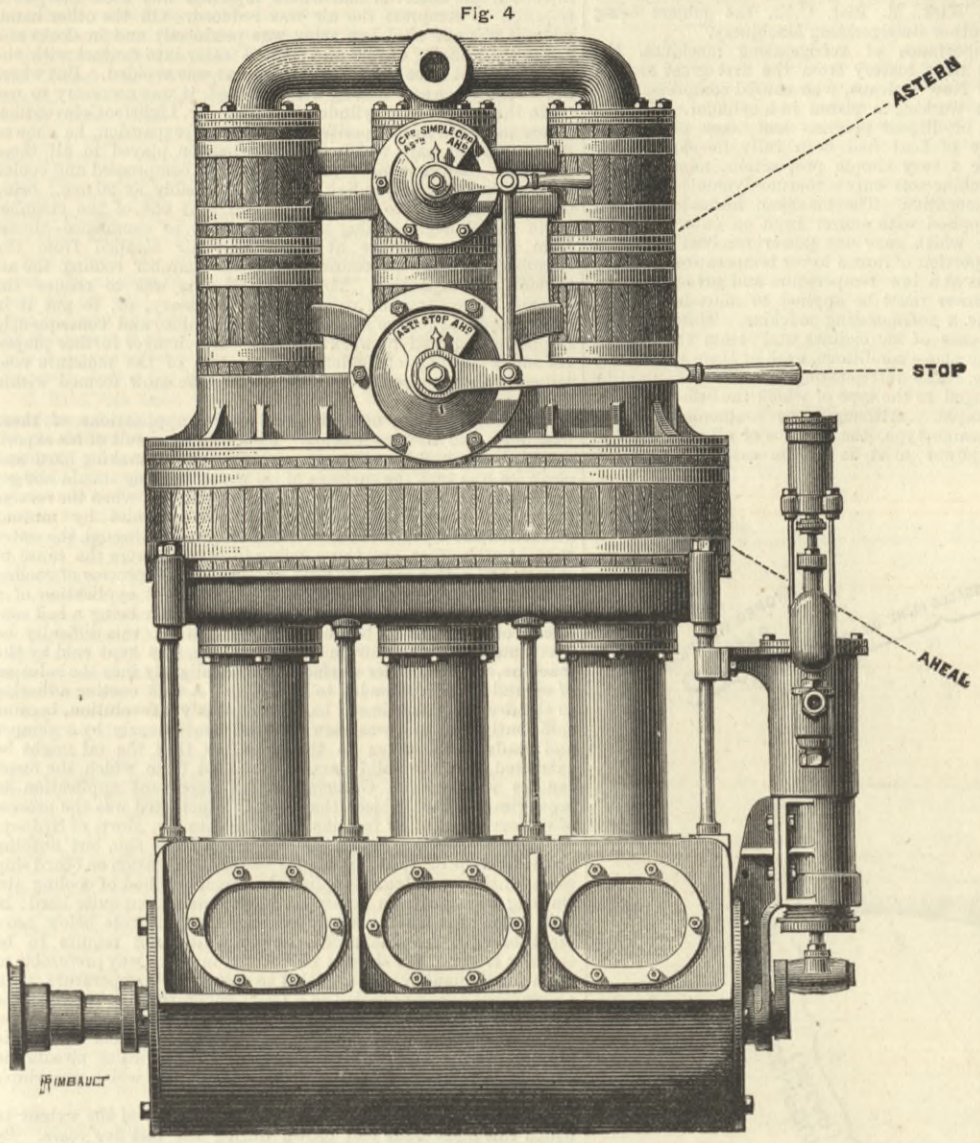


Fig. 1

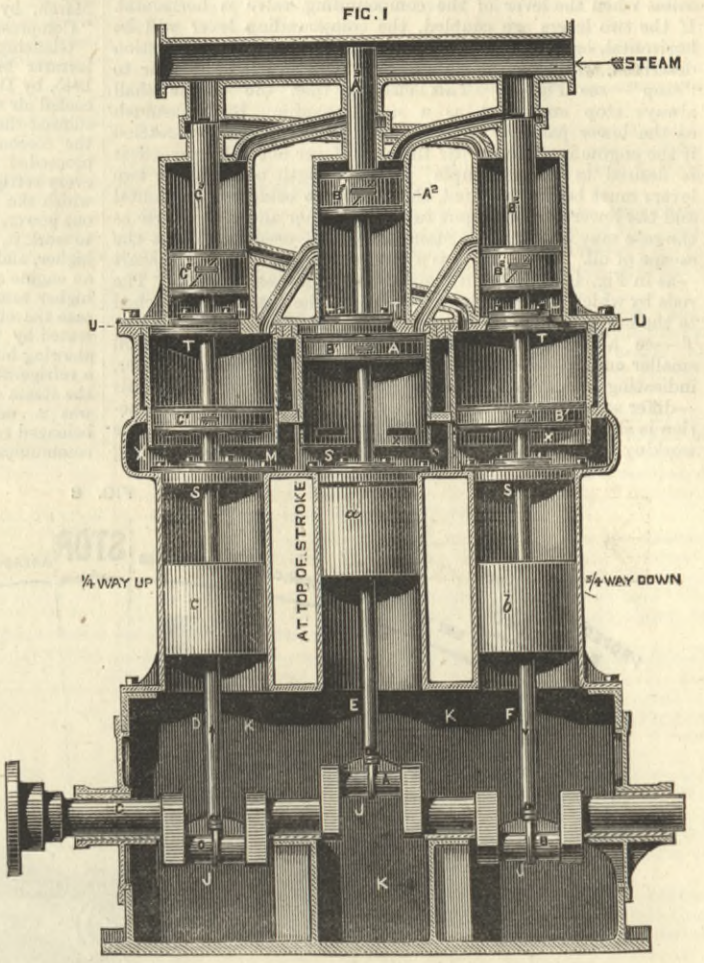


Fig. 3

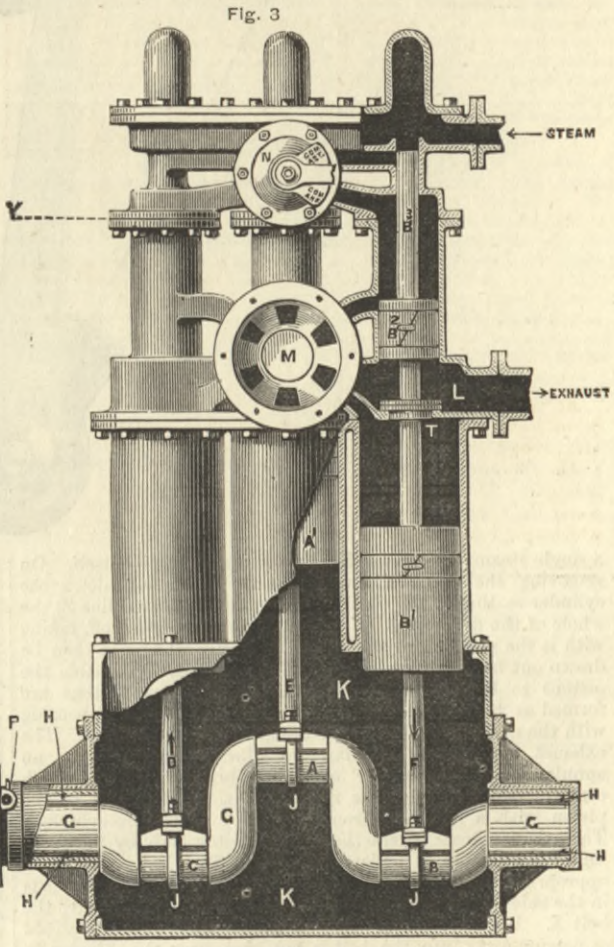


Fig. 2

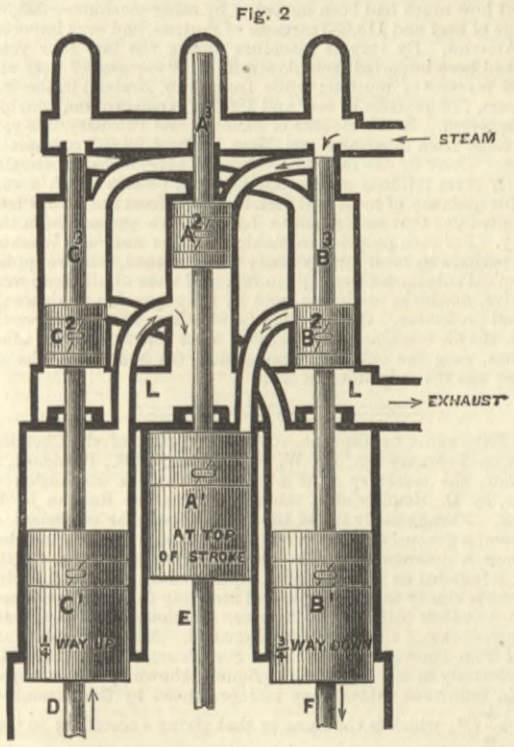
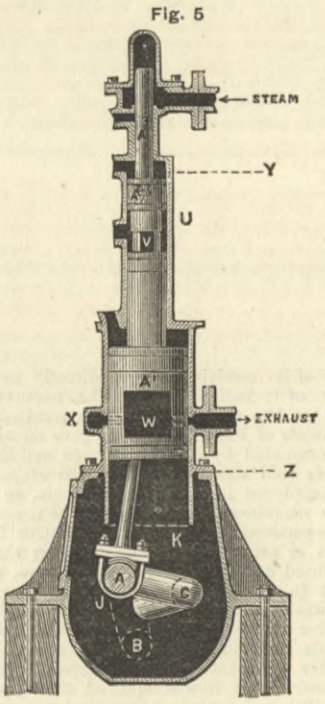


Fig. 5



Although much success has been achieved by engines made under the patents of Mr. P. W. Willans, by Messrs. Willans and Robinson, of Thames Ditton, but little has been published showing their construction or the reasons for their economy and the consequent favour with which they are received. The engravings which we now publish show amongst other things the construction of the recent development of the design by Mr. Willans, by which a very economical compound engine is obtained. This is shown by the engravings, Figs. 1 and 4; but before describing the larger engines we may explain the general principle of their construction, as this also relates to the smaller engines. For this purpose we may first refer to Figs. 1, 2, and 3, Fig. 2 being a diagram showing the relation of the cylinders, ports, and pistons, the latter acting as steam distributors.

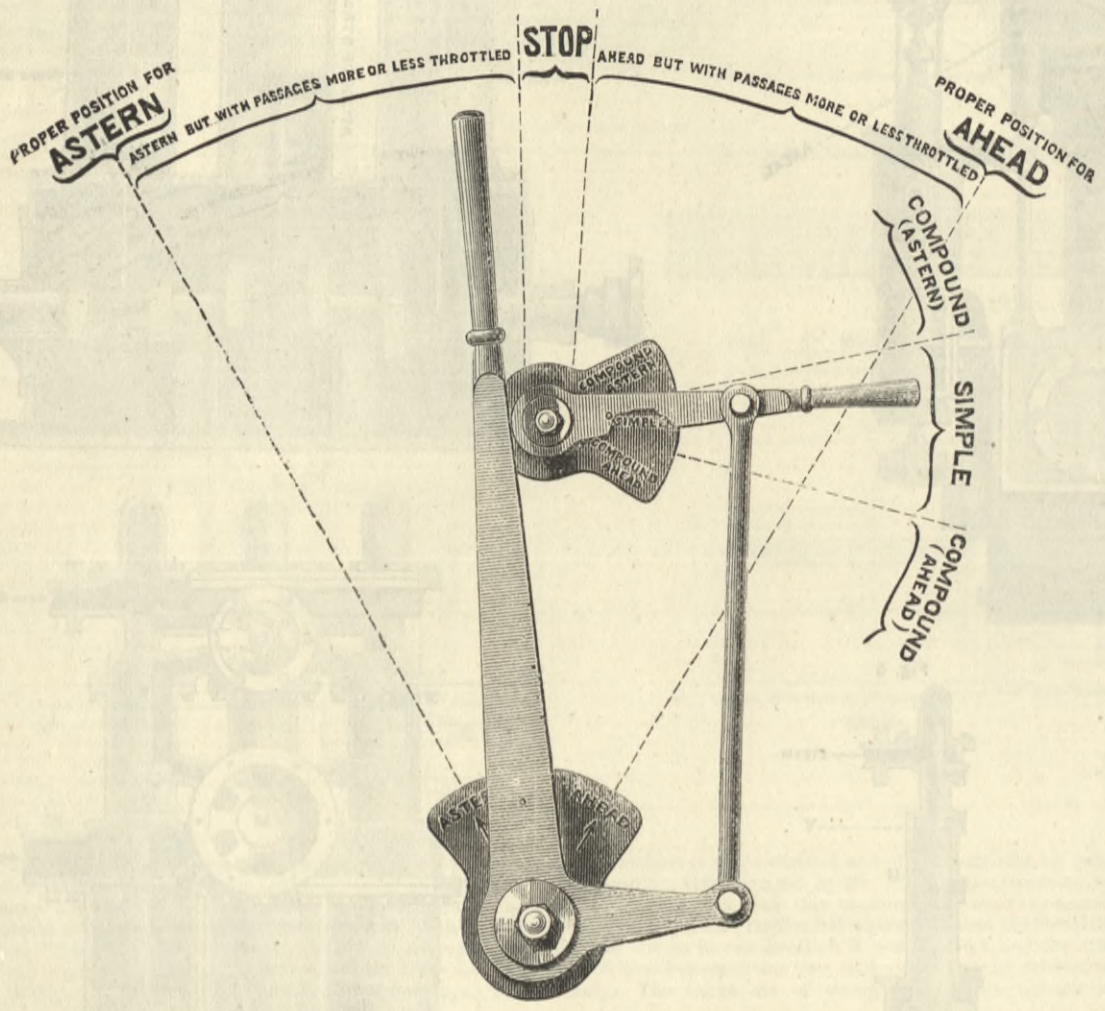
Each of the pistons driving the three cranks A, B, C, consists of three parts, viz., (1) the main or low-pressure piston; (2) the high-pressure piston; (3) the cut-off rod or trunk, forming the valve for one of the high-pressure cylinders. D, E, F, are the connecting rods, of ample length; G, the crank shaft, made strong enough to dispense with intermediate support, and carried by steel roller bearings H H, running in phosphor bronze bushes. The cranks and connecting rods work in the crank chamber K, containing water and oil, which are continually splashed up in spray over all the bearings, and up the inside of the hollow pistons to the steel pins upon which the upper ends of the connecting rods work. As there is constant down thrust upon all working parts there is no occasion for brasses below the crank pins, but a light steel strap, J, is taken under each, without touching it, to guard against accident. With the engine running, say, ahead, B^2 (*i.e.*, the high-pressure part of piston B) forms the valve for A^1 (the low-pressure part of A), and B^2 is supplied from C^3, the cut-off trunk of C. The three cranks are set at equal angles of 120 deg. B, therefore, has just the proper lead of A to enable it to act as A's valve, giving a cut-off at three-quarter stroke, and admission precisely at the commencement of the stroke. This describes not only the relation of B^2 to A^1, but of B^3 to A^2. The relation of C^3 to B^2 is exactly similar. So is that of C^2 to B^1, and of A^2 and A^3 to C^1 and C^2 respectively.

A little consideration will show that the relation of C to A is such that if A^1 and A^2 can be made to draw their supplies from C^2 and C^3 instead of from B^2 and B^3, and so on throughout, the engine will be reversed. This is accomplished in an extremely simple manner by passing all the passages through two large conical three-way cocks, usually coupled together. On giving these one-sixth of a turn the desired change is made; each cylinder takes a fresh valve, and the engine is in back gear instead of forward.

The rod B^3, which—in Figs. 2 and 3—is supplying steam to A^2, one of the high-pressure pistons, commences to uncover the port leading to A^2—actually a ring of small ports or holes, and not a single port as shown in the drawings—when A^2 is at the top of its stroke. B^3, on its way up, closes these holes again, when A^2 is at three-quarter stroke. At about the same time, A^2 begins to uncover the ports in the sides of its own cylinder, which allow the steam, still acting upon A^2, to act also upon C^1, then at the top of its stroke. From this point, until A^2 reaches the bottom of its stroke, the steam expands on A^2 and C^1 together, of course with a very rapid drop in pressure. A^2 then commences to rise, against a pressure which rapidly diminishes as C^1 continues its down stroke. When C^1 has travelled three-quarters of its stroke, A^2, rising, has covered up the port. Thenceforth the steam shut in above A^2 has no exit, and the clearances are so proportioned—including the high-pressure passages—that it is compressed approximately to initial pressure, giving, without appreciable loss, an effective cushion, which is essential to the working of the engine as a single-acting engine in constant thrust. To return to the steam above C^1. Communication with A^2 being severed, this continues to expand for the last quarter stroke. Then A^2 having passed above its port, C^1 is placed in communication with the space L below A^2, and continues so through almost the whole of its up stroke, until A^2 again covers the port on its way down, preparatory to admitting steam for another stroke. L is open to the exhaust. M, in Fig. 3, is the conical seat into which the main reversing valve fits. The openings of the various passages—which are joined in pairs when the valve is on its seat—can here be seen. N is the cover of the "compounding valve," or "compound reversing valve," usually coupled to the other by a link—as shown in Fig. 6—so that both may move together. This valve is substantially the same as M, though smaller, but it differs from it in having the solid parts between the ports or "ways," in both plug and seat, narrower than the ports. The consequence is that, although when put fully over it reverses the passages which pass through it, in the same way as the lower passages are reversed by M, it does not close them when it is in the intermediate position corresponding with that of "stop" in M. The solid parts of the plug not being wide enough to cover up the ports, the steam is then able to pass from each to every other—in fact a general connection is established among them. This has the same effect as doing away with the cut-off rods A^3, B^3, C^3; for when C^3 cuts off steam from B^2 the latter is still able to get steam indirectly from A^3 or B^3, and so on. The high-

pressure pistons A^2, B^2, C^2, have now steam of full pressure upon them on the up stroke as well as on the down; they cease to be working pistons, and become merely valves for distributing steam, at boiler pressure, to the main pistons A^1, B^1, C^1. The engine is then a simple engine. This state of things always arises when the lever of the compounding valve is horizontal. If the two levers are coupled, the compounding lever will be horizontal, or so nearly horizontal as to establish the connection described, whenever the main lever is at "stop" or is near to "stop"—see Fig. 3. This ensures that the engine shall always stop and start as a simple engine. But inasmuch as the lower passages are seriously and wastefully throttled if the engine is worked with the main lever not full over—if it is desired to work "simple" for any length of time, the two levers must be disconnected, the upper one being left horizontal and the lower one being put full open, either ahead or astern as the case may be. P is a Stannah's gland used to prevent the escape of oil. When there is a pump on the fore end of the shaft—as in Fig. 4—a Stannah's gland is also necessary there. The rods by which the high-pressure parts of the pistons are attached to the low-pressure parts pass through metallic stuffing boxes, T—see also Fig. 3—which require no packing. The still smaller engines—*i.e.*, those with 5½in. main cylinders and under, indicating in compound working from 20-horse power downwards—differ somewhat from those above described. Their construction is shown in Fig. 5, from which it will be seen that all the working parts can be removed for examination without breaking

FIG. 6



a single steam joint, other than that of the steam pipe itself. On removing the straps J, and the nuts which hold down the cylinder-casting to the crank chamber, on the dotted line Z, the whole of the upper part of the engine can be lifted off, taking with it the pistons and the connecting rods, which can then be drawn out from the lower ends of the cylinders. To enable the pistons to be thus withdrawn the high-pressure pistons are formed as trunks upon the low-pressure ones, thus dispensing with the metallic stuffing-boxes used in the larger engines. The exhaust space L of the larger engines is replaced by an annular cavity U, under each high-pressure piston which communicates through the interior of the lower part of the piston with a belt X surrounding the low-pressure cylinders. The exhaust steam enters the hollow piston body by the openings V, and leaves it by larger openings W, which, during the appropriate part of the stroke, uncover a number of small ports in the side of the low-pressure cylinder, communicating with the belt X. It will be noticed that the exhaust steam thus described as passing away into the belt is not that from the cylinder in which the ports are formed, but from one of the other cylinders. The ports act, however, as an additional or supplementary exhaust for what may be described as their own cylinders. This action is as follows:—At the extreme lower end of the stroke the piston uncovers the upper edge of the ports, and the greater part of the contents of the cylinder, including the water, are instantly ejected, the engine being thus self-relieving from water, and having unusually free escape for the exhaust steam.

Turning now to Figs. 1 and 4, which show the larger form of the compound engine as used for large boats and for electric lighting work, Fig. 1 is a sectional elevation, showing clearly the arrangement of cylinders, ports, &c. Fig. 4 illustrates, to a scale of 0·75in. to the foot, the 12¼in. engine, which gives 150 indicated horse-power when working compound. The parts are lettered, as in Figs. 2 and 3, and the description given of these will enable our readers to follow this section, and to see the differences which are made in the pistons and passages. We might extend our description of this very ingeniously arranged engine to a great length, but the foregoing with the engravings will have probably sufficed to convey all the necessary information on the subject.

We have seen these engines, which had nothing done to them for over a year but oiling, running noiselessly, and the great favour in which the engines are now held shows more conclusively than anything else their efficiency in their numerous applications.

Lang's Wire Rope.—In our notice of this rope last week, we omitted to say that the rope is made by Messrs. G. Cradock and Co., Wakefield.

THE INSTITUTION OF CIVIL ENGINEERS.

COMPRESSED AIR AND OTHER REFRIGERATING MACHINERY.

The fifth of a course of lectures on "Heat in its Mechanical Application," was delivered on Thursday evening, the 20th of March, by Mr. A. C. Kirk, M. Inst. C.E., the subject being "Compressed Air and other Refrigerating Machinery."

Glancing at the importance of refrigerating machines, the lecturer briefly traced their history from the first great step in 1845, by Dr. Gorrie, of New Orleans, who caused compressed and cooled air to expand in working a piston in a cylinder. He then showed that no really intelligent progress had taken place until the mechanical theory of heat had been fully developed, and proceeded to illustrate a very simple proposition, namely, that every refrigerating machine was only a thermo-dynamic engine in which the power was negative. The machine, instead of giving out power, must be supplied with power from an exterior source to work it. An engine which gave out power received heat at a higher, and rejected a portion of it at a lower temperature. When an engine absorbed heat at a low temperature and gave it out at a higher temperature, power must be applied to move it. In this case the engine became a refrigerating machine. This was illustrated by taking the case of air engines and steam engines and showing how, under the above conditions, each of them passed into a refrigerating machine. The refrigerating machine presented by the steam engine belonged to the type of which the ether machine was a common example. Although the ammonia machine belonged really to the same type, the absence of all apparatus to communicate motive power to it, as in the case of the ether machine, and the fact of its receiving energy directly as heat, rendered special notice of it indispensable. The lecturer then proceeded to observe that the ammonia machines resulted from the well-known experiments of Faraday, and he gave an account of the apparatus as constructed by Messrs. Mignon and Rouart. In this class of machines cold was produced by the evaporation of the volatile liquid employed in it—ether, ammonia, or other substance. In all these machines it was necessary to remove the vapour as fast as it was produced by the volatilisation, or boiling of the ether, ammonia or other liquid; and in order that the liquid might be condensed at the ordinary temperature, it was necessary to compress it to a higher pressure in a condenser. In the ether machine this was done by a piston working in a cylinder. In the ammonia machine the same process was effected by the peculiar affinity ammonia had for water. When a solution of ammoniacal gas and water was heated, the ammonia was forcibly expelled into the condenser where it was liquefied, thence passing to the evaporator it boiled, and cooled whatever substances were exposed to it; and this vapour was instantly again compressed by bringing it into contact with cold water. The same change of temperature of water from hot to cold performed a similar function to the piston, when it moved backwards and forwards in the cylinder of the ether machine. In air machines, on the other hand, the air was compressed and cooled as far as the cooling water available would allow, after which it was permitted to do work on a piston in a cylinder, and in proportion to the amount of work it did the greater cold it produced. The lecturer then proceeded to describe a machine of his own invention, which had been laid before the Institution in 1874. In this machine the theoretical conditions of a perfect air engine were very nearly fulfilled. The regenerator—an invention of Dr. Stirling's—performed the same function that adiabatic expansion and compression performed in Carnot's perfect air engine. Indeed, Stirling's regenerator might, in theory, be held to furnish as perfect a cycle as Carnot's. He next showed that the application of the regenerator was limited to the case of dry air; otherwise at temperatures below freezing it would get closed up by snow. He briefly alluded to a variation of the above machine, in which the cooling-water and the brine which had to be cooled were both injected directly into the compressed and expanding air. The brine in this case washed the regenerator, and prevented the formation of snow. The last type of refrigerating machine alluded to was also an air machine, but in this machine the air which acted as a cooling medium inside the machine was discharged directly into the chamber to be cooled. Tracing the history of these from the earlier attempts of Professor Piazzi Smyth, Professor Rankine, and Sir William Thomson, he observed that its first introduction on a practical and efficient scale was due to Mr. Coleman, who applied it to the cooling of chambers for the preservation of meat. The only question of practical difficulty attending this machine was the production of snow—a difficulty which had not been entirely overcome. The machines in use were of two kinds: one, in which the compressed air was cooled by the injection of water; the other in which it was cooled by coming into contact with cold surfaces, like the surface of the condenser of a steam engine. He showed that in the latter case, when the machine had for a little time drawn air out of the chamber and cooled and returned it to the chamber, the store of moisture in the air would be exhausted and snow cease to be formed. He then described, in some detail, the arrangement of one of Mr. Coleman's machines, working by injection, and observed that where injection was used the power required to compress the air was reduced. On the other hand, when it was not used less snow was produced; and in docks and rivers the bringing of foul and tainted water into contact with the air which had to be passed over the meat was avoided. But where dry compression and cooling were adopted, it was necessary to use oil in the compressing cylinder. Noticing Mr. Lightfoot's invention, where moisture was deposited by a partial expansion, he showed the important part which the interchanger played in all these machines. By that means, instead of the compressed and cooled air entering the expanding chamber, possibly at 90 deg., being cooled from that to — 40 deg., and sent out of the chamber again at 30 deg., cooling might be made to commence almost from the temperature at which the air escaped from the chamber, the cold air coming from the chamber cooling the air previous to expansion. The effect of this was to reduce the amount of compression or expansion necessary, or, to put it in other words, to reduce the size of the machine, and consequently the power required to work it. The interchanger further played the important part of condensing a portion of the moisture contained in the compressed air and bringing the snow formed within manageable limits.

The lecturer then noticed some of the applications of these machines, and first, ice making. Detailing the result of his experiments, he showed that the essential condition of making hard and clean ice was that the surfaces of ice while freezing should not get nearer than within a few inches of each other, as, when the reverse happened, amorphous crystallisation ceased, and by mutual attraction the crystals of ice shot like long spikes through the water to meet each other, and these spikes interlacing were the cause of spongy and rotten ice. He next illustrated the process of cooling paraffin, which was, as far as he knew, the first application of a refrigerating machine to manufactures. Paraffin being a bad conductor of heat, had to be cooled in thin films; this difficulty he overcame by making a drum revolve, which was kept cold by the machine, with its under surface dipping slightly into the solution of oil and paraffin intended to be cooled. A thin coating adhering to the drum, by the time it had made nearly a revolution, became sufficiently cool, and was then removed continuously by a scraper and ready to be taken to the press, so that the oil might be extracted, and the solid paraffin obtained from which the finest candles were made. Glancing at its important application to breweries, the last subject the lecturer elucidated was the process of preserving meat by freezing it. The late Mr. Mort, of Sydney, gave much attention to this subject many years ago, but nothing practical came of it, at least so far as the importation on board ship went, until Mr. Coleman applied the direct method of cooling air. On long voyages from Australia meat was frozen quite hard; in fact, much of it was at a temperature many degrees below zero. Meat brought from America, however, did not require to be actually frozen. He showed that it was in every way preferable to use a small quantity of air, cooled to a very low temperature, than a very large quantity cooled to a less temperature, as it led to the reduction of the space occupied on board ship, the size and friction of the machinery were diminished, and the very cold air, by its greater density, assisted to maintain the requisite circulation amongst the closely-packed cargo of meat with which the ship's hold was filled.

In conclusion, the lecturer gave some statistics of the extent to which this meat trade had grown during the last five years. By the use of Mr. Coleman's machine alone—he had not been able to find out how much had been imported by other machines—563,568 quarters of beef and 113,633 carcases of mutton, had been imported from America. By various machines during the last four years there had been imported from Australia 3159 carcases of beef and 138,664 carcases of mutton; while from New Zealand in the last two years, 728 quarters of beef and 129,732 carcases of mutton, had been imported. In the months of January and February this year there came from Australia and New Zealand 69,663 carcases of mutton. These figures might be taken to represent a gross value of nearly three millions and a-half sterling, besides which a considerable quantity of meat had been imported from the River Plate. He pointed out that each machine had its own proper use in this country. For such purposes as making ice the ammonia machine would perhaps be most largely used; while abroad, where supplies of chemical substances were apt to fail, and were at all times very expensive, machines producing cold by the expansion of air would be found preferable. On the other hand, where water-power could be had, the air machine and apparatus after the type of the ether machines, were the only ones applicable. On board ship the air machine was the only suitable one.

The Expansion of Liquids.—At the meeting of the Chemical Society on February 7th, Dr. W. H. Perkin, F.R.S., President, in the chair, the secretary read a paper, "On the Expansion of Liquids, by D. Mendelejeff," translated from the Russian by B. Brauner. Though every liquid has its own peculiar coefficient of expansion, a general expression for the expansion of all liquids has long been a desideratum. The generalisation now given by the author is founded on the additional experimental material collected by chemists chiefly for the purpose of studying the specific volumes of liquids at their boiling temperatures. In the present paper only the physical side of the question is discussed. Most of the data are derived from Thorpe's paper—*Chem. Soc. Jour.*, *Trans.* 1880, 141. The uniformity in the expansion of liquids, shown by the examples given in numerous tables, may be represented by the formula—$V = (1+\frac{k}{n}t)^n$, which is the same as that giving—according to Gay Lussac's law—the expansion of gases. For gases $n = +1$, for liquids $n = -1$. The expression for liquids becomes therefore—$V = (1-Kt)^{-1} = \frac{1}{1-Kt}$, and as the specific gravities are inversely proportional, if D = density at t, and D_o the density at 0 deg., then $D = D_o(1-Kt)$. The author then gives several examples of the close agreement obtained with the above formula and the experimental results of Thorpe. Thus with phosphorus tribromide, according to Thorpe:

t =	40°	60°	80°	100°	120°	140°
V =	1·0348	1·0530	1·0720	1·0916	1·1123	1·1340
V calculated	1·0348	1·0531	1·0721	1·0918	1·1123	1·1325
K =	0·000841					

The author discusses the varying values of K in the exceptional case of water at different temperatures. The results of the paper may be summed up as follows:—In the expansion of liquids a peculiar regularity and a qualitative uniformity is observed, and the equation given above may be taken as an approximation to reality, K being a constant coefficient characterising each liquid, as the specific gravity, the boiling point, &c. The author proposes to call K the determinator of expansion, and suggests that a determination of its value under different conditions is extremely important for the mechanics of liquids. The expression given above, although many liquids deviate slightly from it, is by itself sufficient in the majority of physico-chemical investigations, just as Gay Lussac's law is sufficient for most physico-chemical work with gases. Dr. Morley said if the expression held with two liquids it ought to hold with mixtures. He examined some time back the expansion of hydrocarbon from petroleum, and found that K first increased then decreased. Such a phenomena could not be explained if the law was rigorously true. Dr. Armstrong read an extract from a letter of Dr. Thorpe, who had seen the paper, in which he expressed his satisfaction that the physical data which he had been at some trouble to obtain should have formed the basis of such an important paper.

RAILWAY MATTERS.

In the French Chamber, on Monday, the vote of 3,500,000f. for the Senegal Railway was passed by 307 to 83 votes, on the understanding that this should be the last expenditure on the scheme.

The plan of a bridge over the St. Lawrence river, to be constructed by the Ottawa, Waddington, and New York Railroad and Bridge Company, has been adopted by the Canadian Privy Council.

The South Staffordshire Railway and Canal Freighters' Protection Association are busy formulating the concession scheme which the railway companies serving the district have invited the members to lay before them.

Rapid progress is being made with the Aliwal North Railway, South Africa. Seven miles of formation have been completed on this section since the beginning of January, and the Stormberg Bridge, 400ft. long, three spans, is expected to be finished in about nine months. This line opens up a short and direct route between the coast and the Free State and Basutoland.

Since 1869 the mileage of Ohio railways has increased 107 per cent., the number of locomotives 145 per cent., and the number of cars 456 per cent. The number of cars to each locomotive in 1869 was 15; now the number is 34. Improvements in permanent way by the laying of steel rails, substantial ballast, and superior motive power, have increased the carrying capacity of Ohio railways 126 per cent. during the last fifteen years.

A Bill has been submitted to the German Federal Council rendering it compulsory for private railway companies to carry out works considered necessary for the national defence, such as increasing the number of lines of rails, constructing sidings, establishing watering stations for the locomotives, and additional junctions between different lines. The decision in regard to the works required will rest with the Emperor.

The final spike in the Mexican Central Railroad was driven on 8th ult. six miles from Fresnillo, in the presence of a distinguished assemblage. There is now an unbroken railroad from Mexico City to the Rio Grande. Much enthusiasm was displayed, and general manager Robinson was warmly congratulated. The two locomotives, one from Mexico City and the other from the United States, decorated with Mexican and American colours, approached until the cow-catchers met. The main line, which is the first completed line from the United States to the city of Mexico, is 1225 miles long, from Paso del Norte to Mexico. Arrangements are also completed for the running of through trains.

Arising out of the main question of railway rates—writes our Birmingham correspondent—is the question of "smalls." The Walsall Chamber of Commerce are taking up the matter vigorously. Until 1877 the railway companies, in giving prices for traffic, charged all parcels not exceeding 1 cwt. as smalls. Since then they have raised the limit to 500 lb., and introduced a regulation whereby, if two parcels of different classes of goods are sent to one consignee—say parcels of more than 3 cwt. each—each is charged as a small, although the two together make much more than 500 lb. These provisions are styled "absurd," and are said to constitute "a monstrous grievance" to the South Staffordshire manufacturers.

Arrangements are being made to manufacture in Detroit, car wheels under the patent of Theodore Thurber, of Auburn, N.Y. This wheel is thus described:—"It consists of a steel tire with inner flange, a central hub, with a similar flange, and two curved steel plates, forming the centre of the wheel. These plates are so arranged that they are fastened to the hub, coming together at the outer edges by being dished in opposite directions. The plates are then driven into the steel tire by hydraulic pressure, and are fastened to the inside of the flange of the tire. One of the advantages claimed for the wheel is that the tire can readily be replaced, nothing being required except taking out the bolts, driving the old off and a new one on. Other plate wheels have to be taken apart for this operation. Another is that the curved steel plates forming a spring give ample and ready compensation for contraction or expansion of the tire." A set of these wheels is to be tried under a passenger car on the Michigan and Central road.

A correspondent of the Cincinnati *News Journal* gives the following description of a railway experience during the recent flood:—"At Newton the train entered the water. Preparations had been made by banking the fire of the engine and laying in a good stock of steam. Deeper and deeper grew the water. A man stood on the platform beneath the headlight, and with a boat hook turned aside drift-wood which otherwise would have got under the wheels. The anxious passengers saw with dismay that the train was going slower and slower. The engine was like a mighty swimmer straining against weakness occasioned by buffeting with the waves. The piston-rods grew less vigorous at each stroke, and the exhaust made a noise almost human. Just this side of Batavia Junction the train stopped. After being 3ft. deep in water it was now only 2ft. The engine took a rest, and another fire was made. One hundred and forty pounds of steam were got up. Then the train started again. The water came over the second step of the coaches and covered the trucks. Three-quarters of a mile took eight minutes and a-half to make the distance. When the engine struck dry land it had forty pounds of steam left, and the fire was out."

A writer in the *Economiste Francais* describing the present condition of communications by water and railway in France, states that there are now 4575 miles of navigable rivers, and 2900 miles of canals. In the year 1852 there were only 4190 miles of river navigable, and 2440 miles of canal, the increase in the length of river being 385 miles, and in that of canals 460 miles. But, as the writer in the *Economiste Francais* points out, this increase has been effected at an enormous expense, the total amount spent from 1852 up to the year 1878 being close upon £14,000,000, while since then, under the scheme of M. de Freycinet for the development of communication by land or water, a further sum of £11,000,000 has already been spent. Thus in round figures the cost since 1852 has been £25,000,000 sterling, and yet the quantity of goods carried by water has only increased 4,000,000 tons. While the increase in the goods traffic upon the railways has been 4 per cent., upon the rivers and canals it has not exceeded 1 per cent., and this the writer in the *Economiste Francais* attributes, not to the unfair competition of the railways, but to the fact that canals cost as much to make as railways, and that the time occupied in transit is so much longer by water than it is by rail.

It was announced that the first section of the Bengal and North-Western Railway, from Gogga Ferry to Baraitche, a distance of seventy miles, will be opened for traffic on the 2nd inst., while the remainder of the line will probably be ready for use by November. It has also been stated that the Nawab of Joonaghur proposes to construct, at his own expense, a line of railway from Jairpore to the seaport of Virawul. This will afford a new outlet for the citron trade between Cutch and Bombay. "The interest felt all over India in the composition of Lord Kimberley's India Railway Committee, and the precise nature of the work which it will be called upon to perform, increases as the date approaches for its first meeting," the *Colonies and India* says. "Already a considerable amount of preliminary work has been accomplished in the way of systematising the character of the investigation which will constitute the task of the Committee. On high authority we are enabled to publish the following statement of the heads of evidence which will be given before the Committee. First, the length of lines necessary to provide against loss of life by famine. Second, other advantages to be expected from these lines. Third, districts where they should be placed. Fourth, the comparative cost of standard and metre gauge constructions and maintenance. Fifth, the advantages to revenue from railways, and the effect on the prosperity of districts. Sixth, the quantities of produce to be moved. Seventh, the possibilities of development of traffic in new districts, judged by the experience already obtained. Eighth, the various plans proposed by the Government of India, including financial arrangements."

NOTES AND MEMORANDA.

The following simple and easy test for glue is given in the *Tischler Zeitung*:—A weighed piece of glue—say one-third of an ounce—is suspended in water for twenty four hours, the temperature of which is not above 50 deg. Fah. The colouring material sinks, and the glue swells from the absorption of water. The glue is then taken out and weighed; the greater the increase in weight the better the glue. If it then be dried perfectly and weighed again, the weight of the colouring matter can be calculated from the difference between this and the original weight.

For the week ending March 8th, 1884, in 31 cities of the United States, having an aggregate population of 7,144,200, there died 2890 persons, which is equivalent to an annual death-rate of 21·0 per 1000, an increase of 1·0 over the rate of the previous week. For the North Atlantic cities the rate was 22·1; for the Eastern cities, 21·6; for the Lake cities, 16·2; for the River cities, 19·7; and in the Southern cities, for the whites 22·9, and for the coloured 36·6 per 1000. The American *Sanitary Engineer* says that of the deaths 35·6 per cent. were under five years of age, the proportion of this class being highest in the Lake cities, viz., 44·1.

Professor G. Forbes has made some observations on a magnetised chronometer watch. The watch went slow several minutes a day. He found the rate to vary with the position of the watch with respect to the cardinal points and also in a vertical plane. He traced the variation of rate to magnetisation of the balance spring, the bar, and the screws. The fact that it varied with position suggested that a magnetised ship's chronometer might be made which would integrate the course and give a mean course. Messrs. E. Dent and Co. had since fitted a gold spring and a platinum iridium balance to the chronometer, and rendered it non-magnetisable.

Professor Foster recently read a paper before the Physical Society by himself and Mr. Pryson on the difference of potential required to give sparks in air. Let V = this difference of potential, l = length of spark in centimetres, their experiments gave approximately $V = 102\ l + 7{\cdot}07$ Tables and curves of the sparking distances, potentials, and electric forces in the experiments were given. The results were got with brass balls 1·35 centimetres in diameter, a frictional machine, and a Foster absolute electrometer. When l = ·142, the electric force giving a spark was 154·76; l = ·284, the electric force was 133·35, or less than at a shorter distance; l = 497, the electric force was 131·66; l = ·9, the electric force was 138·57; that is, it began to rise again.

At a recent meeting of the Philadelphia Engineers' Club, President Ludlow described tests of the crushing strength of ice, which were made by him in order to learn approximately the strength required for an ice harbour of iron screw-piles, in mid-channel, at the head of Delaware Bay. Eighteen pieces were tried with Government testing machines at Frankford, Philadelphia, and at Fort Tompkins, Staten Island. The specimens were carefully prepared 6in. and 12in. cubes, and roughly cut slabs about 3in. thick, of different qualities and from different localities. For pure Kennebec ice, the lowest strength obtained was 327 lb., and the highest 1000 lb. per square inch. For inferior qualities, the strengths varied from 235 lb. to 917 lb. The higher results were obtained, generally, when the air temperature in the testing room was from 29 deg. to 36 deg. Fah., as against from 55 deg. to 68 deg. Fah. for the lower results. The pieces generally compressed from ½in. to 1in. before crushing.

At a recent meeting of the Cambridge Philosophical Society a paper was read, entitled, "A Comparison of Maxwell's Equations of the Electro-magnetic Field with those of Helmholtz and Lorentz," by Mr. R. T. Glazebrook. The author pointed out that the main difference between the two theories turned on the fact that while Maxwell considers the electric displacement throughout the field, Helmholtz deals with the electric moment of each element of volume, supposing that by the action of the inducing force opposite electricities are driven to opposite ends of each element. Maxwell's displacement corresponds to the induction in the magnetic field, Helmholtz's polarisation to the induced magnetisation. The existence of a normal wave was discussed, and it was shown that Maxwell's equations without the solenoidal condition $\frac{df}{dx} + \frac{dg}{dy} + \frac{dh}{dz} = 0$, lead to the same result as those of Helmholtz, at any rate in the case in which a plane wave is traversing the medium. It was further pointed out that in the case in which the induction is due to the presence of electricity at rest outside the portion of the field considered, the above solenoidal condition must hold.

At a recent meeting of the Physical Society Professor Silvanus P. Thompson read a paper on "A New Method of Making Resistance Coils." This consisted in cutting off a piece of the wire of which the coil is to be made long enough to give a resistance some 2 per cent. higher. From the formula, shunt $= \frac{R\,r}{R-r}$, where R is the rough resistance, and r the final resistance, the value of a wire wherewith to shunt the first piece in order to give the resistance required is found. A length of wire giving this resistance—or, rather, about 2 per cent. more—is then cut off and soldered as a shunt to the first piece. Practice shows that this method is very quick and accurate. It is useful for shunts under 10 ohms. Professor Thompson also described a new form of "meter bridge" devised by him. The wire is 2m. long, and there are two wires, one of a resistance about ¼ ohm, the other 8·21 ohms. Contact is made by one or other by a sliding contact with vernier attached. This arrangement is found more convenient than the single wire meter bridge, and allows of higher resistances being measured. A special switch board with an arrangement of mercury cups avoids the necessity of transposing the coils in Foster's method, this being effected by shifting the contact links in the mercury cups.

Lightning rods are not all very efficient in France. M. Cochery, the French Minister of Posts and Telegraphs, has communicated to the French Academy of Sciences an elaborate report on the strokes of lightning which were observed in France during the first half of last year. The report is due to a resolution of the international conference on electrical units held in Paris in 1882. In January there was one stroke injuring a man who carried an open umbrella with metal ribs. In February there were no strokes at all. In March there were four strokes damaging unprotected buildings and a high oak tree. In April there were also four strokes, injuring several persons, some poplar trees, a weathercock, a bell tower, and an isolated building. In May there were twenty-eight strokes, killing two men, seven cattle, three horses, and injuring several persons and two horses as well as numerous trees and houses. The trees were oaks, chestnuts, poplars, and several of the strokes attacked the chimneys of houses. It is notable that a gilt wooden figure of Christ in front of the Church of Bonsecours—Seine-Inférieure—was struck, although the church had a lightning rod on it. During the Month of June the total number of strokes largely increased, there being no less than 113, or from three to four a day. The daily number varied during the month, but was, if anything, larger at the end than at the beginning of the month. Seven men were killed; about forty persons, men, women, and children, were injured. About seventy animals were killed, including fifty sheep and a dog. Many trees, oaks, poplars, elms, firs, were struck. A common object struck is the bell of some church, the chimney of some house, or the weathercock of a barn. Some of the strokes observed were received by the lightning rods of buildings, and did no damage except perhaps fusing the point of the rod. On the other hand, several serious accidents to buildings, and in one case death to a horse, occurred within a comparatively short distance of a lightning rod—from 50 to 80 metres. Isolated trees and animals under them appeared to have suffered most.

MISCELLANEA.

Messrs. Barnett and Foster have been awarded first-class certificates and three prize medals at the Calcutta Exhibition.

The thirty-first anniversary festival of the Society of Foremen Engineers and Draughtsmen is appointed to take place, at the Cannon-street Hotel, to-morrow, at 6 p.m., Mr. Charles Mark Palmer, M.P., in the chair.

Coal workings belonging to the Assam Railway and Trading Company in Assam were opened in February by Mr. Elliott, the chief commissioner of that province, who visited the company's Ledo colliery and Thikak mine.

The ironclad corvette Chen Yuen, built at Swinemünde, this being the second built in Germany for the Chinese navy, left for Eckernfoerde early on the 29th ult. on her trial trip, with Li Fong Pas, the Chinese Minister, on board.

M. Swiridoff, a civil engineer attached to the late Amu Darya Surveying Expedition, which pronounced in favour of the possibility of diverting the river into the Caspian Sea, delivered a public lecture in St. Petersburg on the 29th ult. on the subject. A detailed report of this is now being drawn up.

At the meeting of the Board of Directors of the Suez Canal Company, on Monday, it was unanimously decided, on the motion of M. de Lesseps, that from that day until further orders the special pilotage dues hitherto levied upon ships passing through the canal be abolished for ships of all nationalities.

The vessels launched from the Clyde shipbuilding yards in the past month show a tonnage of above 28,000 as against 30,000 in March, 1883. The quarter's output is about 64,000 tons, compared with 81,000 in the past three months of last year. It is estimated that there are 100,000 tons less new shipping in course of construction on the Clyde than twelve months ago.

On Saturday, the 29th ult., the Dynamo, a steel screw steamer built by Messrs. Earle's Shipbuilding and Engineering Company, Hull, was taken on her trial trip. The dimensions of the vessel are as follow:—Length, 175ft.; breadth, 25ft.; depth of hold 14ft. The vessel is fitted by the builders with triple compound engines of 90 N.H.P., and attained a speed of over eleven knots.

The preliminary work in connection with the International Electrical Exhibition, to be held at Philadelphia under the auspices of the Franklin Institute, is progressing very favourably. The contract has been awarded for the erection of a building on a site granted by the Pennsylvania Company to Messrs. Wilson Brothers and Co., of Philadelphia, and will include a main building 283ft. long and 160ft. wide, with a 60ft. tower at each corner and a large triangular building joined to the main hall. The buildings are to be completed by the 15th of June, exhibits being received from the 11th to the 30th of August, so that the opening ceremonies can be held on the 2nd of September, the exhibition to remain open until the 11th of October.

In his official report of the water supplied by the Metropolitan Water Companies during February Col. Sir F. Bolton remarks that all the companies are now, more or less, voluntarily giving constant supply in some portion of their districts, and points out to consumers that, "in houses supplied on the constant system, all danger of drinking stale or contaminated water from cisterns may readily be avoided if the following recommendation is carried into practice, viz., to attach a small draw-off tap to the communication pipe which supplies the cistern from the main in the street, from which water may be drawn at any moment, day or night, direct from the works, thereby taking full advantage of any efforts made by the companies to purify the water to the utmost extent."

A series of experiments in street electric lighting is in course of being carried out by the Wimbledon Local Board. The precise object of the experiments is to determine the best method of illuminating streets, and of distributing light by electricity, cost, of course, forming an important factor in the consideration. To this end the experiments, extending over some weeks, will be made; the intention being to test every appropriate system. An engine and dynamo machine have been placed in position, and between one and a-half and two miles of streets are already lighted, overhead wires and glow lamps being used. Various lamps, shades, and reflectors are to be tried, and experiments are not under the control of anyone connected with any electric light system or company, but are being carried out in a perfectly independent manner. These results are likely to prove of considerable value.

An interesting illustration of the uncertainties of well-boring operations, has just occurred at Burton-on-Trent. One of the largest breweries there, had occasion to increase its water supply. Recourse was had to boring, and the work was carried out by a local well-sinker. The spot chosen proved an unfortunate one, and after a depth of 176ft. had been reached, Messrs. Le Grand and Sutcliff, artesian well engineers, of London, were consulted as to further search for water. This firm having had considerable experience in well making operations at Burton, advised the abandonment of the boring, and suggested a fresh site which they selected. This suggestion was adopted, and at a depth of only 114ft. a supply of between 5000 and 6000 gallons per hour has been obtained from a single 5in. tube well. It should be mentioned that the level of the two sites was practically identical, and the distance between them about 200 yards.

On Saturday, the 29th ult., Messrs. Edward Finch and Co., Limited, of Chepstow, ran a trial trip with the iron screw steamer Arrow. Her principal dimensions are—260ft. length, 36ft. 3in. beam, and 20ft. 9in. depth of hold amidships. The engines, made by Messrs. Westray, Copeland, and Co., of Barrow-in-Furness, of 160 nominal horse-power, have been fitted on board by the builders, also a double-ended six-furnace boiler by the builders for a working pressure of 90 lb. per square inch. On Monday, the 31st ult., Messrs. Edward Finch and Co., launched from their shipbuilding yard, Chepstow, a finely-modelled iron screw steamer, the Partridge. Her principal dimensions are—length, 158ft.; breadth, extreme, 23ft. 2in.; depth of hold, 12ft. 2in. She has long raised quarter deck over after hold, engines and boilers, short bridge house inclosing accommodation for captain and officers, and topgallant forecastle for crew. The engines are compound surface-condensing of 60 nominal horse-power, constructed by the builders, also a large double furnace boiler for a working pressure of 80 lb.

A Board of Trade report has appeared on the explosion of a pitch cooler, which occurred at the Sussex Chemical Works, East Greenwich, on the 16th February. This cooler was merely a tank of rectangular form, 34ft. 8in. in length by about 8ft. in width, and 4ft. 8in. in extreme height, composed of wrought iron plates about ⅜in. thick, lap-jointed and single-rivetted, with ⅝in. rivets spaced about 2in. apart. The top and the sides were stiffened by angle irons and gusset plates spaced about 4ft. 8in. apart. In the top of the cooler, which was slightly curved, there were two 19in. manholes with loose lids, and also two 4in. filling pipes; the latter, provided with suitable cocks, were in connection with a tar still, and formed the channels through which hot pitch was transferred to the cooler at the termination of each distilling process. In the cooler, at about half its height, a coil made of 4in. wrought iron pipes was fitted. This coil extended from end to end of the cooler, and through it the tar was pumped for charging the still. After the completion of the recent repairs to the coil, the still in connection with this cooler was put in operation for the purpose of extracting, by distillation, naphtha and other light oils from coal tar. At 8.30 a.m. on the 16th ult. the distilling process was complete, and the stillman opened the cocks to empty the residuum—pitch—into the cooler, when about three minutes later the explosion occurred, accompanied by the burning of pitch. The explosion was of a violent nature. Two men were injured, and the explosion is attributed to the ignition of the hot pitch on coming in contact with inflammable material of some kind left inside the cooler when the repairs were effected, or at some intervening time.

HULL AND BARNSLEY RAILWAY—SWING BRIDGE OVER THE OUSE.

MESSRS. ARMSTRONG, MITCHELL AND CO., NEWCASTLE, ENGINEERS.

(*For description see page 265.*

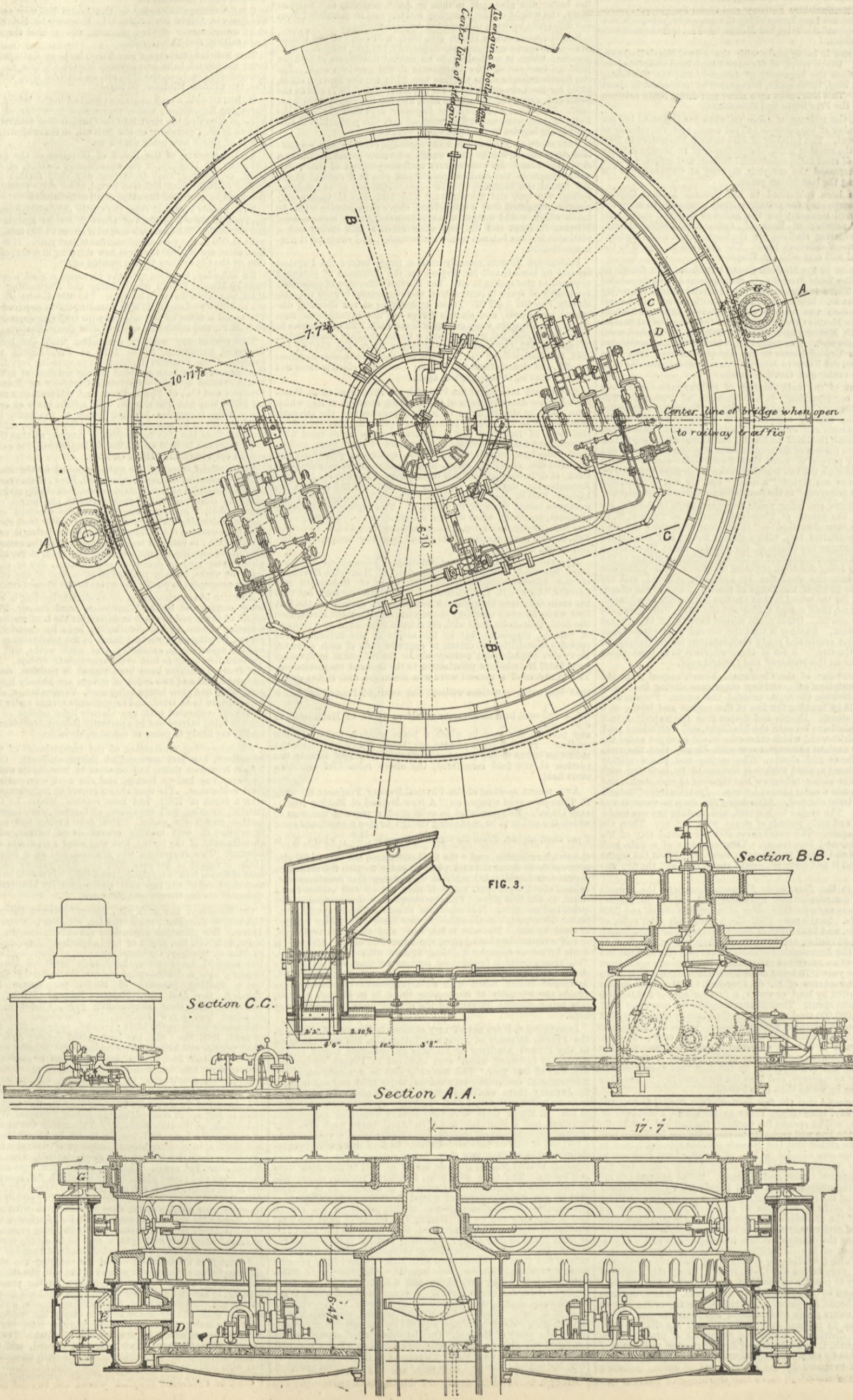


FIG. 3.

FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame Boyveau, *Rue de la Banque.*
BERLIN.—Asher and Co., 5, *Unter den Linden.*
VIENNA.—Messrs. Gerold and Co., *Booksellers.*
LEIPSIC.—A. Twietmeyer, *Bookseller.*
NEW YORK.—The Willmer and Rogers News Company, 31, *Beekman-street.*

PUBLISHER'S NOTICE.

*** *The Publisher begs to announce that next week* The Engineer *will be published on* Thursday *instead of* Good Friday. *Advertisements intended for that number must be forwarded no later than Six o'clock on Wednesday evening.*

TO CORRESPONDENTS.

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

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

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

P. J. P.—*You ought to submit your design to some maker of traction engines.*

C. M. T. (Honiton).—*We have made inquiries, but cannot hear anything of such a book as you name. Why not write and ask the librarian in Oxford?*

Shears.—*The pressure required will depend on the conditions of shearing. Is the whole* 12in. *to be sheared simultaneously or successively from side to side as in a shearing machine? Is the shearing stress as in shearing by a machine required, or as in a structure?*

FORGE MASKS.

(*To the Editor of The Engineer.*)

Sir,—I would be much obliged if any reader could furnish me with the name of any firm that sells masks for protecting the face from heat while cutting or setting under a steam hammer. J. R.

Kilmarnock, April 1st.

THE POWER EXPENDED ON ROLLING.

(*To the Editor of the Engineer.*)

Sir,—May I, as a regular subscriber, ask any reader for a reply in a future issue to the following query? What is the most convenient correct method of calculating from the indicated horse-power absorbed the total squeeze exerted between rollers? *e.g.*, in my case, surface speed of rolls, 18ft. per minute; indicated horse-power, 100. In this instance, by a laborious method I calculate the pressure to be about 100 tons. E. C. S.

New South Wales, February 13th.

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Advertisements cannot be Inserted unless Delivered before Six o'clock on Thursday Evening in each Week.

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

MEETINGS NEXT W K.

The Institution of Civil Engineers.—Tuesday, April 8th, at 8 p.m.: Ordinary meeting. Paper to be discussed, "Experiments on the Composition and Destructive Distillation of Coal," by Mr. William Foster, M.A., F.C.S.

The Society of Engineers.—Monday, April 7th, at 7.30 p.m.: A paper will be read "On an International System of Marine Course Signalling," by Captain Wm. B. Barker, U.S.A., the leading features of which are as follows:—Description of the ordinary system of signalling by sound, and its disadvantages in a fog. Description of Mr. J. Macfarlane Gray's proposed system and those of others; their defects. Description and practical illustration of the author's invention for automatic signalling in a fog. His A B C course signal system explained and illustrated.

THE ENGINEER.

APRIL 4, 1884.

PROFESSOR HUGHES'S THEORY OF MAGNETISM.

It is not too much to say that Professor Hughes's theory of magnetism is the most important contribution that has been made to physical science for very many years. The theory has already been very fully stated on more than one occasion by Professor Hughes; and we have put his facts and his arguments before our readers. His more recent researches confirm his views and lend new force to his deductions; and the importance of the subject is such that we make no apology for running the risk of repeating here much that has been said before; or for endeavouring to put the theory before our readers in so simple and straightforward a way that it may be mastered by any one with very little trouble. There is the less difficulty in doing this that the thing is extremely simple. It is more than probable that nature always avoids complex modes of action; and if we could have the workings of natural laws and their respective modes of operation revealed to us, we have no doubt that the first feeling of the observer would be surprise that matters so simple should have been invested with so much mystery. Professor Hughes has gone far to prove that this is especially true of magnetism. Before proceeding to enunciate Professor Hughes's theory it will be well to state that which it has completely superseded. It had long been assumed that two subtle magnetic fluids existed; and that these could be accumulated in a bar of soft iron or steel; one fluid always going to the north the other to the south pole of the magnet. Under ordinary conditions they were mixed, so to speak, and the bar was non-magnetic; but by rubbing a magnet on a bar of iron, or by sending a current of electricity round the bar, the fluids might be separated. Their desire to reunite caused the north pole of one magnet to attract the south pole of another, and so on. This theory is flatly opposed, it will be seen, to the idea that nature always works by the simplest possible means. It presented many other difficulties on which we need not stop to dwell, such as the apparent inadequacy of the means—rubbing—to the end, namely, separating two fluids. Ampère took the matter up, and after much research constructed the theory, which has been almost generally accepted, and which may be thus enunciated. Ampère discarded the two fluids, and assumed that each molecule of iron or steel was traversed by a closed electric current. When the iron was not magnetised these currents, under the influence of mutual attractions, so arranged themselves as to balance each other, and no external evidence of their existence was afforded. When magnetised, however, the currents in the bars were supposed to be given a parallel direction, when they no longer balanced each other. When complete parallelism had been produced, the bar was said to be saturated. The resultant of all the actions was supposed to be equivalent to that of a current traversing the outside of the magnet. In this way it will be seen that Ampère practically identifies magnetic and electrical force. That there is an analogy between the two is certain; but it has never been accepted as proved that magnetism and electricity were one and the same, and according to Professor Hughes they are quite distinct. It will not have escaped our readers that Ampère has made no attempt to say what electricity is; all that he has endeavoured to do is to show that under certain conditions electrical currents can produce magnetic effects, and how these effects may be produced. But he took us, after all, no nearer the complete solution of the whole problem than we were before.

A certain resemblance exists between the views of Professor Hughes and those of Ampère. The former supposes the existence of closed currents—that is to say, of a current which, taking its rise in a certain place, returns to it again, as, for example, when a current of electricity arising in a dynamo goes back to it along the circuit wires or leads. The fundamental difference between Professor Hughes and all who have gone before him is that he supposes the molecules in an iron or steel bar to be endowed with magnetism from the beginning. Every atom of a metallic bar is a true magnet at all times. It is as impossible to deprive it of magnetism as it is to deprive it of weight. All the molecules of an iron bar are free to rotate on their axes. If left to themselves they will so adjust their north and south poles to each other that a perfect balancing of interactions takes place, and there is no external force left. It is as though in an equation the positive and negative quantities were equal, and resulted in 0. Let, however, the molecules be turned on themselves, and the so-called closed circuit of magnetic influence in the bar no longer exists. North and south poles no longer balance each other, and we have external manifestations of magnetism. There is no magnetic fluid as there is no gravity fluid. Magnetism is an inherent property of iron. Why it is or what it is Professor Hughes no more attempts to say than he does to explain what gravity is. The statement as it stands is sufficiently startling and absolutely original. So far as we are aware, no one before him has even hinted that magnetism was inherent in iron and entirely unalterable in amount. It will now be understood that if Professor Hughes is right, then it is only necessary to alter the molecular arrangement of a bar of iron in order to render its magnetism evident, and this is what Professor Hughes has actually done. By twisting an iron wire first in one direction and then in another, he gets at will north and south poles at either end of the little rod; while the bar being restored to its original condition, all evidence of magnetism disappears. So far we have spoken only of iron and steel, because it is somewhat difficult perhaps to realise the fact that all matter is magnetic; but it is even so. We may now permit Professor Hughes to state his theory in his own words, spoken before the Royal Institution, on Friday evening, February 29th, 1884:—"From numerous researches," said Professor Hughes, "I have gradually formed a theory of magnetism entirely based upon experimental results, and these have led me to the following conclusions:—(1) That each molecule of a piece of iron, as well as the atoms of all matter, solid, liquid, gaseous, and the ether itself, is a separate and independent magnet, having its two poles and distribution of magnetic polarity exactly the same as its total evident magnetism when noticed upon a steel bar-magnet. (2) That each molecule, or its polarity, can be rotated in either direction upon its axis by torsion, stress, or by physical forces such as magnetism and electricity. (3) That the inherent polarity or magnetism of each molecule is a constant quantity like gravity; that it can neither be augmented nor destroyed. (4) That when we have external neutrality, or no apparent magnetism, the molecules or their polarities arrange themselves so as to satisfy their mutual attraction by the shortest path, and thus form a complete closed circuit of attraction. (5) That when magnetism becomes evident, the molecules or their polarities have all rotated symmetrically, producing a north pole if rotated in a given direction, or a south pole if rotated in the opposite direction. Also, that in evident magnetism we have still a symmetrical arrangement, but one whose circles of attraction are not completed except through an external armature joining both poles. (6) That we have permanent magnetism when the molecular rigidity, as in tempered steel, retains them in a given direction, and transient magnetism whenever the molecules rotate in comparative freedom, as in soft iron." Concerning electro-magnets, he said "(1) that a bar of iron under the influence of a current or other magnetising force is more strongly polarised on the outside than in the interior; that its degree of penetration follows the well-defined law of inverse squares, up to the saturation point of each successive layer. (2) The instant that the current ceases, a reaction takes place, the stronger outside reacting upon the weaker inside, completely reversing it, until its reversed polarity exactly balances the external layers." It must suffice here to notice a simple experiment used by Professor Hughes to illustrate his views. If a test tube filled with iron filings be brought into a magnetic field, the contents of the tube will become a magnet, having a north and south pole, and will so remain until the tube is shaken; then all the filings rearrange themselves, and the magnetism disappears. If, however, the filings be secured from motion, as by mixing them with some fluid which afterwards hardens and prevents their rotation among themselves, then the test tube and its contents will continue to play the part of a magnet until the fluid is melted and the motion of the particles is permitted. A soft iron bar will not remain magnetic, because its particles or molecules move freely; a bar of steel being more rigid, retains its magnetism, and some steels which are intensely rigid cannot be magnetised at all—at least, no ordinary force will suffice for this purpose. Heating a bar red hot sets all the molecules free, and magnetism disappears—that is to say, the external evidence of its interior existence vanishes; but only because the magnetic forces neutralise each other.

One of the most remarkable facts to be learned from Professor Hughes' experiments is that the most apparently rigid materials are extremely mobile. In this way, a bar of wrought iron resembles a rope of sand. It will not fail to be noticed that Professor Hughes, throughout the enunciation of his theory—given above—repeats with insistance the words:—"The molecules *or their polarities* have all rotated." There is, however, nothing to be found elsewhere in Professor Hughes's utterances to lead us to believe that he entertains the idea that polarities alone can be rotated. It will be seen, however, that the statement is, in one sense, a very important qualification of his theory. Let us suppose that every molecule has an invariable north and south pole, which is inherent in it and unalterable, and it follows that all the results that Professor Hughes has produced can be made to appear by simply altering the relative position of the molecules, these rotating, and carrying their magnetic poles with them. If, however, the poles themselves can be changed in the molecules without the motion of these last, then we have an entirely new field opened up. As the theory stands, it is impossible to magnetise or demagnetise a bar without shifting its molecules. If poles only can be rotated, then bars of steel, however rigid, might be magnetised and demagnetised without any molecular motion whatever. It is to be hoped that Professor Hughes will take an early opportunity of stating for what purpose he has used the words we have italicised above.

There is, we think, some reason to believe that Professor Hughes's atom can hardly be that of the chemist or the physicist. It is doubtful whether it may not be a comparatively large mass. Sir William Thomson in the course of a lecture "On the Size of Atoms," delivered about a year ago before the Royal Institution, said:—"The four lines of argument which I have now indicated lead all to substantially the same estimate of the dimensions of the molecular structure. Jointly they establish, with what we cannot but regard as a very high degree of probability, the conclusion that, in any ordinary liquid, transparent solid, or seemingly opaque solid, the mean distance between the centres of contiguous molecules is less than the 1-5,000,000th, and greater than the 1-1,000,000,000th of a centimetre. To form some conception of the degree of coarse-grainedness indicated by this conclusion, imagine a globe of water or glass, as large as a football, to be magnified up to the size of the earth, each constituent molecule being magnified in the same proportion. The magnified structure would be more coarse-grained than a heap of small shot, but probably less coarse-grained than a heap of footballs." There is, so far as we can see, no reason why each of Mr. Hughes's molecules should not consist of a number of such atoms. It is at least satisfying to think that such may be the case, for it is difficult to form any rational conception of one of Thomson's atoms with a north and south pole.

The more carefully such papers as those of Professor Hughes, and the lecture by Thomson we have just quoted, are read, the more evident will become our ignorance of nearly all that goes on around us, and the utter fatuity of dogmatising. The molecule of Hughes has probably nothing in common with that of Thomson. The whole theory of chemical science is built upon atoms; but Thomson told his audience that "chemists do not know what is to be the atom. For instance, whether hydrogen gas is to consist of two pieces of matter in union constituting one molecule, and these molecules flying about, or whether single molecules, each individual, or, at all events, undivided in chemical action, constitute the structure." The atom, again, of the crystallographer is different from all other atoms, for he and he alone recognises the fact that atoms are not necessarily spherical—the quartz atom or molecule, for instance, being distinctly "one-sided" or unsymmetrical. Are we because of such fundamental differences of fact—or shall we say opinion? to reject all scientific teaching and hold that the blind are trying to teach the blind? Certainly not. Rather let us seek after the truth, and acquire by observation and research all the information that we can, in the hope that one day light will really dawn on the world of science and illuminate the dark places in which it abounds. But let us above all things avoid that dogmatic and intolerant spirit which assumes that when a man of any eminence in science has spoken, his utterance is a final enunciation of the truth. Men who work as Professor Hughes works are beyond praise. Let

us hope that his admirers and disciples will not claim for him that he is infallible.

DENUDATION BY RIVERS.

Among the many important and complicated questions with which the practical hydraulic edgineer has to deal, there are few more important and few perhaps more complicated than that of the discharge of water through open channels. Naturally, therefore, it has engaged the attention of engineers from an early period, and the formulæ laid down on the subject by Dubuat, Eytelwein, and others date from centuries ago. Their experiments, however, were mostly conducted on channels of very small section; and it has long been recognised that to extend these to natural rivers, or even to channels of different dimensions, is to commit a grave error. Numerous formulæ have since been introduced in the hopes of improving on the results of these early experimenters. Turning, for instance, to the well-known pages of Molesworth's "Pocket-book," we find that the mere list of such formulæ occupies almost a page of small print, and that at least twenty authorities are there mentioned by name as having contributed to the subject. But as a striking commentary on their success a small table is given at the bottom of the same page, where four cases of actual discharge, varying from 24 to over 1,000,000 cubic feet per second, are compared with the calculated results for the same conditions, derived from nine approved rules on the subject. The differences are very striking; in some cases they amount to nearly 100 per cent., and in many cases to at least 50 per cent. Nor is this a solitary instance. Major Cunningham, in his recent work on the Roorkee hydraulic experiments, arrives at very much the same result. Again, in papers published in our issue of November 1st, 1872, p. 293, the results given in the classical experiments of D'Arcy and Bazin are compared with the calculated results derived from several of these same formulæ, the object being to test the value of the formula obtained from theoretical considerations by the late Canon Moseley. Anyone who will turn back to these figures will see divergences startling enough to prove that we must at least use considerable caution in adopting any formula for such purposes; and yet the conditions were here unusually favourable, as the experiments were carried on, not in the difficult and irregular channel of an actual river, but in an artificial conduit specially prepared for the purpose. In spite of these facts, which it is impossible to deny, nothing is more common than to see the most confident and offhand statements made as to the discharge of all sorts of rivers under all sorts of circumstances. To take one example, derived from the science of geology. It is frequently stated in geological works—as, for instance, by Mr. Alfred Wallace, and by Professor Geikie in his late admirable "Manual of Geology"—that a certain definite thickness of earth is removed from the surface of the land every year by the rivers which flow through it, and is by them emptied into the sea. The actual thickness, in thousandths of an inch per annum, is given with all the confidence of an approved scientific fact. We have never been able to trace this statement to its original source; but we have no hesitation, as practical engineers, in pronouncing it to be altogether visionary. It is worth while to consider for a few moments what data would be requisite before such a figure could be laid down, even to the very roughest degree of approximation.

Of course, the only possible method of determining it lies in measuring, by some mode or other, the quantity of mud—or silt, to use the most general term—which all the rivers, say, of this country, carry into the sea during the course of a single year. What would any engineer do if he was given the commission of carrying out such an inquiry? He would have, in the first instance, to ascertain the mean annual discharge of every river or stream emptying itself into the tidal estuaries of Great Britain. It would be worse than useless to conduct observations upon these estuaries themselves, because it is perfectly well known that the silt suspended in such waters at any moment gives no evidence whatever as to the amount of silt which is conveyed into these estuaries from the uplands during each year or day. Therefore, it would be vain, for instance, to compute the silt carried down by the Thames from observations taken below Teddington Weir; we must examine the Thames itself above that weir, and all the streams which enter into it lower down must be subjected to a separate investigation. Let us consider next what will be necessary in the case of any one of those streams. In the first place, our engineer must have the means of measuring its discharge with sufficient accuracy on any particular occasion he may desire. We have said enough already to show that this is an exceedingly difficult matter, that he will be unwise if he relies even upon the best of the dozen or so of formulæ amongst which he may take his choice; and that he is in duty bound to make an accurate determination in the case of each river, in order to take full account of local conditions. Let us assume that he has done so, and that he is thus able by a series of observations to ascertain with fair correctness the discharge taking place on any particular day. It is obvious that to measure this discharge for a single day only would be utterly futile. During a winter flood many rivers, even in England, will send down 50 to 100 times the water in an hour, compared to that which dribbles over their bottom towards the end of a summer drought. Our engineer must, therefore, measure all the great floods which occur during the year he has selected, and must also take a large number of measurements both in the wet and dry seasons. This done, he must search carefully the meteorological records of the district—if he can find any—in order to ascertain whether this particular year may be taken as a fair average example, and if not, he must make such addition to or subtraction from his results as his own judgment shall direct him. Failing this, he will have no resource but to renew his observations from year to year, until, in the lapse, say, of a generation, a true average can be struck. At the end of this time, provided there are no indications of a progressive change in the climate and rainfall, he may fairly be allowed to state what the mean annual discharge of this particular stream may be.

But his work is only begun after all; it is not the quantity of water discharged which he is in search of, but the quantity of silt. He has to determine not only the number of cubic feet of water which has flowed through his channel in a particular year, or a particular half-century, but how much solid matter each of these cubic feet held in suspension while it passed. To do this, it will by no means suffice to pick up a bucketful every time that he makes an observation, have it carefully evaporated, and weigh the residue which remains. We know scarcely anything of the laws of distribution of suspended matter within the waters of a stream. It may, indeed, be assumed that the quantity per cubic foot will be larger towards the bottom than towards the top of the current; but the law according to which this varies is quite unknown. All that we can be sure is that this law itself will vary, and probably vary largely, with the depth of the current, with its velocity, with the contour of the bottom, with the material of which that bottom is composed, and probably with many other local circumstances. It will not do, therefore, to trust to anything less than the collection of a large number of samples, say 50 to 100, from all parts of the cross-section, on each occasion when the discharge is measured, or, at any rate, on each occasion when the river is in any abnormal condition. Suppose this to be done, and the weight of silt per cubic foot at each of these places to be ascertained by the slow method of evaporation and weighing, then it will by no means do to strike an average of all the fifty, and multiply this by the number of cubic foot discharged per hour; for the velocities at different parts of the cross-section are very different, and this will clearly modify the results. Thus, if the velocity at the bottom is half that at the top, whilst the weight of silt per cubic foot is double, it will be seen that the amount of silt carried down per square foot of area at the bottom and at the surface will be really the same. Hence, we must know the average velocity in each of the fifty divisions, say, into which our cross section has been partitioned off for convenience, and we must also know the average weight of silt per cubic foot corresponding to that division. Multiplying together each pair in these two series of numbers, and adding the products thus obtained, we shall arrive at some sort of approximation towards the quantity of silt which our stream was carrying down per hour, on the day when this particular observation was taken; and the same process will have to be repeated for every one of the separate observations which have been described as being necessary in order to solve the problem of mean annual discharge. The experiments must necessarily be conducted over a considerable number of years, because it is quite possible that the effects of drainage, denudation, or other causes, may produce a progressive increase or diminution of the average quantity of silt borne down, and of this it will be necessary to take account.

So much for our single river; we have now to perform the same task for every other river and stream, from the largest to the smallest, which empties into a tideway round the coast of our island. The smaller streams will, no doubt, give less trouble than the larger, but they must by no means be neglected. We have no means at hand of estimating the number of such streams, but assuming that there is merely one for each mile of coast, it will be evident that it will be considerably over 1000. Supposing, however, that the whole of these have been gauged, and the discharge of silt calculated in the manner just described, we may perhaps imagine that our engineer's task is at an end. Not a bit of it. He has to ascertain not merely how much solid matter has been carried into the sea per annum, but how thick a layer of solid matter has been subtracted from the land. Now the quantity of the solid matter upon the land is being added to every year by the operation of certain very obvious causes, such as the falling of leaves, the decay of plants and animals, the application of foreign manures, &c. Possibly some one may object that organisms, whether plants or animals, can only build up their substance from materials already existing in the earth; but a moment's reflection will show that a large part of their substance is derived either from water or from air. It is precisely this decaying organic matter, lying as it does at or near the surface of the ground, which will be washed off in the greatest proportion by rain and by rills, and will so find its way into the rivers and thence to the sea. Therefore, our engineer must of necessity do one of two things: he must either analyse carefully every ounce of silt recovered in his observations in order to ascertain beyond a doubt, first, how much of it is due to organic and how much to inorganic matter; secondly, how much organic matter was derived from the earth and how much from air and water; or, failing this, he must by some means or other calculate the whole volume of matter which has been added to the earth by the causes above mentioned, he must measure the quantity which remains at the end of that period, and he must subtract the difference—or rather the difference less that part of it which is due primarily to inorganic constituents—from the total amount which he has already ascertained to form the burden of the rivers as they fall into the sea.

We have, perhaps, said enough to show, however faintly and inadequately, the nature of the task which an engineer would have before him if he were set to ascertain the correctness of the figure which geologists quote so confidently, viz., the thickness of the layer of soil which is removed annually from our British Isles by the operation of what is called sub-aerial waste. A feeling of longing and regret steals over us as we close the record. What a pity that the determination of this figure is not a matter of paramount national importance, to be settled at any cost! and what a pity that we ourselves are not given the responsible task of settling it! It would resemble one of those magnificent Chancery suits which an attorney of the old school was wont to regard with so much complacency and satisfaction; a suit which he could slowly administer during his life-time, and hand on to his children with his blessing on his death-bed, certain that it would remain as a sure and comfortable source of income to them and their children yet unborn. And yet geologists quote this figure with perfect confidence, as if it was known to the 10,000th of an inch. They do more—they calculate on this basis the number of years which will elapse before Great Britain becomes a dead level, totally forgetting that the diminution of slope all over the country will wholly change the conditions of the problem. They do this in the name of science, and in the next breath inform us that science is measurement!

Our geological problem has detained us so long, even in the mere stating of it, that we have no space left to consider further the special engineering problem—that of determining the discharge of rivers—with which we set out. We hope, however, to return to it at no distant date, having perhaps said enough, even here, to show that it is not one to be settled off-hand, and without either reflection or research.

MESSRS. MATHER AND PLATT'S TECHNICAL SCHOOL.

Technical education has long occupied the attention of teachers and economists; but, as with many things much needed in England, private enterprise will, if it does not lead the way, be contemporary with the movement set on foot by public men and assisted by wealthy institutions. From the point of view of practising engineers, whether of the roads and docks or the mechanical branches of the profession, of the ship-building, or the manufacturing branches, there has been a great difference between the applied sciences of the lecture-room and of the works. A want of appreciation of the practical considerations involved in the application of theory to any piece of work in almost all except the technical establishments under the most recent organisation, has led to a feeling of more or less indifference, sometimes contempt, on the part of those who, in daily practical work, show the student that there should be some relation between science and practice in and out of school. This feeling is not so strong as it was, simply because books, such as those, for instance, on mechanics, are not filled with mechanical paradoxes and enigmas by way of examples, but have, in many cases, reference to real machinery and apparatus, most of which is not obsolete. The same distinction marks the class-room at some educational establishments; but there is even now at most places too much time occupied with ingenious inventions in the way of kinematic and other problems, and not enough with problems of the sort which turn up every day in real work. The teacher has usually, though he may not express it, or may even be ignorant of it, a mental antipathy to practical detail; he prefers to deal with principles, and generally cares little for their application. For this reason technical classes should be taught by men who have a strong liking for theory, but only because it shows them how to solve the problems which present themselves in practice when a project or a piece of machinery has to be designed, constructed, made to work, and obtain the proposed object or end. They must be men whose appreciation and knowledge of these things has been got in the course of experience of doing real work. Seeing the necessity for the theoretical instruction of apprentices in their works, Messrs. Mather and Platt, of Salford, at the instigation of Mr. William Mather, established a school in connection with their works in 1873. Arrangements were made and a system gradually developed under which their apprentices could study applied mechanics, steam and the steam engine, tools, geometry, machine construction and drawing, building, construction, mathematics, and mechanical engineering, under the tuition of teachers who are themselves engaged in the works. Mr. T. Jones is head master, assisted by Mr. A. Hilton, the former being the head of the drawing office of the large Salford Works. The school is open from 1st October to 31st of May on three evenings per week, from 6.30 to 9 and 9.30, and the fee for the session ranges from 2s. to 2s. 6d. Messrs. Mather and Platt require all their apprentices to attend these classes as a condition of their employment in the works, so that each handicraft may be acquired at the same time as the technical knowledge connected with it. At the present time there are ninety-two students, including draughtsmen, fitters, tin-plate workers, turners, smiths, millwrights, joiners, pattern-makers, brass workers, moulders, and clerks. The courses of study are arranged to meet the requirements of the examiners of the Science and Art Department, South Kensington, and of the City and Guilds Institute. Everything required in the way of illustration and example is provided by the firm. The teachers being practical draughtsmen know exactly the requirements of their pupils; and lithographed copies of designs, and papers of questions drawn and composed by them are forthcoming in abundance, while no models are necessary, for the actual patterns are brought from the pattern shop into the school, and returned thither when done with, while the varied productions of the works afford practical illustrations of the lessons given in the class. The school is carried on with zeal, and good results have been obtained, as proved by the large number of prizes and certificates awarded since 1874. Besides others Messrs. Mather and Platt give special prizes for work, and offer a prize of £5 to every apprentice who can devise any improvement in machines or tools. The success of the school, now established ten years, reflects the greatest credit on the teachers, on whom success so much depends, and it indicates what the owners of other works might do for the advantage of themselves and their men. The firm has thus done and is doing some good, and has settled a problem of much difficulty. Of the many advantages which accrue to youths and men whose evenings are spent in these classes it is unnecessary to speak; but it may be remarked that very great interest is taken in the school by all. The Salford Ironworks Science and Technical Institute, as the school is called, was visited by the Royal Commissioners on Technical Instruction a short time since, and it was remarked by the Commission that "if every large firm had some years ago taken the same course as Messrs. Mather and Platt there would now have been no need for a Royal Commission to inquire into the methods adopted in foreign countries for imparting technical knowledge."

THE IRON TRADE ARBITRATION.

The arbitration undertaken this week by Dr. R. S. Watson, of Newcastle, is perhaps the most important that has been held. Prices of manufactured iron in the north are not so low as at some previous periods; but they have fallen very seriously, and it is expected that they will fall further. The demand for manufactured iron, too, is declining, and hence if the actual figures do not justify the demands of the employers the prospects of the trade in the immediate future must be fairly held to do so. But in asking that wages should be lower than at any previous period in the history of the Board of Arbitration, the employers make a request that will be seriously considered before it is granted—considered not only in

the light of the position and the prospects of the trade, but also in the light of the effect that it will have on the associated workmen. It is true that too much attention can easily be given to this part of the question, but it is one that must have consideration, and that will impart to the decision something of the importance of the famous Mundella-Williams award of a few years ago in the same trade. In any case there must be some relief to the employers; but the extent of that relief remains to be settled.

LITERATURE.

The History of the Year. A Narrative of the Chief Events of Interest, from 1st October, 1882, *to 30th September,* 1883. London: Cassell and Co. 568 pp.

The task of encompassing in one small-sized octavo volume a narrative of the chief events which form the salient points in the history of a year, is difficult. This will be best understood by writers, for they alone know how hard it is to say a little on a subject, and yet to say enough to satisfy the larger number of readers. This, however, is a task in which the writers who have contributed to the volume above mentioned, and to that for the year 1881-2, which we have also received, have succeeded. They have not produced a mere catalogue of events, but rather a general account of things in general, or in particular, according to their character.

The first four chapters relate to the general history of Great Britain and Ireland, and the two following chapters give the same with reference to India and the Colonies. The economic history of the year is next supplied, followed by five chapters on the general history of foreign countries. The science of the year forms the next subject, followed by literature and art, music of the year, religious history of the year, athletics of the year, fashions of the year, obituary of eminent persons, and an appendix; these parts occupying about two-thirds of the volumes. In the appendix are given the House of Lords, the parliamentary constituencies of the United Kingdom, members of the House of Commons; British possessions, their area, population, and revenue; public revenue and expenditure; statistics of population; national debt; British and foreign shipping; British import and export trade with foreign countries and British possessions; and railway statistics. In the second volume the title "economic history of the year" is changed to "trade and finance," and literature and art are dealt with under the four heads, literature, the drama, music, and the fine arts.

Most of our readers will no doubt first turn to the part dealing with the science of the year. Some may be a little disappointed that there are not more details given, but none will be better able to appreciate the work crowded into this part than scientific writers. It has evidently been written by a hand well able to separate that which is specially interesting to trained scientific minds from that which is more important to the general reader. Few things and no subjects which have marked the year seem to be omitted, although the reference must of necessity be very brief to some. "Electricity" filled a very considerable portion of the whole of this part in the first volume. The science of the year is equally well treated in the second volume, and as the formation of companies, and company mongering during panic were not so much a feature in the history of electricity, the account has more scientific value, as questions of much permanent interest are more fully discussed. The work of Professor Hughes, of course, comes in a leading position, but other questions of advance in electric and electro-magnetic and electro-chemical science are, considering the space occupied, remarkably well treated. Both volumes are provided with an index, which should be amplified, as the value of these books is confined very much to their reference facility. The books will no doubt find a place in the collection of everyone pretending to any interest in the history of our times.

Free Competition in the Building of Gas Engines. By C. Wigand, Civil Engineer, Hanover. Berlin: A. Seigel. 1884.

The author of this pamphlet is of opinion that gas engines should have a much wider application than at present, and should become as much an article of domestic use as the sewing machine. He inquires into the reason of their slow progress, and concludes that it lies in the want of free competition. The engines at present used, he says, are almost exclusively of the Otto type. This is no doubt a well designed and constructed engine, and is satisfactory in working, but it is dear, heavy, and often difficult to erect. Its weight is in great part due to its having only one explosion for two revolutions. Engines having one or two explosions in each revolution might naturally be of smaller dimensions. Such engines have been built, but were found to use too much gas. The reason of this want of economy, in the author's opinion, is that these older engines did not compress the gas before combustion, thereby losing a great advantage, as was pointed out by Schmidt as early as 1861. To this compression must be added some means of using slow combustion, and so obtaining uniform pressure, as described by Robert Bunsen in 1857. He observes that if an explosive gas and a non-explosive gas are mixed together in certain quantities, a sharp limit is found at which the mixture becomes incombustible; but that compression or heating restores the combustibility. It is this fact which lies at the bottom of all gas engines working without shock, from that of Lenoir to that of Otto; and the mixture must be such that the proportion of non-explosive gas increases from the point where the fire is applied to the other end of the cylinder. Can this principle be claimed as the property of a single patent? To investigate this point the author describes, by the aid of very clear coloured diagrams, the various gas engines of Lenoir, Hugon, Bisschop, Hock, and Otto. He finally arrives at the conclusion that the general principle was fully described by Bunsen in 1857, and used in practice since 1860, with the addition of the compression proposed in 1861. The Otto engine he considers to derive all its advantages from improvements in the mechanical arrangements. We shall not attempt to estimate the value of this conclusion, but can recommend those interested in the question to study the original memoir.

BOOKS RECEIVED.

The Principle and Practice of Electric Lighting. By Alan A. Campbell Swinton. London: Longmans, Green, and Co. 1884.

The Student's Practical Guide to Measuring and Valuing Artificers' Work. By Edward Dobson. Fifth Edition. London: Crosby Lockwood and Co. 1884.

Manual of the Transit Instrument as used for obtaining Correct Time. By Latimer Clarke, M.I.C.E. London: E. and F. N. Spon.

Transit Tables for 1884. *Giving the Greenwich Mean Time of the Transit of the Sun and of certain Stars for every Day in the Year.* Compiled for popular use. By Latimer Clarke, M.I.C.E. London: E. and F. N. Spon. 1884.

Elements of Plane Geometry. Part I. Corresponding to Euclid Books 1 and 2. London: W. Swan, Sonnenschein, and Co. 1884.

Waterworks Statistics, 1884. Edited by C. W. Hastings. London: J. Smith and Co. Fourth issue.

The Gas and Water Companies' Directory, 1884. Edited by C. W. Hastings. London: J. Smith and Co. Eighth issue.

Units of Measurement, for Scientific and Professional Men. By Louis D'A. Jackson. London: W. H. Allen and Co. 1883.

Recent Wonders in Electricity, Electric Lighting, Magnetism, Telegraphy, Telephony, &c. Edited by H. Green. New York: Agent, College of Electrical Engineering.

Hints on the Drainage of Dwellings. By W. Paul Gerhard. New York: W. T. Comstock. 1884.

The Plumber and Sanitary Houses: a Practical Treatise on the Principles of Internal Plumbing Work, or the Best Means for Effectually Excluding Noxious Gases from our House. By Stevens Hellyer. Third edition. London: B. T. Batsford. 1884.

PRIVATE BILLS IN PARLIAMENT.

In the House of Lords, the Plymouth, Devonport, and South-Western Junction and Devon and Cornwall Railway Companies Bill, the last of the group, was, after a short hearing, passed by a Select Committee of the House of Lords. The Bill is the outcome of an arrangement entered into last year by the promoters of rival Bills, with the view of obviating a parliamentary contest. In 1882 a scheme was before Parliament for a line known as the Devon and Cornwall Railway, which was to start from Lidford Junction and, going through a mountainous part of the country, went southwards to connect with the narrow-gauge system at Callington and Calstock, a junction also being formed with the East Cornwall Mineral Railway. The Bill was opposed by the East Cornwall Company; but an arrangement was made by which it was to be bought up by the Devon and Cornwall. In 1883 this company also came to Parliament to extend its line in a southerly direction, and a competitive scheme for a somewhat similar purpose was at the same time introduced into the Legislature. The parties consulted together, and finally it was agreed that the promoters of this last-mentioned line should take over the whole of the powers of the Devon and Cornwall Company, together with all other undertakings and obligations, except as regards a portion of line between Lidford and Gunnislake, which it was proposed to abandon as being unnecessary in the altered circumstances. In pursuance of the terms of this arrangement, the present Bill was introduced. As before stated, their Lordships found the preamble proved.

Group 7.—Sir John Kennaway's Committee gave their sanction to a scheme promoted by an independent company for constructing a railway from Salton Harbour to Willoughby, a distance of seven miles. A junction is to be made with the lines of the East Lincolnshire Company, over portions of whose railway running powers are taken. The next Bill on the list was the Lincoln and Skegness Railway Bill. According to the opening statement of counsel, the Bill proposes a railway from Lincoln to Skegness, a distance of forty miles; and it is intended to construct a loop line at Horncastle and a branch to Spilsby, which, with junctions, &c., will raise the length of line to be laid down under the Bill to something over fifty miles. The estimated cost of these works is £800,000, or about £16,000 per mile, to be covered by £954,000 share capital. Power is also taken under the Bill to borrow £300,000. The proposed line will give direct communication between Lincoln and Skegness, and will accommodate the intermediate district at present practically without a railway. There is every prospect of a goods traffic, the district requiring large supplies of coal, lime, &c., and sending out agricultural and other produce. Having referred to the petition of the Great Northern Company against the Bill, the learned counsel called evidence in support of the scheme.

In the Court of Referees on Friday last the Court met under the presidency of Mr. Pemberton to consider several cases of *locus standi*. For a considerable time the differences of the Dublin (City) Steam Packet Company and the London and North-Western Railway Company occupied the attention of the Court. In the first case, Mr. Pope, Q.C., on behalf of the North-Western Company failed to convince the Court that his clients had a *locus standi* against the Bill; and this being the only petition which had been presented, the scheme has been referred to the Committee on unopposed Bills. A long argument took place on the question of the right of the Steamship Owners' Association to urge their objection to the North-Western Bill before Committee. The Bill is an Omnibus Bill, and amongst its provisions is one by which the steamboat powers of the North-Western—which would otherwise expire next year—are perpetuated and incorporated. The effect of this, the petitioners contended, would be to leave the North-Western masters of the situation in connection with the traffic between England and Ireland. The only opportunity they would have of stating their opinions with regard to this proposal, which they considered most impolitic, would be before a Committee on the Bill. The objection taken by the promoters was that the petition did not disclose the fact that the Dublin (City) Steam Packet Company and the Dundalk and Newry Steamship Companies were members of the Steamship Owners' Association, and as no specific statement of this kind was made, no such interest was exhibited in the petition as gave the memorialists a *locus standi*. The Court, in granting the *locus*, observed that they only did so because they were afraid that otherwise the petitioners' interests might possibly be prejudiced, but the case must not be considered a precedent. The Court also allowed the *locus* of certain traders at Widnes, whose complaint was that they would be injuriously affected by clauses in the Bill raising the rates for the carriage of fuel in company's wagons to Widnes from distances of less than 50 miles. The petitioners in this case submitted that the question of increasing rates should be left until the matter was dealt with by general legislation. With regard to the petition of the Salt Chamber of Commerce against the North-Western Bill, the Court overruled the objection of the promoters as to the insufficiently representative character, as regards the district affected, of a body embracing the salt trade of the kingdom. The Usk and Towy Railway Company and the Central Wales and Carmarthen Company were refused the right to appear before Committee, on the ground that there was nothing in the Bill which was likely to alter their position. The last petition against the Bill was that of Edmund Ralph Vernon, who objected to the proposal of the Bill to close a certain level crossing. After hearing the petitioner, who appeared in person, the Court were of opinion that Mr. Vernon's interests were not such as to bring him out of the case of an ordinary individual who is protected by the local authority, and consequently the *locus* in this case also was disallowed. At their sitting on Tuesday the Court overruled the objections taken by the promoters of the Barry Docks and Railways Bill to the *locus standi* of the Marquess of Bute, the Alexandra (Newport and South Wales Docks and Railway Company and Newport (Alexandra) Dock Company, Limited, and a limited *locus* was given to the Rhymney Railway Company and the Pontypridd, Caerphilly, and Newport Railway Company, as regards the railway portion of the scheme. The Court disallowed the *locus* of the Newport Dock Company against the Great Western Railway Bill and the Cardiff and Monmouthshire Valleys Railway Bill. The Marquess of Bute was admitted to oppose the Treferig Valley Railway Bill.

FOREIGN NOTES.

The Budget Committee of the German Reichstag has decided to supply the sums required by the Chief of the Admiralty for increasing the strength of the Imperial navy, viz., 16,800,000 marks (£840,000) for the construction of seventy torpedo boats, including the necessary supply of torpedoes and Hotchkiss revolving cannon, and 857,000 marks (£42,850) for the purchase of a number of submarine torpedo batteries for coast defence. These latter are the invention of Count Schack, the enterprising chief of the torpedo department of the German Admiralty, and consist of iron caissons, which are submerged at the entrances to harbours and other points liable to be assailed by hostile ships of war. Each caisson contains a battery of Whitehead torpedoes, from three to six in number, together with air reservoirs, propulsion tubes, &c. The manner in which these submarine batteries are operated is as follows:—The torpedoes are charged and placed in the air-guns, the latter being connected with reservoirs containing compressed air. The caisson is then transported to its place of destination, submerged, and if necessary fixed in its proper position by divers. The exact bearings of the points at which the battery lies are then ascertained, and a system of wires connects the discharging apparatus of each torpedo air-gun with an electric battery on shore, from where the torpedoes are fired. Exhaustive experiments have recently been made with this invention in the neighbourhood of Kiel Bay, when the torpedoes were discharged at a moving object with great accuracy, and it was also ascertained that the battery could be kept submerged and ready for action for a term of several weeks at a time, without endangering its proper working when required. As regards the new torpedo boats, the prospects of the German Navy do not appear in so favourable a light, as it is generally believed that such boats cannot be built in Germany to compete successfully with those constructed by experienced English specialists. It is rumoured that the Minister of Marine has not yet definitely decided as to the course to be pursued, as he is anxious to support the native shipbuilding trade, but at the same time will only procure boats of the first quality. Two such craft have been ordered of one of the principal builders on the Thames, at the recommendation, it is said, of an influential British Admiralty official; but as these boats are intended to serve as models to the German builders, it is contended by the latter that one boat should have been ordered of each of the celebrated English builders, so that the merits of both designs might be compared.

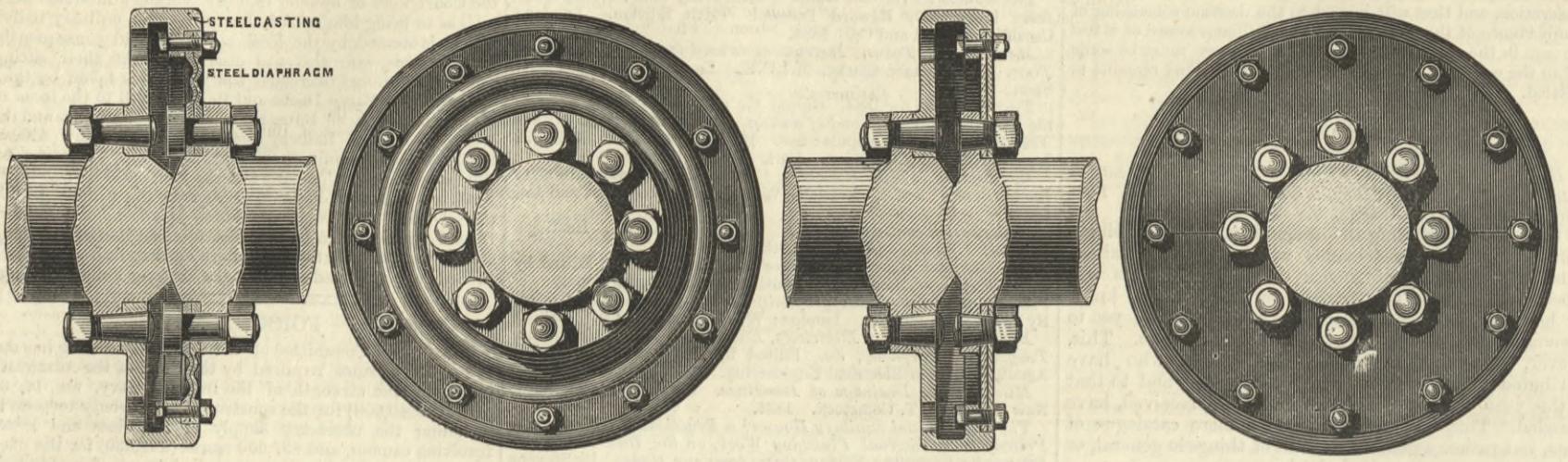
The Russian Minister of War has ordered a large number of Krupp guns, which were procured from Essen some years ago, to be considerably lengthened, and they are at present undergoing this process at the St. Petersburg Arsenal. The barrels of the guns are first bored out to a considerable depth, and steel tubes of the required length are then inserted. Guns converted on this principle are reported to have given satisfactory results.

A steel gunboat for the French Navy was recently launched at Rochefort; she was named "Le Gabès," and is of the following dimensions:—Length between perpendiculars, 149ft. 9in.; extreme breadth of beam, 23ft. 7in.; depth of hold, 10ft. 6in.; draught of water, 8ft. 6in. Her displacement ready for sea is 455 tons, and she will be fitted with engines of 450 indicated horse-power. It is estimated that she will realise a speed of upwards of 10 knots an hour.

The Chinese war steamer, Nan Thin, which was lately detained at Newcastle-on-Tyne, by order of the British Government, was built by Mr. George Howaldt, of Kiel, and was launched in the latter part of last year. The vessel was not built for the Imperial Government, but for the Viceroy of Canton, who possesses a small navy of his own. She is a steel-built corvette of 2200 tons, and is barque rigged. Her principal dimensions are:—Length between perpendiculars, 277ft.; breadth, extreme, 38ft.; depth in hold, 23ft. 4in.; draught of water, 18ft. She is propelled by twin screw engines of 3000 indicated horse-power, manufactured by her builder, and she is said to steam at the rate of 14½ knots per hour. Her armament consists of two 9in. and eight 40-pounder breech-loading Armstrong guns, and it was for the purpose of taking these on board that she proceeded to Newcastle. The action of the British Government in embargoing this vessel has created much surprise on the Continent, as no valid excuse can be found for her detention. It is maintained by competent authorities that the German Government only is responsible for any breach of international law which may have been caused by her departure from a German port. It will be remembered that Mr. Howaldt was the builder of the *ci devant* Peruvian cruisers, Diogenes and Socrates, which were first seized at Kiel by the German, and subsequently at Southampton by the British Government.

A Technological Museum has been established in Sydney, and some of the recent additions show the character of the collection and its technical uses. One new contribution consists of a fine collection of slabs of continental marbles. The slabs are uniformly 20in. square and 1in. thick; they are polished on one face, and on this is a short description of them, the letters being cut into the slabs and gilt. The marbles are from the most celebrated quarries in Germany, Austria, Italy, France, and Belgium. The collection of 6in. cubes of building stones already in the museum has also been supplemented by a number of cubes of limestone, sandstone, granite, lava, &c., from various localities in Europe. As interesting to the users of machinery, forty large framed photographs of machinery, constructed by Messrs. Robert Daglish and Co., of St. Helen's, Lancashire, have been added. Much of this machinery has been specially constructed for colonial requirements, and includes stamp batteries; amalgamators and miscellaneous gold mining machinery; copper ore mining machinery; appliances used in grinding, smoothing, and polishing plate glass; miscellaneous chemical plant, including complete machinery for the manufacture of soda from sea salt; steam cranes, hoists, &c.; large boilers; blowing, winding, pumping engines, &c. The *Sydney Morning Herald* says, a complete series of coloured maps and plans to illustrate the geology of Belgium has also been received.

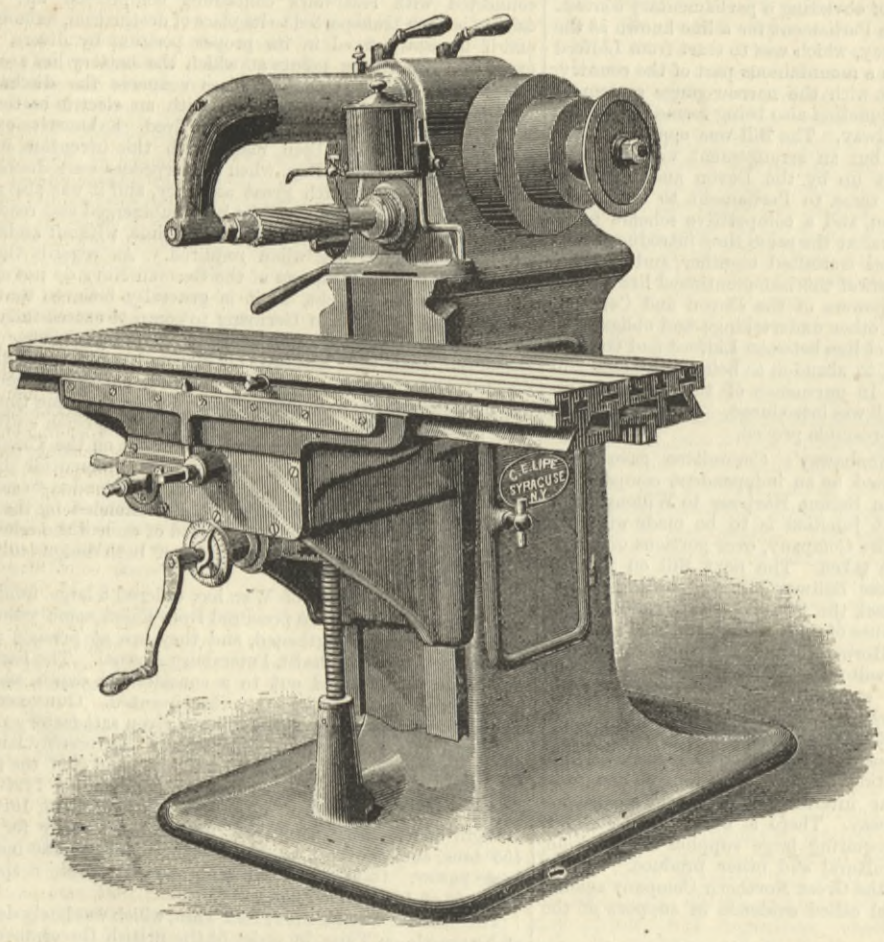
BROTHERHOOD'S ELASTIC COUPLING.

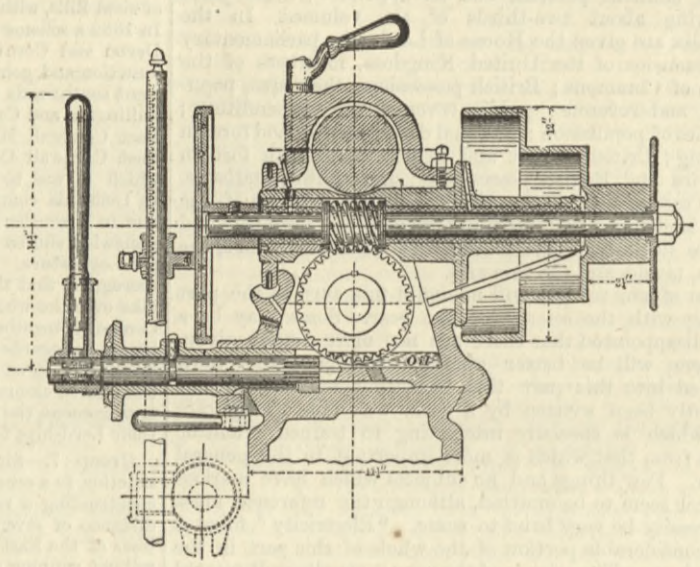


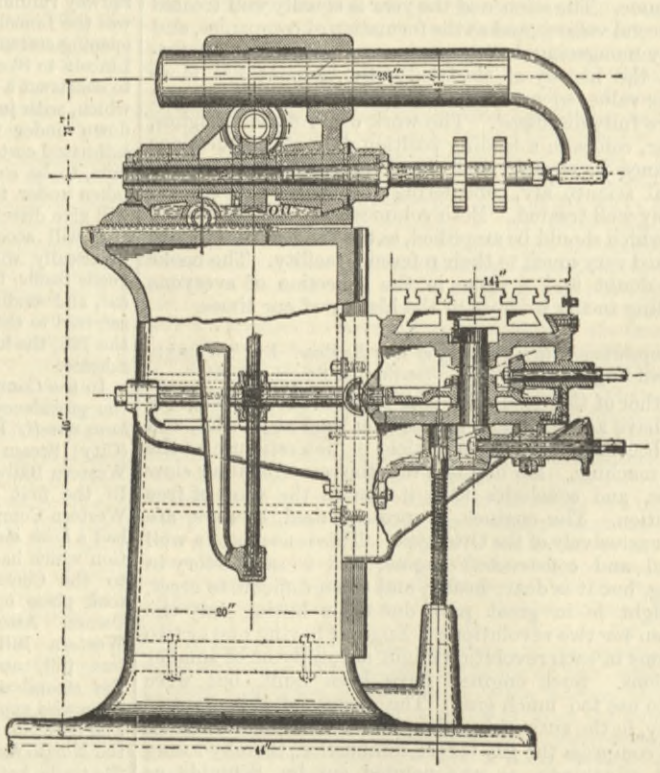
We referred in a recent impression to the use of the flexible coupling recently patented by Mr. Peter Brotherhood, of Belvedere-road, Lambeth, as a means of preventing the fracture of screw shafts. Mr. Brotherhood had already suggested this, and we give above engravings taken from designs submitted some weeks ago for a steamship. The drawing will explain themselves. The shaft ends but against each other to give the thrust. The coupling is effected by steel diaphragm plates, which may be corrugated or plain, as shown.

UNIVERSAL MILLING MACHINE.

MR. C. E. LIPE, SYRACUSE, U.S.A., ENGINEER.







The accompanying engravings, which we take from the *American Journal of Railway Appliances*, represent a heavy plain universal milling machine designed especially for engine and locomotive builders, and manufacturers of wood-working machinery, heavy work requiring a large table capacity and length of cut, and made by Mr. C. E. Lipe, Syracuse. The machine has wide range of adjustment, and is provided with such means for making the adjustment as will enable the operator quickly and easily to arrange his machine to operate on any required piece of work. The table or platen is 5ft. long, 14½in. wide, provided with five bolt slots, running its entire length. It is supported directly on the knee, in bearings, which are 36in. long; and well braced to give strength and stiffness. It has automatic feed and stop motion in either direction, and may be fed its entire length; in other words, the entire top of the table can be surfaced off on the machine itself. The adjustment of cutters in line with the spindle is effected by mounting the spindle driving gear and the feed works on a sliding head gibbed to traverse the top of the column. This gives a long bearing for the transverse slide, and also allows an adjustment of 12in. between limiting points. This adjustment is made by rack and pinion, controlled by a lever at the left of the machine. A graduated dial measures the amount of movement. The spindle has a hole $1\frac{9}{16}$in. through its centre, which tapers to the front to receive the arbor to 1⅞in. Its taper is 1½in. per foot, and for all ordinary work is sufficient to keep the arbor from turning; but for driving gangs and large mills an arbor is used, having a hexagon enlargement just outside the spindle; a cap to screw over the end of the spindle having a hexagon opening in it to fit the arbor, completes a positive driver claimed to have none of the objections of cutting a mortise or key-way in the spindle, or weakening it in any other manner. This cap protects the thread on the spindle, and may be readily moved for a face plate or a large facing mill. The heavy outside centre horn supports the end of the arbor, and is readily removed by raising the grip screws on top of the head, when it may be either swung up out of the way, or taken out entirely when necessary.

The spindle is of tool steel, 3½in. in diameter in the front bearing, and tapers uniformly ¾in. per foot to the back end. Solid bushes are driven in the head to form the bearings. It is driven with a worm and gear, the latter dipping in oil contained in the head. All oil which may work out through the ends of the bearing is caught in pockets and returned to the inside of the case. The manner of raising and lowering the table is the commonly used method of screw and bevel gears, with measuring dial. This dial, and also that on the head, has two circles, properly divided, so as to measure with either the decimal or binary system, as desired. In addition to the automatic feed of the table, two hand feeds are provided—one for a slow and powerful feed, another for quickly locating the table at any point along its path. The automatic feed mechanism starts with a leather covered friction disc on the opposite end of the cone shaft, transmitting its motion to a friction pinion, which may be located at any point at either side of the centre, thereby providing for a table feed in either direction, at any rate of feed from zero to $\frac{1}{16}$in. for every revolution of the cutters. The connection between the pinion shaft and knee is made by a worm and gear attached to each respectively.

THE ROYAL AGRICULTURAL SOCIETY'S SHOW AT SHREWSBURY.

The entries in the implement department of this year's show of the Royal Agricultural Society of England, which is appointed to be held at Shrewsbury next July, closed on Tuesday, and the Allotment Committee will meet in a few days to determine the acceptance or refusal of the applications for space, which, it is believed, will bear the most favourable comparison with exhibitions at much larger places. The two sections of the Shrewsbury Show in which it is reasonable to suppose the largest amount of interest will be centred are those in which special prizes are offered. In the first of these divisions will be found two classes of sheaf-binding machinery, competing for three premiums to the value of £175, of which the sum of £150 is set apart for sheaf-binding reapers, the remaining £25 being designed for separate sheaf-binders; but in both of these classes it is prudently provided that the binding material must be "other than wire." Repeated trials of sheaf-binding machinery have been organised and carried out by the Royal Agricultural Society; but sufficient time has elapsed since the last contest to allow of the development and perfecting of the numerous inventions comprised under this designation which have been patented at home and abroad during the last few years. The trials of the competing binders will, as a matter of course, be deferred until harvest-time; but in accordance with the invariable practice, the whole of the entries will be exhibited at Shrewsbury. Although the prize in the other special section—the "Ensilage" section—is limited to £25 for an efficient machine for cutting and elevating materials to be preserved in silos, a varied exhibition may be looked for, comprising not only cutters and elevators, but an interesting collection of ingenious devices which have been lately patented by enterprising engineers with a view to facilitate the storage of "pitted provender." Exhibits of this nature will possess peculiar interest to thousands of agriculturists, including not only those who have already experimented with the silo, but the still larger number who are seriously contemplating the best means of pitting future fodder crops. The coming exhibition will, it is expected, offer a good opportunity of comparing the different appliances which have recently been brought before the public.

Liverpool Engineering Society.—The sixth meeting of the session was held on Wednesday evening, March 26th, at the Royal Institution, Colquitt-street, the president, Mr. R. R. Bevis, Jun., in the chair; when a paper was read by Mr. W. A. Carver entitled "Estuaries." The author, in opening his paper, dealt with the importance of the estuary in maintaining a channel of sufficient depth for ships; the rise and fall of tide, with its velocities at the surface and at the bottom; giving various data as to the Mersey. He then alluded to the depth of the bar at Liverpool, showing how the variations were due to special causes in the estuary; giving the quantity of solid matter held in suspension.

drawing trade. Current business may almost be said to be at a standstill. The price quoted for ordinary nail rods was £6 per ton.

The ironworkers are evidently going to do their best to resist the appeal of the masters to the arbitration of the Wages Board to declare a further reduction in their remuneration. At meetings of the men, which have been held in two or three parts of the district this week, resolutions have been passed declaring the proposed reduction to be unjustifiable and uncalled for, and pledging the meetings to do all in their power to resist it, "considering that any further reduction in wages will not tend to increase the trade." With a view to united action a meeting of delegates from the various works in the district is called for next Monday, to consider the position.

The reconsideration of the wages question in the coal trade will be introduced by the employers' section at an early meeting of the Coal Trade Wages Board. It would be brought on at once but for the want of a president. Mr. Haden Corser has retired from the office, devoting his attention to politics; and Mr. Alfred Young, of the Oxford Circuit, is to be invited to succeed him. The masters claim to be considered directly this matter is settled. A section of the men in the Dudley part of the district are refusing to accept the Wages Board as in any way binding upon them. Their action may possibly prove to be "ugly" by-and-bye, but it is hoped that better counsels will prevail.

Mr. R. Smith Casson, general manager of the Earl of Dudley's Round Oak Ironworks, Brierley Hill, and well known as one of the patentees of the Casson-Bicheroux gas furnace, has been elected vice-president of the South Staffordshire Institute of Iron and Steel Works' Managers.

The bridge, girder, and roofing trades keep fairly active, with a prospect of other work being given out. The contracts in hand are in much part on export account, but some home orders have been recently received. The prices at which the work has to be accepted do not, however, show any improvement. The new bridge work which has recently come into the district includes a contract for the bridge which is to be thrown across the Thames at Putney. It has fallen to Messrs. Simpson and Wood, of the Grand Junction Works, Darlaston, and Globe Ironworks, Walsall.

The Indian railways are in the Midlands and are just now again in the market for a supply of wheels and axles and axle-boxes for the Government lines. The Oude and Rohilkund Railway Company requires switches and crossings, engine turntables, and ballast wagons. Steam pump and weighing machine makers are trying for the orders which the Great Indian Peninsula Railway Company is about to give out.

The North Staffordshire finished iron trade still evinces no improvement. The hopes which were entertained a few weeks ago of an early revival have been disappointed, and things are now at their normal level again.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—An absence of business in nearly all departments still characterises the iron trade of this district, and with prospects of lessening consumption in some of the iron using branches of industry, and a general want of confidence with regard to the future, buyers naturally are very indifferent about giving out orders beyond what they want for actually known requirements. So far as pig iron is concerned, makers seem to be equally indifferent about pressing sales, and the improvement which has been exhibited in the Middlesbrough market during the past week helps towards encouraging makers in maintaining an attitude of firmness. The condition of the finished iron trade is, to use a very common expression, "sick," and forge proprietors generally find it very difficult to get work sufficient to keep them going, whilst many of the merchants are talking the market down even more than actual circumstances would seem to warrant. There is no doubt a weakness in prices, and in many cases a disposition to make concessions to secure orders, but the leading manufacturers are not disposed to meet buyers to the extent they appear to expect.

The actual business doing at the Manchester market on Tuesday was again extremely small. For local and district brands of pig iron there was so little inquiry that prices were scarcely tested. Nominally quotations were maintained at late rates, Lancashire makers being firm at 44s. to 44s. 6d. less 2½, as their minimum for forge and foundry qualities delivered equal to Manchester, and for district brands the minimum quotations remained at about 43s. 10d. for forge to 44s. 10d. for foundry Lincolnshire less 2½ delivered here, but there was little or no business doing at these figures. For Middlesbrough iron rather more money is being obtained, especially for forward delivery, to secure which buyers are in some cases willing to pay a small premium upon present rates. In some of the best named brands of foundry sales for forward delivery have been made at about 48s. 4d. net cash equal to Manchester, with good ordinary brands averaging 46s. for prompt sales, and 1s. per ton more for forward contracts.

In the hematite trade there is still but a very slow business being done, and orders are only to be got at such very low prices that in some cases makers are declining to entertain offers on the basis of the prices now current in the market. Where sales are made the average prices are about 55s. 6d to 56s., less 2½, for good foundry brands delivered into the Manchester district.

For manufactured iron the average prices are about £5 17s. 6d. per ton for good Lancashire and North Staffordshire bars delivered into the Manchester district, but buyers are holding back for lower figures, and in a few cases there are sellers at £5 15s.; and north country bars continued to be offered freely at £5 12s. 6d. Lancashire made boiler-plates average £7 15s.; sheets, £7 10s.; hoops, £6 7s. 6d.; and common Cleveland plates and angles, £5 12s. 6d. per ton, delivered into this district.

In the engineering trades report generally shows a falling off in the weight of new orders coming forward. In a few special branches activity is being maintained, and the leading toolmakers in the district are kept tolerably well employed. The cotton machine making trade is also tolerably active just at present. The prospects of the engineering trades all through are, however, not at all of a hopeful character, and in most branches a period of dulness is being looked forward to.

The question of safety lamps, which is just now so largely engaging the attention of mining engineers, was again before the members of the Manchester Geological Society at the ordinary monthly meeting on Tuesday. Mr. J. Dickinson H. M. chief inspector of mines, drew attention to Herr Wolff's relighting apparatus described by Dr. Foster, inspector of mines, at the previous Wigan meeting. A question was raised whether an apparatus which enabled a lamp to be relighted might not bring with it an element of danger, as supposing the lamps were full of an explosive mixture when it went out and a light were suddenly struck in the midst of this explosive mixture, it was possible that there might be a great risk of explosion, which would not exist where the gas had been accumulating gradually in a lighted lamp. Mr. Dickinson admitted that under some conditions there might possibly be a risk of danger from this cause, but looking at the great inducements which existed for a miner to unlock and re-light his lamp in a mine when he was at a great distance from the authorised re-lighting station, he could not help thinking that there was room for the introduction of a means of re-lighting, such as Herr Wolff had introduced, in mines where the working places were a long distance from the lamp stations and the travelling roads were difficult to traverse. With regard to the suggestion made by Dr. Foster, that such an arrangement might be an infringement of the Mines Regulation Act, Mr. Dickinson said it could scarcely be urged that the means of re-lighting such as the Wolff lamp possessed was plainly and straightforwardly an infringement of what was the real intention and spirit of the Act of Parliament, because the means of re-lighting was not absolutely and independently in the possession of the miner, but was as much under lock and key as the lamp itself. Another matter connected with mining was also brought forward at the same meeting. Messrs. Tonge and Kearsley, of Hulton, near Manchester, exhibited a model of a new patent safety cage, designed to remove risk of accident in the case of the breakage of the winding ropes. The cage is one of ordinary construction, fitted with a pair of wheels, slightly excentric, one wheel being placed on each side of the conductor or rod. In winding, the wheels are held by the chains, with their longest radius away from the rods. As soon, however, as the chains holding the cage go slack, the wheels are brought together by means of a spring or an elastic band, or by making the longest radius heavier, so that it would fall by its own weight. The conductor, being between, is firmly gripped by the wheels, and the greater the weight, or the stronger the spring, the more tightly are the conductors held. This arrangement has, I understand, already been tested satisfactorily by experiment in a mine shaft, and it is an apparatus, simple in construction, which can be readily adapted to any pit cage.

In the coal trade the month has opened with a falling off in the demand, and a downward tendency in prices. There has been no general announced reduction, but with orders not coming forward more than sufficient to keep pits going about three to four days a week, and, stocks accumulating, colliery proprietors in most cases are prepared to make special quotations for quantities, and at many of the West Lancashire pits reductions of 6d. per ton have been made this month on all classes of round coal. At the pit mouth best round coal now averages about 9s. per ton; seconds, 7s.; and common round coals from 5s. 3d., for steam and forge purposes, to 5s. 6d. to 6s. for house fire qualities. Engine classes of fuel are only in moderate demand; but the limited supplies of slack coming into the market keep up prices, and at the pit mouth burgy averages 4s. 6d. to 5s.; best slack, 4s. to 4s. 3d.; and good ordinary qualities, 3s. 3d. to 3s. 6d. per ton.

For shipment there is a moderate demand, but there is so much stock being pushed upon the market, that very low prices have to be taken to secure orders. Steam coal delivered at the high-level, Liverpool, or the Garston Docks, is to be bought at 7s. to 7s. 3d.; and seconds, house coal, 8s. 3d. per ton.

The continued downward movement in prices is forcing to the front the question of a reduction in wages. Already the matter has been under consideration; and although nothing definite has yet been done, it is more than probable that some action will be taken before long.

Barrow.—I have again to report a most unsatisfactory condition of the hematite pig iron trade of this district, as during the past week no notable change has occurred at market. Makers all round are pretty unanimous in opinion that many months will elapse before a revival will take place in the trade. The business transactions have not in any way improved the aspect of affairs. Consumers are very backward in placing out orders, and when contracts are offered they are limited to more immediate wants, and little speculation is noticeable in transactions. Makers are anxious to do business, although prices are ridiculously low, and they even offer lower quotations for large concessions. The business to hand from home consumers is considerably restricted, and the business doing on foreign and American account is practically *nil*. The output all over the district is being continually reduced, but stocks, owing to the deliveries not keeping pace with the output, are growing rapidly, and some time will elapse before they will be satisfactorily reduced. Prices are unchanged, but have a lowering tendency. No. 1 Bessemer samples are quoted at 47s. per ton net at works, prompt delivery; No. 2 at 46s., and No. 3 at 45s. per ton. Steel makers are but indifferently employed, and find a scarcity of orders. Little business is doing in either the merchant or railway department, and if the trade does not improve makers will be under the necessity of restricting the output. Rails are offered and slowly changing hands at from £4 10s. to £5 per ton at works. Shipbuilders, although in receipt of one or two new orders, are short of work, as are also engineers, ironfounders, boiler-makers, and others engaged in the minor departments of the steel and iron trades. Iron ore is in limited request at low prices. Quotations are unchanged, orders being generally accepted at from 8s. per ton net at mines and upwards. Stocks all round are very heavy. Coal and coke easier. Shipping dull, as freights are low.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

A striking instance of the depreciation of manufacturing property was afforded at Sheffield on Tuesday. The Midland Iron and Steel Works—formerly known as the Cardigan Works—with the file factory, boilers, steam hammers, train of rolls, and indeed the whole of the plant, was offered for the fourth time to public competition. The premises—a portion of which is let for about £220 per annum—are situated in the manufacturing quarter—Savile-street East—and the land is held under a lease for ninety-six years from 1863, at a ground rent of £43. In December, 1881, £3600 was bid for the property, and it was understood that £4000 could have been got for it; in 1882, the highest bid was £2400; and in 1883 no offer could be obtained. On Tuesday, Mr. Bush, the auctioneer, stated that he was there to sell the works, absolutely without reserve. The bidding began at £500, and went up briskly to £1750, at which figure it was knocked down to Mr. B. M. Renton, iron and steel merchant, Wicker. The property was valued to the Twelfth Patriotic Building Society at £10,000, and it was mortgaged to the extent of £42,000.

At the Parkgate Ironworks a notice has been posted intimating that the scale of wages agreed upon in the North of England as the result of the arbitration undertaken by Dr. R. S. Watson upon the claim of the iron manufacturers for a reduction of 10 per cent will be adopted. The Parkgate and the Midland Ironworks are pretty fully employed, but prices are very lean. It is only by the most enterprising and yet judicious management that the volume of work can be maintained, even at the ruling low rates.

Messrs. Edmund Draper and Co., St. Mary's Works, Sheffield, have been the means of obtaining from the Austrian Government a concession of no little consequence—a reduction of duty on table cutlery, which came into force on March 3rd. Table cutlery, which has formerly been charged 30 florins per 100 kilos., is now charged 15 florins. To avoid the heavy tax of 30 florins, manufacturers usually sent goods *viâ* Hungary, but now they will accept the reduced tariff and transmit directly to the Austrian markets.

Mr. Frederick Sibray—Messrs. Sibray, Hall, and Co., of the Fitzwalter Works, St. Mary's-road—has been the leader of a rather important agitation in regard to the Sheffield Assay-office. Mr. Sibray, in several well-written letters, has urged the necessity of having the Assay-office open every day. That this is the general desire of the silversmiths is evident from the presentation of a petition to that effect, signed by every manufacturing silversmith in the town, with one exception. If this concession is granted by the guardians, manufacturers would then be able to send their goods to the Sheffield office, and avoid paying carriage to London and back; and—Mr. Sibray says—would feel themselves placed in a fair position for competing with the London makers, "who are at present able to execute an order while we are waiting for the office opening." Mr. Edward J. Watherston, of Pall Mall East, London, energetically supports Mr. Sibray's proposal, stating that "over and over again has he been disappointed by the non-arrival of ordered work from Sheffield, the only explanation being that the goods could not be finished in time for the Assay-office." It seems singular that in Sheffield, the very centre of the silver and electro-plated trade, the manufacturers should have been so long content with the present inadequate arrangements. Another point is difficult to understand—why, not only in Sheffield, but in London, "the scrape and parting assay" should be continued, instead of "the touch," as in Paris and Vienna. "Only lately," says Mr. Watherston, "two goblets were sent to be hall-marked—one to the Goldsmiths' Hall, the other to Paris. The one left to the tender mercies of Mr. Prideaux and his lieutenants came back scraped and injured past hope of recovery; whereas the one sent to Paris has been returned without a scratch." "The fact is," he adds, "in Paris and Vienna the assay-offices are managed with a view to the encouragement of trade and commerce; in England, on the contrary, they ought rightly to be described as "institutions for the prevention of British trade and commerce."

In the Dronfield district some 400 colliers are on strike against certain alterations in their manner of working which they say would be equivalent to a reduction of 10 per cent. in wages. The dispute is at the pits of the Unstone Coal and Coke Company.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

A quiet feeling pervaded the Cleveland iron market held at Middlesbrough on Tuesday last, both buyers and sellers being apparently inclined to await the issue of the statistics for March before taking further action. Meantime prices remain unchanged, the usual quotation for No. 3 g.m.b. for early delivery being 37s. 3d. per ton. Buyers are ready to give 37s. 3d. for forward delivery, but sellers are not prepared to take that figure, expecting as they do that higher rates will be obtainable when the shipping season has fairly set in. The stock of forge iron has been lately much reduced, and though the demand has also fallen off, the price is well maintained, 35s. 9d. to 36s. per ton being freely given.

There is little inquiry for warrants, and the prices remain at 37s. per ton.

The stock of Cleveland pig iron in Messrs. Connal's store at Middlesbrough has decreased 310 tons during the week. During March it decreased 823 tons. At Glasgow there was an increase of 405 tons last week. During March 80,865 tons of pig iron, and 31,168 tons of manufactured iron and steel were shipped from Middlesbrough. This is an increase over February of about 11,000 tons of pig iron, and about 7000 tons of finished iron and steel. The principal items comprised in these returns are as follows:—Scotland, 23,470 tons; Germany, 18,065 tons; Holland, 8503 tons; France, 5990 tons; and Italy, 5830 tons.

There is no change in the finished iron trade. The demand is as slack as ever, and manufacturers cannot get sufficient orders to keep their mills running full time. Prices, however, are unaltered, ship plates being £5 2s. 6d. to £5 5s. per ton; angles, £4 15s. to £4 17s. 6d.; and common bars, £5 2s. 6d. to £5 5s., free on trucks at producers' works; cash 10th less 2½ per cent.

Dr. Spence Watson, the selected referee, will hear evidence in respect of the wages dispute in the North of England finished iron trade at Newcastle on the 5th inst.

The Sunderland engineers' strike still continues. The men have now been out for nine months, and still continue to receive relief from the strike fund.

The shipbuilding trade at Middlesbrough is almost at a standstill. Messrs. Craggs and Son have no new orders in hand, and have paid off most of their men. Messrs. R. Dixon and Co. have also largely reduced the number of their hands. The new shipyard belonging to the Tees-side Company is nearly ready; but there are no orders to commence upon.

The accountant's certificate, issued according to the provisions of the Northumberland coal trade sliding scale, shows that the average selling price of coal for the three months ending February 29th was 5s. 1⅛d. per ton. By it the wages of underground men and banksmen will be reduced 1¼ per cent.

A statement of the affairs of the Carr House Iron Company, of Hartlepool, has been circulated among the creditors. The total liabilities amount to £16,303, and the available assets to £2567. The latter sum comprises book debts—good—£625; doubtful debts, £747, estimated to produce £3 7s. 6d.; and stock-in-trade, £2016. The debtors state that they had a capital of £4000 in January, 1881, and that this amount was lost during 1883.

Wages throughout the North are everywhere falling. The men seem for once convinced that it is inevitable, and that resistance is hopeless. There are few strikes, and these meet with no encouragement or sympathy, and soon come to an end. To get the best terms possible, so as to keep at work, is the one thing now aimed at. Meanwhile, many hundreds are walking about in idleness, and there is much privation among women and children.

At a public meeting held at Stockton this week resolutions were passed protesting against the ironmasters of the Cleveland district being supplied with water by the Stockton and Middlesbrough Corporations Water Board at 3d. per thousand gallons, which is said to be below cost price. The Corporations were urged to attempt to get an Act of Parliament empowering them to charge, at least, cost price. The object of the promoters of the meeting in question was to cheapen the water supply to householders at the expense of the ironmasters. It is not thought probable that success will attend the movement, as the 3d. rate is embodied in the original Act of Parliament, and was a condition of it being allowed to pass.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Glasgow pig iron market has again been quiet this week, the alterations in the prices of warrants being inconsiderable, although the feeling is somewhat weaker. Pig iron exports are a little larger in amount, but the total quantity despatched in the last quarter is from 9000 to 10,000 tons less than in the corresponding period of 1883. The larger shipments of the week were 2379 tons to Germany and 1500 to France. The inquiry from the United States is comparatively poor, and that from Italy and France is not at all so encouraging as it was several weeks ago. In one or two cases the market values of makers' iron are a shade lower, but on the whole the quotations this week are unchanged. There are ninety-three furnaces in blast as against 111 at this date in 1883. The stocks of pigs in makers' yards are believed to undergo scarcely any change, but there is a gradual addition to those in Messrs. Connal and Co.'s warrant stores.

Business was done in the warrant market on Friday at 42s. 5d. to 42s. 6½d. cash. On Monday forenoon the figures were 42s. 5½d. to 42s. 4½d. cash, and 42s. 6½d. one month, while the afternoon quotations were 42s. 5d. to 42s. 4½d. cash, and 42s. 6½d. one month. Tuesday's market was quiet, at 42s. 4d. to 42s. 3½d. cash, and 42s. 6d. one month. Business was done on Wednesday at 42s. 2d. to 42s. 3d. cash, and 42s. 4½d. one month. To-day—Thursday—being a Church holiday in Glasgow, the market was closed.

The quotations of makers' iron are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 53s.; No. 3, 51s.; Coltness, 58s. 6d. and 51s.; Langloan, 54s. 6d. and 51s. 3d.; Summerlee, 52s. and 48s. 6d.; Calder, 53s. 6d. and 47s. 6d.; Carnbroe, 52s. and 48s.; Clyde, 48s. and 45s. 6d.; Monkland, 44s. 3d. and 41s. 6d.; Quarter, 43s. 9d. and 41s. 3d.; Govan, at Broomielaw, 44s. 3d. and 41s. 6d.; Shotts, at Leith, 53s. and 52s.; Carron, at Grangemouth, 48s. 6d. and 47s. 6d. (specially selected, 54s.); Kinneil, at Bo'ness, 46s. and 45s.; Glengarnock, at Ardrossan, 52s. and 46s.; Eglinton, 46s. 3d. and 43s.; Dalmellington, 49s. and 44s. 6d.

The imports of Middlesbrough pigs at Grangemouth show an increase on the quarter of fully 10,000 tons.

A scarcity of fresh orders is being experienced in the malleable iron and engineering trades, although the necessity for discharging additional workmen does not appear quite so great as it was several weeks ago. The locomotive works in Glasgow and neighbourhood are still well employed, a great proportion of the work in hand being for abroad. Excluding pig iron, the value of the iron exports shipped from Glasgow in the past week was fully £80,000.

There is a moderately active market for coals for home use and shipment, but the pressure of the Quebec trade is not yet fully at hand on the Clyde, while the inquiry for the Baltic is not so good as it will be later on the Firth of Forth. At Glasgow there have been fair shipments for abroad in the course of the week, and the inland demand has been a shade more brisk, there being, however, no

material alteration in prices. The shipments of coal at Grangemouth are about 1000 tons less for the three months than they were in the corresponding quarter of last year, and at the other ports, both on the east and west coasts, the exports are generally behind, the total comparative falling off for the quarter being about 30,000 tons.

The miners continue to agitate for the general adoption of short time, and are holding frequent meetings with this object in view. In some districts the agitation has been successful from the men's point of view, while in others the colliers are wanting the old number of hours. Unless there should come a marked improvement in the trade, there is little probability of the policy adopted by the miners eventuating in a general increase of wages.

The miners in the employment of the principal oil companies of Scotland have agreed to reduce the wages of all their *employés*, the piece workers by 10 per cent. and the weekly wage men in proportion.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

Those ignorant of the private arrangements which have been agreed to between the steel works simply see a lessened market and short time, and reason therefrom that orders are coming in slowly. The fact is, however, that the lessened market is the result of a systematic procedure, though trade is undoubtedly dull. The works in the confederation have agreed to certain restrictions, and no works can make more than a certain number of tons per week, any more than they can quote a price without due consultation. This accounts for the mills in the district being silent on Monday generally, and going only from Tuesday to Saturday.

This confederation has not been started, as is the case in "rings" generally, to obtain an artificial price. The fact is, that the market price of rails was below the cost, and that it was imperative to do one of two things—close the works, or make an arrangement with one another not to make steel except at a certain price. This orderly course now prevails, and is, of course, attended with drawbacks. Prices have been put up a little over £5, and buyers have receded and look on to see what is to follow.

I do not see why the union of steel makers should not be productive of good. Why not in steel as in meat, in corn, in beer? Steel makers only want a fair return for capital and labour.

Substantial fish-plate orders have been booked by Tredegar Company for New South Wales. Landore has a large stock of malleable steel for the suspension bridge of the Frith of Forth, and no doubt will retain its high repute.

An easier tone prevails in the coal trade. In a recent perambulation I heard of steamers idle and collieries quiet. In fact, in the Rhondda at present many collieries are idle a couple of days per week, and prices as a consequence are drooping. The present reaction is perhaps due to the over speculation which not unfrequently obtains amongst some of our coalowners. There has been a good deal done in connection with the Egyptian business, and coaling ports are at present stocked well. Great care is now required to see what the course of things will be. House coal, and indeed seconds, are gone for the present out of active inquiry, and it is only a few of the principal holders of 4ft. steam and Rhondda No. 3 who may be said to be busy. For the principal kinds I do not expect any faltering in demand.

A better tone prevailed at Newport this week. I hear that the Tredegar Iron and Coal Company has secured the orders of the Great Northern Railway of Ireland. Bunker coal is generally 6d. per ton lower.

At Swansea there was a good week's work, represented by 31,000 tons of coal and 10,000 tons of patent fuel. Prospects at this port are very good.

In the colliery districts of Merthyr there has been a good deal of ferment between the men and Messrs. Bailey, the managers. Several actions are pending against the hauliers for neglecting their duty. If these collieries had joined the Association the benefits of the arbitration arrangements of the Sliding Scale Committee would now be evident.

The Sliding Scale Committee met this week at Cardiff, when the question of the Fleuss life-saving apparatus was brought on for discussion, and Mr. Roquet attended and explained its mode of use. Doubtless some practical step will be adopted after the trial, which is fixed to be at Llwynypia this week, Mr. Hood having kindly granted leave.

It has been decided by the colliers to send a deputation to wait upon the Home Secretary for an increase in the number of sub-inspectors of mines.

Some discontent has been shown by the colliers to the removal of the Gelli employers' liability case from Pontypridd to the assizes at Swansea, and it is maintained that this will weaken its usefulness. In Mr. Burt's Amended Bill this will be touched upon.

A fine steamer was launched from the yard of the Usk Shipbuilding Company, Newport, on Saturday, for a Cardiff Company. It has another now in hand.

The examinations for right and privilege of *locus standi, in re* the Barry Dock and other Bills, are now on. In the case of Barry the claim of the Marquis of Bute was allowed.

Launch of a Steamer at Barrow.—There was launched from the yard of the Barrow Shipbuilding Company on Saturday last a splendid new iron screw steamer, built to the order of Messrs. Taylor, Abraham, and Co., of Liverpool, and intended for the general cargo trade. As she left the ways she was named the County of Salop by Mrs. Taylor. The new vessel has been built to the highest class at Lloyd's, and is 295ft. long, 36ft. beam, 24ft. 6in. depth of hold, and a gross tonnage of 2100 tons. She will be fitted with a pair of direct-acting surface-condensing engines, with cylinders 34in. and 64in. diameter, and a stroke of 42in. Steam is generated by two boilers 14ft. 6in. diameter, 11ft. long, with 118ft. bar surface and 3743ft. of heating surface. She is schooner rig, and built to the highest class at Lloyd's.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

25th March, 1884.

5384. Kitchen and Cooking Ranges, J. E. Russell, Spindon.
5385. Looms for Weaving, R. Ingham, Clitheroe.
5386. Rotary Folding Apparatus, G. A. Wilson, Broadgreen, near Liverpool.
5387. Stoppers for Cans and Bottles, H. G. Hellier, London.
5388. Travelling by Water, J. McGuirl, Maryport.
5389. Bustles, &c., J. B. Phillips, New York.
5390. Telegraphic Systems, W. P. Thompson.—(*C. G. Burke, New York.*)
5391. Steam Traps, W. P. Thompson.—(*G. B. McCracken, Connecticut, U.S.*)
5392. Washing and Wringing Machines, E. Taylor, Blackburn.
5393. Steam, &c., Engines, J. C. Rhodes and J. F. Shaw, Manchester.
5394. Obstruction Detector for Locomotives, C. Payant, Stalybridge.
5395. Fasteners for Boots and Shoes, &c., H. Fletcher, Birmingham.
5396. "Excelsior" Floor Cramp, T. Thornton, Bury.
5397. Opening Boxes, &c., T. Smith, Bootle-cum-Linacre.
5398. Automatic Motion for Stopping Looms, E. Smith, Bradford.
5399. Cricketing Spikes, G. S. Smeeth, Salford.
5400. Sleeve Links, &c., W. T. Braham, Manchester.
5401. Protecting Life Ships, &c., from Damage by Waves, J. P. Moss, Southampton.
5402. Umbrella Holder, F. J. Gorle, Droitwich.
5403. Revolving Warp Machines, W. Start, Nottingham.
5404. Warp Machines, W. Start, Nottingham.
5405. Hammerless Guns, J. W. Smallman, Nuneaton.
5406. Bicycle and Tricycle Lamps, G. Baxter, Birmingham.
5407. Screws, F. J. Beal, Sheffield.
5408. Producing Electrotyping Moulds, W. Lowe and D. Cavagna, Salford.
5409. Secondary Batteries, G. Prescott, M. Purcell, D. Sherlock, and W. H. Dunne, Dublin.
5410. Air Pumps, &c., J. Saunders, Liverpool.
5411. Self-lubricating Bush for Corves, Tubs, &c., R. L. Watson and J. R. Wilson, Barnsley.
5412. Gas Engines, J. H. Dewhurst, Sheffield.
5413. Folding Steps, W. J. Gwynn, Malvern.
5414. Water Meter, W. E. Gedge.—(*P. Berthon and A. Debenoih, France.*)
5415. Lamps, J. F. Shallis and T. C. Thomas, London.
5416. Galvanic Battery Cell, &c., H. J. Allison.—(*J. H. Shaw, New York, U.S.*)
5417. Thread Cutters and Holders, J. L. C. Cronyn, Buffalo, U.S.
5418. Boots and Shoes, P. M. Justice.—(*W. A. Reed, Westborough, U.S.*)
5419. Rock Drills, A. W. L. Reddie.—(*H. C. Sergeant, Denver, U.S.*)
5420. Joint for Rails, J. Kerr, London.
5421. Supporting, &c., Dynamo-electric Machines, W. R. Lake.—(*J. W. Boothby, New York, U.S.*)
5422. Explosive Projectiles, H. H. Lake. —(*F. Snyder, Jersey, U.S.*)
5423. Printing Presses, W. R. Lake.—(*B. Humer and W. K. Hodgman, Taunton, U.S.*)
5424. Attaching Busks to Corsets, O. E. Consedine, Brixton.
5425. Working-up Furs, A. C. Wegener, London.
5426. Preventing Liquids Boiling Over, J. Hobbs and T. R. Purdy, London.
5427. Extraction of Wine, J. F. Phillips.—(*A. Rey, France.*)
5428. Harvesting Machines, H. H. Lake.—(*S. Johnson, Brockport, U.S.*)
5429. Tricycles, D. E. and C. F. Dutrow, U.S.
5430. Removing Metals from Ores, &c., E. H. Russell, Utah, U.S.
5431. Removing Precious Metals from Ores, &c., E. H. Russell, Utah, U.S.
5432. Continuously Dressing Lace, &c., A. J. Butler and W. Jennings, Nottingham.
5433. Colouring Articles of Glass, &c., A. H. Simpson, Nottingham.
5434. Pipes and Tubes for Smoking Tobacco, &c., E. J. Alment, Stratford.
5435. Rotary Engines, R. P. Park, South Melbourne.
5436. Combustion of Liquid Hydrocarbons, E. C. Burgess, London.
5437. Steering Apparatus for Ships, &c., J. White, Sunderland.
5438. Glass Show Tablets, &c., S. R. Brewerton, London.
5439. Trunks or Boxes, H. H. Lake.—(*F. H. Ransom, Buffalo, U.S.*)
5440. Iron Folding Chair Bedsteads, W. N. Bryett, London.
5441. Boot-heel Attaching Blocks, C. Dickins, Dublin.
5442. Transmitting Power by Ropes, H. H. Lake.—(*A. D. Whitton, G. Rice, and H. P. Hougen, U.S.*)
5443. Mathematical Dividing Instruments, P. S. Marks, London.
5444. Bearings for the Sliding Seats of Boats, W. R. Lake.—(*J. C. Garrood, Boston, U.S.*)
5445. Eliminating Impurities from Fermented Liquors, H. W. Lobb, London.
5446. Ships' Signal Lights, &c., A. Brock, South Norwood.
5447. Carbolate of Lime, J. B. Austin, Southfield.
5448. Trouser Stretchers, W. H. Thomson, London.
5449. Hanging Carriage Lamps, J. L. Molyneux, Brooklands.
5450. Protecting Ornaments on Chimney-pieces, &c., E. Edwards.—(*L. Girault, Paris.*)
5451. Ruler, T. G. Snell, London.
5452. Omnibuses, &c., F. Biers, London.
5453. Chronograph Watches, A. M. Clark.—(*S. C. Scott, Brooklyn, U.S.*)
5454. Re-starting Tramway Cars, A. M. Clark.—(*J. Wilson and W. Balder, Chicago, U.S.*)
5455. Regulating, &c., by Electricity the Speed of Steam and other Motors, W. Balls, Sheffield, and W. H. Tozer, Melksham.
5456. Crossings, &c., of Tramway Rails, H. Withy, R. W. Vick, and C. Salt, Durham.
5457. Bats for Lawn Tennis, &c., R. S. Moss, London.

26th March, 1884.

5458. Yellow Colouring Matters, F. Machenhauer, Reddish, near Manchester.
5459. Toothed Grid for Machines for Preparing Textile Fibre, S. W. Gillett.—(*Messrs. M. Descards et la Société Flecheux, père et fils, et Jantot, France.*)
5460. Earthenware, &c., J. and J. F. Maddock, Burslem.
5461. Cycle Indicator, S. Hill, Worcester.
5462. Spring Bellows Pannell, J. Powney, Leeds.
5463. Halter for Horses, &c., J. Wright, jun., Manchester.
5464. Velocipedes, A. W. Hirst, Croydon.
5465. Putting Ships' Boats out ready for Lowering, J. McAuley, Lancashire.
5466. Flushing Tank, &c., W. Bell, Carlisle.
5467. Metallic Bedsteads and Cots, J. Talbot, Birmingham.
5468. Rotary Web Printing, &c., Machines, J. H. Buxton, D. Braithwaite, and M. Smith, Manchester.
5469. Rouche Frilling or Trimming, W. H. Farmer, Nottingham.
5470. Circular Machines for Producing Ribbed Looped Fabrics, S. Jamson, Nottingham.
5471. Belt Driving Pulleys, A. C. Wells, Manchester.
5472. Butter Workers, &c., R. T. Williams, Fromefield, Somersetshire.
5473. Making Bricks, &c., R. Middleton, Leeds.
5474. Type Writers, R. H. Brandon.—(*H. B. Richardson, Massachusetts, U.S.*)
5475. Gloves, E. F. Brown, Liverpool.
5476. Clip Pulleys, G. J. Lampen and E. C. Theedam, Wakefield, and J. W. Blackburn, near Leeds.
5477. Bicycles, &c., J. Monteith, Lanarkshire.
5478. Tricycles, J. Monteith, Lanarkshire.
5479. Cooking by Gas, &c., J. Balbirnie, Sheffield.
5480. Moving Air for Ventilating, &c., J. Adams, Liverpool.
5481. Valve Gear, J. Binks, Bolton.
5482. Looms for Weaving, T. R. Hill and T. Marshall, Bradford.
5483. Enabling a Mortar or Gun to be Carried on and Fired from a Boat, W. C. Nangle, Portsmouth.
5484. Gas Motor Engines, J. Magee, Belfast.
5485. Rendering Apparent the Discharge of Oil from a Lubricator, J. Dewrance and G. H. Wall, London.
5486. Extracting Fat from Cocoa, W. E. Gedge.—(*Dr. H. Michaelis, Berlin.*)
5487. Pocket Knives, H. H. Lake.—(*B. A. Fiske, Washington, U.S.*)
5488. Kilns for Burning Bricks, &c., H. Wedekind. —(*H. Dueberg, Berlin.*)
5489. Grate-bars, T. Dugard.—(*J. Mailer, San Francisco, California.*)
5490. Making Matrices for Producing Printing Surfaces, J. H. Johnson.—(*R. L. Kimberley, Philadelphia, U.S.*)
5491. Taps, H. Y. Dickinson, Berkshire.
5492. Holding, &c., Paper from Rolls, H. S. Earl.—(*J. H. Earl, Chicago, U.S.*)
5493. Spinning, &c., Fibrous Substances, J. H. Clapham, T. R. Whitehead, and T. W. Wheelwright, Bradford.
5494. Syphon Flushing Apparatus, D. Hynd, Dundee.
5495. Packing for the Stuffing-boxes of Steam Engines, J. Bell, Liverpool, and R. H. Harper, London.
5496. Magazine Cartridge Boxes, W. R. Lake.—(*C. Krnka, Bohemia.*)
5497. Motive Power Engines, N. Browne.—(*L. A. Bontemps, Paris.*)
5498. Perforated Plates, H. J. Haddan.—(*E. Landreau and C. Bonnet, France.*)
5499. Cutting Straight, &c., Grooves, H. J. Haddan. —(*O. Buchbinder and L. Voyt, Vienna.*)
5500. Mowing Machine, A. H. Reed, London.
5501. Mortising Machines, R. S. Greenlee, Chicago.
5502. Transmission of Speech, C. E. Allen, Berkshire, Massachusetts, U.S.
5503. Two-wheeled Vehicle, H. Kinder, Leicester.
5504. Safety Money Chests, &c., S. Withers, West Bromwich.
5505. Collar-stud, &c., Holder, W. G. Robins, Southsea.
5506. Universal Music Type, J. Francis, Rochford.
5507. Lucifer Matches, T. Allen, Reading.
5508. Rotary Engine, A. M. Clark.—(*J. Blair, Tacoma, and A. W. Black, Portland, U.S.*)
5509. Revolving Chart and Map Stand, A. M. Clark. —(*H. E. Hayes, Brooklyn, U.S.*)
5510. Printing Telegraphs, W. R. Lake.—(*A. F. Johnson, Brooklyn, U.S.*)
5511. Decorating Wood, &c., J. H. Johnson.—(*A. Semal, Belgium.*)
5512. Yellow Colouring Matters, J. H. Johnson.— (*The Badische Aniline and Soda Fabrik, Germany.*)
5513. Carving Forks, C. G. Morgan, Chatham.
5514. Cleaning Ships' Bottoms at Sea, C. White, Hawsker, near Whitby.
5515. Furnaces, H. D. Pochin, Barnes.
5516. Attachable Buttons, &c., A. Macmillan and A. M. Festing, London.
5517. Umbrella Frames, A. Macmillan and A. M. Festing, London.
5518. Spring Holders for Scarf Slide, A. M. Festing, and A. Macmillan, London.

27th March, 1884.

5519. Working Steam, &c., Engines, H. Hudson, Shrewsbury.
5520. Sulphate of Ammonia, W. A. Meadows, Rainhill.
5521. Adjustable Seats and Foot Rests, F. B. Welch, Manchester.
5522. Tobacco Pipes, R. Boughton, London.
5523. Furnaces of Steam Boilers, J. Stevenson, Lanarkshire.
5524. Coupling for Railway Wagons, R. H. Herriott, and W. Tomblin, and S. W. Betts, Nottinghamshire.
5525. Securely Fastening Sash Windows, T. C. Morgan, Breconshire.
5526. Furnace Bars, J. K. Broadbent, Salford.
5527. Extinguisher for Paraffin Lamps, A. Millington, Birmingham.
5528. Cranes, W. Dodds, Jarrow-on-Tyne.
5529. Furniture Castors, G. H. Brown, near Wolverhampton.
5530. Trouser Suspenders, J. Lawrence, Birmingham.
5531. Marking the Game of Billiards, T. Trussell, Nottingham.
5532. Oil Cans, H. and J. Blamires, Huddersfield.
5533. Stirrup Leather Buckle, W. Letheren, Exeter.
5534. Taper Turning Lathe, S. Hazeland, Cornwall.
5535. Re-capping and Re-loading Cartridges, J. C. Cocker, Aston.
5536. Letting-off Motion of Looms, C. Catlow, Burnley.
5537. Self-acting Stop-motion for Steam Engines, H. France and T. E. Taylor, Marsden.
5538. Steam Boilers, W. B. Thompson, Dundee.
5539. Potato Diggers, J. Marshall, Maybole.
5540. Self-gripping Immovable Spike, H. Pentony, London.
5541. Registering the Supply of Milk to Hotels, &c., E. W. and F. Gillingham, London.
5542. Slate Grinding Machinery, G. Walker, Armley, near Leeds.
5543. Shaping Boot and Shoe Counters, H. A. Bonneville.—(*A. M. Morin, France.*)
5544. Voltaic Battery, C. W. Stewart and G. H. Harrison, London.
5545. Flues of Steam Boilers, J. Beaumont, Honley, and H. Thorp, New Hill, near Huddersfield.
5546. Dendrometers, D. F. Mackenzie, Liberton, Midlothian.
5547. Bicycles, &c., R. Paulson, London.
5548. Water-closet Supply Valves, M. Syer, London.
5549. Corkscrews, S. Plant, Wolverhampton.
5550. Pocket Scissors, A. Oppenheimer, London.
5551. Protector for Watches, &c., R. A. Flather, Southampton.
5552. Bichromate of Soda, E. P. Potter and W. H. Higgin, Little Lever.
5553. Refuse Receptacles, A. M. Festing and A. Mac Millan, London.
5554. Fastening Sheet Metal Boxes, W. A. Barlow. —(*E. Ritter, Ehrenfeld.*)
5555. Rotary Clockwork Motion, W. H. Pannell, London.
5556. Fence for Wood Moulding Machines, J. Hayes, London.
5557. Clearing the Vents or Discharge Pipes of Sinks, &c., C. W. Meiter and R. C. B. Moth, London.
5558. Waterproof Coats, &c., C. W. Meiter and R. C. B. Moth, London.
5559. Reflector, F. J. Harrison, London.
5560. Revolving Heel for Boots and Shoes, J. R. Baker, London.
5561. Lubricating Apparatus, P. Jensen.—(*L. C. Nielsen, Copenhagen.*)
5562. Stuffing-boxes, J. Lewis, New Cross.
5563. Stoves, &c., J. B. Petter, Yeovil.
5564. Breech-loading Small-arms, W. M. Scott, Birmingham.
5565. Protecting Ships' Bottoms, &c., from Corrosion, B. L. Thomson, London.
5566. Screw Clamps, W. R. Lake.—(*P. F. Corbett, Boston, U.S.*)
5567. Styles for Manifold Writing, &c., J. D. Sprague, London.
5568. Fire-proofing Joists, &c., of Buildings, A. M. Clark.—(*W. H. Dolman, New York.*)
5569. Halters for Horses, &c., W. R. Lake.—(*J. C. Lighthouse, Rochester, U.S.*)
5570. Fire-stove Screens, R. Spear.—(*J. Spear, Fuerth.*)
5571. Ships' Logs, A. M. Clark.—(*D. Carroll, U.S.*)
5572. Laying and Protecting Underground Telegraph, &c., Wires, J. B. Pash.—(*T. R. James, Royal Park, near Melbourne.*)
5573. Electrical Suspensors or Bandages, C. B. Harness, Battersea.
5574. Receptacles for Coal, &c., A. Foley, Salisbury

28th March, 1884.

5575. Boxes or Cases, A. McDonald, Langside.
5576. Hauling Tackle, J. Dick, Glasgow.
5577. Driving Reciprocating Cutters of Reaping Machines, &c., J. F. Moore, Liverpool.
5578. Lock Nut and Bolt, R. A. Smith, Plumstead.
5579. Pianofortes, F. G. Fairfield, Knowle.
5580. Lever Press for Silo, E. P. Plenty, Burghclere.
5581. Turning in Shirt Factories, J. Nicholson, London.
5582. Working Railway Points, &c., E. Hancox, London.
5583. Ploughs, J. Hornsby and W. Grice, Grantham.
5584. Dress Improvers, E. H. Garner, Leighton Buzzard.
5585. Metallic Pens, F. R. Baker, Birmingham.
5586. Ships' Davits, J. S. Wilson, Southampton.
5587. Air Cushion Riding Saddle, &c., J. S. Cave, Gosport.
5588. Keels of Vessels, H. St. C. Christophers, Parkhurst.
5589. Spinning, &c., Cotton and other Fibrous Materials, T. Ainsworth, Bolton.
5590. Apparatus Used in Conjunction with Locomotive Steam Engines, W. Macpherson, Manchester, and W. Jones, Blackley.
5591. Steel or Iron, E Edmunds, Newport.
5592. Roof Covering, A. Steenberg.—(*V. Schourup, Viborg, Denmark.*)
5593. Magazine Rifles, C. Garbe, Berlin.
5594. Warm Air Firegrate, J. Grundy, London.
5595. Yeast Food, C. R. Bonne, Manchester.
5596. Fenders, C. E. Harton, Ashton-on-Mersey.
5597. Winding Sewing Silk Twist on Spools, E. Trafford, Leek.
5598. Sliding Saddle for Velocipedes, J. Roots, London.
5599. Gravitating Lever Clutch for Tricycles, V. A. Wraight, London.
5600. Curtain Stretching, &c., Machine, J. Shore, Brockley.
5601. Sewing Machines, E. A. Brydges.—(*G. Mertens and H. Hülfert, Berlin.*)
5602. Case for Violins, &c., L. Orth, Paris.
5603. Cases for Postage Stamps, &c., C. E. S. Parker, Perth.
5604. Drawing Pens, C. Pollak, London.
5605. Keyboard Musical Instruments, &c., N. B. Dennys, London.
5606. Converting Metal into Steel, E. H. Andreoli, London.
5607. Toy Money-box, S. and J. Homan, London.
5608. Heaving up Slips, T. Summers and A. J. Day, Southampton.
5609. Stringing Musical Instruments, T. J. Brinsmead, London.
5610. Pen, &c., Holders, H. A. Eliot.—(*B. Carter, New Zealand.*)
5611. Toilet Appliances in combination with Parasols, B. Jacobs, London.
5612. Telephone Transmitters, W. Moseley, London.
5613. Making Cotton Loop Bands, J. Wagstaff and G. Bradley, Glossop.
5614. Machine for Distributing Manure, H. Skinner, Aberdeen.
5615. Pointing, &c., Pins, &c., J. Richardson, Leeds.
5616. Raising Chains, &c., J. Stephenson, Leeds.
5617. Applying Elastic Tires to Vehicles, W. H. J. Grout, London.
5618. Furnaces, L. Hopcraft, Anerley.
5619. Bearings, G. de Laval, Stockholm.
5620. Stopping Casks, &c., W. R. Lake.—(*W. Kromer, Germany.*)
5621. Propelling Apparatus, F. Wirth.—(*E. Göhrung, Stuttgart, Germany.*)
5622. Automatic Feeding Box, B. J. B. Mills.—(*L. Deguenant, Paris.*)
5023. Telephonic Apparatus, T. Preece and P. Loftus, Bradford.
5624. Electric Mains, J. E. H. Gordon, London.
5625. Combined Canteen, Water-bottle, and Cooking Apparatus, W. Harrington, London.
5626. Propelling Screws, A. D. de Bruignac, Versailles, France.
5627. Cranes, W. L. Williams and H. Adams, London.
5628. Economising Fuel, T. J. Barnard, London.
5629. Car Couplings, A. J. Boult.—(*T. L. McKeen, Easton, U.S.*)
5630. Attaching Handles to Tools, A. J. Boult.—(*C. H. Grellner, St. Louis, U.S.*)
5631. Rope-making Machinery, A. J. Boult.—(*M. Leleu, Epinac, France.*)

29th March, 1884.

5632. Kettle, &c., J. H. Lock, London.
5633. Flushing Closets, &c., C. Winn, Birmingham.
5634. Corrugating Plates, F. D. Rose, Manchester.
5635. Wringing, &c., Machines, G. H. Richmond , Manchester.
5636. Gas Motor Engines, J. Magee, Belfast.
5637. Carding Engines, G. and E. Ashworth, Manchester.
5638. Indicating Power of Steam Engines, T. H. Blamires, Huddersfield.
5639. Busks, &c., C. Miles and P. Jolin, Bristol.
5640. Finishing Woven Fabrics, J. Smith, Thornliebank, N.B.
5641. Gas Engines, J. J. Butcher, Newcastle.
5642. Umbrellas, &c., T. Wrench, Liverpool.
5643. Fittings for Displaying Goods, F. McIlvenna, Manchester.
5644. Raising Window-blinds, &c,, W. Unsworth, Liverpool.
5645. Solitaires, &c., W. H. Birt, London.
5646. Tobacco-pipes, J. Wood, Bath.
5647. Photographic Camera Stands, J. Thomson, Liverpool.
5648. Dumb-bells, J. Dawes, Manchester.
5649. Pumps, W. Jarvis, Banbury.
5650. Four-cylinder Air Engine, W. Jarvis, Banbury.
5651. Mechanical Movement, G. Mason.—(*W. G. Gass, Philadelphia, U.S.*)
5652. Obtaining Printed Impressions of Natural Objects, A. S. King, Norwich.
5653. Armatures of Dynamo Machines, E. J. Paterson, London.
5654. Digger, W. Simpson and A. Bateman, Ramsey.
5655. Stoppering Bottles, E. G. Colton.—(*M. Rubin, Philadelphia, U.S.*)
5656. Convertible Chair or Table, J. Teasdill, Leeds.
5657. Gas Burners, &c., T. Singleton, Over Darwen.
5658. Raising Water from a Lower to a Higher Level, C. S. Vereker, London.
5659. Sight-feed Lubricators, G. Sumner, Oldham.
5660. Filters for Fuel Economisers, A. Roberts, Shrewsbury.
5661. Trouser Stretcher, A. W. Harrison, London.

5662. COMBINED BOTTLE and STOPPER, J. Walker, London.
5663. PRODUCING RIBBED WORK on STRAIGHT KNITTING FRAMES, F. Brown, Leicester.
5664. CENTRIFUGAL DRESSING, &c., MACHINES, H. Simon, Manchester.
5665. TUNNELLING APPARATUS, J. Greathead, London.
5666. FIXING METALLIC LETTERS to CLOTH, &c., J. H. Hollinghurst, London.
5667. COMBS, W. H. White, East Retford.
5668. STEEL, J. Toussaint, Upper Saltley.
5669. DRESSING and POLISHING STONE, P. Corcoran, Chorlton-on-Medlock.
5670. CIRCUIT CONNECTIONS for ELECTRIC LIGHTING, H. Edmunds, jun., London.
5671. SLOTTING, &c., MACHINES, E. P. Alexander.—(*C. Weitmann, Stuttgart.*)
5672. LATHES, J. C. Eckhardt, Stuttgart.
5673. GOVERNOR for STEAM, &c., ENGINES, J. C. Mewburn.—(*G. Miotti, Austria.*)
5674. MANUFACTURING ELECTRICAL CONDUCTING WIRES and RODS, J. B. Spence.
5675. SELF-ACTING BUTTON for FASTENING DOORS, &c., W. Sanderson, Gateshead.
5676. REGULATING the SUPPLY of WATER to WATER-CLOSETS, H. W. Buchan, Edinburgh.
5677. WORKING of RAILWAYS by means of AUTOMATIC LOCKING APPARATUS, J. Aubine, France.
5678. ATTACHMENTS to TRICYCLES, &c., J. I. Mitchell, London.
5679. TYPE MARKERS, J. S Ranson, London.
5680. GLAZING, J. Pinchen, Market Lavington.
5681. ELECTRIC HIGH and LOW-WATER ALARM for STEAM BOILERS, G. Southey and W. Rusden, Cardiff.
5682. CENTRIFUGAL SEPARATORS, G. de Laval, Stockholm.
5683. PREPARING MEDICINAL FOOD for DOMESTICATED ANIMALS, &c., R. Griffiths, Aston.
5684. DYNAMO-ELECTRIC MACHINES, G. F. Redfern.—(*P. A. A. M. A. Favier, France.*)
5685. BOOTS and SHOES, W. Garrood, Northampton.
5686. FRAMES for STRETCHING PAPER, W. R. Lake.—(*L'B. Raboisson, Paris.*)
5687. TROUSER STRETCHERS, C. W. Meiter and R. C. B. Moth, London.
5688. MITRE-BOXES, A. M. Clark.—(*J. Cashin, Washington, U.S.*)
5689. AUTOMATIC GAS REGULATORS, A. M. Clark.—(*J. Bowie, New York, U.S.*)
5690. CURRENT-REGULATING DEVICES, S. F. Walker and F. G. Olliver, Cardiff.
5691. AUTOMATIC SAFETY MINERS' LAMP, J. G. Tongue.—(*J. G. Body, Belgium.*)

31*st March*, 1884.

5692. METAL FRAME for TEA-POT STAND, J. Gilbert, Walsall.
5693. INODOROUS PRIVY, G. Burnell, Bristol.
5694. HATS, &c., J. W. Gosling, Stockport.
5695. SAFETY CUT-OUTS for ELECTRIC LIGHTING, A. W. Brewtnall, near Warrington.
5696. BRUSHES, J. E. Poole, near Coleshill.
5697. INJECTORS for RAISING, &c., FLUIDS, S. Borland, Manchester.
5698. WATERPROOF FLOORING, W. P. Thompson.—(*A. Danman and A. Cassard, Belgium.*)
5699. FIRELESS STEAM ENGINES, W. P. Thompson.—(*C. Heinzerling, Germany.*)
5700. IMPARTING MOTION to the PRESSER of SECTIONAL WARPING MACHINES, J C. Stafford and G. Heap, Salford.
5701. TONGS for COAL and TABLE USE, G. and C. Ball, Birmingham.
5702. ELECTRIC HAIR BRUSHES, W. Tapp, Bristol,
5703. FASTENING RAILWAY CARRIAGE DOORS, &c., A. Porecky, London.
5704. STEEL STREET PAVEMENT, C. Stiller, Berlin.
5705. SPRINGS for GLOVES, W. Bown, Birmingham, and G. Capewell, Aston.
5706. ROLLER BLIND FURNITURE, W. M. Simons, Nottingham.
5707. MEASURING TAPS and VALVES, J. Beck and F. M. Truelove, London.
5708. PROPELLER SHAFTS, H. C. Bull, Liverpool.
5709. COVERED INK WELLS, J. Meir and J. J. Christie, Burslem.
5710. PICKER ARM for WEAVING LOOMS, D. F. Harrop, Lockwood.
5711. KILTING MACHINES, J. W. Hammett, London.
5712. SELF-INKING ENDORSING or OBLITERATING HAND STAMP, A. Green, Plashet.
5713. LUBRICATING, &c., HIGH-SPEED MACHINERY, L. A. V. Pellegrin.—(*G. Carette, Paris.*)
5714. STEAM BOILERS, W. Clark, Plumstead.
5715. CHAMBER STAND, H. Elliott, London.
5716. MEASURING, &c., ELECTRIC CURRENTS, A. Wright, London.
5717. CLEANING the SIDES and BOTTOMS of SHIPS AFLOAT, A. D. Spiers and A. S. Brown, Glasgow, and D. Hunter, Troon.
5718. PERAMBULATORS CONVERTIBLE into CRADLES, G. C. Bond and J. Sadler, Nottingham.
5719. MICROPHONES, F. J. Semal, Belgium.
5720. SCREWED JOINTS or COUPLINGS for PIPES, &c., T. Brooks, Huddersfield.
5721. IRON HAND-RAIL STANCHIONS, W. and G. Rockliffe, Sunderland.
5722. HORSE CLIPPERS, W. Bown, Birmingham.
5723. RANGE FINDING, H. Macaulay, Kingston Hill.
5724. METAL ROPES, &c., T. C. Batchelor, London.
5725. BREWING APPARATUS, &c., H. J. Haddan.—(*B. Gervais, France.*)
5726. RAILWAY CARRIAGES, H. J. Haddan.—(*L. T. de Kossuth, Turin.*)
5727. BREAD-CUTTING MACHINES, F. Eskau, Hamburg.
5728. LOOMS for WEAVING WIRE, W. Begg, Glasgow.
5729. BINDERS for NEWSPAPERS, W. A. F. Blakeney, Glasgow.
5730. LAMP GLOBES and SHADES, F. J. and H. A. Biertumpfel, London.
5731. JOINING MILL BANDS, W. H. Chase, London.
5732. HAIR COMBS, R. Stevens, Bromley.
5733. SAFETY SUSPENDERS for STIRRUP LEATHERS, W. J. Bacon, Poole.
5734. TREATING CANDLE WICKS, &c., B. J. B. Mills.—(*A. Duparquet, Lyons.*)
5735. GUN CARRIAGES, H. C. E. Malet, Brighton.
5736. CONTINUOUS BRAKES, F. Wirth. (*C. R. van Ruyven, Holland.*)
5737. TRUSSES for HERNIA, W. Miller, London.
5738. PRINTING TELEGRAPHIC APPARATUS, C. J. A. Munier, France,
5739. SECURING TARPAULIN COVERINGS, R. A. Hopper, Stockton-on-Tees.
5740. TRAMWAY ENGINES, N. S. Russell, London.
5741. PREPARING COLOURING MATTERS, J. H. Johnson.—(*H. Caro, Germany.*)
5742. BUILDING in CONCRETE, F. E. Street, London.
5743. DISINFECTING WATER-CLOSETS, &c., J. M. B. Baker, London.
5744. TENNIS BATS, H. W. White, London.
5745. DECORTICATING GRAIN, &c., E. L. H. Bauermeister, Hamburg.
5746. DRYING DAMP GRAIN, R. F. L. Plönnis, Germany.
5747. PRESERVING BEER, W. Aubert, jun., Balham.
5748. PORTABLE SILOS, E. Cory, London.

ABSTRACTS OF SPECIFICATIONS.

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

2086. APPLIANCES for STEAM BOILER and other FURNACES for the MORE PERFECT COMBUSTION of FUEL, *D. Whitehead, Birmingham, and F. B. Chadwick, Cardiff.*—24*th April*, 1883. 8*d.*

Relates partly to the application to furnaces of a radiator provided with diverging wings or divisions, for directing and diffusing the currents of air and steam from the mouth.

3430. DETACHING GEAR for SHIPS' BOATS, *R. Hudson, Blyth.*—12*th July*, 1883. 6*d.*

Relates to the combination of parts forming an automatic detaching gear consisting of double locking hoops, the releasing gear operated either by springs or by falling weights and the connecting rod to cause the releasing action to be simultaneous.

3565. PLATES or ELECTRODES for SECONDARY or STORAGE BATTERIES, &c., *R. Cunningham, London.*—20*th July*, 1883.—(*Not proceeded with.*) 2*d.*

These are made from tapes or plates of lead having a roughened or cellular surface on both sides.

3768. INVALID COUCHES, CARRIAGES, &c., *W. Dickinson, Manchester.*—1*st August*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to construct an invalid bed so that the invalid can attend to the requirements of nature without being disturbed or lifted up.

3773. MANUFACTURE of GLASS TABLETS, *J. Forrest, sen., Glasgow.*—1*st August*, 1883.—(*Not proceeded with.*) 2*d.*

Consists in depicting by any suitable means each letter upon, that is to say, at the back of a separate piece of glass, so that the letter is seen through the glass and secured thereto from injury by a backing of enamel, varnish, paint, or like materials, or the said letters may be burned into the back of the glass.

3843. TRAYS for BAKERS' OVENS, *R. Morton, Wishaw.*—7*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The trays or pans are formed of thin sheet metal which are corrugated in one or both directions, and is strengthened round the edges by a metal rod or wire or by turning over.

3844. CHEMICAL FIRE-ENGINES, *J. Gibbs and D. Fotheringham, Glasgow.*—7*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates partly to the arrangement of the bottle for containing the acid.

3866. PROCESS for PROVIDING PIECES of COMPRESSED GUN-COTTON, COMPRESSED NITRATED WOOD, or other CELLULOSE with a COATING by TREATMENT with a MEDIUM ACTING as a SOLVENT of or to the SAME, *F. C. Glaser, Berlin.*—9*th August*, 1883.—(*A communication from W. F. Wolff, Walsrode, and M. von Förster, Berlin.*)—(*Not proceeded with.*) 2*d.*

The pieces are laid or steeped in liquids which dissolve them (acetic ether, nitro-benzole, and others), and are then taken out and dried, when a firm coating of the dissolved material is formed over the piece.

3869. BOGIE TRUCKS for LOCOMOTIVES, &c., *T. English, Dartford.*—9*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the construction of the bogie frame.

3872. TRICYCLES, *J. McCoig, London.*—9*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the construction of the tricycle so that it can easily be taken to pieces.

3879. MANUFACTURE of MATERIAL SUITABLE for TRUNKS, BOXES, &c., *H. A. Silver, London.*—9*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The inventor moulds or otherwise shapes sheets of paper or mill, straw or like boards in corrugated or uneven order, and with bands, linings, or strips of metal or other material on the inside or on the outside at the desired parts, to obtain additional strength and finish.

3880. STEAM WINCHES for SHIPS' DECKS, *R. Roger, Stockton-on-Tees.*—10*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to construct steam winches which shall use a less quantity of steam than those now in use.

3882. LOOMS for WEAVING, *T. Kidd and J. Mangham, Burnley.*—10*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to an arrangement of let-off motion; and consists in the employment of a metallic band, which passes over and partially encircles a collar fixed on the end of the yarn beam.

3885. BEARINGS for VELOCIPEDES, *J. Bradbury, Braintree.*—10*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The bearing is constructed in two portions, so arranged that the outer one may have a rocking motion over the inner one, the axle or shaft passing through both.

3887. ATTACHING DOOR KNOBS, &c., TO THEIR SPINDLES, *J. Finney, Bocking.*—10*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to attaching door knobs by means of a stud.

3889. APPLIANCE for CONTAINING MEMORANDA to BE EMPLOYED in CONNECTION with the HANDLES of WALKING STICKS, &c., *A. Watson, Willesden.*—10*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the employment of a roller, on which is fixed a label having the name and address, &c., of the owner of the article. This roller is mounted in a suitable recess formed in the article, and is closed over with a cover.

3890. CONSTRUCTION of APPARATUS for EVAPORATING, CONCENTRATING, and DISTILLING SUGAR JUICE, SEA WATER, &c., *E. Furness, London.*—11*th August*, 1883.—(*Not proceeded with.*) 4*d.*

Relates to improvements in the general construction of the apparatus.

3892. FILTERS for SACCHARINE JUICES, SYRUPS, &c., *C. D. Abel, London.*—11*th August*, 1883.—(*A communication from A. Perret, Roye, France.*)—(*Not proceeded with.*) 2*d.*

Relates to the use for filtering liquids of sponges or spongy material.

3899. LOOMS for WEAVING, *J. and W. Youngjohns, Kidderminster.*—11*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The inventors employ a cam disc driven from the crank shaft, and within the groove of a cam is received a "runner" on a stud affixed in a pendant lever. The bottom or lower end of the lever is by screw-adjusting link connected with a vertical lever, received and working on the "monkey tail levers" shed, the upper end of the vertical lever being attached by link as ordinarily to the needle or wire carrier.

3900. METHOD and APPARATUS for SCORING LAWN TENNIS, &c., *E. R. Kesterton, London.*—11*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to construct or arrange an apparatus in or by which the progress of a game can be scored during its progress, the register being visible from both sides.

3902. MAGAZINE or REPEATING FIRE-ARMS, &c., *G. V. Fosbery, Guildford.*—11*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates partly to the means employed for feeding cartridges into magazine or repeating rifles, and permits of cartridges being fed one by one into the breech end of the weapon from a carrier, the carrier containing two rows of cartridges side by side, so that a larger reserve of cartridges can be carried by the weapon than was heretofore practicable.

3903. MACHINES for CUTTING the EDGES of LAWNS, *T. Green and J. Hargrave, Leeds.*—11*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The inventors employ a spindle or cylinder carrying a number of cutters similar to what are used in the ordinary lawn mowing machines.

3907. TIMEPIECES with CALENDAR DEVICE, *O. Fleischhauer, Berlin.*—11*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Consists in a novel combination of a calendar for timepieces, whereby the calendar indicator or hand, moves automatically and uninterruptedly forwards over a fixed disc provided with the initials of the day of the week.

3905. APPARATUS for PURIFYING WATER or APPARATUS for OBTAINING MOTIVE POWER from WATER, *J. H. Johnson, London.*—11*th August*, 1883.—(*A communication from E. Couillant, Paris.*)—(*Not proceeded with.*) 2*d.*

The object is to provide an apparatus for pumping or raising water for obtaining motive power therefrom or for other purposes, wherein a compensation is obtained by which the water pumped or drawn in can be elevated to any height, without other effort than that which is employed to act upon the actuating parts to elevate the water from the level of the supply up to a level but a short distance above this.

3908. EXPLOSIVE CARTRIDGES for BLASTING ROCK, &c., *S. Trivick and J. Macuab, London.*—13*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Consists in constructing a cartridge of any known explosive, with which is placed a given quantity or charge of liquid ammonia or other chemical body confined or hermetically sealed in a glass tube or other suitable case, the cartridge being fired by any known method of ignition. Modifications are described.

3909. THRASHING MACHINES, *E. A. Brydges, Berlin.*—13*th August*, 1883.—(*A communication from Messrs. Vogel and Co., Neusellershausen.*)—(*Not proceeded with.*) 2*d.*

A special sieve is inserted in the machine in order that the corn may pass direct from the lower hopper into the chaff box, so as to prevent the same being mixed with the short straw.

3913. TUBE EXPANDERS, *G. Lohf, Berlin.*—13*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The principal feature of this tube expander is that every roller has a separate casing, which is hinged to a common ring by means of a link, so that during the expansion of the rollers the casing rests always firmly against the ring, with a point of its surface, like a wheel rolling on a fixed base. The roller casings are further held together concentrically by means of an india-rubber ring.

3914. PURIFYING WATER and SEWAGE, *A. Goldthorpe, Wakefield.*—13*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the purification of water and sewage by precipitating and extracting the lime, iron, and solids therefrom.

3920. MECHANISM CHIEFLY DESIGNED for CONTROLLING the OPERATION of STRETCHING MACHINES for DRESSING and FINISHING WOVEN FABRICS, *H. H. Lake, London.*—13*th August*, 1883.—(*A communication from La Société Anonyme des Teintures et Apprêts de Tarare, France.*) 6*d.*

Consists partly in the governing or controlling mechanism characterised by the combination of two racks, between which is arranged a pinion capable of being rotated in either direction by means of a hand lever, one of the said racks controlling the mechanism for putting the machine in or out of gear, and the other having movement imparted to it by the machine after the same has been put in gear.

3921. SIGHTING DEVICES for FIRE-ARMS, *A. J. Boult, London.*—13*th August*, 1883.—(*A communication from L. de Lunden, Brussels.*)—(*Not proceeded with.*) 2*d.*

Relates to the construction of the sighting bar and the attachment to the barrel.

3924. HARROWS, DRAGS, and CULTIVATORS, *W. Ogle, Ripley.*—13*th August*, 1883. 6*d.*

Relates to the forming of the tines or teeth and the mode of securing the same.

3925. RUDDERS, *A. J. Boult, London.*—13*th August*, 1883.—(*A communication from O. D. Levis, Pittsburg, U S.*)—(*Not proceeded with.*) 2*d.*

Consists in the application to and combination with a boat rudder of a broad flange or cleat, arranged and projecting horizontally from each side thereof at or near its bottom.

3928. TREATMENT of HOPS for the OBTAINMENT of CERTAIN USEFUL PRODUCTS, *W. Linden, London.*—13*th August*, 1883. 4*d.*

Relates to a process for extracting and preserving the constituents of hops for the purpose of rendering the same soluble, permanent, and lastingly useful.

3930. MANUFACTURE of ARTIFICIAL IVORY, *H. H. Lake, London.*—14*th August*, 1883.—(*A communication from J. B. Edson, Adams, U.S.*) 2*d.*

Relates to the method of forming artificial ivory as a substitute for ivory, by forming the material for the several growths or layers of xylonite or similar substance of different densities or different characteristics of composition, cutting the same into sheets, and then compressing the several sheets of all the elements into one entire mass, and making into sections the several layers as by the process of cutting, for producing the sheets to imitate ivory.

3934. DYNAMO-ELECTRIC MACHINES, *W. P. Thompson, Liverpool.*—14*th August*, 1883.—(*A communication from R. J. Sheehy, New York, U.S.*) 8*d.*

This relates to a generator having two armatures revolving through magnetic fields of constant but opposite polarity. The variations in the strength of the field are employed as a source of power to operate a switch, which introduces into or withdraws from a shunt circuit one or more fine wire coils, placed so as to more or less demagnetise the field magnets.

3938. FABRIC for COVERING PULLEYS, &c., *C. D. Abel, London.*—14*th August*, 1883.—(*A communication from W. Painter and L. R. Keizer, Baltimore, U.S.*) —(*Not proceeded with.*) 2*d.*

A fabric is employed, consisting of ductile metal in the form of wire, or strips, or bands, or plain or perforated sheets, combined with a flexible material.

3940. CONSTRUCTION of ROADWAY, *L. Stiebel, London.*—14*th August*, 1883.—(*Not proceeded with*). 2*d.*

Relates to the construction of roadways from powdered rock, asphalte, and broken stones.

3942. SHRAPNELS or CASE-SHOT, *H. J. Haddan, London.*—14*th August*, 1883.—(*A communication from Captain K. Fronhöfer, Prenzlau.*)—(*Not proceeded with.*) 2*d.*

The shell comprises an inner metal case, or the projectile proper, the outer surface of which is screw-threaded inversely to the rifling of the gun, and with a pitch depending on the twist of the rifling. The inner case is provided at its open end with a slightly conical rim adapted to receive a cylindrical cap of sheet metal, which is loosely fitted to the same and secured by lead rivets. The inner case and the cap are both fitted with balls or grenades, which latter are ignited by suitable means.

3944. MACHINERY for the MANUFACTURE of TUBULAR WIRE, &c., *W. R. Lake, London.*—14*th August*, 1883.—(*A communication from H. S. Bacon, Milford, and A. Eppler, jun., Boston.*) 10*d.*

Relates to the construction of apparatus for manufacturing tubular wire for forming the same into nails, pointing the latter, and then driving them into the soles of boots and shoes.

3945. CHRONOMETER ESCAPEMENTS, *W. Clark, London.* 14*th August*, 1883.—(*A communication from A. W. Kientoff, Dallas, U.S.*—(*Not proceeded with.*) 4*d.*

Relates to the peculiar construction and arrangement of the parts.

3946. APPARATUS for GENERATING and UTILISING ELECTRIC CURRENTS, *P. Higgs, Leith.*—14*th August*, 1883.—(*Not proceeded with.*) 4*d.*

This relates to the construction of the main frame of the generator, and to the use of two armatures, so arranged that the magnetic field is strengthened by the inductive action between the two armatures. The method of constructing the armature core permits of a free circulation of air.

3950. HOLDERS for CIGARS and CIGARETTES, &c., *J. H. Johnson, London.*—15*th August*, 1883.—(*A communication from W. B. Espeut, Jamaica.*) 4*d.*

Thin sheet steel known as "pen steel" is taken, and blanks are cut therefrom consisting of head or holding pieces and shanks, and a connecting piece to be held by the hand.

3956. TREATMENT of COTTON SEED OIL, MUCILAGE, &c., for the OBTAINMENT of VALUABLE PRODUCTS THEREFROM, *J. Longmore, Liverpool.*—15*th August*, 1883. 4*d.*

Consists partly in saponifying, adding an indifferent powder, separating with caustic alkali, and drawing off the colouring matter in the lye.

3960. MANUFACTURE of CHLORATE of POTASH, *E. K. Muspratt, Liverpool, and G. Eschellmann, Widnes.*—15*th August*, 1883. 4*d.*

Relates to the manufacture of chlorate of potash by the employment of magnesia in conjunction with chlorine.

3962. BALE HOOP FASTENERS, *J. W. Allen, Manchester.*—15*th August*, 1883. 4*d.*

Relates to forming fasteners with a projecting finger to resist the tendency of the fastener to turn.

3967. INSULATING SUPPORTS for TELEGRAPH and TELEPHONE WIRES, *S. Woolf, Mexborough, Yorkshire.*—15*th August*, 1883. 6*d.*

These consist of a tubular arm, having at one extremity an enlargement, shaped to partly embrace the pole, and at the other an insulator cup, the whole being moulded in one piece of earthenware.

3968. PRINTING MACHINES, *C. Pollak, London.*—16*th August*, 1883. 6*d.*

The object is to print from one block of type in different colours in one operation.

3969. MEANS and APPLICATIONS of MATERIALS EMPLOYED in the PROCESS of TRANSFERRING ORNAMENTAL or other DESIGNS to FABRICS, *T. J. Warwick, London.*—16*th August*, 1883. 2*d.*

Consists of a mixture of 3 lb. of compo black, 1 lb. beeswax, and 1 lb. white lead, thoroughly mixed and incorporated together by heat.

3972. TREATING VOLATILE or INFLAMMABLE FLUIDS and OILS for STORAGE, TRANSPORTATION, and other PURPOSES, *S. M. Eiseman, New York.*—16*th August*, 1883. 4*d.*

Relates partly to the process of granulating, coagulating, solidifying, or hardening volatile or inflammable fluids and oils, the said process consisting in dissolving in or mixing with the said fluids or oils a fatty substance in the presence of acid or acid combinations, and mixing the so heated volatile or inflammable fluids or oils with an alkaline substance or substances for producing the granulation, coagulation, solidification, or hardening of the fluid or oil so treated.

3973. APPARATUS for CARRYING, LOWERING, and DETACHING SHIPS' BOATS, *J. H. Barry, London.*—16*th August*, 1883. 6*d.*

Relates to improvements in the general construction of the davits and the appliances connected therewith.

3974. PROCESS for the UTILISATION of GALVANISERS' FLUX or SKIMMINGS, and OBTAINING AMMONIA and ZINC PRODUCTS THEREFROM, *T. Kenyon, Eccles.*—16*th August*, 1883. 4*d.*

The inventor claims as a working process the partial decomposition of flux liquor by means of an insufficient quantity of alkali, alkaline earth or carbonate of alkali, and the subsequent recovery of muriate of ammonia from the same by evaporation and crystallisation.

3975. MANUFACTURE of FIRE LIGHTERS and FUEL BLOCKS, &c., *J. Templeman, Glasgow.*—16*th August*, 1883. 6*d.*

Relates to a grinding apparatus and the moulds for moulding the firelighters.

3976. MANUFACTURE of or PRODUCTION of CARBONIC ACID from the CARBONATES of CALCIUM, MAGNESIUM, STRONTIUM, and BARIUM, and APPARATUS THEREFOR, *W. L. Wise, London.*—16*th August*, 1883.—(*A communication from Dr. H. Grouven, Leipsic.*) 10*d.*

Relates to the employment of steam, and to the construction of a furnace.

3978. LOCK NUTS, *R. D. Sanders, Glasgow.*—16*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to so construct and secure nuts upon screw bolts that they shall be prevented from shaking loose where screwed up to the work.

3982. MANUFACTURE of LACE, *C. D. Abel, London.*—16*th August*, 1883.—(*A communication from E. Daveniere, Paris.*) 6*d.*

Relates to the manufacture of lace on "Leaver's" machines, wherein a brilliant or satin-like appearance is obtained by causing certain of the bobbin threads to be floated, so as to hide the connection between the other bobbin threads and the warp threads.

3983. MACHINES for CUTTING PAPER, *A. J. Boult, London.*—16*th August*, 1883.—(*A communication from J. Meyer-Fröhlick, Basle.*)—(*Not proceeded with.*) 2*d.*

Relates to the construction of a machine for cutting rolls of paper into strips.

3986. AMALGAMATING PROCESS for the EXTRACTION of GOLD and SILVER from THEIR ORES, and APPARATUS EMPLOYED THEREIN, *J. N. Longden, W. P. Morgan, and A. W. Stirling, London.*—16*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates partly to the construction of an apparatus for passing the ores through mercury.

3987. WATERPROOF GARMENTS, *H. L. Rothband and G. and S. Mandleberg, Manchester.*—17*th August*, 1883. 6*d.*

Relates to the manufacture of waterproof garments so that air may pass freely through them.

3988. HOLDERS for PAPER in the ROLL, *H. J. Fitch, London.*—17*th August*, 1883. 6*d.*

Relates to the combination and arrangement of a holder or frame, a roll of paper parallel in guide grooves therein, and a movable or fixed straight-edged plate or flap pressing against the roll by its own weight or by springs.

3990. BRAKES for WHEELED VEHICLES, &c., *J. S. Humberstone, Brentford.*—17*th August*, 1883. 6*d.*

Relates to the combination of a removable brake block having a dovetailed or equivalent shaped rib or projection on the back thereof, with a block hanger or block holder having a correspondingly shaped groove on the front thereof or *vice versâ*, the brake block being connected with the block hanger by the interlocking of the said rib or projection and groove maintained in position thereon.

3991. FRAMES for BACKBONES of BICYCLES, *W. S. Simpson and J. W. Phillips, London.*—17*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to divide the backbone or its equivalent of a bicycle, or to so arrange the lower rear portion of one as to hinge or joint it to the upper or main portion, and to fit a spring at or near the hinged portions to receive and absorb the vibration of the small rear wheel, while travelling, whereby the rider is kept steady in his seat, the small rear wheel readily adjusting itself to the inequalities of the road, without the usual jumping motion being felt by the rider.

3996. MOTOR or AUXILIARY ENGINES for LIFTING, STEERING, &c., *F. W. Scott, London.*—17*th August*, 1883. 6*d.*

Consists in the combination of two single-acting pistons united by a rack and gearing with a pinion on the shaft of the pitch chain, wheel, or other means of transmitting motion with a four-way cock, or other suitable contrivance for admitting steam, water, or compressed air to either end of the cylinder as required.

3997. TERMINAL ORNAMENTS or MOUNTS for PILLARS of METALLIC BEDSTEADS, &c., *T. Causnett, Birmingham.*—17*th August*, 1883. 6*d.*

The object is to produce the terminal ornaments and their caps and shells in one mounting.

3998. MANUFACTURE of BOOTS and SHOES with INDIA-RUBBER SOLES, *W. Lilley and W. B. Skinner, London.*—17*th August*, 1883. 4*d.*

The inventors apply india-rubber soles to boots or shoes having leather, canvas, or other uppers, and in such a manner that the sole, when applied, has the same appearance as an ordinary leather sole, and is thoroughly watertight.

3999. Construction of Apparatus Employed for Concentrating Sugar Cane Juice, &c., *G. Davies, Manchester.*—17*th August*, 1883.—(*A communication from H. Ysaba y Lazarte, and E. P. Larée, Cuba.*) 6*d.*

Consists principally in placing the boiling or evaporating pan or pans in direct communication with the steam boiler or generator, so that the high-pressure steam in the boiler acts direct against the bottom of the boiling or evaporating pan or pans without having previously to pass through steam pipes.

4000. Ore-roasting Furnaces, *H. H. Lake, London.*—17*th August*, 1883.—(*A communication from T. Walker and J. F. Carter, Philadelphia.*) 6*d.*

The object is to automatically, continuously, rapidly, and cheaply desulphurise, oxidise, and chloridise properly prepared ores, also to generate sulphurous acid fumes from pyrites.

4001. Treating Solutions Containing Compounds of Ammonia to Obtain Useful Products therefrom, *A. McDougall, Penrith.*—17*th August*, 1883. 2*d.*

Relates to treating solutions containing compounds of ammonia by acid phosphates or superphosphates.

4002. Apparatus eor Grinding or Reducing Ores, Phosphates, Quartz, &c., *J. Wood, West Stockwith.*—17*th August*, 1883. 6*d.*

Consists, First, of an apparatus for grinding or reducing the ores, phosphates, quartz, or the like to powder, wherein the weight of the crushing wheels is concentrated on a very small space, so that the most refractory materials are crushed simply by dead weight with but little friction and no attrition and without the employment of centrifugal force; and Secondly, of an apparatus for separating the ground material by means of a current or currents of air.

4005. Promoting the Surface Combustion of Fuel in Steam Boiler Furnaces, *A. M. Clark, London.*—17*th August*, 1883.—(*A communication from B. Sloper, New York.*) 6*d.*

Consists in the process of promoting the surface combustion of fuel, and bringing the same to an intense incandescent heat by the decomposition of steam in connection with highly heated air, both the steam and air being delivered in a broad thin stratum over and into the whole surface of the fuel, so that all the atoms of steam come into contact with the fuel.

4006. Looms, *T. Crabtree, Shipley.*—17*th August*, 1883. 6*d.*

Relates to improvements in the method of the treading of healds, and warp threads for weaving.

4007. Internally Fired High-pressure Steam Generators, &c., *F. Livet, London.*—18*th August*, 1883. 6*d.*

Consists partly in the combination of internally-fired high-pressure boilers, composed of two or three cylinders with external flues, so arranged that the major portion of the cylinders are exposed to the heated gases, and expanding continually from the end of the furnace to the damper flue.

4009. Apparatus for Weighing and Measuring Parcels, *W. Tozer, London.*—18*th August*, 1883. 6*d.*

Consists in the combination of a spring balance, scale, or steelyard, with a measure or rule, whereby the weight, measurement, and cost of postage of any parcel can readily be ascertained.

4010. Apparatus for Trimming or Delivering Grain, &c., from Elevators or other Sources over Different Parts of a Quay or other Area, *I. A. Mack, Liverpool.*—18*th August*, 1883. 6*d.*

Relates to the manufacture and use of apparatus for trimming or delivering grain and other like matter from elevators or other sources over different parts of a quay or other area, consisting in whole or in part of a hopper or chamber, into which the grain is delivered in combination with telescopic spouts radiating from said hopper or chamber, and provided with doors or valves to regulate the delivery.

4011. Packing for Piston Rods, Spindles, and other similar Moving Parts of Machinery Requiring Tight Joints, *R. H. Harper and J. H. Chapman, London.*—18*th August*, 1883. 4*d.*

Consists of a central core of cork, perforated or not, of desirable section, with an outer covering of asbestos, or other suitable woven fibrous material, or a combination of woven and spun fibrous material.

4013. Furnaces for Steam Generators, *C. D. Abel, London.*—18*th August*, 1883.—(*A communication from J. Ferrando, Genoa.*) 6*d.*

Consists partly in constructing the fire-grate of a steam generator of deep transverse bars dipping into water, and having through them holes for passage of air.

4014. Apparatus for Shipping, Unloading, and Moving Grain, Seed, and similar Matters, *R. A. Sacre, West Kirby.*—18*th August*, 1883. 6*d.*

Relates partly to an apparatus for depositing elevators in the hatchways of vessels, consisting principally of a sheer frame hinged to a turntable, and provided with a jib hinged to a part fitted to be moved up and down the sheer frame, and having its end connected with the elevator, the whole mounted on a barge and provided with actuating tackle.

4018. Kilns or Ovens for the Annealing of Bottles, &c., *D. Rylands and R. Potter, Barnsley.*—18*th August*, 1883. 6*d.*

Relates to several improvements in the general construction of the kilns.

4019. Manufacture of Horseshoe Nails, &c., *S. S. Allin, London.*—20*th August*, 1883. 6*d.*

Relates to the construction of a machine in which is a mould, open at top and bottom, of the exact form of the outline of the nail to be made. Below this mould is a vibrating anvil, and above is a hammer stock to which motion is given by any suitable means.

4021. Bracelets, *A. Desbats, London.*—20*th August*, 1883. 6*d.*

Consists of a bracelet formed so that it can be expanded and contracted.

4022. Utilising the Bye-products in the Coking of Coal and in the Ovens employed therefor, *C. and J. Thomson, Glasgow.*—20*th August*, 1883.—(*Void.*) 2*d.*

Consists partly in constructing the ovens either with flues under the bottom and at the sides thereof or by flues under the bottom only, the coal being either charged beforehand or after or during the firing up of the ovens.

4025. Arrangement of Boilers, Engines, and Propellers for Ships, &c., *C. H. Simpson, Bushey.* 20*th August*, 1883. 8*d.*

Consists principally in arranging or combining the boilers with the cylinders and principal parts of the engines and propeller floats all in one and the same drum, which is arranged inside a casing which is open below and communicating with the external water through the bottom of the ship, and which may or may not be placed in a tank which fits into a well in the ship.

4027. Apparatus for the Extraction and Refining of Fatty Matters from Bones, &c., *A. C. Henderson, London.*—20*th August*, 1883.—(*A communication from Dr. W. Schneider, Ausbach.*) 6*d.*

Consists of a boiler mounted or set in brickwork; in this the bones or other matter are placed. A solvent liquid, such, for example, as benzine, contained in a reservoir, is conducted to the matter to be operated upon by means of a tube communicating with the bottom of the boiler. Just above this tube or pipe is a serpentine steam pipe, through which steam is made to pass by any convenient method, so as to bring the solvent liquid to a state of ebullition.

4028. Apparatus used for Covering Wire with Plastic Material, &c., *E. T. Truman, London.*—20*th August*, 1883. 4*d.*

The plastic material is caused to pass from the forcing machine along a tube or channel which has an opening, through which such a portion as is necessary finds its way into the chamber or nozzle in or by which the wire is covered, while the remainder enters an overflow pipe, and either returns to the forcing machine or is allowed to escape.

4029. Constructing and Fitting the Seats of Ships, &c., to Render them Available as Lifebuoys or Rafts in case of Need, *E. S. Copeman, London.*—20*th August*, 1883. 6*d.*

Relates to the general construction of the seats, &c.

4032. Galleys and Frames for Holding Set-up Type, *J. Heywood and R. C. Ross, Manchester.*—20*th August*, 1883. 6*d.*

The object is to obtain more ready and accurate means for adjusting the width of the space for the type, or of locking the type, and this is accomplished by acting upon an adjustable bar at two or more points by means of a setting bar, so that the said adjustable bar is compelled to maintain its parallelism with the fixed side of the galley or frame in all positions.

4033. Appliances for Heating Steam Boilers, *H. Lane, London.*—20*th August*, 1883. 6*d.*

The inventor constructs baffle plates of a modified V form of section, the two angular sides being curved and forming V channel plates.

4039. Hand Grip for Breech-loading Rifles and Guns for Military and Sporting Purposes, *S. Bexfield, London.*—21*st August*, 1883. 6*d.*

The hand grip is made of wood, metal, ebonite, vulcanite, or xylonite, and in the groove of the hand grip is attached a preparation of asbestos.

4042. Furnaces, *J. West, Manchester.*—21*st August*, 1883. 10*d.*

Relates to forming an arched chamber, producer, or furnace proper, where the heat is generated under the retorts.

4043. Manufacture of Explosive Compounds, *J. C. de Castro, Manchester.*—21*st August*, 1883. 4*d.*

Consists in the admixture of bran or other suitable form of cellulose, ter-sulphide of antimony, or natural sulphide of antimony, with the addition of saturated solution of chlorate of potash and the agglomeration of the compound into suitable forms for use.

4045. Apparatus for Joining Lead and other Pipes, *H. J. Hampson, Manchester.*—21*st August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the insertion of a special lining pipe.

4046. Gas Motors, *D. Clerk, Glasgow.*—21*st August*, 1883. 6*d.*

Consists partly in the combination with the ordinary parts of gas motors of starting apparatus, consisting of a receiver to contain a combustible gaseous mixture under pressure, a connecting pipe, and a valve, which is an ordinary check valve for preventing the return of gas passing through it when the receiver is being charged, but in connection with which there is also a spindle and hand lever for opening it for the purpose of starting the engine.

4047. Construction of Thrashing Machines, *E. Foden, Sandbach.*—21*st August*, 1883. 6*d.*

Consists in the combination with a fixed "caving" riddle of an endless band passing around rollers, and provided with fingers or scrapers, which drag the short straws, &c., over the said fixed riddle, and cause the corn to fall through the holes or interstices thereof.

4050. Augers and Bits, *H. J. Haddan, London.*—21*st August*, 1883.—(*A communication from H. E. Fuller and E. C. Bramhall, Washington, U.S.*) 6*d.*

Consists in the combination with curved or downwardly arched cutters of depending guide spurs or cutters.

4054. Universal Joints, *W. G. Edmonds, Devonport.*—21*st August*, 1883.—(*A communication from R. Edmonds, Norfolk, U.S.*) 6*d.*

Consists in the combination with a sectional concave bearing and a circumferentially grooved ball engaging said bearing of pivotted clutch devices extending into the concave bearing to engage the groove of the ball.

4055. Propulsion of Vessels on Water or through Air, and Apparatus therefor, *H. Imray, London.*—21*st August*, 1883.—(*A communication from E. Oppikofer, Rozschach, Switzerland.*) 10*d.*

Consists mainly in causing a body of considerable mass to travel longitudinally backwards and forwards on the vessel in such manner that the *vis viva* of its forward motion is communicated to the vessel, which is consequently also made to move forward.

4061. Manufacture of Commercial Products Resulting from the Operation of Galvanic Batteries, *G. C. V. Holmes and S. H. Emmens, London.*—21*st August*, 1883. 4*d.*

The nitrogenous fumes are treated so as to produce nitrite and nitrate of ammonia. The spent fluid from the negative cells described in patent 4059, of 1883, is used as a disinfectant, or mixed with bones, &c., to form manure. The spent zinc solution is used for preparing oxidised lead plates for secondary batteries, or for zinc plating.

4062. Rotary Pumps, *S. George, London.*—21*st August*, 1883. 4*d.*

Relates partly to the combination in a suitable containing chamber of a disc, drum, or cylinder, having teeth or projections fitting into recesses in a drum valve rotating on an axis parallel to that of the said disc, drum, or cylinder.

4063. Lacing Hook or Fastener for Boots and Shoes, *H. H. Lake, London.*—22*nd August*, 1883.—(*A communication from E. H. Train, Union City, U.S.*) 4*d.*

Consists of a base provided with prongs for attachment to the upper, and a hook turned up from and over toward the base, with an upward projection from the base on each side, but so as to leave the base in a continuous plane from the hook between the projections to the opposite edge.

4065. Machinery or Apparatus for Bevelling Angle, Tee, and other Metal Bars, *N. Arthur, Leith.*—22*nd August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the arrangement of rollers and to the gearing.

4066. Shirt Studs, *C. Cooper, Birmingham.*—22*nd August*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to avoid the liability of separation of the parts when a slight pressure is accidentally exerted upon the stud.

4067. Machinery for Splitting or Breaking Wheat and other Grain, *H. Simon, Manchester.*—22*nd August*, 1883.—(*A communication from H. Seck, Dresden.*) 6*d.*

Consists partly in the use of a grooved cylinder constructed and operating in combination with a toothed or serrated cylinder or roller in such manner that the grain, in lying in a longitudinal direction in the grooves of the cylinder, projects partly out of the same, and in this position is split, cut, or sheared by the combined action of the toothed cylinder and the edge of the groove in which it lies.

4069. Construction of Bicycles, *A. C. Henderson, London.*—22*nd August*, 1883.—(*A communication from W. Bäuerle, Augsberg.*) 6*d.*

Relates, First, to the treadles; Secondly, to the spokes.

4072. Securing Fur or Settled Fur Bodies on to Hardened or Partially Felted Bodies of Wool or Mixed Wool and Hair in the Manufacture of Napless Fur-plated Hat Bodies, *C. Vero and J. Everitt, Atherstone.*—22*nd August*, 1883. 4*d.*

Consists partly in consolidating a covering or light body of fur with a hardened or unfelted body of wool or wool and hair, which is mounted upon a perforated metal cone by wrapping wet flannels around the light body or covering, and then placing over them another perforated metal cone; next admitting steam to the interior of the inner cone, and afterwards working the outer cover to and fro.

4071. Galvanic Batteries, *O. C. D. Ross, London.*—22*nd August*, 1883. 6*d.*

The cells are connected by flexible pipes to a series of vertical tubes connected at their upper ends with a horizontal main pipe, the position of which can be lowered to drain the cells. The plates dividing the cells are made of porous carbon, and serve as the negative elements. Red fuming nitric acid, mixed with water and sulphuric or hydrochloric acid, is used as the exciting fluid.

4076. Applying Colours to Surfaces, &c., *A. M. Clark, London.*—22*nd August*, 1883.—(*A communication from H. Abbott and W. C. Harrison, Newark, U.S.*) 6*d.*

Relates partly to the method of preparing letters, figures, or designs in colours for ornamenting enamelled, vitrified, or vitrifiable surfaces, which consists in causing said colours to adhere to a film of collodion or other like material.

4078. Miners' Safety Lamps, *S. Pitt, Sutton.*—22*nd August*, 1883.—(*A communication from H. Pieper, Liége.*) 6*d.*

Consists essentially in the combination of an accumulator carried at the bottom of a safety lamp, a wire which can be turned into position to come above or in proximity to the wick, and means for causing an electric current to pass from the accumulator through the wire when so brought in proximity to the wick so as to heat the wire and ignite the lamp. A tube surrounds the wick tube to extinguish the lamp whenever it is opened or closed.

4079. Manufacture of Chlorine, *W. Weldon, Burstow.*—23*rd August*, 1883. 6*d.*

The inventor claims, First, obtaining chlorine mixed with other gases, by heating in a current of air manganese chloride in the state of powder; Secondly, obtaining chlorine not mixed with other gases, by dissolving in aqueous hydrochloric acid the oxide, or mixture of oxides, of manganese, which is obtained as the residual product of the treatment by heat and air of manganese chloride, subjected to such treatment in the state of powder; Thirdly, mixing powder of manganese chloride, before subjecting it to the treatment by heat and air, with powder of manganese oxide, or of a mixture of manganese oxides, previously obtained by treament of manganese chloride by heat and air; and Fourthly, the use, for the treatment by heat and air of a powder of manganese chloride, previously mixed or not with powder of manganese oxide, or of a mixture of manganese oxides, of a revolving retort furnace.

4080. Arrangement and Construction of Gas Motor Engines, *S. Griffin, Bath.*—23*rd August*, 1883. 8*d.*

The objects are, First, to arrange the motor cylinder, slide valves, and parts connected and working in connection therewith, so as to entirely eject the products of combustion from the cylinder and compression space after each explosion, and fill same with a uniform mixture of air and gas. The slide valve performs the double office of admitting air and gas to the cylinder and afterwards firing it, and is arranged to make one stroke to three of the piston, which has one impulse to three revolutions of the crank. According to the Second part of the invention, the cylinders, and parts connected and working in connection therewith, are arranged so as to obtain an impulse or explosion at every one and a-half revolutions of the crank shaft, the explosions taking place alternately at the back and front of the motor cylinder. The Third part consists in the employment of a cam, working in connection with a wheel and shaft, which gives motion to the slide valve, and which is arranged to open the gas valve during a portion of one stroke of the piston, and during the whole of the next stroke of the piston.

4084. Manufacture of Sugar from Sugar-cane, &c., *G. Fry, London.*—23*rd August*, 1883.—(*A communication from W. B. Espeut, Jamaica.*) 4*d.*

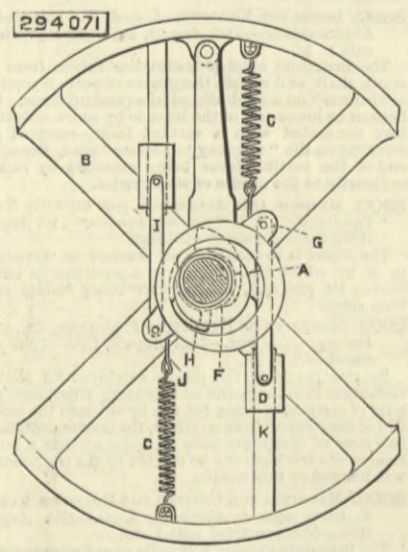
This relates to improvements on a patent dated 23rd December, 1882, and consists in the manufacture of sugar from vegetable substances, by boiling in an open vessel with a solution containing sulphurous acid and a base or alkali.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

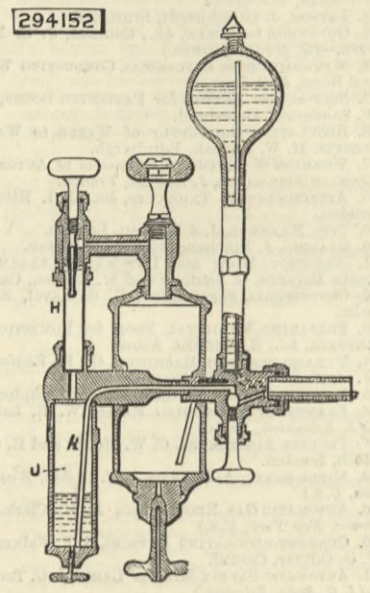
294,071. Shifting Excentric, *David W. Payne, and Charles R. Williams, Elmira.*—*Filed November 21st*, 1883.

Claim.—(1) A shifting excentric, the hub of which is provided with peripheral cams, substantially as and for the purpose set forth. (2) In a shifting excentric, a hub provided with peripheral cams, in combination with counter-balancing springs and connecting straps, bands, or chains, substantially as specified. (3) In a shifting excentric, a hub provided with peripheral cams, in combination with counter-balancing springs, centrifugal weights, connecting links and straps, bands, or chains, substantially as specified. (4) In a steam governor of the class specified, the combination of centrifugal weights and counter-balancing springs with an excentric formed with or connected to a hub having peripheral cams, and with devices for connecting the said excentric with said springs and weights, substantially as specified. (5) The combination of an outer excentric with an inner excentric, having as adjuncts peripheral or circumferential cams, and with centrifugal weights and counter-balancing springs, constructed and arranged substantially as and for the purpose described. (6) The combination of an excentric, a link plate, and oppositely-arranged peripheral cams with connecting straps, bands, or chain, substantially as specified. (7) The combination of the excentric F, link plate G, and cams H H, with the shaft A, wheel B, springs C, and centrifugal weights, and the links I, and straps, bands, or chains J, substantially as shown and described. (8) The combination of shaft A, wheel B, guides K, weights D, links I, straps, bands, or chains J, and springs C, with an outer excentric suspended by an arm to said wheel, and with the inner excentric, having a link plate and peripheral cams, substantially as shown and described.



294,152. Lubricator, *Samuel Reid, Chicago, Ill.*—*Filed June 11th*, 1883.

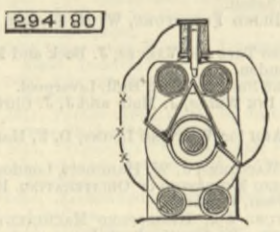
Claim.—(1) The herein-described method of compressing and maintaining compressed air in the sight tube of a lubricator, the same consisting in subjecting the air to a direct pressure of water, afterwards displaced by oil under pressure, and in its passage to the device to be lubricated, substantially as described. (2) The combination, in a hydrostatic lubricator, of a sight-feed tube filled with air compressed by and in direct contact with water, substantially as described. (3) The combination, with the lubricator and the sight-feed tube thereof filled with air, of a water



chamber connected with said tube, and in turn having a direct communication with a steam pipe or other steam containing device to which the lubricator is attached, whereby condensed steam may be employed for forcing the air from said chamber and compressing it in the sight-feed tube, substantially as described. (4) The combination, in a lubricator, of the sight-feed tube H, the chamber J, the tube *k*, and devices connecting said parts with the oil reservoir, the condenser, and the device to be lubricated, substantially as described.

294,180. Regulator for Dynamo-electric Machines, *Charles E. Ball, Philadelphia, Pa.*—*Filed November 19th*, 1883.

Claim.—(1) An automatic regulator for a dynamo-electric machine, comprising an electro-magnet or solenoid in the external circuit of the machine, and having its armature or core connected to both the commutator brushes or collectors, said brushes or collectors being movable toward and from each other, substantially as shown and described. (2) In a dynamo-electric machine in which the armature is



adapted and designed to rotate in the inductive field of only one magnetic pole, the combination, with two movable commutator brushes or collectors, of an electro-magnet or solenoid in the external circuit of the machine, and having its armature or core connected with both said brushes or collectors, whereby variations in said circuit will affect said magnet and produce the movement of both said brushes or collectors, substantially as shown and described.

CONTENTS.