SOUND STEEL CASTINGS.

No. II.

IT is no doubt desirable that the conclusions* stated in our impression for March 4th, should be tested by further experiments; indeed, it is clear that chemistry has not yet said her last word on the question. Thus, the well-known and valuable researches of Graham are contradicted in some parts by the late experiments of Parry; but we shall not attempt to judge between them. Again, Parry found that grey pig iron absorbed hydrogen in large quantities, and most readily at a red heat, but it does not, of course, follow that the same is the case with steel. Lastly, Regnault, Troost and Deville, and Graham, hold that hydrogen will pass through hot steel, even against atmospheric pressure; thus, Regnault sent a current of hydrogen for some hours through a red-hot steel tube, and on shutting off the flow found that a high vacuum formed within the tube. But this process is a slow one, occupying many minutes, even some hours; hence, long before a gas bubble in steel could thus disappear—supposing the process to go on in this case—the metal would have set, and the cavity would thus be rendered permanent. Such facts are not, therefore, able to invalidate the numerous and equally definite experiments described above. Neither Dr. Müller nor Mr. Windsor Richards appears to doubt that the gases in the cavities of steel are composed simply of hydrogen and nitrogen. It is true that when this statement was first published, it excited much incredulity in France; and M. Pourcel went so far as to suggest that Dr. Müller had quenched his ingot in water, and that the red-hot metal had sucked the hydrogen out of the water into its interior. Dr. Müller refutes this ingenious hypothesis with a fine touch of scorn; first, by denying the fact, and then by asking how he could have bored his ingot at all if it had been previously hardened by quenching from a red heat.

We have decided what these gases are; it still remains to ask where they come from. This question Dr. Müller has already answered, apparently correctly. It is clear that the two main components—hydrogen and nitrogen—are contained in the air, more or less moist, which is blown in vast quantities through the metal during the process of conversion, and out of this they have probably been derived. It might be objected that this could not explain the presence of hydrogen in pig iron which has been melted by the hot blast, but it does not appear how heating air to any extent can eliminate the moisture from it, though it may change it into a highly superheated steam gas. It is possible, however, that in this case part of the hydrogen may be derived from the water which is squirted upon the molten pig to cool it. The presence of hydrogen in pig iron, from whatever source derived, of course explains its presence also in Siemens-Martin steel. Similarly, the well-known development of CO in the blast furnace, and subsequently in the converter, fully explains its presence in the cast ingot. We may, therefore, assume that the liquid metal simply retains a portion of each of the gases with which it has come into contact; the only change being that the aqueous vapour is decomposed in the process, and the oxygen either liberated or combined with CO to make CO_2.

We have now cleared the ground sufficiently to see where we are. The existence of cavities in steel castings—other than the great central hollow—is caused by the evolution of hydrogen and nitrogen during the process of cooling, this evolution being due to the fact that steel can hold a greater proportion of these gases in solution when it is liquid than when it is cold. Granting this, we may go on to enquire, with better prospect of obtaining an answer, how the evil is to be cured.

The gases, as we have said, are composed of hydrogen and nitrogen, but the proportion of nitrogen is comparatively small, and we may therefore put it aside for the present, and consider hydrogen alone. We have shown that this hydrogen is derived from the moisture of the air which is blown through the metal; that it is freed from its oxygen by the action of the metal, absorbed in it, and retained there until partially expelled during the process of cooling. When thus expelled, and if unable to escape at the top, it forms bubbles of greater or less dimensions, which are sealed into the ingot, as described by Chernoff.

Admitting these facts, it is evident that there are at least four methods on which we may attempt the suppression of these cavities, and thereby the solution of the great problem of sound steel castings. (1) We may remove the moisture from the air, and thus stop the entrance of hydrogen into the metal at all. This may be called the Preventive Method. (2) We may expel the hydrogen from the metal after it has entered, by some chemical or mechanical means. This may be called the Removal Method. (3) We may mix some other substance with the metal, which shall combine with the hydrogen, and form a compound, the capacity for absorbing which is not diminished as the metal cools. The compound will then be retained in the cold metal, exactly as is the CO. This may be called the Chemical Method. (4) We may maintain such a pressure in the interior of the ingot, during the whole process of setting, that the gas may never be able to develope itself into bubbles at all. This may be called the Mechanical Method.

Now on all these four methods we have plans before us, some of which are actually in more or less successful operation, whilst all are of a sufficiently practical character to deserve consideration. In briefly discussing these we have the best chance of arriving at a conclusion as to which of the four methods offers the most promising field for further research.

1. *The Prevention Method.*—Dr. Müller suggests that it would be possible to dry air completely before sending it into a converter, by passing it through burnt lime. For reasons given in the next paragraph he considers that this would only be needed during the last few minutes of the blow, and that if so it could be done with little expense; he estimates the lime required at only 25 lb. per charge. It must be considered doubtful whether this would altogether prevent the presence of hydrogen in the metal; because Parry and Müller himself have shown—in the analyses already given—that hydrogen exists in ordinary pig iron. At the same time, since castings from such pig iron are not nearly so liable to porosity as steel castings, it must be supposed that the hydrogen in the case of pig iron is so far reduced in tension as no longer to be dangerous, and if so the same good results might be expected to follow the drying of the air in the case of steel. The method at least seems worthy of spending on it the small amount of money which would be required for the purpose of experiments.

2. *The Removal Method.* — Here, again, we have a suggestion of Dr. Müller, founded upon a theoretical view, which we must briefly explain. He refers to the fact that when water is saturated with a gas which it holds readily in solution, and is then exposed to a strong current of another gas which is not soluble in it—*e.g.*, common air—the effect is that the first gas, to a very large extent, is carried away mechanically by the particles of the second. He applies this to the fluid metal in the converter, and supposes that, while hydrogen is a gas easily soluble in this metal, CO is not. This latter supposition he, of course, derives from his own analyses; it is, however, disproved by the analyses of Parry, and the reason why Müller's analyses did not also disprove it has been already pointed out, viz., that Parry analysed the gases occluded in the metal, while Müller analysed those excluded in the cavities. But this error of Müller's does not really affect his argument, because the development of CO in the converter is so large that, although the metal can take up a considerable quantity of that gas, it must soon become saturated, and when that has once happened all the CO which is subsequently developed may be treated as if it were insoluble in the metal. As a matter of fact a large quantity of CO does certainly pass away, and Müller's argument is that this gas carries off with it mechanically a great quantity of the hydrogen which would otherwise remain and form injurious cavities. In support of this argument he adduces two practical facts.—First, samples of Bessemer steel, taken about the middle of a blow, are often sound, when samples taken towards the end of the same blow are porous; the reason being that in the latter case the development of CO, and the consequent removal of the hydrogen, had ceased before the sample was taken. Secondly, at the Bochum Works, and at the Hösch Works, in Dortmund, perfectly sound ingots are regularly obtained by blowing the charge completely dead, and then pouring in about 7 per cent. of liquid spiegeleisen. This causes a violent reaction, the carbon in the spiegeleisen combining with the oxygen left in the metal to form CO; and the hydrogen, which is also in the metal, is carried away at the same time. To prove this we need only consult the subjoined analyses, made at Bochum, of the gases escaping during the final reaction, in which it will be seen that hydrogen was present in about the proportion which would be expected:—

	CO.	CO_2	N.	H.	O.	Total.
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Analysis No. 1 ..	82·6	0·0	14·3	2·8	0·0	99·70
,, 2 ..	78·55	0·86	16·38	2·52	1·32	99·63

On this theory, as Dr. Müller remarks, the tables are completely turned on the supporters of the CO doctrine; and that calumniated compound, instead of being the cause of unsoundness in steel castings, turns out to be, whenever and as far as it is able, the most efficient agent for its prevention. The practical operation founded upon, or, at least, explained by, the theory, is one that would neither be difficult nor expensive, unless where spiegeleisen was exceedingly dear; but it, of course, requires further trial to see whether it would have the same good effect with the steel of other districts as it has with that of Westphalia.

3. *Chemical Method.*—To the greater number of metallurgists this method will undoubtedly appear the most attractive; and it may derive a stimulus from the fact that the application of the same principle has already yielded a practical success in the case of another metal—copper. Mr. J. B. Sharp has stated that copper is now cast perfectly sound, in ingots up to 4ft. high, by means of some chemical reagent which is kept a secret, but which is most probably phosphorus; so that of two samples from the same ladle, one treated by the new method and the other not, the former will be perfectly sound, while the latter will be exceedingly porous. There seems no reason why a similar process should not be discovered in the case of steel; and, in fact, Chernoff lays down, in his last paper, that the celebrated castings of Terrenoire are actually produced by a method of this kind. The agent in this case is silicon, which is considered to have the property of diminishing the solubility of gases in steel during the process of melting, and also of impeding the formation of CO. This latter property—now that the researches of Müller have proved CO to be beneficial rather than the reverse—cannot be said to contribute to the end in view; but the importance of the former property is unquestionable, since any diminution in the quantity of hydrogen left in the fluid steel would certainly diminish its tension, and therefore, as we have seen, its power of forming bubbles during the subsequent cooling. For hard steel castings the process at Terrenoire consists in melting steel, rich in carbon, in crucibles, and pouring it into sand moulds, each charge having added to it a sufficient quantity of silicious pig iron to give the metal a percentage from 0·3 to 0·4 of silicon. For mild steel, however, it is necessary also to add manganese, in order to reduce the oxide of iron which is dissolved in the metal. Spiegeleisen, or ferro-manganese, is employed for that purpose; and the Terrenoire Works have improved on this by adding silicon, producing what is called a "ferro-manganese-silicon melting," which is added to the converter just before casting. The proportions should be such that the cast metal will contain 0·2 to 0·3 per cent. of silicon, and about half as much again of manganese, the large proportion of the latter being necessary to prevent the silicon from separating the carbon out of the iron, which would otherwise occur. The result of the above addition is the formation of a double silicate of iron and manganese, which, being very buoyant, rises freely to the surface. The steel is then poured into the moulds, a head being added, as in iron castings, to do away with the top contraction cavity; and this steel is found to send up no bubbles to the surface in setting, and when cold to be perfectly sound. That this system has been successful in overcoming the difficulties of sound steel castings will scarcely be doubted—at least, by any who saw the splendid collection of Terrenoire castings exhibited at Paris in 1878. Dr. Müller, indeed, seems inclined to question the fact, on the ground that many of the German steels give very porous ingots, which yet are rich in silicon. But, as Chernoff has remarked, the silicon contained in the iron at the beginning of the Bessemer process is generally oxidised, and carried off in the slag. Hence, at the end of the process, when alone the injurious hydrogen is entering, there will not be silicon enough present to produce those evolutions of iron silicates of which we have spoken, and so to eliminate the hydrogen, although there may be enough to show the same proportion of silicon in the finished metal, as is shown in the finished Terrenoire ingots show, after the silicates have passed away. At the same time the fact adduced by Dr. Müller makes it doubtful whether the eliminating effect is really due to any chemical action of the silicon, or whether the hydrogen is simply carried off mechanically by the rising silicates, as it is by the CO at Bochum, in the removal method. If the latter be true, the Bochum would seem to be probably superior to the Terrenoire system; because the one effects, by the addition of spiegeleisen alone, what the other effects by the addition of spiegeleisen combined wilh silicon, a substance which is in itself prejudicial, and has, therefore, to be neutralised by a double dose of manganese. We may add that neither of these processes, so far as we know, has been tried in England, and, since neither of them is expensive, it seems very desirable that a careful comparison should be made between the two on neutral ground.

4. *The Mechanical Method.*—To explain the force of this method, let us consider what is meant when we say that a bubble forms at any point within a liquid. It means, in the first place, that gas is present at that point, which gas may be either the vapour of the liquid itself, as steam within boiling water, or a different element altogether, as hydrogen within molten steel. It means also that the tension of the gas at that point has become higher than the pressure exercised upon it by the molecules of the surrounding liquid; that in consequence the gas has pushed those molecules apart and made a chamber for itself, in which it gathers and expands either until the tension and pressure become equalised, or until, by the fluid pressure from below, it is forced up to the surface. Hence it is easy to follow the whole process of bubble formation in steel, as described by Chernoff and Müller. We have to conceive the liquid steel as holding imprisoned among its molecules a great quantity of hydrogen gas, somewhat as water is held in a sponge. This gas will, of course, have a tension of its own, which will bear at any moment a certain ratio to the pressure of fluid cohesion which imprisons it. If this ratio is one of equality, the steel will be called saturated with the gas; because, if any further gas were added, the tension would be increased so as to overcome the pressure, bubbles would form, would float to the top, and a portion of the gas would escape. It is not necessary to suppose this to be the case with the steel; in fact, as Müller has observed, even if it were true of the steel in the ladle, a certain amount of the gas would certainly be lost as the metal splashed down into the mould. We may suppose, however, that the steel, as it rises in the mould, is not very far below the point of saturation; and now let us see what will happen. If the steel begins to set irregularly, as it will in a metal mould, then the first particle that solidifies against the side causes a contraction and reduction of pressure just at that spot; the tension of the gas then overcomes the cohesion of the steel, and a bubble is formed. The same will take place as the second, third, &c., local setting takes place, until a fringe of bubbles is formed all round the outside of the ingot, as seen in Fig. 1. If the metal sets more regularly, as in a sand mould, these local disturbances do not take place; the whole crystallises together, and, from its diminished power of holding the gas in solution, sends a portion of it inwards to the still fluid interior. By this means the tension of the gas, in the zone next within the now solidified shell, is increased; the point of saturation is soon reached, and bubbles thereupon form. Some of these probably, even from the first, are caught and imprisoned by the rapid setting of the metal around them, but the greater part rise to the surface and escape. This, however, can only take place so long as the surface itself is fluid; the moment this solidifies the bubbles can escape no longer, and the whole of them are imprisoned somewhere, chiefly towards the top of the ingot below the solid crust. As the successive zones continue to set, this process—the inward flow of the gas, the consequent rise of tension, the generation of bubbles, and their imprisonment somewhere below the top crust—goes on with increased intensity; and hence we see why the bubbles appear more and more thickly up to the very centre of the ingot. But, in every case the formation of the bubble can only arise from the tension of the gas at that particular point overcoming the cohesion of the fluid metal. Now, this cohesion may be increased in two ways—(1) By the natural solidifying of the metal; (2) by the application of external force. If, then, we can only bring a pressure to bear from without, which shall so increase the natural cohesion of the fluid metal as to make it greater than the maximum tension given to the gas by its inward flow, and if we can maintain this pressure until the whole of the ingot has solidified, then no bubble will ever be able to develope itself,

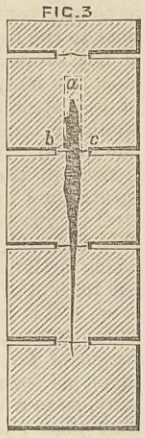
* They may be considered also to hold generally in the case of iron, but with some difference as to the numerical quantities.

and we shall have a perfectly sound casting. This is the principle of the mechanical or compression method.*

As our readers will be aware, this method has been applied in practice on two different systems; one the solid hydraulic piston of Sir Joseph Whitworth, the other the application of steam pressure, as discovered about the same time by M. Considère, in France, and Mr. H. R. Jones, in America. The exact details of the Whitworth process have never, we believe, been made public; but some account of it will be found in "Jeans on Steel," p. 490, and elsewhere. The metal is poured into an annular steel mould of great strength, into which fits an annular ram connected with the piston of an hydraulic press. When the mould is full the ram is brought down upon the metal with a pressure which is increased up to several tons per square inch, and which is maintained until the whole of the ingot is completely solidified. The second, or steam-compression process, has been described by Mr. Alfred Davis before the Iron and Steel Institute, and more recently before the Institution of Mechanical Engineers. It simply consists in providing the ingot mould with a lid, to which is attached a flexible pipe leading to a high-pressure boiler. As soon as the ingot mould is full the lid is fastened down by keys or otherwise, and steam admitted through the pipe to the top of the steel, where it is maintained until the whole ingot is set.

In comparing these two systems together, it will be obvious at first sight that the second possesses a very great advantage over the first in one important respect, namely in simplicity and cheapness. The Whitworth system must therefore establish a great superiority as to the quality of the product, or the convenience of manufacture, in order to enter into competition. It can hardly be said that this is the case. We may admit, indeed, that Sir J. Whitworth does produce by his process ingots which are perfectly sound. That the steel is, however, stronger or more ductile than if made by other methods does not appear. Chernoff gives tests of compressed steels—up to 2100 atmospheres pressure—made at the Abouchoff Works, and compares them with tests of other steel made at the same works, at Terrenoire, and elsewhere; and the superiority by no means lies on the side of the former. With regard to the convenience of working, the process is obviously limited to ingots, or at any rate to large castings of the very simplest form; and the great strength required in every part is a fertile source of difficulty and expense. At the Abouchoff Works, and at Neuberg, in Styria—the only places except Manchester where the process has been tried—it appears to have been abandoned on this account. The main difficulty is the enormous pressure, and the misfortune is that this pressure is not necessitated by the useful work to be done, but only by the mechanical conditions of the case. Professor Tyndall, indeed, appears to have imagined that the ram acted on the gases by simply driving them out through the outer and inner walls of the annular mould. But even if this be the case, it is a wholly needless operation, since, if our explanation of bubble formation be correct, all that is required is the very moderate pressure which is sufficient to overcome the tension of the gas, and prevent the bubbles from forming.† If the metal, therefore, set equally, a pressure of a ton or more per square inch would be quite beside the mark. But of course the outer and inner zones of the annular ingot set in reality earlier than the middle portions; and great pressure is needed to crush down these partly solidified shells, and so enable the moderate pressure, which is all that is really needed, to act upon the fluid centre. As the process goes on, the effect thus required increases, and the pressure must, therefore, increase up to the moment when the centre itself becomes solid. If this is not attended to, grave evils may result, especially with solid castings. Chernoff gives a section of a solid compressed steel ingot, Fig. 3, which illustrates this very forcibly. The ingot had been compressed, but not sufficiently, and the consequence was that while the whole of the outer part of the ingot was perfectly sound, the centre, which the pressure had not been able to reach, was a mass of cavities. It is obvious that such an ingot might have been converted, say, into a solid crank shaft, without the possibility of a suspicion arising that it had a dangerous flaw in its heart.

FIG. 3



The above objections do not attach to the compression of the ingot by means of a gas, such as steam. The pressure then follows the metal downwards as it shrinks without any difficulty, and need never be unduly high. In America, 100 lb. per square inch is said to have been found sufficient for ordinary rail steel. For English mild steels a higher pressure seems to be necessary; but though the process has been under trial at the works of the Barrow Steel Company and of Messrs. Bolckow, Vaughan, and Co., no results have been published sufficient to decide this point. A greater difficulty may be found in the application of the system to general castings. Doubtless it is not so limited in its sphere as the Whitworth press; but it is obvious that while it may be easy to arrange for supplying steam from a boiler to three or four ingots standing in a row, it will be a very different matter to adapt the same plan to the ordinary work of a large foundry, where thirty or forty different moulds, large and small, may be waiting for the same run. And yet any system which aspires to solve the problem of sound steel castings must clearly meet this difficulty. It has already been suggested in these columns that it might be met by simply confining in the top of the mould, within the lid, some substance which, under the influence of heat, would evolve large quantities of some innoxious gas, and would continue to do so for a considerable time. It has been objected that the pressure thus obtained would be likely to rise too high and to cause explosion; but to obviate this it would only be necessary to attach a pressure gauge to the lid, and to make the joint of the lid, whatever the packing, by ordinary bolts and nuts. If the gauge were observed at any time to be rising too high, a turn back of these nuts would allow leakage enough to remedy the evil. As a cheap and simple method, easily applied to any number of moulds, this seems to be worth a trial.

Hitherto we have considered the question of hydrogen only; but it will be remembered that nitrogen is also present in ingot cavities. The mechanical has here an advantage over the other methods, inasmuch as it is the only one which deals equally with both these elements. But nitrogen is present in all steel, and has even been held to be essential to its production; and its amount in all the analyses is only a fraction of that of hydrogen. It is fair, therefore, to conclude that, left to itself, it is not able to overcome the cohesion of the metal, and thus to form bubbles, though it may flow into those already formed by the more powerful hydrogen.

One further remark must be made before we part company with the mechanical method. It is obvious that, under whatever form, it is quite unsuitable to the sand moulds of an ordinary foundry—which would be blown to pieces by the lowest pressure that could possibly suffice to prevent the formation of bubbles. This pressure, therefore, necessitates the provision of an iron gas-tight mould, with properly fitting lid, and means of securing it, for every single article that has to be cast in steel. What this means, anyone who has had the practical management of a foundry will thoroughly appreciate. From this point of view the mechanical method, otherwise so promising, is seen to labour under a serious practical defect, which nothing can cure.

It is time to conclude an article in which the interest and importance of the subject have carried us far beyond our intended limits. On the whole, it would seem that the efforts of any engineer who aspires to solve the problem of sound steel castings should be directed to the task either of preventing hydrogen from entering the steel at all during the process of manufacture, or of removing it, to a considerable degree, after it has entered. For the first object a method has been proposed by Prof. Müller, which, however, is altogether untried in practice as yet. For the second object we may choose between the Bochum process, which removes the hydrogen mechanically by means of CO, and the Terrenoire process, which removes it—partly chemically, partly, in all probability, mechanically—by means of manganese and silicon. Assuming the two to be equally successful, it can hardly be denied that the second must be more expensive, and also more risky, than the first; and the first, therefore, is the road on which, in our opinion, the investigator should decide to make his earliest explorations. If this article shall have aided him to form his decision, and afterwards helped him a step or two along the road he has chosen, our share of the work needed to solve this great problem will have been fully accomplished.

* The above explanation of the process of bubble formation differs somewhat from that given by Chernoff in his last paper, inasmuch as he assumes that the increase of tension in the gas itself tends to prevent the formation of bubbles, not to assist it. If the increased tension in the gas at one part of the mass could take the form of an external compression on the gas at another part, tending to assist the cohesion of the metal, this would be true. But it is difficult to conceive that this can be the case with a gas like hydrogen; and the description above seems to meet all the facts of the case, at least as well, and more simply, than the longer explanation of Chernoff.

† It may be asked what, in that case, becomes of the hydrogen? It may either remain in forcible captivity among the steel molecules, or may gradually work its way to the surface; since Regnault found, as mentioned above, that if hydrogen, even at atmospheric pressure, be sealed in a red-hot tube, it will somehow escape, the pressure falling to almost an absolute vacuum. The point might be examined by testing samples of the same ingot, on Parry's method, at various intervals of time after casting.

LETTERS TO THE EDITOR.

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

SIR WILLIAM THOMSON'S TIDE PREDICTING MACHINE.

Sir,—A few days ago I saw my tide predicting machine described as "Roberts' Tide Predicting Machine" in a reprint of your number for 19th December, 1879, which was exhibited by Mr. E. Roberts, of the "Nautical Almanac" office, at the Institution of Civil Engineers, in the course of a discussion on my tide gauge and tide predicting machine last week and the week before.

I think it just to call your attention to the fact that the tide predicter is in no sense of Mr. Roberts' invention or design. He was employed by me, as chairman of the British Association Tidal Committee, to calculate the numbers of teeth in the wheels of the first tide predicter—now property of the British Association permanently deposited in the South Kensington Museum—and to superintend its construction in London by Messrs. A. Lègè and Co. The second tide predicter was made for the India Office, according to my advice, by Messrs. A. Lègè and Co., of London, under the superintendence of Mr. Roberts. In respect to the plan of the wheelwork, which is wholly due to Messrs. Lègè, it is a copy of the first instrument. It is an improvement on the first instrument in having twenty tidal components instead of ten, and in having the well-known rigorous method of the slide—Thomson and Tait's "Natural Philosophy," sec. 55; or "Elements of Natural Philosophy," sec. 72—for producing simple harmonic motion in a straight line from circular motion, instead of the approximate method of pulleys centred on crank pins, which, for simplicity and economy, I used in the first instrument. William Thomson.

The University, Glasgow, March 19th.

A NEW CONDENSER.

Sir,—In your issue of the 18th inst., I notice a letter from Mr. Flannery. In the sketch shown there is nothing new. I designed one five years ago for a stationary engine. The differences between the one illustrated last week and mine, are one annular foot valve instead of a number of small ones, and working the injection valve intermittently. The arrangement of injection valve shown is not the best that might be adopted; also the form of condenser at the bottom is not a good one, causing the water to turn an abrupt corner, and the small valves will obstruct the free flow of the water.

These and other forms of blow-through condensers are by no means new, having been used in Scotland for many years, and are well known there. Full particulars of trials of condensers of a better form than the one illustrated last week, will be found in the "Transactions of Engineers in Scotland," in the year 1868 or 1869.

March 22nd. Peter Dunlop.

AGRICULTURAL EXHIBITION IN HUNGARY.

Sir,—I beg to inform you that the Chamber of Agriculture of the County of Zala, in Hungary, intend to hold in the town of Zala-Egerszeg, on the 1st, 2nd, and 3rd of May, 1881, an International Exhibition of Agricultural Machinery—excluding steam machinery—and a ploughing match. The machinery exhibited will be subjected to competitive trial, and diplomas First and Second Class and of Honourable Mention will be awarded.

Machinery or implements to be exhibited have to be in Zala-Egerszeg at the latest by the 20th of April, 1881. Applications for space have to be made up to the 1st of April, to the Chamber of Agriculture—Landwirthschafts-Verein—in Zala-Egerszeg, Hungary, and must specify the objects intended for exhibition and their price. The said Landwirthschafts-Verein will purchase of the prize machinery to the amount of 1500 florins. Further information will be furnished by the Consulate-General.

F. Krapf,
Assistant Consul-General.

Imperial and Royal Austro-Hungarian Consulate-General,
London, 29, St. Swithin's-lane, E.C., March 22nd.

LINKS IN THE HISTORY OF THE LOCOMOTIVE.

Sir,—Want of interest for some time in mechanical pursuits caused me to neglect regular perusal of your valuable paper until Saturday last, when—I was a visitor in the Royal Exchange Newsroom here, on the introduction of a Glasgow press friend, who kindly entered my name—I took up your impression of 18th inst., wherein I observed an article, No. 10, on "Links in the History of the Locomotive," and in which you seek for information as to who the man in oblivion was who designed the improvements to which you refer in the locomotive engine Planet. On that point I have reason to believe that I can furnish you with the information required, by stating that his name was Alexander Fyfe, late designing engineer and draughtsman to the late George Stephenson. Whether or not, the fact might easily be confirmed or contradicted, on reference to Fyfe's original drawings, which should be found on searching through George Stephenson's voluminous papers, if any of his relatives, so privileged, will take the trouble to look through them.

From family reminiscences I am glad that I am thus in a position to communicate with you; and when doing so, I presume I may take the liberty to note certain incidents in Alexander Fyfe's career, during his life, as a thoroughly practical and theoretical engineer of more than ordinary capacity, who, through his single-minded, natural, unselfish, kindly nature, lavished his mechanical talents upon friends who better knew how to turn them to personal account commercially than he ever thought of doing, or cared to do. "Scheming," as you term it, in his profession was, unfortunately for his family, his only one and constant study, that ultimately prematurely closed his useful life.

Born at Aberdeen—his father, an engineer before him, was, I believe, one of the engineers who laid out and built the harbour of Aberdeen. Alexander Fyfe in early life, along with his brother James, my father, was one of the engineers employed by the late John Cargill—one of the contractors under Government who constructed the Caledonian Canal, then considered the greatest undertaking of the day. On that work the Fyfes were principally engaged on the central district, at Fort Augustus, where they erected a Bolton and Watt beam engine, one of the largest then made—and it still stands there in good working condition—which, together with a dredging machine, the brothers Fyfe tended, with other engineering work, until the completion of the canal. I may here mention one rather amusing incident that occurred before the opening of the canal, that I remember related by my good father. Government sent two members of Parliament to make an inspection of the work. Cobbet, if I recollect correctly, was one of them, and when at Fort Augustus—a week's journey then, or more, from London—they breakfasted one morning on board the dredger, and, to the great amusement of their hosts, produced from their pockets a knife and fork each that they had carried from London, fearing that in such an outlandish district knives and forks could not be obtained. After the Caledonian Canal was finished, Alexander Fyfe was employed by George Stephenson, for some time on colliery engineering work at Berwick-upon-Tweed, and afterwards upon the construction of the Liverpool and Manchester Railway, as his chief designer and draughtsman, from its first commencement until after its opening, and for some time afterwards he remained with that company, employed as manager and superintendent of the locomotive department. Whilst with Stephenson he designed the improvements of which you speak in the locomotive engine. In fact, Fyfe made all the improvements in Stephenson's time in the locomotive. The Edge Hill Tunnel at Liverpool, and the Sankey Viaduct on the Liverpool and Manchester line, were constructed from his drawings and designs, and it was his "scheming" that surmounted the great difficulty that Stephenson encountered in crossing Shap Moss, where wood piles were driven to secure a foundation. Fyfe's canal experience suggested that idea to his mechanical, ever fertile brain. At the opening of the line he and his brother—my father—stood close to where Huskisson stood on the day when he was killed, and, if I remember correctly, I have heard my father say that the Duke of Wellington was present that day.

The Mr. Forsythe referred to in your article was one of two brothers employed upon the line. The father was also employed as a time-keeper. One of the sons, Thomas, lost one of his legs through an accident on the line, and he was afterwards taken into the drawing-office by Fyfe, which accounts for the table of locomotives, given on page 194 of your journal, as "originally prepared by Mr. Forsythe." From the Liverpool and Manchester Railway Alexander Fyfe was induced, by Bidder, sent specially to Manchester by Stephenson to prevail upon him, to go to London, where he went, and undertook the superintendence of the locomotive department of the Eastern Counties Railway at Stratford-le-Bow, when Mr. Crawshaw was one of the directors of that line. Through over-exertion of brain, Fyfe's health, after a time, gave way, which caused him to resign his situation with that company, and after a protracted severe illness, he died in or about the year 1848, in about the fifty-eighth year of his age, and was buried at Stratford, leaving his wife and family unprovided for. The widow after his death, and up to the time of her death—she died in the house of David Elder, of engineering celebrity on the Clyde—was in receipt of a small annuity, which at her death was discontinued to the family, from a metal society, of which a Mr. Tool was at that time secretary. Speaking from memory, I am under the impression that to Alexander Fyfe's brain some person in Manchester, I think a Mr. Gordon, was indebted for the invention of the steam whistle. When living at Manchester—Ivy Cottage, Regent-road—Fyfe and other engineers were consulted by the Inglebys, of the Cheedle Copper Works, in reference to some mechanical difficulties desired to be overcome at the works. Fyfe at once suggested a remedy, which was carried out, and proved successful, and for years afterwards he received very handsome presents—not money presents—from the Inglebys. His professional acts of kindness, innumerable, were in like manner gratuitously proffered to his friends, or any person who solicited his genius. Amongst the working mechanics employed under him he was also greatly esteemed, and was presented with numerous testimonials from them, and even from abroad, by some of his men who were sent abroad on railway work. Yet, whilst his friends around him piled up fortunes one after another, he, with all his genius, died a poor man, and being poor, his genius, utilised by others, buried with him, dead, forgotten to all, save those once dear to him, and to they who, for themselves built monuments of wealth and fame upon his genius, and cannot, dare not, now say from whence it sprung, lest in the telling, that name, long since dead, might shine more bright, and rank again amongst genius of its brilliant engineering type. How many reticent, unostentatious men of similar mechanical genius to Alexander Fyfe have passed away unnoticed, forgotten, and unknown to all, save those in luxury, for whom they toiled to build up fortunes through their genius? Their numerous lonely silent graves can never tell!

His family are now all dead, except his only daughter Isabella, who is the widow of an engineer, recently dead, and I am sorry to say she is left penniless, with two daughters, and one son about twenty-three years of age, who is badly paid, as a clerk, in a com-

mercial office in Glasgow. He lives with his mother, who, with his kind assistance, manages to keep up a respectable appearance by letting her rooms; and it so happens, that I am now with them, whilst I am in Glasgow on business. It has occurred to me that something might be done to assist this family in their distress by getting the son into more lucrative employment, and by bringing their unfortunate position before the notice of gentlemen in railway and engineering circles, who knew Alexander Fyfe personally, and shared his friendship, profiting through his genius.

Touching Alexander Fyfe's railway pedigree again, I may, in corroboration of the facts herein written thereon, refer you to Mr. George Richardson, late passenger manager of the Eastern Counties Railway, now living retired at The Wycke, Burnham, Essex. He is a relation of the family, and was first employed upon the Liverpool and Manchester line along with my late mother's brother, George Baker, deceased, who booked the first passenger who travelled upon the Liverpool and Manchester line. Alexander Fyfe was best known in Manchester. The palmy days of his life were spent there, amongst such engineering men as the Galloways and Nasmyths, who were his intimate friends. My father, James Fyfe, brother to Alexander Fyfe, having married the niece of the contractor, John Cargill, son of Donald Cargill, the Covenanter beheaded at Edinburgh—remained at the Caledonian Canal, where he buried his genius, and until his death, in 1863, was engaged as engineer and superintendent of the central district of the Canal at Fort Augustus. In corroboration of that fact, I refer you to Sir J. C. Cowell, K.C.B., Master of H.M. Household. He was my companion in boyhood at Fort Augustus, and, with me, was educated at the Royal Academy, Inverness.

THOMAS CARGILL FYFE,
Nephew of the late Alexander Fyfe.
12, Greenvale-place, Glasgow, March 21st.

SOUTH LONDON TRAMWAYS.

SIR,—Statements having been published in several newspapers that the Committee on Standing Orders in the House of Lords had thrown out the Company's Bill for their extensions between Wandsworth-road Railway Station and Vauxhall, Westminster, Southwark, and London Bridges, I am instructed to say that this announcement has been made prematurely, and to make the following explanations:—It is true that the company's first application to the Lords' Committee was refused, owing to an omission inadvertently made to comply with the form prescribed for preparing the plans. Representations, however, having been made to Lord Redesdale that these omissions had only been made on those portions of the deposited plans referring to the route between Wandsworth-road Railway Station and Vauxhall Cross—a distance of about one mile—the committee consented to allow the Bill to proceed for the remainder of the routes, which embrace all to the north and east of Vauxhall Station.

H. CAMERON RICHARDSON,
South London Tramways Company, Secretary.
7, Drapers'-gardens, London, E.C., March 17th.

WOOD-CENTRED RAILWAY WHEELS.

SIR,—Allow me to draw attention to what I believe to be partly the cause of the destruction of wood-centred wheels, viz., lateral strains. I think it will be admitted that the wheel is weakest in this direction; no doubt the brakes will shorten the life of the wheel, and especially so when the brake gear is of a bad arrangement. I think it is well that the wear of brake shoes should be taken up from a common centre, as in the latest Westinghouse arrangement, so that inexperienced men can make no mistake.

I hope the point I have drawn attention to may be investigated, and if found to share in the rupture of the wheels as shown in your illustration of 12th December, then Mr. Cleminson's system is the right one, as it will prevent lateral as well as torsional twisting; but perhaps it would be better to have six arms.

R. RICHARDSON.
Blythswood-road, Renfrew, N.B., March 15th.

HIGH-SPEED LOCOMOTIVES.

SIR,—The letters on the above I have read with great interest. I entirely agree with most of the opinions expressed on high speeds, especially the Great Northern Railway. That the Great Northern runs the fastest train in the world there can be no mistake. "Running Board" makes a great fuss about the Dutchman, but she slows considerably as she gets further from London, while the Flying Scotchman keeps up her high speed to the end, the figures being 48 against 50 on the side of the Great Northern. The 5 p.m. ex King's-cross does 53·1 miles, Hitchin to Peterborough, Sundays only. Generally they run five and six minutes under time. The Lord Mayor's train last summer did the distance, King's-cross to York in 21 minutes less actual time than the Scotchman; in one part a speed of 64 miles an hour was run for 22 miles; in another 70 miles for 5 miles. Beyond doubt it was the fastest time ever run anywhere, a uniform speed of 60 an hour being kept up for 86 miles—a very good performance. The Leeds express 3¾h. Grantham to Wakefield, 70¼ miles done in 79m. = 53·4. So it will be seen that the Great Northern Railway can give as good account of itself as the Great Western, if not better. The 5 p.m. ex King's-cross is only an ordinary train, yet it is as fast as the Dutchman. It does the Great Northern great credit to possess such splendid engines as their 8ft.; they are beyond all doubt the best engines ever designed for the narrow gauge. At the time they began to run it was confidently asserted that they would fail, but their great success must have astonished all their enemies—and Mr. Stirling too, after so much hostile criticism. They have now twenty-eight of them; their numbers are 1, 2, 3, 5, 7, 8, 22, 33, 34, 47, 48, 53, 60, 62, 69, 93, 94, 95, 98, 221, 544, 545, 546, 547, 548, 549, 550, 662, totally outnumbering the 7ft. singles—a standing proof of their great superiority over all others. Coupled engines are never put on a main line express. I doubt if the 8ft. will find their rivals. The Midland cannot run them; they are very fond of running with two engines, 7ft. coupled—it is of daily occurrence—and with only twelve carriages, while one 8ft. can pull more than that number. They can run sixteen carriages—Midland Railway—at 60 miles an hour, but they cannot run 50 miles with twelve, that is a fact. G. N. R.

Peterborough, March 14th.

SIR,—I think that the hourly express trains running on the Cheshire Lines Railway between Manchester and Liverpool deserve some notice on account of their fast speed. The distance between the two cities is thirty-four miles, and is run in forty-five minutes; this includes a stoppage at Warrington of three minutes to collect tickets, and allowing two minutes for gradually stopping and starting, leaves forty minutes for the entire run, or fifty-one miles per hour. There are four trains in addition each way which, I believe, run through regularly without stopping at Warrington in thirty-eight minutes, or 53½ miles per hour. H. B. M.

Manchester, March 16th.

SIR,—In reading your valuable paper, I notice a letter from Mr. F. H. Cridland, Bournemouth. He is desirous of information as regards domes on locomotive boilers, the advantage and disadvantage derived therefrom. He remarks that the fastest trains in the kingdom are run by engines minus domes, viz., the 10.0 a.m. from King's Cross and 11.45 a.m. from Paddington. May I be be allowed to give my experience on this subject? I am an engine driver on the Manchester, Sheffield, and Lincolnshire Railway, and shall I say it has been a lifetime of experience of locomotives? I have been accustomed all my life to engines with domes, and now for the advantages derived therefrom:—

First: By having a dome, the regulator situated therein is so much higher than the water in the boiler that the engine gets the steam cleaner, and by so doing the slide valves and pistons are kept in better condition. Again, for instance, we have an engine shy of steaming; by filling the boiler well up at a station we get a good start for a mile or so before commencing to put any more water in.

Second: Now for engines without domes. The regulator is generally placed inside the top of the boiler and near to the smokebox. The drivers cannot carry a full boiler of water; the consequence is, if they do, the water gets into the steam pipe and thence to the slide valves above mentioned, which makes bad work of them.

I have seen drivers who have had engines without domes run their engine boilers with the water only just in sight in the water gauge glass; this has been done for the very cause I have mentioned above, viz., to keep the engine from throwing water out at the chimney. And when a driver is working the boiler so low of water as I have mentioned, I myself call it very unsafe. Shall I say while it is my privilege to drive a locomotive I hope it will always be one with a dome on? W. T.

Stockport, March 17th.

SIR,—I have remarked lately in your columns several letters on the high speed now reached by the most important railway companies of this country. No doubt these letters may prove interesting to a few of your readers, but I do not consider them as having the technical character which the letters addressed to the editor of this important paper should bear. It would be far more useful for the engineering world to know something more precise about the means of obtaining these boasted high speeds. There is in this subject a good deal of interesting matter to be cleared up, which is still very confusing. I have tried to collect some documents on this subject; my labours have simply led me to the conclusion that proper data and calculations are still wanted in locomotive engineering.

I read, however, with pleasure, in your issue of March 18th, a good suggestion of "Running Board." I am sure it would prove highly interesting and beneficial to your readers to try to solve questions similar to the one he proposed in his letter. For my part I tried to do it after my own ideas; my calculations showed that the engine in question must have 19in. by 27in. cylinders—if the diameter of the driving wheels is 7ft., the pressure in the boiler 150 lb., and the conditions of the traffic the same as mentioned in the letter. The adhesive weight of the engine is in this case 37·2 tons. This is enormous. If such an engine were to be built some new designs should have to be got out. The Fairlie engine is, I think, the proper sort of disposition to be resorted to. But I am rather afraid that Fairlie's engines are not fit for high speeds. I have eulogised them in my letter of the 14th of January last, more as engines meeting some of the difficulties of construction inherent to the actual engine than as a high speed engine.

"Running Board" must not be astonished at the above results. An average speed of sixty miles is semething very difficult to realise, it means that the engine has to run sometimes—very often most likely—at speeds of seventy-five miles an hour. Now there is a fact too often overlooked in locomotive engineering; it is this, no engine can do more than sixty-five miles an hour, and it is only a momentary speed—*un coup de collier*. Sixty miles an hour in the case of "Running Board's" engine cause a great resistance per ton especially on sharp curve and on steep incline; it must be remembered that the resistance to traction increase as the square of speed. The engine of the Holland State Railway may run sixty miles an hour, but it is not, I am aware, in a very hilly country. Besides we have no diagram of the line's sections. M. Rabeuf has been the first to prove that no engine of the present type was fit to do more than fifty-six miles an hour, owing to the very disposition of the engines of a locomotive. I am not aware that his very interesting memoir has ever been published and discussed in your columns.

I am afraid to occupy more space than you can allow for such generalities, but I purpose, with your consent, sending the solution of a problem similar to that of "Running Board," as well as some details on M. Rabeuf's experiments. EDWARD GOBERT, Ing.

39, Heskey-street, Nottingham.

HIGH-SPEED ENGINES.

SIR,—A perusal of the correspondence which has recently appeared in THE ENGINEER respecting the above induces me to think that the new rotary engine patented by Mr. Hodson, C.E., and some time since described in your columns, must have escaped notice. This engine I have seen working continuously at a speed of 1200 revolutions per minute, with the greatest regularity. I have also, through the kindness of the patentee, witnessed its performance in driving the Siemen's and Gramme dynamo-electric machines at speeds of 680 and 900 revolutions per minute, respectively, with what appears to be the greatest success. This engine appears to me to meet "J.'s" requirements, and the "impressions" and "thinkings" of your other correspondents are easily disposed of when they can see it at work any day. If I remember rightly, the agent for these engines is Mr. Earle, 80, Cannon-street, who will no doubt be able to answer any questions regarding their performance. VERITAS.

FIRE-BOX ROOF STAYS.

SIR,—In reply to Mr. E. G. Sheward's letter in THE ENGINEER of the 18th inst., permit me to say a word or two. I certainly was not aware, nor do I think that any of your readers were aware, that the expansive portion of my stay was a colourable imitation of his, or any other expansive stay which has been introduced by locomotive builders any time within the last thirty years or more. Had Mr. E. G. Sheward's experience extended beyond twenty years, he would have known that what he would have called colourable imitations of his arrangement existed even then; and I am much mistaken if Mr. Reid, of Neilson's, whose experience does extend beyond twenty years, cannot tell him the same thing. Expansive arrangements of roof stay bolts, all bearing features more or less similar, have been introduced by the score, and many of them with as much success as, I doubt not, attended Mr. E. G. Sheward's colourable invention. The very point where he accuses me of perpetuating an evil is the one where I claim to have introduced an important improvement—namely, the mode of connection through the copper plate, by cutting in the bottom of the stay to an impervious bearing, and filling up the recess with cement, by which means the constant leaking of stays—as in Mr. Sheward's invention, or all colourable imitations thereof—is effectually prevented; I myself having had many hundreds taken out in my practice, extending over thirty-five years; and how Mr. Sheward can say it is not so effective as it appears I am at a loss to understand, when he knows nothing of its practical working.

Manchester, Sheffield, and Lincolnshire Railway (Locomotive Department), STANHOPE PERKINS.
Gorton, March 22nd.

THE EFFICIENCY OF A TANDEM ENGINE.

SIR,—It seems to me that the difficulty to be got over in Mr. Longridge's report on Messrs. Nuttall's engine admits of a simple solution. It seems to be obvious that the engine could not have given out a horse-power with an expenditure of but 16·7 lb. of steam per indicated horse-power per hour, and the total horse-power is obtained under such conditions that cylinder condensation must have been entirely prevented, which is quite out of the question. Yet, on the other hand, it seems that the feed-water was measured carefully enough, although the precautions taken to secure accurate registering of the number of tubs were not sufficient. When I carry out trials of the kind I always superintend the water measuring myself, and allow subordinates to take diagrams. They can be checked subsequently. A water list cannot. The best plan is, no doubt, to have a self-acting register, which can be made with a float, a sheet of paper stretched on a board, and a pencil; or it may take the form of a counter connected with the taps of the measuring tub.

To go back, however, to what I first said, it appears to me that an error has probably been made in calculating the diagrams or in taking them. The planimeter, I know by experience, will give a higher average pressure than the ordinary system, especially unless it is used very carefully, and it introduces certain sources of error which must be cautiously guarded against. It is not everyone who can use a planimeter. Besides the chance of error here, there is also the chance that the indicator springs were not accurate. They seldom or never are unless they are specially tested and verified, and if they are much used, they will become weak and register too high. Before Mr. Longridge carries out any more experiments with Mr. Nuttall's engine, I suggest that he have his indicator springs tested and verified. An error of 1 lb. in the average pressure in the small cylinder equals nearly 9-horse power, and the same error in the condensing cylinder means about 24-horse power. I do not say that Mr. Longridge's springs were wrong to this extent, but I have known new indicator springs as much as 2 lb. weak in 80 lb. It would be interesting to many of us if Mr. Longridge would have the springs he used tested by dead weights, and let us know the result through your columns. J. R.

Bradford, March 23rd.

SAFETY VALVES.

SIR,—My letter to you about the safety valve should read, "will prevent steam rising more than 1 lb.," in place of 7 lb. as printed. By inserting this correction you will oblige X. X.

IRON AND STEEL INSTITUTE.—The annual general meeting of this Institute will—by the kind permission of the president and council of the Institution of Civil Engineers—take place at 25, Great George-street, Westminster, on the 4th, 5th, and 6th days of May ensuing, commencing each day at 10.30 o'clock in the forenoon. The annual report of the council and the financial statement will be presented. The president-elect, Mr. Josiah T. Smith, will deliver his inaugural address. The following papers, or a selection of them, will be read and discussed:—"On the Results of Experiments Relative to Corrosion in Iron and Steel," by Mr. William Parker, of Lloyd's Registry, London; "On the Manufacture of Armour Plates," by Mr. Alexander Wilson, of Sheffield; "On the Manufacture of Steel and Steel Plates in Russia," by Mr. Sergius Kern, St. Petersburg; "On the Use of Steel for Shipbuilding," by Mr. William Denny, Dumbarton; "On some Physical Properties of Cast Iron," by Mr. Charles Markham, Staveley; "On the Desulphorisation of Iron," by M. Rollet, St. Chamond, France; "On Iron and Steel Permanent Way," by Mr. R. Price Williams, London; "On Hydraulic Appliances for the Bessemer Process," by Mr. Michael Scott, London; "On the Manufacture of Bessemer Steel and Steel Rails in America," by Captain Jones, Edgar Thomson Steel Works, Pittsburg, U.S.A.; "On a New Form of Bessemer Crane," by Mr. Thos. Wrightson, Stockton-on-Tees.

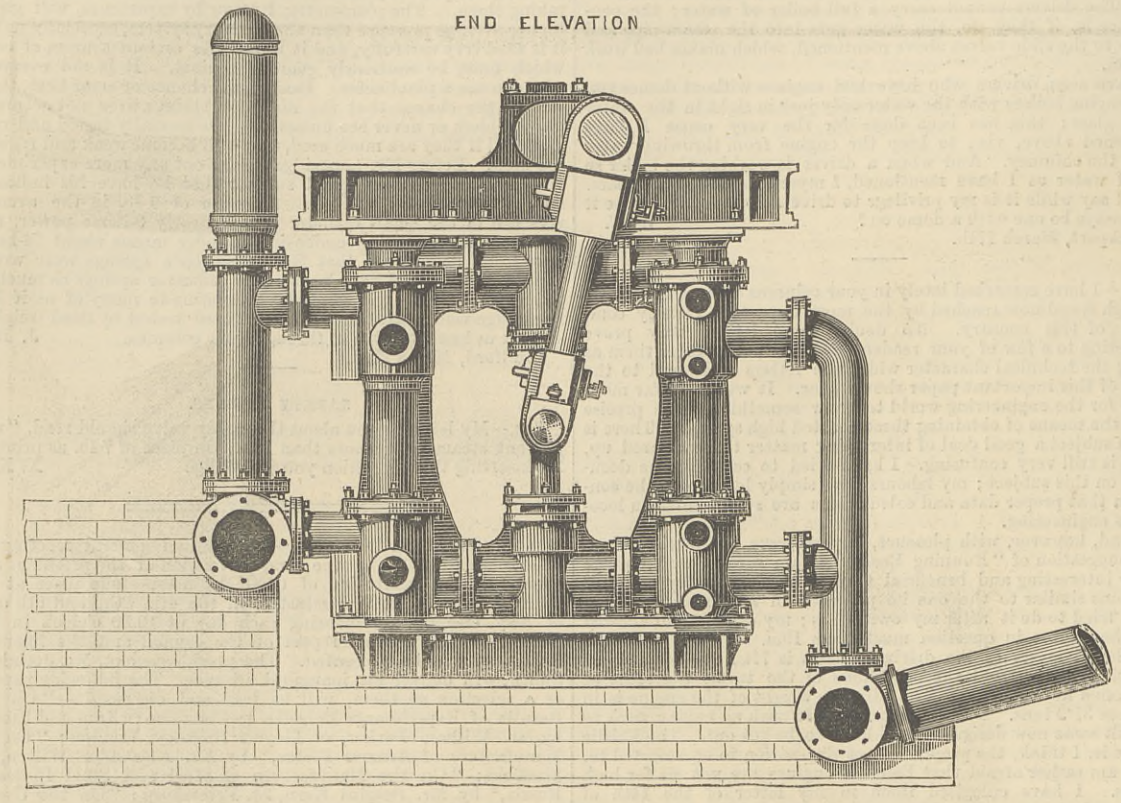
MR. JAMES FLETCHER.—We regret to announce the death of Mr. James Fletcher, of Crumpsall Green, Cheetham Hill, who was head of the firm of Messrs. William Collier and Co., engineers and tool makers, and for many years took a leading part in the conduct of public affairs in Salford. Born at Birtles, Lancashire, in 1806, Mr. Fletcher was apprenticed at an early age to the late Mr. Thomas Smith, millwright, of Burnley. At the expiration of his apprenticeship he came to Manchester, where, after being employed for some years by the late Mr. Charles Dyer, he entered the service of Messrs. Sharp, Stewart, and Co. Being subsequently invited to take the management of the works of Messrs. William Collier and Co., then situated in Greengate, he became a partner in that firm in 1853, and on the death of the late Mr. William Collier, in 1863, he became sole proprietor. He was elected a councillor of the borough of Salford in 1868, and an alderman in 1871. He retired from the Council in 1877. In 1843 he took out a patent for improvements in the "going in" and "winding on" motions of self-acting mules, including also a novel application of the principle of connecting the "copping" and "winding on" motions, so arranged that the one should control and regulate the other. His patent of 1845 relates to flyers, and consists in an improvement in what is known as the "presser flyer," and also to the use of malleable cast iron as a material for flyers. In conjunction with Mr. Thomas Fuller, one of the partners in Collier and Co., he patented, in 1849, a number of improvements in machine tools, including a double-acting sliding and surfacing lathe; an apparatus for boring locomotive cylinders *in situ*; a tool for planing the valve-faces of locomotives when in their places; and various improvements in the slotting and shaping machine, including the use of elliptical gearing for a quick return. In 1861 he was the patentee, along with Mr. J. W. Fuller—another of the partners—of a planing machine, and in 1862 he took out a patent, also with Mr. Fuller, for rolling, bending, and planing metals. As a practical engineer Mr. Fletcher's advice and assistance were frequently sought, and he was a director of several large iron and engineering companies in the neighbourhood of Manchester, and also in Glasgow and Middlesbrough. He retired from business in 1875, on account of failing health.

THE DRAINAGE OF BIRMINGHAM.—A step towards the fulfilment of the drainage scheme adopted ten years ago by the Birmingham Corporation has been taken. The Birmingham, Tame, and Rea District Drainage Board, at a meeting in the Birmingham Council-house, resolved to apply to the Local Government Board for their sanction to a loan of various sums amounting in the whole to £180,000, the money to be spent in the purchase of land and the construction of works. At the same meeting a report was adopted from the Works Committee, which dealt with the manner in which it is proposed to spend this money. It is intended to acquire 867 acres of land for irrigation at Tyburn, on which there will be constructed the works necessary to utilise it for the purification of sewage. The works will cost between £90,000 and £100,000. Included within them is the building of a circular conduit of 8ft. diameter, having a fall of 2ft. per mile, and being 2¾ miles in length. This conduit will convey the sewage from the existing sewage works at Saltley to a proposed new farm. The surplus capacity allowed in the conduit for increase of population will be valuable for storage, in which function, the committee point out, it may be supplemented by the sixteen small tanks at Saltley. The total storage room thus obtained will be about eight million gallons, or nearly two-thirds of a day's flow of present dry weather sewage. In this way the Board hope to avoid the construction of storage tanks on the one hand, and on the other the very undesirable practice of using sewage during the night. The sixteen small tanks at Saltley will be connected with the main conduit by suitable culverts, fitted with penstocks. The new buildings recommended comprise a model farm at Tyburn, consisting of farm buildings, with standings for about 100 cattle, and ten-stall cart-horse stable, with barns, sheds, granaries, nag stable, machinery, rick yard, &c.; a manager's house, with dairy, and six labourers' cottages. The Works Committee further advise that six labourers' cottages, and accommodation for twenty cattle, be erected on land obtained from the Earl of Bradford. In connection with the model buildings they point out that general practical opinion, confirmed by experience of the sewage lands at Saltley, shows dairy farming to be a very favourable method for disposing of the produce from sewaged lands. They think, further, that there is scope for a large establishment of the kind near Birmingham, which, unlike some other large towns, appears to be supplied chiefly by small dealers. A farm of about 48 acres, situated between two parts of the property already purchased by the Board, it was determined, on Tuesday, to buy at the price of £6000.

PUMPING MACHINERY, RAJAWELLE, CEYLON.

MR. JOHN BROWN, C.E., ENGINEER.

END ELEVATION



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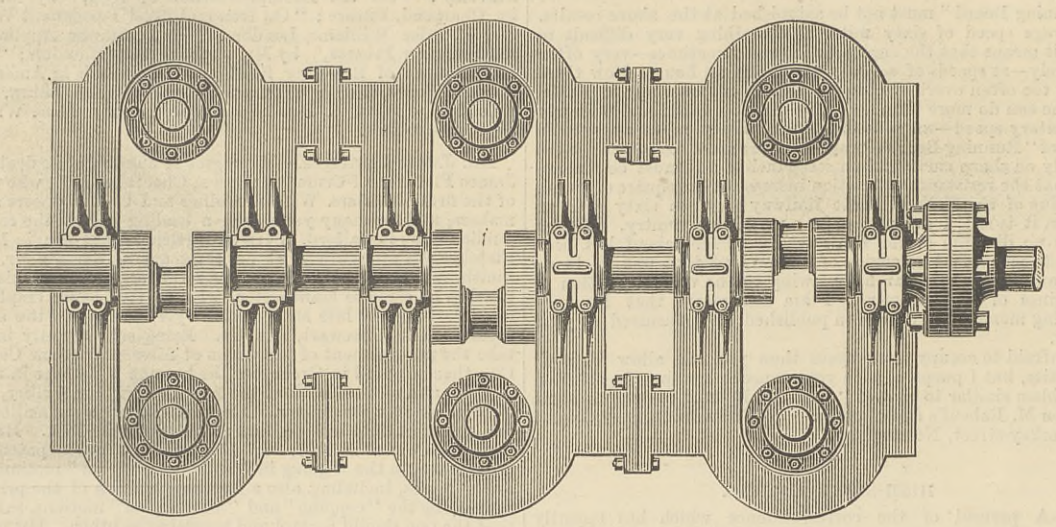


It is not so well known as it ought to be that extensive engineering works have often been carried out abroad by private enterprise ; and in many instances descriptions of such works could not fail to prove instructive to that large class of rising members of the profession who intend ultimately to seek their income in other countries. We illustrate this week, above and at page 222, machinery which is of exceptional interest in many ways, and loses nothing of that interest or of its value as an example of good work well done under very trying conditions, because it was completed in 1858. It is still at work doing its full duty, and has never given any trouble. It will be seen at once that the machinery consists of a set of pumps driven by a reaction turbine—Whitelaw and Stirrat's. The dimensions of the machinery are, however, very large, and the lift about the highest ever dealt with by a turbine. Its history and use may be briefly stated as follows.

At Rajawelle, Ceylon, is a very large coffee estate, the property of Messrs. Morton and Tytler, wealthy Ceylon merchants. The coffee plantations lie on both sides of a hill or small mountain range, and to make them productive require constant irrigation. The only available source of water for this purpose is the river Mahavalaganga, distant several miles from the foot of the hills, and separated from them, moreover, by high intervening ground.

Mr. John Brown, now of Cannon-street, then in Ceylon, was consulted about the year 1856 as to the best course to pursue, and he suggested the cutting of a canal from the river, and the erection of a turbine to work a set of pumps for irrigation. This was agreed to, and Mr. Brown cut a canal capable of conveying a stream, 18ft. wide and 2ft. 6in. deep, from the river to a site near the base of the coffee hills, and here he put up the machinery which we illustrate. The water-wheel was a success from the first; but the pumps, made by an eminent London firm, were not. They had to deliver water at the top of the hill, 500ft. above them, and 1⅛ miles distant, at the rate of 1000 gallons per minute, and this they were quite unable to do. The framing had to be braced and strutted with heavy timbers, and even then the lift had to be limited to about 300ft. Thus the plantation on one side only of the hill could be watered.

To irrigate the other slope, it was essential that the water should be pumped over the top of the hill. For a couple of seasons the machinery worked in a makeshift fashion, and then Mr. Brown suggested that he should make a trip to England and find something suitable in the shape of pumps for his purpose. This was done, but his search proved unsuccessful, the working conditions being quite unusual. At last Mr. Brown found in Mr. James Abernethy, of Aberdeen, a man able and willing to help him, and between Mr. Brown and Mr. Abernethy, the pumps we illustrate were designed and manufactured.

With the water wheel, &c., Mr. Abernethy had nothing to do. This wheel is, as we have said, of the Whitelaw and Stirrat type, and was manufactured by them. It is 15ft. 3in. in diameter, and 2ft. 8in. deep, and it gives off 200-H.P., with an efficiency of about 76 per cent. Within each of the arms is a regulator, consisting of a small sluice by which the orifice of discharge may be contracted in dimensions, or even almost closed. This sluice is kept open by a spring. A weight acts on this spring and the sluice in such a way that, should the velocity of the wheel increase too much, the centrifugal force of the weight enables it to overcome the resistance of the spring and close the sluice more or less. This apparatus works admirably, keeping the speed of the wheel very steady. Water is led to the wheel from the canal by a pipe, 6ft. 3in. diameter inside. The effective head is 18ft. and the wheel makes 42 revolutions per minute. At the top of the main spindle is keyed a cast iron mitre wheel, 7ft. 4in. in diameter, which gears with a similar wheel keyed on a horizontal shaft, which is connected by a coupling with the crank shaft of the pumps. There are, it will be seen, three sets of pumps of very peculiar construction. Each set consists of four plungers 6in. in diameter and 20in. stroke. These plungers are arranged so as to resemble the letter H. The connecting rod grasps the centre of the cross bar of the H and the ends of the two uprights represent the four plungers. No guides are required in addition to the stuffing-boxes. Each pair of plungers has one suction and one delivery valve arranged in clack-boxes as shown, and the hollow pillars of the frame are used as waterways in a manner which will be readily understood from our engraving. The valves are of the double beat type, striking metal to metal. The water enters between them and is delivered through them upwards and downwards. The entire seat, valve, and all can be readily removed if necessary. Each set of pumps is provided with a tall air vessel, and we understand that notwithstanding the great speed for the lift at which these pumps are driven, there is no concussion, and the delivery is quite constant and steady. The main is 1⅛ miles long, the lift is 500ft., and the calculated delivery 1000 gallons per minute. The machinery has been almost constantly at work since 1858, a period of nearly twenty-three years, and during that time it has done its duty almost without repairs. A crank shaft was, we believe, broken after about fifteen years of service, but this was the only failure of the least importance which has taken place.

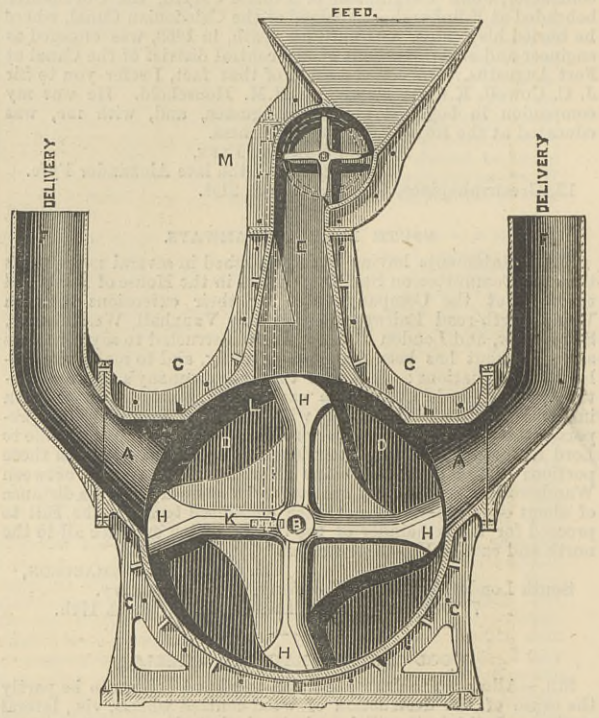
The carrying out of this work reflects very great credit on Mr. Brown, then a very young man. The locality is extremely unhealthy for Europeans, and in the hot season for natives, cholera abounding. But Mr. Brown escaped, although much of his time was spent now and then in doctoring the natives. The most difficult work was cutting the canal, which had in one place to be blasted for more than a mile through solid rock 40ft. deep.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty :—James A. Shawyer, chief engineer, to the Defence, vice Keeling; and John Lanksbury, chief engineer, to the Revenge, vice Topp.

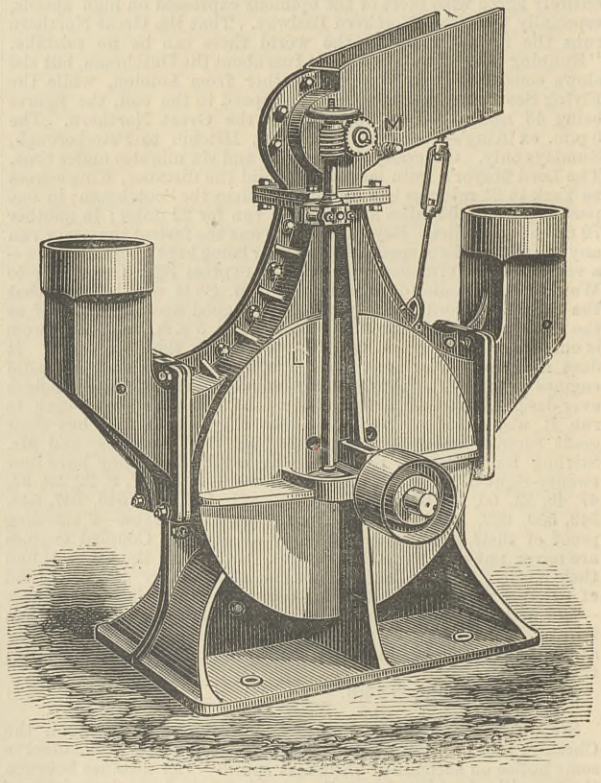
Cousinly Amenities.—If a disinterested person—that is a "Roosian," or a "Proosian," or a Turk—feels the need of an emetic, we advise him to read the article in The Engineer of February 4th, entitled "Selected American Patents." If it does not retch him it will be useless to try lobelia or ipecacuanha. —*American Manufacturer.*

JORDANS' PULVERISING MACHINE.

The object the inventors had in view when designing and working out this invention was, we are told, to produce a machine capable of reducing all kinds of materials from the hardest, such as emery, to the softest, such as cereals, and artificial manures, to any even degree of fineness without the use of sieves, by impact or percussion only, and not by grinding or frictional action, and this by the most simple combination of solid working parts. The following explanation will we think demonstrate the principle and manner in which this has been effected. Two circular dished castings C, each having a long bearing projecting from its centre are bolted together by their flanges, and form the crushing, chamber, which has an inlet opening on the top, and two outlet openings, one on each side. The two bearings carry short wrought iron spindles, which meet end to end in the centre of the crushing chamber. On the inner end of each spindle is keyed a set of four arms H, nearly the diameter of the chamber, the surfaces of the one set of arms being set at 45 deg. with the horizontal centre line so that they are parallel to and face those of the other set.



These arms pass in opposite directions close to each other and to the sides of the chamber, and their backs are so formed as to create a blowing or fan action in the chamber, drawing air through openings in the sides and near the centre of the chamber. On the outer end of the spindles are keyed pulleys for driving by belts, the spindles and their arms and pulleys being quite free and independent of each other to turn in opposite directions. One of the said spindles has a worm M engaging a wheel, and working the vertical shaft; this again drives at a given speed the automatic feeder. By means of driving belts on the pulleys, the spindles and their arms are revolved in reverse directions at any speed suitable for the materials to be crushed. The material falling into the chamber from the automatic feeder, is struck by one of the arms, owing to the angle of its face, into the path of those revolving in the reverse direction, and is by them,

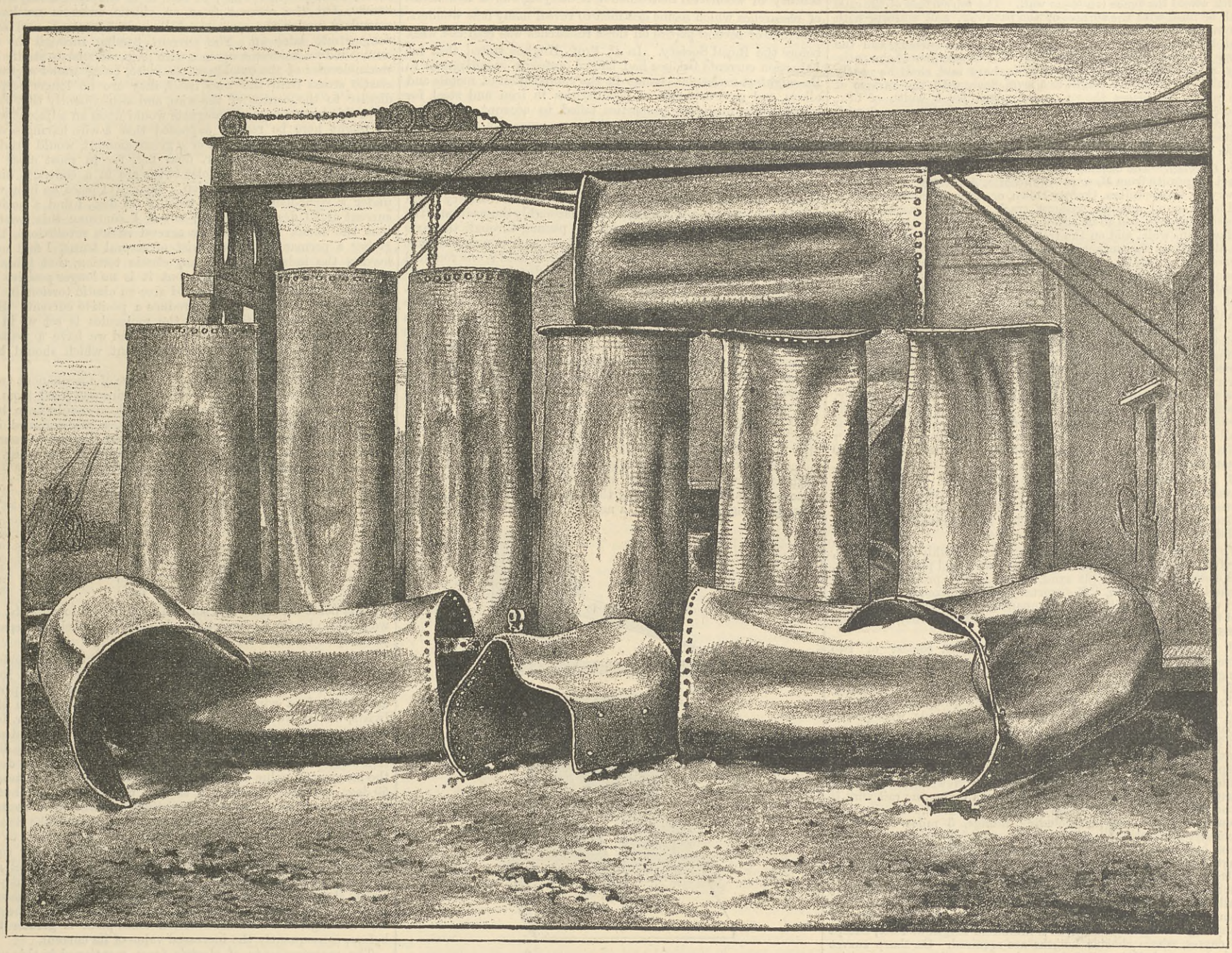


for the same reason, immediately returned. Thus it is with great force struck to and fro from arm to arm until as fine as required. There is therefore no grinding action, the crushing being done entirely by percussion or impact, but without centrifugal force. This is the whole process of crushing.

The fineness of the materials leaving the machine is regulated by the current of air, which immediately takes away all particles light enough to float in it, and the force of this current can be adjusted by simply closing or opening the apertures in the casing for this purpose. The current in the machine is sufficient to carry the crushed material up 10 or 20 feet of pipe to another chamber, the height of the column of pipe also regulating the size of the particles delivered, different sizes being delivered at various levels if required.

This machine has now been at work for some months on quartz, cement, paint material, dyes, cereals, &c., all of which substances it is reducing to impalpable powder, and we are informed that Messrs. Jordan and Son, of 52, Gracechurch-street and Bermondsey, have a machine constantly in action, and are prepared to crush samples of any kind for intending purchasers.

COLLAPSED MARINE BOILER FURNACES.



It has been known for some time that the flues of marine boilers collapse under very mysterious circumstances. The facts are in all these cases very similar, and may be briefly stated. A steamer with, perhaps, new boilers, goes to sea, and before a week has elapsed, the crown of a furnace comes down. At the end of the voyage, this is either lifted or patched, or a new furnace is put in. Then another furnace collapses, and so on; sometimes three furnace crowns come down together. In all these cases there is an ample supply of water, and the pressure does not exceed that which the boilers were intended to carry. The engraving above from a photograph shows a stack of collapsed furnaces of Yorkshire irons, to be seen at the works of Messrs. John Stewart and Son, Blackwall. All these furnaces have collapsed under the conditions stated—that is to say, the pressures have been moderate, and there was plenty of water.

To such proportions has the evil grown that "Lloyd's" have been applied to to investigate the matter, and Mr. Parker has been carrying out an exhaustive series of experiments to ascertain the causes of these collapses. A report on the subject will soon be made, and it would be premature at present to say more than that Mr. Parker has made some curious discoveries, and has apparently traced the cause of the collapses to the use of a particular oil for lubricating the cylinders.

It will be seen that the admirable quality of the plates was sufficient to prevent accidents. No rupture has taken place. The plates have become red hot and collapsed quietly—in many cases without starting a rivet or springing a leak.

CONTRACTS OPEN.

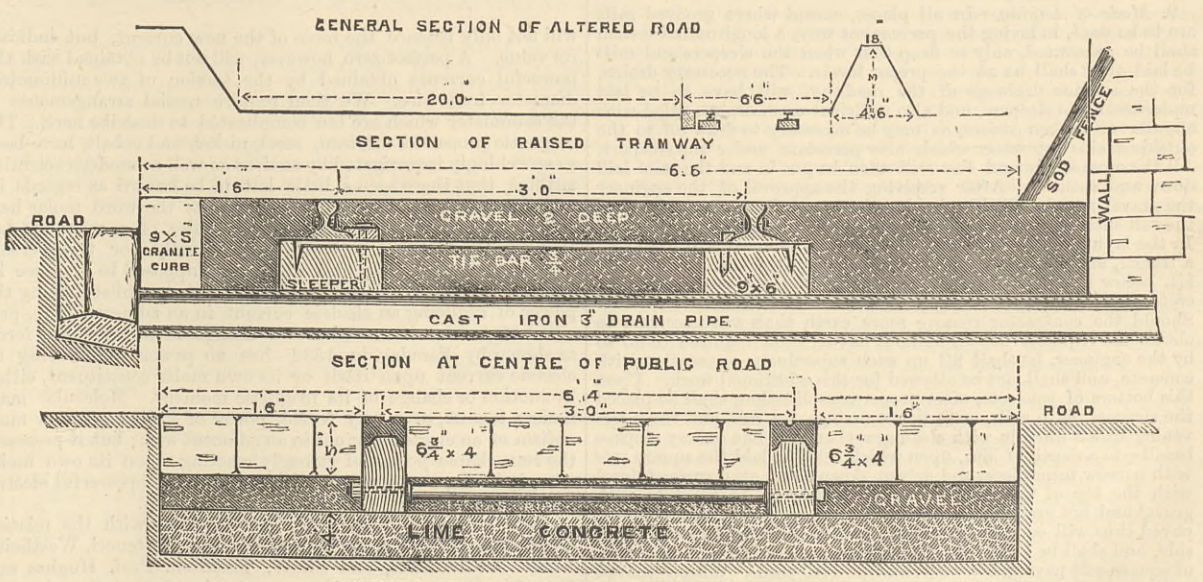
GIANTS' CAUSEWAY TRAMWAY.

The following is an abstract from the specification of works in the contract for the construction of this tramway :—

1. *Extent of Work.*—The work comprises the construction of a tramway from Bushmills to Portrush, both in the county of Antrim, Ireland, along the main coast road between those places, terminating at the Northern Counties Railway Station at Portrush, a distance of 5 miles 75 chains. The contract includes making, altering, reforming, or rebuilding the existing fences of the public road, according to the plans and cross sections; also the formation of a raised tramway siding, together with all necessary drains, channels, and culverts; also the excavating, embanking, forming, and metalling, and paving of the tramway, roadways, and crossings; the laying of the permanent way, points, crossings, and sidings, and every other work that may be necessary for the entire completion of the tramway, whether specially named herein or not. The work, when finished and ready to hand over to the company, is to be in every respect conformable to the plans, sections, and drawings of the company's engineer. The level of the rails to be approximately the same as the mean level of the existing roadway.

2. *Permanent Fences.*—(1) The existing road fence along the north side of the line between Bushmills and Portrush, being a length of 5 miles 20 chains, is to be reformed according to the cross sections shown on contract plans, so as to increase the width of roadway from what it is at present to a width of 26ft. 6in. in the case of a new sod fence; and of 27ft. if the fence on the north side be a stone wall, the width to be measured from the toe of the opposite fence. The new fences will have to correspond to the fences along the said county road as now existing, and shall consist of earth having a base of 4ft. 6in. on a level with the tramway path, hereinafter described, and 3ft. high above such level and 18in. wide at the top, the front or roadside of which and the top shall be built or covered with green grass sods, and the remainder be sown with grass. (2) A dry rubble wall, neatly built and finished off, even on the top, and coped with large through stones, set in mortar, bringing all up to the height of 3ft. above the tramway. The stone composing such fence shall be basalt, but a continuous coping of white limestone in large blocks will be allowed, but no random admixture of basalt and limestone will be admissible. (3) *Rubble Masonry Walls.*—These are to be built of angular basalt rubble stone, properly bonded, to be carried up to 2ft. 6in. above the level of the tramway path, 18in. wide on the top, and coped with large thorough stones of basalt. The foundations are to be carried down, so as to secure a firm and continuous bearing, and the wall to be brought up with a batter of 1 in 6. (4) Wire fencing on the top of earth mound is to consist of two lines of wire of No. 6 gauge, charcoal iron wire; wire to be strained and stapled to posts of larch 3ft. 6in. long, and of not less than 12 square inches section, placed 8ft. apart, and driven 24in. deep, having been first barked and charred for that length. Straining posts of 18 square inch section, to be placed at every 100 yards, with proper stays and binders. For the different varieties of fences assume lengths as follows :—No. 1. Sod fence, 4 miles 1000 yards; No. 2. Dry stone rubble, 800 yards; No. 3. Masonry wall, 300 yards; No. 4. Wire fencing, 2 miles. In the several kinds of fences where at present field gates or entrances exist, gaps 6ft. wide are to be left neatly finished off, but no gates nor gate posts supplied, but where gates or posts exist they are to be re-erected in line of the new fence.

3. *Culverts and Drains.—Culverts.*—In all places where shown on the plans the culverts under the roadway shall be lengthened to the outside of the new fences, in all respects as to size and build similar to the existing culverts. *Drains.*—To carry off the road surface water under the tramway, cast iron pipes 3in. in diameter and long enough to go through fence, shall be laid underneath the stone curbing and sleepers in such a manner that the water shall have free vent. Such drains shall not be less in number than twenty to the mile. When the tramway is paved any surface or other drain which shall be interfered with, shall be so reconstructed



SECTIONS OF ROADS, PATHS, AND PERMANENT WAYS.

that no obstruction to the free passage of the surface or drain water shall be caused.

4. *The Raised Tramway Path.*—The raised tramway path shall resemble an ordinary foot pathway, and be formed along the north side of the road, from the cross roads near Bushmills to the gasworks at Portrush, and shall be formed as follows, except where special description or modifications are mentioned hereafter or shown upon the plans :—A clear width of roadway of 20ft. shall be left from the outer edge of the raised path to the toe of the opposite fence. The outer edge of the tramway path shall be formed of a stone curbing—described below—elevated above the side of the road from 2in. to 6in., so as to keep the pathway in as nearly as possible even gradients, approximately uniform with the

gradients of the road, but irrespective of small irregularities. The fall of the road from the centre to this curbing forming a sufficient water-table, no paving being required. This pathway shall have a width of 6ft. 6in. from the edge of the curbing to the toe of the fence, where such fence is an earth and sod mound, and 7ft. in width where the fence is a stone wall. The top surface of the rails shall be flush with the surface of the pathway, and uniform with the top surface of the curbing. The inside edge of the outer rail shall be distant 18in. from the outer edge of the curbing, and the gauge between the rails shall be 3ft. The top surface of the pathway, after the sleepers, rails, and ballast are laid, shall be neatly gravelled for its entire length to a level flush with the surface of the rails. At places shown on the plans for a width of 6ft., where the tramway path crosses other roads it shall be paved with square setts, laid flush with the level of the rails, and the roadways adjacent metalled up to the same level; guard rails being laid at these places for such lengths as may be required.

5. *Curbing.*—The curbing of the raised pathway shall be composed of granite from Mourne—Newcastle, Annalong, or Kilkeel—Newry, or Castlewellan, County Down, or other approved quarries, and be of sound quality, without crack or wedge marks on the exposed surfaces, and to be chisel-dressed or picked upon the top surface, 5in. wide, and on the front 9in. deep, and on the back for 2in. down from the surface; the bottom surface must be flat and average 5in. in width, but no portions may be less than 4in. wide. The average lengths of the stones to be 3ft. 6in., and minimum length 3ft. A proportion of shorter lengths, not exceeding 5 per cent. of the whole length to be used where necessary. Total quantity, assume 9200 yards. Ramped curbing for gate entrances 7in. by 7in., dressed on the top and face, in 4ft. lengths, two for each crossing. Adjoining stones of curbing to be chamfered after laying. Total length required, 280ft. Such curbing can be obtained from Mr. Coulter, Newcastle, County Down, delivered at Portrush harbour at about 2s. per yard forward. *Square Setts.*—The square setts shall be either of granite from Mourne, Newry, Castlewellan, or Goraghwood, or other approved quarries, or of the hard blue basalt of the district, County Antrim, their dimensions shall be 6¾in. by 4in. by 5ft. deep, and 36 per cent. of the number to be 4in. by 4in. by 5in. deep. Quantity to be laid assume 2800 square yards.

6. *Lime Concrete.*—The concrete shall consist of good coarse washed gravel, free from loam or clay, and freshly slaked lime, in the proportion of 5 measures of gravel to one of lime, to be mixed dry, and afterwards thoroughly incorporated with only a sufficiency of water when required for use.

7. *Mortar.*—The mortar shall consist of freshly slaked lime, carefully watered to prevent any solid unslaked peas remaining, and clean sharp river or pit sand, mixed in the proportion of two of sand to one of lime. The mortar must be mixed in a dry state and well tempered with a proper quantity of water before using, and be used freshly made. All mortar more than twenty-four hours mixed with water must be rejected.

8. *Permanent Way.—Rails.*—The rails shall consist of two patterns, to be approved of by the engineer-in-chief. First, for the greater part of the way for 5 miles 22 chains, the rails shall be rails of Barrow steel flange, or other approved quality, weighing 40 lb. the yard, in lengths of 24ft., to be laid straight or curved as may be required, free from twists or uneven bends, with proper expansion at joints. The rails are to be joined with fish-plates 1ft. 3in. by 2in. by ⅜in., secured by bolts and nuts, three to each joint, weighing 2 lb. each. The rails are to be secured to the sleepers by six wood-screws 5in. long, weighing ¾ lb. each, having washers 2in. by 2in. by ¼in. thick; and six Newman's non-rising dogspikes ¾in. in diameter, to each rail. In laying, no rail joint is to be closer than 3ft. to any joint between the longitudinal sleepers. Total length, including sidings, 5 miles 33 chains. Secondly, grooved steel tramway rails, weighing 45 lb. to the yard, to be laid in the streets of Bushmills and Portrush, assume total length, including sidings, 60 chains. For the several curves the rails are to be bent cold to the proper curve, and to exhibit no cracks or flaws after such bending. *Sleepers.*—The sleepers shall be of Baltic red pine, pitch pine, or Memel, free from sapwood, shakes, or cracks, and be 9in. by 6in. to scantling, in lengths of 24ft., or a minimum length of 18ft., except on curves, where shorter lengths are required. On sharp curves such sleepers shall be scarfed to each other to form the requisite curves. Cross struts and ties shall be inserted between the sleepers to prevent lateral displacement, of which there shall be two, at least, for each sleeper. The tie bars shall be ¾in. bar iron passing under the rails in a groove, cut in the sleepers, the ends being turned at right angles for a length of 2½in., pointed and driven into the sleepers. Where the groove tramway rails are to be used, the sleepers shall be of pitch pine, Memel, or Baltic pine, 4in. by 6in. scantling, free from all flaws or cracks, and creosoted, scarfed to each other, and tenoned accurately to receive the rail, and to be in lengths of not less than 18ft. On curves the sleepers shall be steamed and bent to the proper curve before laying, and all sleepers splitting in such bending are to be rejected. At distances of not more than 10ft. apart proper struts are to be inserted of 1in. gas pipes, with ¾in. bars, passing through the sleepers with heads, screw nuts and washers. The rails shall be secured to the sleepers by sufficient lateral spikes, or other approved method before the paving is put down.

9. *Mode of Laying.*—In all places, except where grooved rails are to be used, in laying the permanent way, a longitudinal trench shall be excavated, only so deep that when the sleepers and rails be laid they shall be at the proper levels. The necessary drains, for the surface drainage of the roadway, will have to be laid underneath the sleepers, and also sufficient cross drains, filled with angular or broken stones, as may be necessary to draw off to the outside drains any water which may percolate under the sleepers. All the cross struts and ties will then be put in and the rails laid down and secured. After receiving the approval of the engineer the gravel may be filled in, having the top surface brought level to the rail surface, by a covering of 2in. of fine gravel and blinding. In the laying of the permanent way, where grooved rails are used, a trench, 6ft. 6in. wide, shall be excavated to the uniform depth of 1ft. below the ultimate rail level, and filled 4in. deep with concrete, which must be brought to a level surface before setting. Should the contractor remove more earth than was necessary to obtain the requisite depth, without having been required to do so by the engineer, he shall fill up such superfluous excavation with concrete, and shall not be allowed for this additional work. Upon this bottom of concrete, after proper consolidation, shall be placed the sleepers, with rails, cross ties, crossings, &c. &c., and the intervening spaces filled in with clean gravel or very fine quarry chips—basalt—to a depth of 3in., upon which shall be laid the square sets with narrow interstices, and driven down to an even surface, level with the top of the rails. The interstices to be filled in with gravel and hot grouting of tar, brimstone, and sand. The portion paved thus will comprise between the rails, and for 18in. on either side, and shall be laid breaking joint at every course. Total length of square sett paving, 6ft. wide, assume 1400 yards. Where grooved rails are used, switch points will not be required, but only the ordinary movable steel points, pivotted at the base and moving in the groove junction, also the necessary crossings.

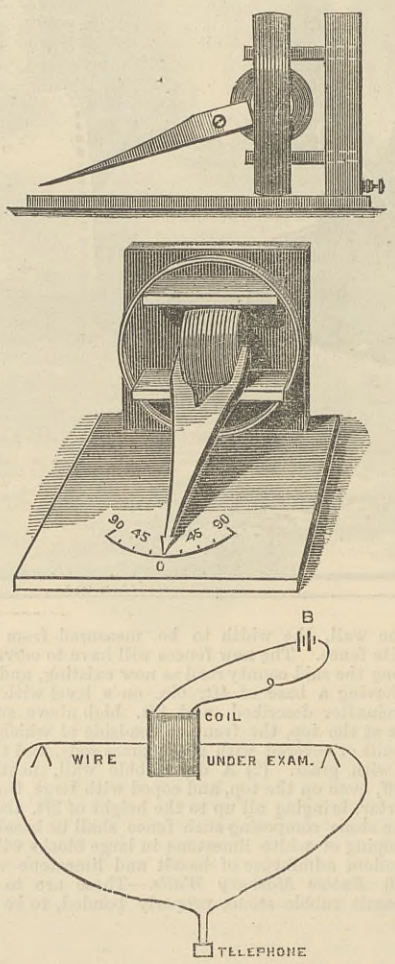
10. *Passing Places* shall be made where shown on the plans. The tramway path or pathway at such places being finished off level with the curbing for a width of 15ft., the distance between the rails of the main line and the nearer rail of the passing place being 4ft. 6in. There shall be switch points and levers at each end of the passing places.

It is intended to work the tramway and railway by steam power.

Mr. Wm. A. Traill, M.A. Ing., is the engineer of the company, and tenders, on forms to be provided for the purpose, are to be sent in to the Secretary, Giants' Causeway Company, Portrush, on or before the 31st inst.

MOLECULAR ELECTRO-MAGNETIC INDUCTION.

Prof. D. E. Hughes, F.R.S., by no means content with having given to the world two of the most wonderful instruments in a century of wonderful instruments, is carrying out a new series of researches which seems destined to reveal many new wonders. The first of several papers on these researches was read last week before the Royal Society. In it Prof. Hughes stated that his induction currents balance had shown extreme sensitiveness to the slightest molecular change in the composition of metals and alloys, and gave evidence of peculiarities in iron and steel, for which their magnetic properties failed to account. The new investigation was commenced to obtain a cause for these peculiarities, and the experiments have been carried out by means of a new apparatus, in which the acting portion is the wire undergoing examination. The apparatus consists, first, of an instrument for producing the new induction current; second, of a sonometer or balancing coils; third, rheotome and battery; and fourth, the telephone. The diagram shows roughly the position of the apparatus, the wire under examination passing through the axis of the coil. The wire is rigidly fixed at one end, so arranged that torsion can easily be applied. The sonometer used is one founded on a principle laid down in *Comptes Rendus* in 1878. It consists of two coils at right angles, the internal coil movable about a vertical axis, and having a pointer clamped to it so as to enable the number of degrees of motion to be easily observed on a graduated scale. Whenever the axis of the interior coil is perpendicular to the exterior coil, no induction takes place, and we have a perfect zero; by turning the interior coil through any degree we have a current proportional to this angle, and in the direction in which it is turned. As this instrument obeys all the well-known laws for galvanometers, the readings and evaluations are easy and rapid. Prof. Hughes, in his paper, says, "If the coil upon the stress bridge is perpendicular to the iron wire, and if the sonometer coil is at zero, no currents or sounds in the telephone will be perceived, but the slightest current in the iron wire produced by torsion will at once be heard; and by moving the sonometer coil in a direction corresponding to the current, a new zero will be obtained, which



will not only balance the force of the new current, but indicate its value. A perfect zero, however, will not be obtained with the powerful currents obtained by the torsion of two millimetres diameter iron wire. We then require special arrangements of the sonometer which are too complicated to describe here. The magnetic properties of iron, steel, nickel, and cobalt, have been so searchingly investigated by ancient as well as modern scientific authors, that there seems little left to be known as regards its molar magnetism. Professor Hughes uses the word molar here simply to distinguish or separate the idea of a magnetic bar of iron or steel magnetised longitudinally or transversely from the polarised molecules which are supposed to produce its external magnetic effect. Molar magnetism, whilst having the power of inducing an electric current in an adjacent wire, provided that either has motion or a change in its magnetic force, as shown by Faraday in 1832—has no power of inducing an electric current upon itself or its own molar constituent, either by motion or change of its magnetic moment. Molecular magnetism has no, or a very feeble, power of inducing either magnetism or an electric current in an adjacent wire; but it possesses the remarkable power of strongly reacting upon its own molar wire, inducing—comparatively with its length—powerful electric currents in a circuit of which this forms a part.

After referring to the work in connection with the relation between stress and magnetism of Ampire, Mattencci, Westheim, Vilari, Weidermann, and Sir W. Thomson, Prof. Hughes said from his own researches he was convinced that "we have in molecular magnetism a distinct and separate form of magnetism from that which we develope, or render evident, longitudinal or transversal magnetism, defined above as molar. If we place an iron wire, say 20 centimetres long, 1 millimetre diameter, in the axis of the coil of the electro-magnetic balance, and if this wire is joined to the telephone, we find that on passing an electric current through the inducing coil no current is perceptible upon the iron wire; but if we give a very slight twist to this wire at its free end—one-eighteenth of a turn, or 20 deg.—we at once hear, clear and comparatively loud, the currents passing the coil; and although we only gave a slight elastic twist of 20 deg. of a whole turn, and this spread over 20 centimetres in length, making an extremely small molar spiral, yet the effects are more powerful than if, using a wire free from stress, we turned the whole coil 40 deg. The current obtained when we turn the coil, as just mentioned, is secondary, and this with the coil at any angle any current produced by its action, either on a copper, silver, iron, or steel wire; in fact, it is simply Faraday's discovery, but the current from an elastic twist is no longer secondary under the same conditions, but tertiary, as I shall demonstrate later on. The current passing through the coil cannot induce a current upon a wire perpendicular to itself, but the molecules of the outside of the wire, being under a greater elastic stress than the wire itself, they are no longer perpendicular to the centre of the wire, and consequently they react upon this wire as separate magnets would upon an adjacent wire. It might here be readily supposed that a wire having several twists, or a fixed molar twist of a given amount, would produce similar effects. It, however, does not, for in most cases the current obtained from the molar twists are in a contrary direction to that of the elastic torsion. Thus, if I place an iron wire under a right-handed elastic twist of 20 deg., I find a positive current of 50 deg. sonometer; but if I continue this twist so that the index makes one or several entire revolutions, thus giving a permanent molar twist of several turns, I find upon leaving the index free from any elastic torsion, that I have a permanent current of 10 deg., but it is no longer positive but negative, requiring that we should give an elastic torsion in the previous direction, in order to produce a positive current. Here a permanent elastic torsion of the molecules is set up in the contrary direction to its molar twist, and we have a negative current, overpowering any positive current which should have been due to the twisted wire."

"The following table shows the influence of a permanent twist, and that the current obtained when the wire was freed from its elastic torsion was in opposition to that which should have been produced by the permanent twist. Thus, a well-softened iron wire, 1 millimetre in diameter, giving 60 deg. positive current for a right-handed elastic torsion of 20 deg., gave after 1 deg. ·80 permanent torsion a negative current of 10 deg.

1	complete permanent	torsion	(right-handed)	negative	10
2	ditto	ditto	ditto	.. ..	15
3	ditto	ditto	ditto	.. ..	15
4	ditto	ditto	ditto	.. ..	16
5	ditto	ditto	ditto	.. ..	12
6	ditto	ditto	ditto	.. ..	10
7	ditto	ditto	ditto	.. ..	5
8	ditto	ditto	ditto	.. ..	4
9	ditto	ditto	ditto	.. ..	3
10	ditto	ditto	ditto	.. ..	3

At this point the fibres of a soft wire commence to separate, and we have no longer a complete single wire, but a helix of separate wires upon a central structure."

Sending the current through the wire with the telephone to coil the tertiary effects are obtained, but the effect is not found in using non-magnetic metals. It requires a great many permanent twists in a wire to be able to see any effect from these twists, but if we give to a wire, 1 millimetre diameter, forty whole turns—or until its fibres become separated—we find some new effects; we find a small current of 10 deg. in the same direction as its molar twist, and on giving a slight twist—20 deg.—the sonometric value of the sound obtained is 80 deg. instead of 50 deg., the real value of a similar untwisted wire; but its explanation will be found by twisting the wire in a contrary direction to its molar twist. We can now approach the zero but never produce a current in the contrary direction, owing to the fact that by the spiral direction, due to the fibrous molar turns, the neutral position of its molecules are no longer parallel with its wire, but parallel with its molar twist; consequently an elastic strain in the latter case can only bring the molecules parallel with its wire, producing no current, and in the first case the angle at which the reaction takes place is greater than before, consequently the increased value of its current.

The measurements of electric force mentioned in this paper are all sonometric on an arbitrary scale. Their absolute value has not yet been obtained, as we do not, at our present stage, require any except comparative measures. Thus, if each wire is of 1 millimetre diameter and 20 centimetres long, all render the same stress in the axis of its coil, and the following are the sonometric degrees of value :—

	Deg.	
Soft iron	60	Tertiary current.
Hard drum iron	50	,, ,,
Soft steel	45	,, ,,
Hard tempered steel	10	,, ,,
Copper, silver, &c.	0	,, ,,
Copper, helix, 1 centimetre diameter, 20 turns in 20 centimetres	45	Secondary currents.
Iron, spiral, ditto, ...	45	,, ,,
Steel	45	,, ,,

The tertiary current increases with the diameter of the wire, the ratio of which has not yet been determined; thus, an ordinary hard iron wire of 1mm. diameter giving 50 deg., one of 2mm. diameter gave 100 deg.; and the maximum of force obtained by any degree of torsion is at or near its limit of elasticity, as if in same time we also pass this point, producing a permanent twist, the current decreases, as shown in the case of a permanent twist. Thus, the critical point of 1 mm. hard iron wire was 20 deg. of torsion, but in hard steel it was 45 deg.

Longitudinal strains do not produce any current whatever, but a very slight twist to a wire, under a longitudinal strain, produces its maximum effects; thus, 20 deg. of torsion being the critical point of iron wire, the same wire, under longitudinal strain, required but from 10 deg. to 15 deg.

A large number of experiments have been made, some of which, through the kindness of Professor Hughes, we have witnessed, all tending to prove the theory he has advanced. He finds that heat has a very great effect upon molecular magnetic effects. On iron it increases the current, but diminishes it in steel. The paper we have thus briefly described was devoted to experimental facts by Prof. Hughes, who said :—

"If we assume with Poisson, that the paths of the molecules of iron are circles, and that they become ellipses by compression or strain, and also that they are capable of being polarised, it would sufficiently explain the new effects.

"Joule has shown that an iron bar is longer and narrower during magnetisation than before, and in the case of the transverse strain the exterior portions of the wire are under a far greater strain than those near the centre, and as the polarised ellipses are at an angle with the molecules of the central portions of the wire, its polarisation reacts upon them, producing the comparatively strong electric currents described."

South Kensington Museum.—Visitors during the week ending March 19th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m to 10 p.m., Museum, 10,578; mercantile marine, building materials, and other collections, 3592. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 5 p.m., Museum, 1429; mercantile marine, building materials, and other collections, 214. Total, 15,813. Average of corresponding week in former years, 15,914. Total from the opening of the Museum, 19,769,599.

RAILWAY MATTERS.

MR. SHAW LEFEVRE has been appointed chairman of the Select Committee to which Major Nolan's Bill on tramways has been referred. Among other things, the Bill proposes that there shall be an increase of speed, that steam shall be used, and that in certain cases the rails shall be laid above the level of the thoroughfares. The committee will meet to take evidence on Friday next.

IT has been judicially decided in the American law courts that a mail agent, or travelling post-office servant, when travelling as such on railroad trains, is not a passenger, and cannot therefore recover damages for injury in case of accident; also, that a passenger riding in a baggage car when there is room in the passenger cars, cannot recover in case of injury, if it shall appear that he would not have been injured if he had been in the passenger cars.

IN concluding a report on the collision which occurred on the 13th of January, near Wakefield (Kirkgate) station, on the Lancashire and Yorkshire Railway, Major-General Hutchinson says: "This collision could not have happened had the locomotive siding been provided with safety points properly interlocked with the main line signals; and it is to be hoped that the remodelling of this important station will now not be deferred a moment longer than is absolutely necessary."

THE official statement of the numbers and classes of the cases relieved out of the casualty fund of the Railway Benevolent Institution shows that during the past year 2177 cases have been relieved. Out of these, 130 claims have arisen from the deaths of railway servants killed by accidents, 1837 from injuries received by members in accidents, and 210 from deaths by sickness and natural causes. These claims have arisen on nearly every railway in the kingdom; the most prominent forms of accident being injuries sustained in track coupling and injuries by falls.

THE construction of the St. Gothard Railway on the Tessin side is now, the Geneva correspondent of the *Times* says, in so forward a state that the completion of the section between Airolo and Bellinzona by the end of June is regarded as certain. The section between Bellinzona and Locarno has been in running order for some time. Owing, however, to the condition of the great tunnel, where the so-called windy stretch, a bed of rotten limestone and gypsum, which swells on exposure to the air, is still breaking the engineers' hearts, the line is not likely to be ready for through traffic before October, if then. The Federal Tribunal have decided against the contractors for the great tunnel in respect of their demand for a prolongation by 780 days of the time originally fixed for the completion of the work.

THE report of the North British Railway Company for the meeting on the 31st inst., shows that the company now possesses of effective stock 470 engines, 426 tenders, 297 first-class carriages, 67 second-class, 662 third-class, 178 composite, 140 horse boxes, 148 passenger luggage vans, 1 post-office, and 1 meat van, 101 carriage trucks, 1 horse carriage, or 1596 in all. The effective stock in the wagon department includes 27,866 vehicles of all kinds. The total number of miles of line worked by the company's stock and engines, including those rented and worked over, is 1085½, the miles owned by the company being 870. The total train mileage in the half-year ending 31st January was, passenger trains 2,278,652, and of goods and mineral trains 2,776,618. The locomotive power cost, including all expenses, £129,577 14s. 8d.

IN the last report of the American Postmaster-General it is stated that one of the greatest improvements in the service has been the abolition of "distributing" post offices, and the enforcement of close and thorough distribution of all mail matter in transit upon the railroad lines, thereby expediting the delivery of matter to all parts of the country by many hours. A necessary consequence of this innovation has been the subordination of all postmasters in everything affecting the distribution and despatch of mails to the General Superintendent of Railway Mail Service and the divisional superintendents under his orders, thus securing uniformity of practice. And it is added, in connection with this change, that during the past year only one piece of matter out of every 3482 handled by the servants of the Railway Mail Service was incorrectly distributed, and that every such error was promptly detected, and the servant who committed it notified of the fact.

IT has been remarked in the money article of the *Times* that "there is a good deal of comment in the market on the fact of the North British Railway directors declaring a dividend on the Ordinary stock in present circumstances. A full explanation is called for as to the mode of dealing with the finance of the new Tay bridge. When the accident happened the directors wrote off £120,000 at once, partly at the expense of the Preference shareholders, about whose losses there was a great deal of outcry at the time. But if the old bridge is to be virtually condemned, even this £120,000 is not sufficient; the whole cost, which was over £300,000, ought to be written off. If a new and wider bridge is built the excess of cost to build it as compared with the cost of the old bridge may, perhaps, be fairly charged to capital; but whatever has been really lost, must be made good out of revenue. The question is of general interest in railway finance, and we trust a complete account will be given of what is going to be done, and the reasons for it."

THE annual report of the State Board of Health of Connecticut gives statistics relating to the visual power of the railway men of the State. According to the *Scientific American*, Dr. Bacon examined 326 servants of the New York and New England road; 211 of the New York, New Haven, and Hartford road; 76 of the New London and Northern; 121 of the Norwich and Worcester; 98 of the Connecticut Western; 59 of the Connecticut Valley; 133 of the New York, Providence, and Boston; and 5 of the South Manchester road. Total, 1029. Of these 160 were engineers; 157 firemen; 100 conductors; 327 brakemen; 90 switchmen; 97 station agents; 98 flagmen and other signal men. Of the total number 35 were red or green blind; 13 defective in colour perception; 78 less than normal vision. Total defective, 120. Dr. Carmalt examined 921 *employés* on the New York, New Haven, and Shore Line, Housatonic, Naugatuck, Northampton, Air Line, Danbury and Norwalk, Shepaug, New Haven and Derby, and New Canaan Railroads. Of the engineers he examined 131, and found 23 with defective vision and 5 dichromatic—two colours—of the 128 firemen, 6 had defective vision and 2 dichromatic; of 102 conductors, 14 had defective vision and 3 dichromatic; of 308 brakesmen, 38 had defective vision and 13 dichromatic; of 137 switchmen, 22 were defective in vision and 2 were dichromatic; of 115 station agents, 25 were defective in vision, and 3 dichromatic.

IN the report of the directors of the North British Railway to the meeting to be held on the 31st inst., they express their belief that the Tay bridge finally decided upon is the best possible under all the circumstances. It provides for the navigation of the river four spans of a width of 245ft., the greatest height being, from high-water to the under side of the girders, 62ft., as against 88ft. in the old bridge. The line of the bridge will be of a uniform gradient of 1 in 180, while in the old bridge the gradient varied considerably, being in one part as severe as 1 in 74. North of the four navigable spans, there were in the old bridge nine other large spans; in the new bridge these will be replaced by eighteen spans of half the old dimensions, the girders being placed below, instead of above the rails as before. Each of the piers will be of concrete and brickwork up to 8½ft. above high-water, and of plated wrought iron from that level to the under side of the girders. The termination of the bridge at each end will be by brick arching, and a substantial parapet will be erected throughout its entire length. Many suggestions have been made for the utilisation of the old foundations, which in themselves are quite capable of sustaining the weight of the superstructure, but the insuperable objection to their use lies in the fact that they are liable to scour, and this in the new bridge will be prevented by making all the foundations, except those in rock, 20ft. below the bottom of the river, where they will be beyond the reach of any possibility of scour.

NOTES AND MEMORANDA.

UNDERGROUND telegraph wires or cables are being laid from Nancy to Paris. The cable contains twelve insulated wires and is placed in cast iron pipes provided with removable caps, and with man or large hand-holes for removal of the cables and examining them at about 500 yards apart.

THE growth of New York was more rapid last year that in any since 1872, when the speculative building mania reached its height. In that year the expenditure on buildings was not less than £5,400,000. In 1877 it was less than half that sum. It increased to £3,300,000 in 1878. In 1880 the expenditure was £4,800,000 for new buildings.

AT the Royal Observatory, Greenwich, the duration of registered bright sunshine during the week ending the 12th inst., was 16·4 hours—against 12·5 hours at Glynde-place, Lewes—the sun being above the horizon during 79·6 hours; the recorded duration of sunshine was, therefore, equal to 21 per cent. of its possible duration.

AT a meeting of the Paris Academy of Sciences, a paper was read "On the Presence of Alcohol in the Ground, in the Water, and in the Atmosphere," by M. Müntz. He has developed the method depending on the change of alcohol into iodoform, so that one-millionth of alcohol in water can be detected. Alcohol is found in all natural waters except very pure spring water; also—and more of it—in snow. Rain water and Seine water contain about 1 gr. per cubic metre. Alcohol no doubt exists as vapour in the air. In soils, especially those rich in organic matters, there is a considerable quantity. The destruction of organic matter by various agents of fermentation accounts for the wide diffusion of alcohol in nature.

ACCORDING to the Registrar-General's weekly return of births and deaths in London and nineteen other large English towns for the week ending March 12th, the annual rate of mortality averaged 23 per 1000 of aggregate population, which is estimated at more than seven and a-half millions of persons in the middle of this year. The rates of mortality in the several towns, ranged in order from the lowest, were as follows:—Brighton, 15·8; Bradford, 18·7; Sunderland, 19·3; Hull, 20·1; Nottingham, 20·8; Bristol, 20·9; Portsmouth, 21·0; Birmingham, 21·2; Leicester, 22·1; Salford, 22·3; London, 22·4; Sheffield, 23·2; Wolverhampton, 23·8; Plymouth, 24·1; Newcastle-on-Tyne, 25·1; Norwich, 26; Oldham, 26·6; Liverpool, 26·7; Leeds, 27·8, Manchester, 28·8.

ATTENTION is again being called to the formation of a permanent inoxydisable coating on iron articles. The Barff and Bower processes are very well known. A new process, devised by Mr. Ward, consists in the combined application of silicates and heat, this process being the basis of several subsequent processes for ornamenting the surface of the metal. The iron objects are coated with a silicate composition, which is applied either by means of a brush or by dipping the iron in a bath of the solution. The coating quickly dries upon the objects, which are then passed through a furnace heated according to the nature of the articles under treatment. The silicate composition is thus fused, and, it is said, absorbed into the pores of the metal, becoming homogeneous with it. Upon cooling the articles treated are found to be covered with a dull black coating, which, it is stated, is found not to suffer change from long exposure to the atmosphere, nor to disintegrate or separate from the surfaces to which it has become applied.

FROM an article in *Wiedmann's Annalen*, it appears that Herr Holtz has been able to measure the modulus of elasticity of rods of carbon used for the electric light, by acoustical methods; the rod being held in the middle with two fingers, and stroked lengthwise with two other fingers on which resin has been rubbed. The modulus increases with the density, which is, as a rule, greater in the thinner rods. The tone of thin rods alters a good deal, on repeated rubbing, through heat being generated. On an average the modulus is equal to that of lead. As to the proved increase of electric conductivity of carbon rods with rise of temperature, Siemens has tried to account for it by supposing allotropic modification—as is probably the case with selenium—Herr Holtz, however, shows that pyrolusite, a metallic oxide, behaves similarly, but such an explanation would not here apply. Nor does pyrolusite conduct as an electrolyte; there is no polarisation. For carbon Herr Holtz adheres to his hypothesis of closer pressure of molecules caused by heat conduction.

THE production of pig iron in the United States in 1880 was 4,295,414 net tons, or 3,835,191 gross tons. The production in 1879 was 3,070,875 net tons, or 2,741,853 gross tons. The increase in 1880 over 1879 was, therefore, 1,224,539 net tons, or 1,093,338 gross tons, or 40 per cent. The production of 1879 was larger than that of any preceding year, but the production of 1880 was not only 40 per cent. larger than that of 1879, but it was 50 per cent. larger than that of the two active years, 1872 and 1873. The following figures give the production for nine years:—1872, 2,854,558; 1873, 2,868,278; 1874, 2,689,413; 1875, 2,266,581; 1876, 2,093,236; 1877, 2,314,585; 1878, 2,577,361; 1879, 3,070,875; 1880, 4,295,414. Of the total production of pig iron in 1880, 1,807,651 net tons were made with anthracite coal; 1,950,205 tons with bituminous coal and coke; and 537,558 tons with charcoal. The increased production of the year over the product of 1879 was very evenly divided among the different fuels. The production of charcoal pig iron has, however, increased with that of anthracite and bituminous pig iron.

THE population of the German Empire on the 1st of December, 1880, has now been fully ascertained. It amounts in all to 45,194,172 souls, as against 42,727,260 at the previous census in 1875. The increase in five years is therefore 2,466,912. The population of the different States of the Empire is now as follows:—Prussia, 27,251,067, against 25,742,404 in 1875; Bavaria, 5,271,516, against 5,022,390 in 1875; Saxony, 2,970,220, against 2,760,586 in 1875; Wurtemburg, 1,970,132, against 1,881,505 in 1875; Baden, 1,570,189, against 1,507,179 in 1875; Alsace-Lorraine, 1,571,971, against 1,531,804 in 1875; Hesse-Darmstadt, 936,944, against 884,218 in 1875; Mecklenburg-Schwerin, 576,827; Mecklenburg-Strelitz, 100,269; Saxe-Weimar, 309,503; Saxe-Meiningen, 207,147; Saxe-Altenburg, 155,062; Saxe-Coburg Gotha, 194,479; Schwarzburg-Rudolstadt, 80,149; Schwarzburg-Sondershausen, 71,083; Reuss—elder line—50,782; Reuss—younger line—101,265; Osdenburg, 337,454; Brunswick, 349,429; Anhalt, 232,747; Waldeck, 56,548; Schaumburg-Lippe, 35,332; Lippe-Detmold, 120,216; Lubeck, 63,571; Bremen, 156,229; and Hamburg, 454,041.

THE American Consular Agent at Maracaibo, describes a remarkable deposit of petroleum as existing between the Rio Tara and Zulia. Near the former, there rises a sandbank about thirty-five yards in extent, and some ten yards in height. On its surface is visible a collection of cylindrical holes of different diameters, through which streams of petroleum, mixed with boiling water, gush out with great violence, accompanied with a noise as though two or three steamers were blowing off steam. Dr. M'Gregor states that from one of these holes, notwithstanding the difficulties of the position, he filled in 42 seconds a vessel containing 15 bottles, or as fast as four gallons per minute, or 240 gallons per hour, or 5760 gallons during the 24 hours. A curious phenomenon, the *Times* says, has been occasionally seen in Venezuela ever since the conquest, consisting of a frequent lightning, which is observable from the bar at the entrance of the Lake of Maracaibo, close to the island of Pajoseco, and which Colonel Codazzi, in his geography, attributes to the vapour ascending from the Cienega de Agna Caliente. This appearance, called by mariners, "El farol de Maracaibo," is more probably due to inflammable gas known by the natives as "El Inferno." It is possible that the supply of petroleum is abundant here and in the Republic of Columbia, where, between Escuque and Bettijoque, the labourers gather it up in handkerchiefs, which, when saturated, are squeezed out into barrels.

MISCELLANEA.

THE Centennial Exhibition Buildings cost £1,049,000; but New York proposes to have her buildings one-fourth larger and to erect them for £800,000.

ONE hundred and fourteen shipyard labourers from the Clyde recently arrived at Montreal on their way to Wynlock shipyard, at Detroit—all, the *American Manufacturer* says, under contract.

WE understand that Young's Paraffin Light and Mineral Oil Company, Limited, have obtained at the Melbourne Exhibition, as they did at the Sydney Exhibition, a first-class award for the excellency of their paraffine and other products.

THERE are in the United States, according to the Census report, 25,520,582 males, and 24,632,284 females. The natives number 43,475,506, and the foreign born 6,577,360. There are 43,404,877 whites, 6,677,151 coloured, 105,463 Chinese, and 225 other Asiatics. There are 15,153 coloured persons to each 100,000 whites, against 14,528 in 1870; 15,359 foreigners to each 100,000 natives, against 16,875 in 1870, and 96,519 females to every 100,000 males, against 97,801 in 1870.

ON Tuesday morning there was launched from the dockyard of Messrs. Raylton, Dixon and Co., of Middlesbrough, a steamer named the Iron Acton, built for Bristol owners for the timber trade. Her dimensions are:—Length over all 235ft., breadth, 32ft. 6in. and depth of hold, 16ft., and she will carry about 1450 tons on light draught. She has water ballast in after and main holds, and iron decks right fore and aft and will be fitted with engines of 100-horse power by Messrs. Thos. Richardson and Sons, of Hartlepool.

THE last stone of the masonry of the Brooklyn approach to the East River Bridge was laid February 17th. The first eight floor beams of the superstructure were laid the same day. About 400 tons of the 5000 tons of the steel required in the superstructure have been delivered, or enough to construct about 100ft. on each side of the Brooklyn tower where the work has been begun. The *Scientific American* says "that engineers believe that the superstructure will be completed by next autumn, and the bridge opened by January 1st, 1882."

THE following letter from the Edgar Thompson Steel Company to the "Bulletin" of the American Iron and Steel Association is of interest:—"Your statement showing the work done by the Cambria Iron Company's Bessemer department is correct as far as claiming to be the best twenty-four hour's, the best week's, and the the best month's work. But the last item does not place them in the front rank. For the last twelve months the Edgar Thomson Steel Company's works produced 130,694·94 tons of ingots, 106,722·92 tons of rails, and 3421·9 tons of merchant steel; total finished product, 110,144·81 tons. This was done in the same time in which the Cambria Iron Company's works produced 126,194·33 tons of ingots."

THE Aireside Hematite Iron Company, which has introduced concrete slag as a substitute for stone, has erected new offices at its works in Hunslet, Leeds, in which all the door and window facings, and the ornamental work, are composed of the slag from its own furnaces. A new feature of such an elevation is a display of imitation carved bricks, in various colours, made of the slag, the cost of which is said to be 50 per cent. less than the real article of clay which hitherto has been so much in fashion. The Aireside Company is, we are informed, supplying the Midland and North-Eastern Railway Companies with slag concrete flags, ready prepared for use, in the laying down of platforms at railway stations. The Staveley Company has for a long time used slag lumps for building purposes, much of the slowly-cooled massive slag having the appearance of basalt and other rocks.

THOUGH it is impossible that a Channel tunnel railway can ever pay unless some genius in railway management arises to show how trains can be made to follow through the tunnel at more frequent intervals than they do at present on the Metropolitan Railway, and also to persuade more millions of passengers to travel between England and France than now travel on the great London underground system, the South-Eastern Railway Company is still spending money in boring into the chalk near Abbot's Cliff. Already it is stated that a 7ft. heading of 300 yards on a sharp gradient has been cut by one of Brunton and Trier's boring machines made on the principle of their stone-dressers, and Colonel Beaumont, R.E., is busy on the work. A small steam pump is sufficient at present to keep the water under, but the heading is yet only at about low-water tide level, and doubts of the entire freedom from shakes or fissures of large size in the chalk are not altogether absent. Does Sir E. Watkin think he is going to frighten the shareholders in the London, Chatham, and Dover by this costly little experiment

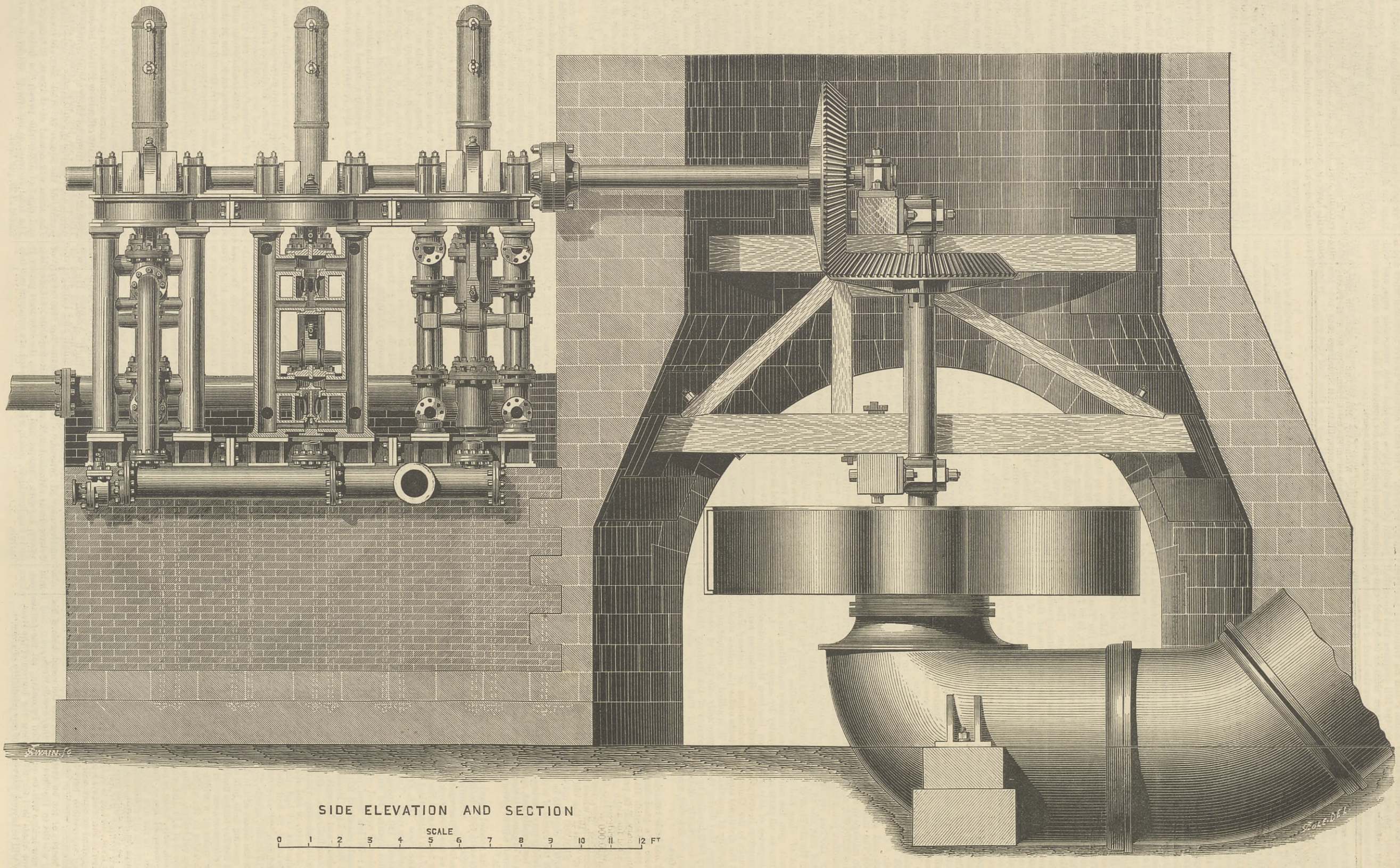
THE Pennsylvania Railroad Company has recently issued new specifications for steel boiler and fire-box plate, which we give below, and which annul all former specifications. The *American Manufacturer* remarks that this company has been using steel plates for its locomotive fire-boxes for several years, and its experience with it, together with the chemical and physical tests which are constantly being made in its testing laboratory at Altoona, qualify it perhaps in a higher degree than any other concern to establish definite specifications regarding its quality. The specifications for boiler and fire-box steel contain the following leading conditions:—(1) A careful examination will be made of every sheet, and none will be received that show mechanical defects. (2) A test strip from each sheet, taken lengthwise of the sheet and without annealing, should have a tensile strength of 55,000 lb. per square inch and an elongation of 30 per cent. in a section originally 2in. long. (3) Sheets will not be accepted if the test shows a tensile strength of less than 55,000 lb. or greater than 65,000 lb. per square inch, nor if the elongation falls below 25 per cent. (4) Should any sheets develope defects in working they will be rejected. (5) Manufacturers must send one test strip for each sheet—this strip must accompany the sheet in every case—both sheet and strip being properly stamped with the marks designated by this company, and also lettered with white lead to facilitate marking.

THE Gas Light and Coke Company has completed arrangements for experimentally lighting by improved lamps the thoroughfare from Palace-yard, Westminster, to Trafalgar-square, including Parliament-street, Whitehall, and Charing-cross. There are 78 lamps in all, which, with the exception of two, are to be fitted on the existing standards, the two extra lamps being those on a refuge in front of the Home Office. Of these 78 lamps, 63 are of 60-candle illuminating power, and are distributed along the sides of the roadway; 10 are of 180-candle power, and are those placed on the various refuges; one is of 200-candle power, and is in front of the statue of Charles I. at Charing-cross; the remaining four being of 100-candle power, and placed around the statue itself. Sugg's combination flat-flame burners are to be employed, those of 60-candle power having four, those of 180-candle power having five, and those of 200-candle power having six burners in a group. The burners are enclosed in Sugg's patent lanterns, of special shape and ornamental appearance, glazed with clear glass in the lower part, and having porcelain reflectors fitted in the upper portion. The experiment is intended to demonstrate the practicability of lighting streets in a thoroughly efficient manner with gas, with but a small comparative increase of cost upon the ordinary system of street lighting, and it is intended to continue it for three months. It is estimated that the extra expenditure for gas will be 6s. per hour for the entire lighting, or a little over 1d. per lamp per hour. Mr. Sugg has submitted a proposal to the Government to illuminate Trafalgar-square on the same principle, and is awaiting their permission; that of the St. Martin's Vestry has been given for the portion of the Square in which they are immediately interested. The series will consist of 48 lamps, 40 being of 60-candle power, and eight of 180-candle power, the latter being on the refuges. The total increase in the cost of gas for the whole series is estimated at 2s. per hour.

PUMPING MACHINERY, RAJAWELLE, CEYLON.

CONSTRUCTED BY MR. JAMES ABERNETHY, ABERDEEN.

(*For description see page* 218.)



SIDE ELEVATION AND SECTION

SCALE

0 1 2 3 4 5 6 7 8 9 10 11 12 FT

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.*

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 2d. 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.*

D. S.—*The use of oil for stilling the waves seems to be hampered with the difficulty that it cannot be got far enough to windward in a heavy sea to do much good.*

W. (Warrington).—*With coal liable to clinker, bars with straight spaces between should be used. It is impossible to keep the air spaces open unless a pricker can be run through them, which cannot be done if the bars are zig-zag shaped.*

J. B.—*Jackets are made in various ways. Sometimes a steel, wrought iron, or cast iron lever is forced into the outer shell of the cylinder, in other cases the liner is fitted into collars, round which are grooves, steam-tight joints being made by caulking the grooves with copper wire. In small engines the jackets are usually cast with the cylinders.*

ERRATA.—*In our last impression, in an article on "Tar Pumps," page* 200, *line* 11 *from the top, for "access can be obtained to the* boilers," *read access can be obtained to the* valves. *Page* 206, *third column, last line of first paragraph, for* confined *read* conferred.

DUNN'S FIRE-BARS.

(*To the Editor of The Engineer.*)

SIR,—May I beg that any of your readers will tell me who are sellers of Dunn's patent fire-bars? G. H.
Swansea, March 19th.

CONFECTIONERY AND CHOCOLATE MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Would some of your readers kindly inform me who are good makers of machinery used by confectionery and chocolate manufacturers?
London, March 17th. W. K.

PURIFYING OIL.

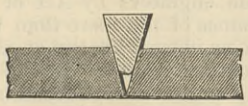
(*To the Editor of The Engineer.*)

SIR,—Can any reader recommend a cheap process for taking the dark colour from the olive oil extracted from the residue, by the aid of sulphide of carbon? OLIVE OIL.
London, March 19th.

THE ANGLE OF REST OF IRON.

(*To the Editor of The Engineer.*)

SIR,—Will any reader say what is the angle of rest iron on iron—that is, what is the angle at which a wedge might be driven into a V without tendency to spring back? DRAUGHTSMAN.



Carlinghow, March 19th.

A PROBLEM ON THE CONDENSATION OF STEAM.

(*To the Editor of The Engineer.*)

SIR,—Given a steam pipe 6in. diameter, through which is flowing a current of steam having a pressure of 35 lb. and temperature 259·3 deg. Into this pipe opens another ½in. in diameter; through this flows steam of 70 lb. pressure and 303 deg. Fah. The end of the small pipe is so bent that the steam issues in a jet, the arrangement resembling a blower in a funnel. Will any of your readers tell me what happens to the 70 lb. steam? I have asked several engineers, and about one-half the number tell me that as the 70 lb. steam has a higher temperature than the lower pressure steam, a portion will be condensed, but they do not say how much. The other gentlemen tell me that no condensation will take place, but that the 70 lb. steam expanding the moment it enters the low-pressure steam will be slightly superheated. Which is right? A MUDDLE.
London, March 23rd.

PROBLEM IN WINDING GEAR.

(*To the Editor of The Engineer.*)

SIR,—One of the conditions of the problem as given in your issue of the 12th inst., is that the longer rope exceeds the shorter in the proportion of 5 to 3, plus 280 yards, and another that the 280 yards is comprised in the 12 coils on the larger drum in excess of the number on the smaller one. The two solutions you publish to-day do not comply with these conditions, because

360 − 280 = 80, then 80 : 72 :: 5 : 4·5 (instead of 3)

Again, $\frac{280}{20 \text{ (circumference of drum)}}$ = 14 coils (instead of 12).

The following dimensions are, I believe, the correct ones. Perhaps it is not necessary to supply the workings:—Circumference of larger drum, 23·333 yards; circumference of smaller drum, 13·999 yards; length of longer rope, 419·999 yards: length of shorter rope, 83·999 yards.
March 18th. R. R. N.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, March 29th, at 8 p.m.: Paper to be discussed, "On the Comparative Endurance of Iron and Mild Steel when exposed to Corrosive Influences," by Mr. David Phillips, M. Inst. C.E.

SOCIETY OF ARTS.—Monday, March 28th, at 8 p.m.: Cantor Lectures, "The Scientific Principles Involved in Electric Lighting," by Professor W. G. Adams, F.R.S. Lecture IV.—Subdivisions of the electric current—Incandescent lamps—Luminous effects of electric currents in a vacuum, and in various gases. Wednesday, March 30th at 8 p.m.: Ordinary meeting, "Recent Advances in Electric Lighting," by Mr. W. H. Preece, M. Inst. C.E. Dr. C. W. Siemens, LL.D., F.R.S., will preside.

THE ENGINEER.

MARCH 25, 1881.

THE NAVY ESTIMATES.

ON Friday night Mr. Trevelyan moved the Navy estimates in a speech at once complete, modest, and lucid. It evoked very little criticism, although the sums for which Mr. Trevelyan asked are very large. Nor, indeed, is it easy to criticise a scheme which is in almost all respects admirable. Up to the present it has been constantly charged against Liberal Governments that they are invariably the reverse of liberal in dealing with the Navy; and that when they go out of office they leave the ships of which they have had the care in a miserable and dilapidated condition. It would seem from Mr. Trevelyan's speech that this objectionable charge cannot for the present at least be brought against Mr. Gladstone's Administration. Not only does the present Board of Admiralty approve of what was done by its predecessors, but it goes further in the same direction, and announces that the Navy of England must be supreme, and that supremacy can only be obtained by taking advantage of all the aid that science can lend. We are to have everything that is new provided it be also good. Steel armour, breech-loading guns, torpedoes, torpedo boats, machine guns, and electric lights are all to be pressed into the service of the Navy. The price to be paid will be high; but omelettes cannot be made without breaking eggs. The old estimate for first rates was £1000 a gun. Thus the cost of the Duke of Wellington, the last of the great three-deckers which have made England's flag glorious, including her machinery, did not exceed £150,000. In the present day we cannot get an ironclad fit to fight in line of battle for less than £400,000, and the price of such ships as the Inflexible far exceeds that sum. The Italians spend nearly a million on each of such ships as the Duilio and the Lepanto. To argue that the sums thus laid out in Great Britain are wasted, is to show that the questions at issue have not been fully grasped. Not less than one-half the whole mercantile marine of the world sails under the British flag, and relies for protection on British ships of war. Under the circumstances it is important that our Navy should be of adequate power. Money spent in rendering our merchant ships safe from pillage could not be regarded as wasted under any circumstances, so long as its expenditure secured the required end. But wholly apart from this consideration is another, which may well deprive the Navy estimates of their terrors. When we spend half a million on an ironclad, we really, as a nation, do not lose the money. John Bull takes it out of one pocket and puts it into another. To cite armour-plates as an example. In their production quite a small army of men is employed in raising coal, smelting iron, making bricks, and, finally, in producing the plates themselves. The construction of armour-plate mills and furnaces gives employment to yet other workers by the score. In making guns and ammunition Woolwich Arsenal keeps over 7000 hands employed, and in time of pressure as many as 13,000. In our dockyards thousands of men earn their living. Our engine builders, when they get orders from the Admiralty, are delighted. Not one sixpence need be spent out of Great Britain, which is absolutely self-sufficing in the matter of war ships. Abroad it is different. France, Germany, Italy, have all to come to us for armour-plates, at least, and for much else besides. It may be urged that if we did not spend half a million on a ship, we could save that amount in taxes, which would do us more good. Perhaps the saving would amount to about 3½d. per head of the population, or in a family of seven to, say, two shillings—an appreciable sum; one as nothing compared to the advantages accruing to many hundreds of artisans employed in the construction of our navy. A modern English ironclad is not, therefore, as some would have us think, an embodiment of waste. There is more to be urged in her favour than the bald statement that, whether she does or does not represent money misspent, she is indispensable.

Those portions of Mr. Trevelyan's speech possessing most interest for our readers refer to three subjects, namely, the construction of new ships; the adoption of breech-loading guns in the Navy; and the pay and position of naval engineers. The programme of the Admiralty for the coming year is easily stated. The Agamemnon and Ajax are to be completed for sea at Chatham; the Inflexible is to be commissioned in June or July; the Conqueror, an improved Rupert, is to be pushed on; the Polyphemus is to be completed; the Colossus and the Majestic will each be advanced about a quarter; the Collingwood will also have work done on her. So much for what may be termed old ships. The most noteworthy feature in the Admiralty scheme is the construction of ships of a new type. These will be partially armoured cruisers, intended to cope with the second-class ironclads of other Powers, and to protect our commerce all over the world. Time was when comparatively small and cheap ships would have been deemed sufficient for the purpose. Sir E. J. Reed—then Mr. Reed—was carried to fame and fortune by designing small men-of-war which should have a high speed. He made his ships short, therefore they were small and handy. Making them speedy was the affair of the marine engineer, and Messrs. Penn, Maudslay, Ravenhill, Rennie, and others gave Mr. Reed what he wanted. But the day of Bellerophon's is over, and the small ship of the epoch is described by Mr. Trevelyan in the following passage:—"Her length is to be 315ft.; her extreme breadth 61ft.; and her tonnage about 7300. Her horse-power 8000; her bunkers will hold 900 tons; and her speed on the measured mile will be sixteen knots. She has the great advantage of twin-screws. She will have a belt 8ft. broad and 140ft. long amidships, of steel-faced armour, 10in. thick with 10in. of backing, protecting her engine-room and boilers 3ft. above water and 5ft. below. She will have a conning tower of steel-faced armour; a protecting deck of inclined steel, 3in. thick, 5ft under water, covering the whole of that part of the ship, both fore and aft, which is not clad in iron. She will carry an armament of four 18-ton 9·2in. breech-loading guns, mounted in barbettes, with protection against bullets, which at a thousand yards will pierce 16½in. of iron armour, and more than 13in. of steel-faced armour. She will carry likewise six 6in. breech-loading guns, equal in range to those which carried desolation at a distance of five miles into the Peruvian harbours; she will be equipped with boat guns, torpedoes, machine guns, and will probably be fitted with a couple of torpedo boats in addition; and she will have room for over 400 men and officers to work her and fight her. She will combine the speed of the Leander with guns of greater power than the Thunderer or the Devastation; and the Admiralty with some confidence submit her to the criticism of a nation which thinks little of a vessel that cannot travel far and fast, and fight sharply and long. She will rank high among cruisers, and high among second-class ironclads; and in the hope that she will meet the ends for which she is designed, it is proposed to lay down one such vessel this year at Portsmouth and another at Chatham. Her hull and engines will cost £400,000, as against £550,000 for the Collingwood, and £150,000 for the Leander. Later on we propose to confide the construction of another to a private yard." It is impossible within reasonable limits of space to attempt to criticise such a design as this; but we may point out that the adoption of comparatively light guns of enormous power has alone rendered such a ship possible. A comparatively small cruiser of 7000 tons displacement and 8000-horse power may well excite the wonder of those who once held that the days of big ironclads were numbered. The new ship will hold a rank in the Navy not quite equal to that formerly held by the 74-gun ships. It will not be out of place to give for the sake of comparison a few particulars concerning these 74's. One, the Ajax, was perhaps the fastest ship of the kind under steam in the Navy after she had been cut down. She was 176ft. long between perpendiculars, 48ft. 6½in. beam, and drew about 23ft. Her displacement was about 3000 tons. The power of her engines, indicated, 846 horses, and her speed unrigged but ballasted 7·147 knots. The Blenheim, another 74 cut down, was of nearly similar dimensions, and rigged and fully equipped for sea, had under steam a speed of 5·81 knots, obtained with 811 indicated horse-power. It is not thirty years since these ships were regarded as powerful vessels, fit to go anywhere and fight anything afloat.

The Admiralty have finally, and we think prudently, determined to adopt breech-loading guns. In the art of constructing such things the world has made great progress within the last fifteen or twenty years; and whereas a 10in. breech-loading gun, trustworthy and capable of firing a very heavy charge, was an unknown weapon as late as 1871, there can be no doubt now that such a gun can be produced. Comparisons have been drawn between the breech-loading guns of the French navy and our own muzzle-loaders, wholly to the disparagement of the latter. But this is wrong. The French naval breech-loader has already been illustrated in our pages. It is a gun of the past, powerful but in name, and the whole French navy will have to be re-armed ere long; and progress is being made in that direction. The great advantage of breech-loading is that it permits the use of a very long gun on board ships; and great length of bore is essential to give the enormous velocity which can alone enable a comparatively light projectile to get through a great thickness of armour. It used to be a rough rule that the gun must have a diameter equal to the thickness of the plate to be punched; thus a 9in. gun would punch 9in. plates, a 12in. gun 12in. plates, and so on. But the new 9in. gun can punch 16½in. of armour at 1000 yards. This is a terrible weapon, and must by no means be taken as representing finality.

We shall make no attempt to follow Mr. Trevelyan through his speech, which all deserves perusal by those interested in the Navy, but proceed at once to deal with the position of engineers in ships of war. Sir E. J. Reed and other speakers all ably advocated their claims to consideration. So far as we understand these claims at present, they are not for augmented pay, but for improved position. Engineers wish for higher rank and more social advantages on board ship. Now we have long and persistently advocated the cause of the engineers in the Navy, and we must not be accused of speaking harshly or unjustly concerning them when we say that they are gradually drifting into a false position, and that much mischief in one shape or another may ultimately be done to their cause by themselves. It is a standing subject of complaint at present, that the modern naval engineer is neither a gentleman nor an engineer; and with limitations, we are compelled to accept the statement as not far removed from the truth. Before going further we must add that there are in the Navy numbers of men who are both engineers and gentlemen in the fullest sense of the words, and these officers will be the first to admit that there are also many men who are neither. The law of the survival of the fittest may come into play, and in process of time the "shovels" will all disappear, and educated gentlemen, quite entitled in every respect to rank with and mess with the other officers, may take their place. Then there will be no more complaints about want of social status. The combatant officers will like the engineers, and will associate with them as their social equals. No possible rule which an Admiralty could frame could bring about this result. What the engineers want they must get for themselves by themselves, and we have no doubt that the new men coming in under the present system and specially educated, will ultimately have nothing to complain

of; and that this result is generally anticipated is demonstrated by the apparently growing popularity of the service. "With regard to the engineers," said Mr. Trevelyan, "a great deal has been done. But I think it undesirable that whenever a new Board of Admiralty comes in changes shall be looked for. But the Admiralty fully recognise the change of *status* which is being effected in the case of the engineer. At the same time I think their position is looked upon as a good one, for in 1877 I find that for forty-two posts there were 142 candidates in the engineers' service; in 1878, 214 candidates for sixty posts; in 1879, forty vacancies attracted 230 candidates; and in 1880 there were 188 candidates for sixty-five posts. As regarded the character of the candidates the right hon. member for South Devon said they were just the sort of men that were wanted. I do not think, therefore, that at the present time we are justified in raising the pay of the engineers. At the same time we will carefully watch over the interests of that branch of the service, and it is admitted that they deserved somewhat different treatment from what they have hitherto received. There is great difficulty in the question of cabin accommodation, but the recommendations of the committee will be kept in view."

But the whole question can be regarded from another point of view, and much that is now said concerning engineers in the Navy induces us to question whether it is desirable that gentlemen should be employed in the engine rooms of our ships. They may have no cause to complain; but the country may have good reason to wish that gentlemen did not go into engine rooms. A great deal is said about the responsibility devolving on the engineers of a large ironclad. But just as much and more devolves on the driver of every express train in the kingdom. The value of a fast passenger train with its engine may be taken at a moderate estimate at £10,000, and the whole of this may be lost by a single act of negligence on the part of an engine driver. He has besides many lives depending for safety on him. It would be almost impossible for a naval engineer to do £10,000 worth, or even £1000 worth of damage by negligence—except systematic and protracted negligence—on board an ironclad. The naval engineer has no designing to do. He can alter nothing; he builds no engines; he is not expected to make a suggestion; his use on board ship is to keep machinery in order, and to do this he must take off his coat and use his hands. Brain work is scarcely needed at all. But gentlemen do not follow handicraft trades; and the work of a naval engineer if it is properly done is the work of a tradesman, and is not professional labour. The engineers know this perfectly well, and the man who works is called by those who do not "a shovel." The new men wear kid gloves and keep their uniforms clean; and to meet this evil and get work done the Admiralty have had to call into existence an entirely new class within the last ten years, namely, the engine-room artificers, on whom, in some ships, devolves all the dirty work, and, in fact, all the work of every kind requiring the use of tools or an oil can. Now this is not as it should be, and we are disposed to think that the country would be much better served by employing thoroughly competent artisans, men who are not afraid of a chisel and hammer, to look after the machinery of our ironclads, than the class now finding its way into our engine-rooms. Each ship ought, however, to carry a superintending engineer, who would, as a matter of course, be an educated, cultivated gentleman. He would have his foremen under him, and would take charge of all the machinery in the ship. His position would be analogous to that of the engineer of any of the large works and factories with which England abounds. No matter what may be said on the subject by those who know little or nothing about it, the charge of marine engines in the Navy is not ennobling, nor exalted, nor intellectual. It involves nothing which calls for the display of talent, and it gives a really clever man no opening whatever. In the mercantile marine an able man has a hundredfold the opportunity of doing something which will show that he has brains and can use them. Under the circumstances we regard the present system as a mistake, and in this view we are supported by large numbers of engineers who have given the subject their attention.

THE TELEPHONE, AND WHAT IT MIGHT DO FOR LONDON.

One enormous benefit which the telephone is calculated to confer upon London seems scarcely to have received any kind of recognition. The boon which this marvellous invention is adapted to bestow on the metropolis illustrates the unfailing principle which seems to govern the affairs of men—that when a want arises, the means of supplying it immediately present themselves. In a somewhat higher sense than that which is commonly signified, the demand may thus be said to create the supply. The immense and ever increasing population of the metropolis is producing a problem which requires very special means for its solution. A large and, in a military sense, an undisciplined army has the command of the streets, and throngs them to a degree which threatens an absolute block. When this danger began to present itself, some twenty years ago, the railways interposed, and, by penetrating the mass, took off some of the pressure. The provincial and suburban lines, converging on the metropolis, planted their termini nearer the centre. The underground railway—Metropolitan and District—rendered further and very important help by creating a sort of locomotive basement—a veritable lower storey—along which thousands of passengers travel every hour of the day without burdening the "upper air." Piercing crowded localities with broad thoroughfares has also afforded means of relief; and the splendid roadway by the Thames, partly created by the reclamation of mud-banks, has been of similar service. But still the main thoroughfares in the central and most important parts of London are crowded to a serious extent during the busier portions of the day. Unless something more can be done to relieve the traffic, it seems inevitable that this crowding and thronging, with the tendency to actual congestion, must go on increasing. It is true that the population of Inner London is not growing so rapidly now as it was ten or twelve years ago; but if we take London in its entirety, so as to comprehend what is called the Outer Ring, we find the population still increasing at an enormous rate, and we have to remember that the traffic of the London streets is made up not only of those who are included in the census of the Inner Circle, but partly of those who dwell outside. The growing population of the kingdom also affects the metropolis, and in this respect the railways operate so as to augment the difficulty—facilities for travelling bringing an increasing number of visitors to London, and thus the provinces pour into the metropolis an ever-growing stream of human beings.

To pull down a number of houses and widen the streets in certain directions is a remedy of a very costly nature, and can only proceed at a moderate pace. To construct railways overhead, in addition to those that are under ground, is a device which the public would rather not see adopted. But the question may be asked, Why do people go along the streets, on foot or in vehicles as the case may be? In how many cases is the object merely that of personal communication. Clerks and messengers are despatched in all directions, with written or verbal messages, and principals go to meet principals for purposes which could be accomplished equally well without leaving their offices, if only they could hear each other speak from their respective sanctums. The electric telegraph has saved much hurrying to and fro. But as a general rule the message has to be sent to a telegraph office, and the telegraph boy has to serve as a connecting link Even if the electric telegraph were laid on to every house, the case would not be met, for there must be a skilled operator at each end of the wire, and this condition could not be universally fulfilled. The need that now presents itself is far some means of verbal intercourse equivalent to the electric telegraph, without the necessity for skill and expertness in working the machinery. At this juncture the telephone offers exactly the kind of service that is wanted. Through the medium of an "exchange" station one person can converse with another, though miles distant, with the same ease that he can communicate through a speaking tube with the occupants of the next floor. Let only a considerable number of the principal men of business in London avail themselves of this invention, and a large amount of street running and riding will be obviated. Let a telephone become a common thing, generally adopted, and the day when the crowded streets will be almost impassable will be postponed to a happily remote date. Whenever the obstruction becomes painfully great, a further recourse to the telephone will be the result.

Yet London has been slow to adopt the telephone. The Government has stood in the way, and the Post-office monopoly—good as it is for many reasons—has tended to wither and blight the young sapling which otherwise might spread its branches readily over every city and town in the kingdom. Had the Government possessed a monopoly of the gas supply, it would probably have put in a claim to the electric light. Its claim to the telephone has been mischievous, and we fear lest it should continue to be so. There is a warning in the event. If railways were the property of the State, we should probably find the Crown lawyers advising that every description of railway—including a line worked by electricity—was State property. Even a flying machine, if such a thing were ever invented, might be brought within the meshes of the Act by which the Government bought up the railway companies. There is no city in the world where the telephone is so much wanted as in London. The over-gorged traffic of the streets calls for every possible means of relief, and here is one method which is creeping into use as slowly as if we were a nation of Turks, resolved to adhere to the manners and customs of our forefathers, however ill they might accord with the growing demands of the age.

ENGINEERS BY ACT OF PARLIAMENT.

Engineering as a profession is in an anomalous position in the opinion of a great many persons, whose statements are worth listening to. Any man who can get the public to believe in him can write C.E. after his name and practice as an engineer, without fear of penalty. Lawyers cannot practice thus, nor can physicians or apothecaries; neither can a man get a commission in the army or navy until he has proved that he is fit to hold one. In all other professions, save that of the engineer, a man must undergo a regular course of study and pass examinations before he can legally pursue his calling. If he attempts to practice without permission, he renders himself liable to a prosecution. It has long been argued that engineers should follow the example set them by physicians and lawyers, and establish an examining body empowered to grant diplomas; and it is indisputable that there is much to be said in favour of the scheme. But, as we hope to show as we proceed, there are great difficulties in the way of putting this scheme into practice; and it is by no means clear that the existing system is so defective as many persons think.

It is evident that the first thing to be done if the scheme whose nature we have indicated is to be carried out, must be the appointment of an Examining Board, with power to grant diplomas. The Colleges of Surgeons and Physicians afford examples of the species of Board wanted. The Board cannot consist of all engineers, and a selection must be made. Possibly one hundred of the more eminent members of the profession might form the primary nucleus of the College of Engineering. But when this nucleus had been formed, after an amount of wrangling and heart-burning, and bitterness and littleness, pitiful to contemplate, it would be totally powerless to enforce its rules without the sanction of the Legislature. Such a body would have no *locus standi* whatever in a court of justice, if it sued for penalties an unfortunate engineer who did not hold its diploma. The only way out of this difficulty lies through Parliament; that is to say, the College of Engineering would have to get a special Act passed, incorporating it, and giving it powers to prosecute. It is perhaps because it is obvious that to obtain such an Act would be extremely difficult, that nothing has been heard about the subject in this country. It has remained for Canada to attempt the scheme; and the effort shows in little, exactly how an attempt to reduce the idea to practice in this country would work. We have written "Canada," but it is really only to a section of that enormous country that the credit of the enterprise is due. We have lying before us a Bill which was presented to the Legislative Assembly of the province of Ontario, and read for the first time on the 10th of February. It is entitled "An Act respecting Civil Engineers," and is endorsed by Mr. Badgerow. This Bill is a very curious and even amusing document, and we regret that it is too long to reprint in our pages. The preamble states that "Whereas it is expedient with a view to the proper and efficient qualification of civil engineers in the province of Ontario that the same should be regulated by statute; therefore her Majesty, by and with the advice and consent of the Legislative Assembly of the province of Ontario, enacts as follows." Then comes the Bill. It is not easy to gather from the preamble whether it is the qualification of civil engineers or the province of Ontario that should be regulated by statute, and there is even some opening left for the surmise that the qualification of engineers depends on the statutable regulation of the province; but there can be little doubt that Mr. Badgerow intended to say that it is expedient that the practice of engineering as a profession should be regulated by law. The first clause deals with definitions of words and phrases contained in the Bill. The second clause simply states that "Civil engineering may be divided into departments or branches, and civil engineers into grades or classes." The third and fourth clauses are two of the most remarkable to be found in any proposed Act of Parliament, and deserve consideration. We have pointed out that it is essential, if engineers are to be provided with diplomas, that some licencing body must be created. Mr. Badgerow cuts the Gordian knot very ingeniously. We give the two clauses in question in full to show how:—"(3) The following persons shall be civil engineers in Grade A, within the meaning of this Act—namely, Walter Shanly, T. Trudeau, Samuel Keefer, Sandford Fleming, J. L. P. O'Hanly, John Page, Thomas Guerin, Marcus Smith, T. C. Keefer, Frank Shanly, Kivas Tully, Charles Baillarge, Peter Grant, Chas. T. Legge, and all other persons who shall obtain a diploma or commission in the manner hereinafter provided shall be civil engineers. (4) Within thirty days after the passing of this Act the Lieut.-Governor in Council shall appoint eight of the above-named civil engineers, who, with the Commissioner of Public Works and the professors of civil engineering, mineralogy, and geology, and natural history of the School of Practical Science, Toronto, shall form a board of examiners for the examination of candidates to practice as civil engineers, and of students desirous of being indentured to civil engineers." Here then we have fourteen gentlemen made engineers by Act of Parliament at one stroke; the names of not more than two are in any way known to fame, or indeed known at all outside a limited circle in this country as engineers, and it is worth notice that the railway engineers of Canada have been as a body wholly left out. From these fourteen specially favoured ones, are to be appointed eight who will have absolute power to prevent their compeers from practising if they so please; for the Act is to be retrospective; and the utmost concession that is made to old practitioners is, that "Any person practising as a civil engineer in any of the provinces of the Dominion of Canada before the passing of this Act, upon his producing satisfactory evidence to the Board of his having so practised, shall be eligible for final examination at any meeting of the Board." This is to say, that men who have already carried out important engineering works, and are in considerable practice, must attend before this examining board and pass an examination. The synopsis of the said examination is contained in the Bill, and reads, as one correspondent of the *Toronto Mail* points out, like the index to Rankine's "Civil Engineering." It seems to us absurd to suppose that any intelligent body of men, like the Legislative Assembly of Ontario, should ever pass an Act placing the whole future of a large number of engineers in the hands of a wholly irresponsible body of examiners, who have been arbitrarily selected, it does not appear by whom. In no case should such an Act be retrospective; it should touch no one who at the time it was passed was practising as an engineer. The conduct of our own Board of Trade in dealing with sea-going engineers may be cited as an example. When the Act was passed which made it imperative that passenger steamers should carry engineers certificated by the Board of Trade, it was well known that there were hundreds of efficient men at sea who could not pass the Board of Trade examination, and who were far too old and too busy to read up for it. These men were all provided with special certificates on giving proof of service and good character. In the same way an examining board for civil engineers ought to give either honorary diplomas to those already in practice, or else leave them entirely unnoticed. We shall say nothing here concerning the proposed examination save that it is exceedingly unpractical, and covers far too wide a range. The entire scheme as set forth in the Bill is, indeed, crude, and in many respects absurd and unjust to an extreme degree; and it is not impossible that it has been prepared wholly by the gentlemen whose names we have given above. Although Canada is an English dominion, and Ontario is essentially an English province, it does not appear that Mr. Badgerow ever thought of consulting the Institution of Civil Engineers here; and yet it is sufficiently obvious that nowhere else could so much information be obtained as to the proper method of carrying such a scheme into practice; and if the Bill had been modified and obtained the sanction of the Institution a great deal would have been done to insure its success. So far, the scheme for making engineers by Act of Parliament seems to be extremely unfortunate.

Before we conclude we wish to say a few words concerning the assumed defects of the existing system, or want of system. Although it is quite true that many men write C.E. after their names who are not really engineers, it does not appear that any harm is done to the

general public. The great body of employers are far too wary to engage the services of any man on the faith of his own unsupported assertions. When a railway company wants a new line made, it will certainly not employ a man who cannot give some proof that he is competent. If a town wishes to have docks, the engineer appointed to design them and superintend their construction must give proof that he has been well trained and possesses experience. Even a draughtsman cannot get a situation unless he can give some evidence that he has been taught to draw, and has profited by the instruction. Of course there are incompetent men who get employment now and then. This holds good of all professions, but as as rule, such men are not incompetent for lack of training. The man who would be most likely to pass an examination may be the worst possible man to entrust with the sole charge of works. It is doubtful whether any examination or system of granting diplomas would do more to ensure the employment of competent men than is done now. The truth is that the engineer requires a combination of powers which cannot be conferred by any training such as can be got at a college or from a crammer. He should know, to cite one example, how to rule men. His power of doing this no Board of Examiners could ascertain. He must be able to make things pay. No diploma could confer upon him the means of doing this. At the present moment the great body of engineers in practice belong either to the Institution of Civil Engineers or the Institution of Mechanical Engineers, or to both; and although neither body professes to examine, there is a species of *lex non scripta*, well understood, that renders it certain that a man cannot become a member of either Institution unless some persons who are qualified to judge, and in a position to pronounce an opinion, are ready to certify that the candidate for election is really an engineer, and competent to practice some branch of the profession. It may yet be that the Institution may see fit to examine candidates and grant diplomas, and this without arrogating to itself the power of prosecuting offenders against its rules; but it seems to us that at present it can do all that is needful by exercising vigilance in the election of candidates, and taking much care to place those elected, each in his proper class. The mere fact of being a member of the Institution of Civil Engineers now carries great weight with it; and we doubt that any substantial advantages would be gained by establishing an examining board, and making men engineers by Act of Parliament.

PEATY DISCOLORATION OF DRINKING WATER.

IT is not universally admitted that water discoloured by passing through peat soils or collected from peaty areas, may be perfectly harmless in respect of that discoloration. People are sometimes alarmed at the appearance of water so coloured, though the water may be in every way excellent for drinking purposes. A case in point comes from Lancaster, which is provided with spring water from the millstone grit occasionally supplemented by an earlier source of supply, the Grizedale Brook, which runs through a good deal of peat country. Sometimes this water is much coloured, and when used imparts a colour to the rest; and Dr. Harker, the medical officer of health for Lancaster, stated, in a recent report, that he had observed the "usually exquisitely pure Lancaster water, mostly derived from springs out of the 'millstone grit,' occasionally after storms stained with brown vegetable matter, a material fruitful in propagating disease germs." As this remark from the medical officer was likely to alarm people, Mr. Jas. Mansergh, C.E., engineer of the works, wrote to the water committee, drawing attention to the harmless nature of the colouring matter, and to the fact that it is totally free from any disease-propagating property. This fact is borne out by the analyses and observations of our principal chemists and waterworks' engineers, and Mr. Mansergh was able to satisfy the Lancaster people by sending the opinions of Drs. Frankland and Tidy. In his letter to Mr. Mansergh, Dr. Frankland remarks: "I know of no facts in support of the assertion that peaty matter is a material 'fruitful in propagating disease germs.' From all that I know of the sources of the Lancaster water supply and from the analysis I have made of it I should consider it to be at all times wholesome; and although it may, at times, be unpalatable, I believe it to be, on the whole, one of the very best supplies in the kingdom." This letter is brief but to the point, although Mr. Mansergh points out that so far as his personal experience goes, and so far as he has been able to learn by inquiry, the water even when most highly coloured has never been accused of being unpalatable. Dr. Tidy replied to the inquiry addressed to him rather more at length. He said, "The medical effect of peaty water has been a subject to which I have devoted a good deal of attention. There is not a single iota of evidence to show—so far as I know—that it is injurious in the least degree. The only charge against it that seemed to be of importance was that it caused diarrhœa. Apart from the fact that we should conclude from *à priori* reasoning that peaty matter, if it did anything, would produce an opposite effect, facts certainly disprove that peat has any diarrhœa-producing action whatsoever. Let me give one case. Limerick is supplied with a peaty water. The diarrhœa death-rate is above the average diarrhœa death-rate of England and Wales. And so people said it is due to the peat. But there is another Irish town where the peat in the water supplied is greatly in excess of the Limerick water, where the diarrhœa death-rate is greatly below the normal diarrhœa death-rate of England and Wales. I am convinced that peat is not injurious, and all my researches have compelled me to the conclusion that it does not even cause diarrhœa." These expressions of opinion are of much value, and beside allaying the fears of the Lancaster people raised by the inconsiderate remarks of their medical officer of health, they show how wrongfully a water may be stigmatised. The latter remarks of Dr. Tidy also suggest that the system of supply of Limerick has more to do with diarrhœa than the source of supply. We may add that the water supplied from the Vartry to Dublin is considered admirable by all authorities, but this water is almost always stained with the colouring matter of peat.

ALGERIA AND THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE French Association for the Advancement of Science seems to possess the vigour and energy that characterised the British Association twenty years ago. At the time the leading men of British science took an active part in its proceedings at the various meetings. There was not then that "social science" element in the meetings which has introduced so much twaddle, and driven real science away. Much of the interest in the yearly gatherings has, however, always centred in the excursions and visits to places of scientific, industrial, or historic interest, and judging from the programme of the French Association for this year, the French is going to outdo the British Association in the extent of its excursions. The annual congress is to take place on the 14th April next. In Algiers excursions will be organised throughout the country, and every facility will be afforded to the numerous guests expected to arrive for studying the riches and beauties of the neighbourhood. The country abounds in mineral riches and relics of archæological interest; while the study of the manners and customs of the people, and the rich scenery of the Atlas Mountains will, it is expected, tempt many who would not undertake the journey for scientific purposes alone. The French railway companies have consented to carry members at half prices, taking full fare for the passage out and giving a free return. The Spanish railway companies have consented to somewhat similar arrangements, while the French Government has placed at the disposal of the association one of their war ships, with a free passage from Marseilles to Algiers, calling at Port-Vendres. This vessel will leave Marseilles on April 11, call at Port Vendres on the 12th, and arrive at Algiers on the 13th. She will return on or about the 23rd April, calling again at Port-Vendres *én route* to Marseilles. Any gentleman desirous of joining the association, and of having further details as to railways, transport, lodgings, &c., may address Mr. F. Maxwell-Lyte, F.C.S., Hon. Foreign Secretary of the French Association, at the Science Club, Savile-row, who will be happy to afford all further information on the matter, and to receive applications for membership of the association. The excursions, for which arrangements have thus been made, will undoubtedly attract a large number of members and visitors, and many will, no doubt, attend with a view to gaining information on the trade and commerce of Algiers as well as the enjoyment of intelligent company in new scenes.

THE TEES BRIDGE SCHEME.

ONE of the strongest of the Parliamentary struggles of the present session seems likely to be on the Bill authorising the construction of a new bridge across the river Tees at Stockton. The old stone bridge connecting Durham and Yorkshire is alleged to be inadequate for the traffic, and as there is a probability of a growth of that traffic, a Bill for the construction of a new bridge is promoted by the towns of Stockton and South Stockton. Public opinion in the former town seems so divided as to the advisability of the support of the scheme that a poll of the ratepayers has been taken. It is not alone against the cost, but against the character of the approach to the bridge on the northern side that there is opposition internally; but there is beyond this an opposition so peculiarly illustrating the fact that the ratepayer is the common paymaster, that it is worth recording it. The two counties concerned have the liability of repairing the present bridge; and it is proposed by the promoters of the new scheme that they should each pay a contribution of about one-fifth of the total cost of the new bridge and be relieved from that liability. The counties object to the amount, and there is to be witnessed the internal war between the towns and the counties of which they form a part, and for the cost of which the much-suffering taxpayer will be responsible, whosoever loses. One of the chief reasons for the construction of the proposed new bridge is that the present one materially affects the tidal flow of the river Tees, its stone piers being heavy buttressed erections, and as the proposed bridge would be so built as to increase the scour of the river, it is proposed that the Tees Conservancy Commissioners should contribute about a sixth part of the cost, and to this they agree. But the conflict of the authorities is so great that the progress of the Bill in committee will be watched with as much interest on this as on engineering grounds. Except on the one point of the approaches, no objection has been taken to the proposed new bridge, and the need for it is generally admitted, on the ground of the growing traffic between the two towns, and with the expectation that it will facilitate tramway traffic on Tees-side. The marvellous development of that district has been accompanied by no commensurate growth of facilities for crossing the stream, for though there have been many proposals to bridge the Tees during the last few years, all have been defeated. It is a matter of regret, therefore, that a needed work should be proposed under circumstances such as those glanced at, which must militate against the probabilities of its being carried out in its present form.

LITERATURE.

Elementary Theory and Calculations of Iron Bridges and Roofs. By AUGUST RITTER, Dr. Phil., Professor at the Polytechnic School at Aix-la-Chapelle. Translated from the German—Third edition—by H. R. SANKEY, Lieutenant, Royal Engineers. E. and F. N. Spon. 1880.

THERE is probably no branch of engineering science on which so much has been written in this country, during the last thirty years, as on the methods of calculating the stresses produced by given loads on iron roofs and bridges. The subject has been treated from almost every point of view—in most cases by men eminently qualified for the work which they undertook. The result is a number of books which will bear favourable comparison with those of any other country. If there is any part of his professional knowledge which a young engineer may hope to master without having recourse to books written in a foreign language, surely it is the one which forms the subject of this treatise. Should we conclude from this that there is no room for a translation of Professor Ritter's book? Not so. On the contrary, we have no hesitation in saying that Mr. Sankey has done very good service to English readers in placing this work before them.

So far as the subjects treated are concerned there is little deserving particular notice, except a few problems showing how to determine the form a structure should have in order to fulfil given conditions as regards the stresses. For instance, to find the form which a girder must have in order that the maximum stresses in the diagonal braces may be equal, or one in which the stresses in the bow may be the same throughout. As the title states, the book is of an elementary character, and some of the more difficult problems connected with bridges, such as continuous girders of more than three spans, and rigid arches, are omitted. Indeed, the subject of rigid arches is dismissed in a rather summary fashion with some remarks to the effect that the stresses in an arch without hinges depends on the horizontal thrust at the springing, and that that thrust is indeterminate. This is, doubtless, an easy, off-hand way of dealing with a difficult subject. The translator has added a note on this point, contradicting the author, but without throwing any real light on the matter. Indeed, the reasoning on one side is about as satisfactory as that on the other.

In finding the stresses in roofs the practice is followed, which too long prevailed in this country, of taking the wind pressure acting vertically. Now it is quite true that there is much uncertainty respecting both the maximum force of the wind which should be estimated, and the manner in which that force acts on a surface which it strikes obliquely. But surely that is no reason for assuming the force to act in that direction which is the most unlikely of all. It is, happily, a somewhat unusual occurrence for the wind to blow right down our chimneys. If the wind had blown vertically on the Tay Bridge, that structure would most probably have been still in its old place. To treat the action of the wind as always equivalent to an increase of the force of gravity is not only to relinquish all claim to scientific accuracy, but to disregard the plainest teaching of common experience.

The merit of this work consists in the method employed in the treatment of the subjects. It contains the development and extended application of a principle which, though well known in this country, and employed by Rankine and others in a few special cases, has not received as much attention as its importance and usefulness deserve. The principle may be briefly stated thus:—If any structure be conceived to be divided into two parts by an ideal surface, the sum of the stresses along the pieces cut by that surface must balance the external forces which act on each of the two parts. If the structure be framed—such as a roof or a girder—and if the number of bars cut by the ideal surface do not exceed three, it is evident the stresses in these bars may be found from the external forces; for the vertical and horizontal components of all the forces which act on either part of the frame, including the unknown stresses, and the moments of the same forces about any point must be each equal to zero. Hence three independent equations can be formed containing the three unknown quantities which are to be determined. This manner of proceeding is rather tedious in practice. If the lines of stress in two of the bars cut by the ideal surface intersect, then by taking the moments of all the forces about their point of intersection the stress in the third bar can be found from a single equation. In this way, too, the stress in a bar may be found, although the ideal surface cut more than two other bars, provided the lines of stress in all these others meet in a point. This is the method used by Professor Ritter throughout the book, and is called by him the "Method of Moments." Another advantage of this method is, that the equation of moments for finding the stress on any bar, when written out in full, shows whether any one of the external forces produces tension or compression; hence it can be readily seen which distribution of the load produces the maximum or minimum stress in the piece. The lever-arms of the moments may be found by calculation, or, more easily, by measurements from a drawing.

While recommending the "Method of Moments" as well worthy of attention, we are far from saying that it is the best in all cases. For instance, those who have been accustomed to determine the stresses in roofs by the graphic method, especially by the use of Clerk Maxwell's self-checking figures, are not likely to change it for any other.

The book is written with a fair degree of clearness and accuracy, which is more than we expected to find after meeting two blunders on the first page. Curiously enough one of these occurs in the first sentence, where the author is made to say the opposite of what he obviously means.

The book is beautifully printed on good paper, and profusely illustrated. Indeed, one of its chief features is the number and excellence of the diagrams. On the whole, in spite of some blemishes, this book is worthy of a place beside the works of our best English authors.

TENDER.

STAPLETON, NEAR BRISTOL, SEWERAGE.

FOR the construction of 7300 yards of brick sewers and 13,300 yards of stoneware pipe sewers, with manhole, flushing valves, lampholes, &c. Quantities supplied by the engineer, Mr. James P. Curtis.

	£	s.	d.
A. J. Bevan, Bedminster	16,950	0	0
Wilkins and Son, Bristol	26,800	0	0
G. Raynor, Bootle, Liverpool	25,550	0	0
C. Deacon, London	23,000	0	0
Currall and Lewis, Birmingham	16,326	0	0
T. Yalland, Fishponds—accepted	13,920	0	0
E. Monks, Fishponds	18,103	0	0
Case and Day, Fishponds	17,723	11	0
F. Dawson, Bury	14,650	0	0
Thomas and Son, Newport	23,000	0	0
McKensie, London	20,500	0	0
Geo. Stevenson, Chesterfield	19,456	0	0
Durnford and Son, Totterdown	18 500	0	0
E. C. Howell, Bristol	21,500	0	0
Wm. Mereaweather, Bristol	18,600	0	0
J. Neave, London	14,648	0	0
J. Mackay, Hereford	23,400	0	0
J. Meredith, Gloucester	14,470	0	0
Keneday, Westbury	14,835	0	0
Kirby and Hickery, Bristol	23,168	0	0

SANITARY INSTITUTE OF GREAT BRITAIN.—At a meeting of the Sanitary Institute of Great Britain, held on March 9th, Dr. B. W. Richardson, F.R.S., in the chair, the discussion was continued upon the paper read at the previous meeting by Mr. W. H. Michael, Q.C., F.C.S., upon "The Law in Relation to Sanitary Progress." The points to which attention was specially directed were—(1) The rearrangement of districts; (2) the reconstruction of authorities; (3) the extension of sanitary powers. The discussion was carried on by Mr. J. Bateman, F.R.S.; Dr. Willoughby; Mr. H. Law, C.E.; Mr. Rogers Field, C.E.; Mr. Fooks, jun.; Mr. Burdett; Dr. Saunders; Dr. Bartlett; and Mr. Rigg. With regard to the rearrangement of districts, there was very little doubt that, for all sanitary legislation, it was very desirable that the division should be in conformity with some natural or physical feature, such as river basins. It was considered that the removal of urban and rural distinctions would be a great benefit, and that a Ministry of Public Health should be formed to guide, encourage, and control local self-government, and place it on a good basis. Most of the speakers agreed with Mr. Michael, that sanitary legislation, to be effective, must be compulsory, especially as regards the isolation of infectious diseases, and the prevention of overcrowded dwellings.

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

(From our own Correspondent.)

The iron trade is tending to more than the quietude customary within three weeks of a spring series of ironmasters' quarterly meetings. Though much of the business doing is at little or no profit, orders are now difficult to secure, and the prolongation of the period of unprofitableness is developing troubles in a few cases which is to-day exercising an unsatisfactory influence.

Very little business could be done either to-day—Thursday—in Birmingham, or yesterday in Wolverhampton. The quarterly meetings will begin in Wolverhampton upon April 13th, and all orders for which urgency cannot be pleaded are being withheld till that time; for higher prices are wholly unlikely then to prevail, while the probabilities are in favour of the occurrence of slightly easier terms in respect of a few sorts which buyers contend are amenable to the influences now at work.

The course which at the quarterly meetings the marked bar firms may take no one but the firms concerned can state. Neither in Birmingham nor Wolverhampton would such firms concede the probability of the crucial quotation being brought down to £7, though it was known that the belief has obtained currency in the London metal market that the odd 10s. now quoted will be then taken off. The rates at which alone marked bars, rolled by the chief makers of that class of iron, could be bought yesterday or to-day offered no encouragement to the expectation—from £7 10s. to £8 2s. 6d. was demanded. Good medium bars were, however, procurable at 30s. under those figures, and bars of a minimum quality were to be had, as last week, to as low as £5 15s. At all and any of the rates the supply was abundant.

Not many inquiries were upon the market for baling strip for the United States. Makers to-day quoted for unvarnished strip £6 12s. 6d. to £6 15s., but now and then orders might have been placed at from 1s. 3d. to 2s. 6d. per ton less money. Most of the iron of this class is now going from the mills by canal to Ellesmere Port, where the chief buying firm in Liverpool are japanning and otherwise finishing the commodity for export in the style in which they are used.

A little business was done to-day in braziery sheets at, in some cases, as low as £7 15s. to £8 per ton for doubles. For these the galvanisers were the chief customers, but for roofing sheets the same class of buyers were less disposed to give out orders, and it was not with ease that some of the specifications in fulfilment of orders some time ago distributed could be obtained by makers. The quotations for ungalvanised sheets for corrugating yesterday were £9 10s. to £10 for latens, £8 5s. to £8 10s. for doubles, and £7 5s. to £7 10s. for singles. The new orders of the week for sheets, both black and galvanised, have come mostly from India, from which the indents are proportionately more satisfactory than from Australia, though the greater quantity of capital now in circulation compared with a year ago is encouraging inquiries from quarters which have not heretofore yielded orders for Staffordshire mills and forges; and the success of the chief bar firms here at the exhibitions of Sydney and Melbourne is leading to the adoption of such iron for carriage axles and such-like uses by manufacturers at the antipodes.

The sheet firms that have been doing a good business on account of Australia learn this week, with other than satisfaction, that the Esbank Ironworks Company, of Lithgow, New South Wales, are making arrangements for the production of corrugated iron and wire. The Esbank Works were established in 1875, in the Lithgow district, which consists of about 3000 acres of good mining land. Upon the surface of this land is found clay of an excellent quality, suitable for brickmaking; then a foot of iron ore; then a bed of freestone, so hard that the company cut their own grindstones from it. Beneath this freestone is found a 10ft. seam of coal. The iron ore, lime, and coal, are said to possess peculiarities requiring special treatment; but an experienced manager has overcome most of the difficulties. The works at present consist of furnace, foundry, forge, and rolling mill. The two branches are connected by a horse tramway. Most of the plant, including a 24-ton fly-wheel, was made upon the ground. The blast furnace is capable of producing 100 tons of gray, or 115 tons of white, iron per week. Both pig and malleable iron are made. A large quantity of rails for the Sydney Tramway have been rolled, and the company possess the necessary plant for making boiler plates.

The boiler plate mills are much in want of new orders, yet it would be possible to buy good brands at from £8 to £9. These were the prices quoted yesterday in Wolverhampton. Plates for tank making were to be had at from £7 5s. to £8.

Pig iron was difficult to sell at the rates which makers would alone accept either yesterday or to-day. All-mine hot blast iron averaged from £3 5s. down to close upon £3, but cold blast was quite £1 per ton more money. Derbyshire iron was quoted at from 47s. 6d. to 45s. easy; Willingsworth iron was quoted 45s., but might have been got at less. Cinder pigs were rarely quoted at 40s., makers asking 37s. 6d. Tin-plates were in fair sale for export; good qualities are going in larger quantities to the United States, to Germany, and to Australia.

Coal was less easy to buy for household use, but furnace and forge sorts were plentiful and easy, for the tendency is towards a lessened demand at the blast furnaces.

The members of the South Staffordshire Ironmasters' Association have just received a circular from the secretary, who has to lay evidence before the Select Committee on Railway Freightage Charges, asking for any illustrations of unfair or improper rates of charges in this district of which they may have knowledge. Similar applications are being made of the other manufacturers by the Chambers of Commerce. Perhaps the grossest anomaly in the freightage charges made by the railway companies for the carriage of hardwares from this district to various parts of the kingdom may be found in the charges levied by the companies for carrying wire to and from Birmingham. At present the companies are actually bringing Westphalian wire all the way from Rotterdam, *viâ* London, for 16s. 8d. per ton; whereas for precisely the same description of wire of Birmingham manufacture, sent from Birmingham to London only, they are charging 22s. 6d. per ton, or about 35 per cent. for considerably less than half the distance.

In addition to the firms mentioned last week, the following Birmingham manufacturers have received first-class awards at the Melbourne Exhibition:—R. Tummins and Sons, for hammers, pincers, shoe tools, &c.; W. A. Lyndon, Minerva Works, for spades and shovels; Sidney, Flavell, and Co., for kitcheners; W. and C. Wynn and Co., for steel toys and tools of every description; and Hoskins and Sewell, Bordesley, for metallic bedsteads.

From information just issued by the United States Consul in Birmingham, it appears that the improved character of the export business from this district to America, which began in 1879, was well sustained up to the close of last year in nearly everything but iron, and that the last quarter of 1880 shows the substantial advance of £15,000, or 8 per cent., upon the corresponding quarter of 1879. During the twelve months ending September 30th last the total exports from Birmingham and district amounted to a million sterling, which was rather more than double the total value of the exports for the year previous. The principal items were iron and steel, hardware and cutlery, guns and materials, jewellery and fancy goods, pens and tips, chains, hoes and scythes, anvils and vices.

Constructive engineers continue to receive new orders of considerable value for bridge work. Some good contracts have recently fallen to Wolverhampton firms. The Tank and Boiler Company there have begun upon the order for a bridge of fair dimensions, to be used for highway traffic over the railway at Tunbridge Wells. Mr. Geo. Fletcher, of the Brunswick Works, Wolverhampton, has secured the contract for a bridge at Islip, on the Oxford and Bletchley branch of the London and North-Western Railway. About 250 tons of wrought iron will be employed in the erection. The bridge will have a span of about 190ft., and the main girders will weigh 20 tons each. For the Northampton and Market Harborough branch of the same line the firm is about completing the third and last bridge. This bridge will be 75ft. long, with a span of 25ft., and will contain two side and one middle girder. Amongst the roofing contracts in hand at the Brunswick Works is one for 120 tons of roofing and 40 tons of girders, to be used in the erection of the new carriage and wagon shop of the London, Chatham, and Dover Railway at Battersea. Two fine tanks are also on hand at the Brunswick Works for the American Oil Company, Thames-Avon, London. They are of 40,000 gallons capacity, 90ft. length, 18ft. width, and 4ft. depth. In the manufacture of these and other tanks, this firm employs a punching machine capable of punching no fewer than 48 holes at once.

The new outfall sewage works erected at Hanley have just been formally opened. These works are the complement of the system of drainage that has been executed in Hanley at a cost of £62,000. They are situated on the Trenthay Farm, upon an area of 23 acres very near to the river Trent, into which the effluent will find its way. A spacious engine house and several large tanks have been constructed, and very powerful machinery has been supplied for them by Messrs. Tangye Bros., Birmingham.

A new goods station is in course of erection at Ettingshall, on the London and North-Western Railway, to relieve the present one in Wolverhampton, which is overcrowded. The work of laying down a double line of rails on the north side of the passenger station in Wolverhampton to the new goods station is now almost completed. When it is quite finished the goods traffic will be carried on outside the station walls, and the rail area inside the station will be contracted to allow more platform accommodation.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—An almost complete absence of either demand or inquiry is still the most characteristic feature of the iron trade of this district. So far as any new business doing is concerned, trade is in quite as bad a condition as at any time during the extreme depression of last summer, and judging from the present prospects of the market, the return of prices to a similarly low level would seem to be only a question of time. It is evident that at present there are no pressing requirements for iron amongst consumers in this district, and buyers, in the face of a continually weakening market, naturally hold aloof from speculative purchases. The business doing during the past week has been altogether of a retail character, and scarcely an important inquiry has been reported in the market.

Lancashire makers of pig iron are still kept fairly going with deliveries on account of contracts, and small sales continue to be made on the basis of about 46s. 6d. for No. 3 foundry, and 45s. 6d. for No. 4 forge less 2½ per cent., delivered equal to Manchester, but for good orders local makers are open to offers at under these figures.

Outside brands of pig iron offering in this district are very irregular in price, and all sorts of figures are mentioned in the market as the prices which sellers would be willing to accept. There are also indications of "bearing" operations, which have been anticipated for several weeks back, in north-country iron. There are, however, so few actual transactions that it is scarcely possible to say what prices actually are, and the nearest figures at which iron could be bought that I have been able to arrive at are about 45s. 4d. to 45s. 10d. per ton net cash for g.m.b. Middlesbrough, and from 45s. up to 46s. 6d. per ton, less 2½, for Lincolnshire and Derbyshire irons delivered equal to Manchester.

Some of the local finished ironmakers are still kept fairly busy on old contracts, but there are very few orders coming in for any description of manufactured iron. Prices generally are weak, and for delivery into the Manchester district may be quoted at about £5 17s. 6d. to £6 for bars, £6 10s. to £7 for hoops, £7 10s. for common plates, and £7 12s. 6d. to £7 15s. for sheets.

Founders are very short of work, and I hear that the tenders recently sent in for one or two pipe contracts have been at extremely low figures.

The position of engineers and machinists throughout this district continues very unsatisfactory. A few firms are tolerably busy on shipping orders or specialties, but the bulk of the trade is dull, and there is so little new work in prospect that any orders coming into the market are so keenly competed for that prices are cut down in many cases below the margin of profit. With regard to the engineering and iron trades throughout the country, I may state that recent returns from all the important centres give very unsatisfactory reports as to the prospects for the future.

In the coal trade business is quiet. The supplies of all descriptions of fuel are in excess of requirements, and prices, so far at least as round coals are concerned, are gradually receding to the old level upon which advances were made during the recent strike. Common classes of round coal for iron making and steam purposes are becoming rather a drug in the market, and any scarcity of engine fuel has been removed for the present by the increased production of slack. The average quotations at the pit mouth are about as under:—Best coal, 10s. per ton; seconds, 7s. 6d. to 8s.; common coal, 6s. to 6s. 6d.; steam and forge coals, 5s. 6d. to 6s.; burgy, 5s. to 5s. 6d.; and slack, 3s. 6d. to 4s. 6d. per ton according to quality. These quotations, however, can scarcely be considered as fixed prices, buyers in many cases being prepared with concessions to secure orders.

The shipping trade is very dull, and low prices are being quoted at Liverpool and Garston.

For coke the demand is very limited at the prices now being asked.

The first annual meeting of the members of the Manchester Coal Exchange, to the formation of which I have referred in previous reports, was held on Tuesday, and the committee were able to present a report showing that the success of the undertaking had been placed beyond question. The number of members who had subscribed for the present year was 336, as compared with 227 in 1880; and after paying all liabilities incidental to the formation of the association, and the expenditure of the year, there remained a balance to the funds of the Exchange of £40. Mr. James H. Johnson, of the Abram Coal Company, was elected president, and Mr. J. Hodgson—J. Scowcroft and Co.—was re-elected secretary for the ensuing year.

Barrow.—From what I can learn from careful inquiry into the state of the hematite market, there is a much better demand all round. I hear for a fact that orders have been opened much more freely both from consumers at home and abroad. So far as American demands are concerned, I am in a position to state that orders are being booked from that quarter to something like the extent which, at the beginning of the year, was expected would be the case as the spring season advanced.

The furnaces are still in full work, producing a heavy tonnage of metal, and this output will shortly be considerably increased by the blowing in of the four furnaces at Askam, which are at present damped down till the new company get them into thorough working order again.

Prices as last quoted are still the ruling figure; but the fact of prices not rising must be attributed, I think, to the large output of metal and the slow demand of a few weeks ago. As the demand increases stocks will diminish, and we are likely to see a rise in the value of hematite pig iron shortly. Makers do not seem anxious to do much business at present; being well sold forward they prefer to wait for the brisk demand which is confidently expected later on. Of course both increase of prices and demand greatly depend upon what America may require.

The steel mills are well supplied with work. A good demand is experienced, and a few fair contracts are on the books.

Shipbuilders have quite as much work as they can manage, and this industrious outlook will continue for some time to come. Ironfounders, engineers, &c., are fairly well engaged.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

Never since the revival of trade in the autumn of 1879 has the tone of the iron market been flatter than was the case at Middlesbrough on Tuesday. This may, perhaps, be partly accounted for by the weather, which was cold, raw, and cheerless. Snow had fallen more or less during two days, and though it did not remain long on the ground, it still left an unpleasant appearance and effect upon foot passengers. It seems scarcely reasonable to suppose that a little bad weather in the middle of March should be taken into account as having much influence on trade. But so fresh on the memory of all is the retardation produced by the recent long-continued frost, that many seem unable to forget it, and are full of fear lest it be still further prolonged. Other causes, however, are contributing to anxiety. Glasgow market keeps creeping downwards, and Scotch pig iron may now be had for less than 48s. Then, again, stocks continue to accumulate at both centres, and there seems little or no probability of a sufficiently rapid increase of consumption to absorb the current make. Fears are expressed lest the warrant-holders should take fright and begin to sell in competition with smelters. If this happened a still further fall would undoubtedly take place. Two more manufactured ironworks have been announced as being about to suspend operations altogether, and thereby diminish consumption of pig iron. One of these is the Northfield Ironworks, near Sheffield. In share capital and debentures not far short of £100,000 has been subscribed; the shareholders have never received a dividend, and now the works are to be laid in. The other is the Imperial Iron Company, formerly Jackson, Gill, and Co., of Middlesbrough, and recently carried on by the liquidator—Mr. Peat—and a committee of shareholders. Bars, angles, and puddle bars have chiefly been produced. Being satisfied that manufacture cannot be continued under present conditions, without a loss of about 10s. per ton, and all attempts to sell the works having proved fruitless, those in authority have wisely decided to stop the works forthwith. Accordingly a fortnight's notice was given on the 12th to all hands. These and other similar causes combined affected the market on Tuesday adversely. The price of No. 3 g.m.b. was 37s. 9d., free in trucks or f.o.b. cash, less 2½ per cent. Forge iron was 1s. per ton less, warrants 1s. 3d. more. The increase in Connal's store during the week was 1610 tons, making a total accumulation of 156,976 tons At Glasgow the stock now amounts to 533,693 tons.

In manufactured iron a further fall has taken place. Plates may now be considered to be worth £6 7s. 6d. per ton free in trucks, cash less 2½ per cent.; or possibly for large and good specifications a little less might be accepted. Bars and angles are quoted at £5 5s., and puddled bars at £3 12s. 6d. Old rails have fallen considerably in the absence of competition from the United States, and a purchase of 2000 tons has just been made for £3 7s. 6d. c.i.f. Tees. The sellers were the Dutch Government. For some time scarcely any old rails have been used up by the Cleveland manufacturers, because they were not obtainable under about 5s. per ton more than puddled bars could be bought or made at. Now the case appears to be altered, and with a 5s. margin on the other side, large quantities may again be expected to find their way to the iron metropolis. The coal trade is flat in sympathy with iron, and also because of the near approach of spring and summer. It is thought that few of the coalowners can now be working at a profit.

Three of the men burned by the accidental overturn of a converter at Eston have since died. The remainder, with one or two doubtful exceptions, are in a fair way for recovery. At the inquest, held under the presidency of Mr. J. T. Belk, coroner, much interesting evidence was given. The immediate cause appears to have been the breaking of a joint in the pipe connected with the hydraulic manipulating gear. This pipe, whatever called, must clearly have been acting as an "exhaust" or "exit" pipe, and not as a "pressure" pipe, at the time of the accident. The force which upset the converter must have been the weight of the molten metal accumulated near the throat. The resistance which should have controlled this force could only have been the water locked up in the exit pipe. When the latter gave way control was lost. This point was never made clear at the inquest, whilst the expression, "failure of a pressure pipe," was continually made use of without challenge. The newer converters are fitted with worm-wheel gearing, which, if made of sufficient strength, is clearly the best and safest, though, perhaps, not the quickest mode of dealing with such heavy and dangerous masses of molten metal.

The shipbuilding industry at the northern ports continues very active. The men are working well, having received substantial advances in almost every department. The principal cloud on the horizon is the chance that they may again begin to agitate for further concessions. The shipbuilders are daily booking fresh orders, and with the benefit of lower prices for material, they would seem likely to have a very profitable year before them. The new French Merchant Shipping law is already beginning to have some effect. Consignments of shipbuilding iron are leaving Middlesbrough for French ports, and larger orders are expected. Messrs. Bolckow, Vaughan, and Co., have discharged a large number of workmen hitherto engaged in constructing their new works at Eston, as they had no longer need for them.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The pig iron market has been flat since the date of last report, and prices both of warrants and makers' iron are again lower. A large quantity of warrants have changed hands with the usual result when trade is dull of depressing quotations. The export demand for pig iron is still unequal to expectations, and the recurrence of wintry weather has intensified the dulness of the market. Reports from the United States are the reverse of cheering. Stocks of Scotch pigs there do not appear to have diminished, and prices in private despatches are quoted 2s. per ton less. A few small orders are being executed for Canada. The continental inquiry is as yet backward. At home the consumption is fairly steady, but prices are low. There are 120 furnaces in blast, as compared with 114 at the same date last year, and of this number seven are making hematite. Stocks continue to increase, and the additions to Messrs. Connal and Co.'s stores in the course of the past week have been 2316 tons, the total now amounting to 534,051 tons.

Business was done in warrants on Friday forenoon at 47s. 10d. to 48s. 1d. cash, and 47s. 11d. to 48s. 3d. one month, the afternoon quotations being 48s. to 48s. 2½d. cash, and 48s. 1½d. to 48s. 4½d. one month. On Monday morning business was done at from 48s. 2½d. to 47s. 11d. cash, and 48s. 4½d. to 48s. one month; and in the afternoon from 47s. 11d. to 47s. 9½d. cash, and from 48s. to 47s. 11d. one month and 47s. 9½d. fourteen days were the quotations. The market was steady on Tuesday, with business at 47s. 7½d. cash and 47s. 9d. one month to 47s. 9d. cash. The market was rather firm on Wednesday, with business up to 48s. one month, 47s. 11½d. cash. To-day—Thursday—the strong feeling continues, with business from 47s. 10½d. to 48s. 11½d.

The demand for makers' iron has been quiet, and prices are reduced from 6d. to 1s. per ton. Merchants now quote Gartsherrie, No. 1, f.o.b. at Glasgow per ton, 58s.; No. 3, 50s. 6d.; Coltness, 58s. 6d. and 50s. 6d.; Langloan, 58s. 6d. and 50s.; Summerlee and Calder, each 58s. and 50s.; Carnbroe, 55s. 6d. and 50s.; Clyde, Monkland, Quarter, and Govan, 49s. 6d. and 47s. 6d. each; Shotts at Leith, 59s. and 51s. 6d.; Carron, at Grangemouth, 52s. 6d.; specially selected, 56s. and 51s. 6d.; Kinneil, at Bo'ness, 50s. and 48s. 6d.; Glengarnock, at Ardrossan, 55s. 6d and 50s. 6d.; Eglinton and Dalmellington, each 49s. 6d. and 47s. 6d.

The malleable trade is quiet, with apparently no extra move-

ment except in shipbuilding irons, which continue in request. The iron manufactures shipped from the Clyde in the course of the last two weeks embraced £20,000 worth of machinery, including six locomotives, valued at £8880, for Bombay; three locomotives, £5000, for Santos; £2730 for Calcutta, and £950 for France; £27,000 worth of cast iron pipes, of which £16,200 went to Rio de Janeiro, £4700 to Yarmouth, £3070 to Queensland, £1100 to Brisbane, and £1000 to Barcelona; £32,000 other goods, including £4500 to New Zealand, £5500 to Adelaide, £4400 to Rangoon, £3200 to Bombay, £2300 to Calcutta, £3400 to Mediterranean ports, £2200 to New York, £1800 to Oporto, and £1200 to Newfoundland; £14,000 worth of sewing machines, of which £3450 went to France, £2807 to Barcelona, £2377 to Bilboa, £2153 to Oporto and Cadiz, and £2544 to Adelaide.

A good trade continues to be done in coals, especially in the West of Scotland. The snowstorm has had the effect of increasing the domestic consumption, and there have been large shipments in the course of the past week at most of the ports, the departures from Ayrshire being particularly good. Prices for all sorts are nominally unchanged. It was expected that by this time the eastern ports would be busy, but the renewal of bad weather has somewhat impeded business. As most of the northern continental ports are now, however, opening, it is expected that a good export trade will be done in coming weeks.

The committee of shareholders appointed to confer with the directors of the Monkland Iron and Coal Company as to the means to be adopted to improve the financial position of the company, have had several conferences on the subject, and it is believed that arrangements will be made to place the concern on a sounder basis.

The Court of Session has appointed a provisional liquidator to deal with the affairs of the Glenduffhill Coal Company, Limited, and fixed the 12th May next as the date of appointment of an official liquidator.

I stated at the time that a number of ironworkers had left the Clyde on 3rd February to work for the Detroit Dry Dock Company, Wyandotte, Michigan, and some of the men who have just returned state that they and others had left because the wages at which they were engaged were considerably below those paid at Wyandotte.

The sixth meeting of the present season of the Institution of Engineers and Shipbuilders in Scotland was held in Glasgow on Tuesday night, when a paper was read by Mr. Andrew Jamieson, C.E., principal of the Glasgow Mechanics' Institution, on "The Technical Education of our Young Engineers, Shipbuilders and Artisans," and Mr. John Turnbull, jun., exhibited and explained a new form of lubricator for steam engines. The following were admitted as members:—Geo. H. Baxter, Leith; Thos. Burt, engineer and founder, Glasgow; Wm. Crockall, mechanical engineer, Glasgow; Wm. A. Mackie, ship draughtsman, Glasgow; and Wm. Menzies, superintendent engineer, Newcastle-on-Tyne. As graduates: D. Davidson and Robt. Watson, Glasgow.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

IN the steel rail trade Messrs. Wilson, Cammell and Co., of Dronfield Steel Works, have booked an order for 5000 tons for the Great Northern and Great Eastern (joint committee). The same firm are now delivering 15,000 tons of steel rails to the order of Mr. Vanderbilt, of New York.

In commercial circles I hear a good deal of complaint at present about "cutting" of prices. I was informed this week that one company had accepted an order for railway material 20 per cent. below the average rates of the district, which are said to be so "lean" or to yield little more than 1s. 6d. to 2s. 6d. a ton.

Messrs. Ward and Payne, West-street, have received information of their having secured a first-class medal at Melbourne for their exhibit of edge tools, sheap shears, files, &c. Similar honours have been conferred on Messrs. W. Marbles and Sons, Hibernian Works—joiners' tools, &c.—Messrs. Tyzack, Sons, and Turner, Little London Works, Abbeydale—saws, scythes, &c.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

IN a very little time the whole of the old iron department of Dowlais Works will be restarted in some form or other. The one stagnant spot, that opposite the office, is the last that remains unlit, and general gratification is felt that this is soon to change The tin-plate business at these works is improving, and has almost doubled itself since the beginning.

Coal is expected to be struck shortly in the Bedlinog colliery, and prospects are good that the great difficulty met with has been surmounted. Dowlais is also adding a large area of all the seams of coal by sinking in the spot once selected for the purpose by Mr. Fothergill. This will yield ample supplies for many years to come, and gives Dowlais a command over the minerals for nearly six miles in extent. In fact, had Mr. Crawshay anticipated the taking of Nixon and Cory at Merthyr Vale by adding it to his Castle pit, the Cyfarthfa estate would not be better off than Dowlais will now be. It is evident from this that the directing mind at these extensive works and collieries is now assured that the Thomas and Gilchrist patent for dephosphorisation of iron does not mean the extinction of the Welsh industries. The total iron exports from Wales last week were about the same as the preceding, namely, 10,000 tons, and it is satisfactory to note that good orders remain on the books. Bars remain at £5 5s., rails from £5 10s. to £5 15s.

I am inclined to think it possible that we shall have a revival again, and possibly the price of coal will be restored; 10s. 6d. is still asked and obtained, f.o.b. at Cardiff, for best screened steam.

The men continue working with considerable regularity at all places, except the Coedcae. In the lower measures of this pit, where the steam coals are worked, the men are on strike. They plead for certain allowances to be given, as allowed in neighbouring pits, ignoring altogether the fact that the conditions in the Coedcae are altogether different. The owners oppose this plea, and, in my opinion, justly; but it is to be regretted that the men will not give way sensibly, and develope the fine measures in this pit.

A downward movement has set in with regard to iron ore—a natural result, as previously noticed, of the large quantities poured into our ports. At Cardiff last week, 13,000 tons came to hand.

A new colliery company has been started at or near Carmarthen, called the Caerbryn—capital £20,000, in £10 shares.

I have no improvement to report in connection with the tin-plate trade. The forgemen remain out, and though the make is considerably reduced, there is no improvement in price.

A fire took place last week near the pit shaft of the Marine Rhondda Colliery, Pontypridd, and some amount of damage was done.

The output at Lan Colliery, Pentyrch, attained a higher point in the week preceding the last than has been known—another tribute to the energy and ability of the manager.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

15th March, 1881.

1108. SPINDLES, G. W. von Nawrocki.—(*R. Schrke and Messrs. Büldge and Hildebrandt, Berlin.*)
1109. CUTTING APPARATUS, J. F. Flannery, London.
1110. FASTENINGS, R. Jenkins.—(*C. Morse, Rhinebeek.*)
1111. ROLLERS, J. and P. Hawthorn, and J. P. Liddell, Newtown.
1112. ASPHALTE, &c., S. C. Joyce, London.
1113. OMNIBUSES, &c., H. Gardner.—(*F. F. de Moraes, Rio de Janeiro.*)
1114. LIFE-BUOYS, E. T. Jones, Southampton.
1115. CHAIRS, P. Leone, Genoa.
1116. MEASURING, &c., APPARATUS, A. Légé, London.
1117. SADDLES, H. S. Wilton and B. S. Weston, London.
1118. DITCHING, &c., MACHINERY, C. H. Binney, Ilford, and S. W. Blyth, Ongar.
1119. TELEGRAPHY, S. Pitt.—(*O. Lugo, New York, U.S.*)
1120. LAMPS, S. Pitt.—(*W. Robins, Cincinnati, U.S.*)
1121. CAST IRON POTS, J. V. Hope, Wednesbury.
1122. SCARF, &c., FASTENERS, C. Edwards, Birkenhead.
1123. DRIVING ROLLERS, P. V. Gelder, Liverpool.
1124. STEAM, &c., ENGINES, F. J. Burrell and T. T. Burall, Thetford.
1125. BOTTLES, H. Codd, London.
1126. SHARPENING PENCILS, J. Darling, Glasgow.
1127. INJECTING, &c., AIR, W. Fairweather.—(*J. Glasier, Paris.*)

16th March, 1881.

1128. LOCOMOTIVE ENGINES, &c., F. W. Webb, Crewe.
1129. FURNACES, W. Thompson.—(*O. Orvis, Chicago.*)
1130. ENGINES, H. Jenkin and A. Jameson, Edinburgh.
1131. SKATES, S. V. Wheatley, Sheffield.
1132. MARKING APPARATUS, E. Coote, New Wimbledon.
1133. MILK CANS, T. W. V. Harte, Reddish.
1134. LAMPS, J. Fyfe, Glasgow.
1135. UMBRELLAS, W. Gedge.—(*Revel, Père et Fils, France.*)
1136. COMBING WOOL, W. Lake.—(*F. G. Lange, France.*)
1137. PLATES OF TIN, &c., F. H. F. Engel.—(*New York Hamburger Gummiwaaren Compagnie, Hamburg.*)
1138. FRAMED BLIND CLOTH, W. P. V. Wyk, London, and B. Armitage, Manchester.
1139. REGULATORS, A. Clark.—(*C. Kuhne, Pennsylvania.*)
1140. HANDLES, A. Clark.—(*W. Johnson, Industry, U.S.*)
1141. AROMATIC SALT, T. Morgan.—(*D. Viard, J. Espinasse, and L. de Raismes, Paris.*)
1142. VENETIAN BLINDS, R. Marshall, Wandsworth.
1143. DOOR LOCKS, W. R. Comings, London.
1144. REFRIGERATORS, H. J. Haddan.—(*J. S. Forshay, New York, U.S.*)
1145. BIT for HORSES, G. W. von Nawrocki.—(*G. W. Waldemar von Nostitz and Taenckendorf, Rosswein.*)
1146. WATER HEATERS, A. Sweet, London.
1147. TRANSPARENT ICE, H. J. West, London.
1148. COAL GAS, F. J. Bolton and J. Wanklyn, London.
1149. WATER PIPES, L. S. Powell, London, and C. V. Boys, Wing Oakham.
1150. NAILS, J. Noad, Ham.
1151. FIREMAN'S DRESSES, C. Wraa, London.
1152. OPENING BOTTLES, H. Codd, London.
1153. STAMPING LETTERS, H. Codd, London.
1154. PACKING, J. Packham and J. Pelton, Croydon.
1155. FIRE-BRICKS, S. J. Payne, Charlton.
1156. POSTAL WRAPPERS, J. A. and C. Elstob, London.
1157. COP SPINDLES, G. W. Stafford, Lawrence, U.S.

17th March, 1881.

1158. MEASURING APPARATUS, F. Macdermot, Dublin.
1159. BEVERAGE, W. Thompson.—(*C. Desnos, Paris.*)
1160. ENGINES, H. Jenkin and A. Jameson, Edinburgh.
1161. ALKALINE SOLUTIONS, E. Carey, H. Gaskell, jun., and F. Hurter, Widnes.
1162. FURNACES, J. Swain, Oldham.
1163. DESICCATING EGGS, E. P. Alexander.—(*L. J. Cadwell, Chicago, U.S.*)
1164. SEWING MACHINES, B. Hunt.—(*J. Bond, jun., and C. M. Swain, Philadelphia, U.S.*)
1165. WHEAT, T. A. Marshall, Renfrew, N.B.
1166. STOPPING ENGINES, E. F. Schöne, Grossröhrsdorf.
1167. MARINE GOVERNORS, J. B. Scarlett, Oxford.
1168. INDICATING APPARATUS, W. R. Lake.—(*P. J. Pointe and C. C. Porcher, Paris.*)
1169. BICYCLE SADDLES, &c., W. R. Lake.—(*C. H. Veeder, Plattsburg, New York, U.S.*)
1170. LOOMS, T. Singleton, Darwen.
1171. COCKS, &c., J. H. Johnson.—(*J. Zeleny, Prague.*)
1172. REGLETS, &c., J. Bryceson, London.
1173. PULVERISED MATERIALS, A. W. L. Reddie.—(*W. Kracht, Russia.*)
1174. MOULDINGS, &c., F. A. C. Koenemann, London.
1175. IRON, W. Lake.—(*T. A. Blake, New Haven, U.S.*)
1176. WELDED IRON TUBES, J. C. Johnson, Wednesbury.
1177. HINGES, F. E. Martineau, Birmingham.
1178. TAB CONNECTORS, T. Walker, Birmingham.

18th March, 1881.

1179. HELICAL SPRINGS, L. Sterne, London.
1180. NEEDLES, T. F. Burgess, Dundee.
1181. TAPS, S. Hands and W. Weaver, Wolverhampton.
1182. CLEANING APPARATUS, X. Courtil, France.
1183. HANDLES, M. Bauer.—(*G. Bourgade, France.*)
1184. JOINTS, J. A. Berly.—(*L. Langlois, Louvain.*)
1185. MACHINE GUNS, F. Lobel, Brighton.
1186. CHAIN GEARING, N. K. Husberg, Stockholm.
1187. TRICYCLES, J. I. Warman, Coventry.
1188. ALKALI, J. MacTear, Glasgow.
1189. TRAVELLING RUGS, I. Pick, London.
1190. COMBS, F. H. F. Engel.—(*New York Hamburger Gummiwaaren Compagnie of Hamburg.*)
1191. VENTILATING HATS, W. R. Seaton, Manchester.
1192. BOTTLE STOPPERS, C. Warner, London.
1193. LOCKS, W. S. Smith, Highgate.
1194. CHECKING APPARATUS, W. M. Llewellin, Bristol.
1195. BALLOONS, E. Brewer.—(*A. Debayeux, Paris.*)
1196. COVERING STEAM BOILERS, D. H. Dade, London.
1197. EMBOSSING PAPER, P. Jensen.—(*Hohenstein and Lange, Berlin.*)
1198. PRESERVING EGGS, F. Wolff.—(*L. Boje, Denmark.*)
1199. CARRIAGES, L. Higginbottom and T. Mannock, West Gorton.
1200. WHEELS, A. Brydges.—(*U. Goetzenbruegger, Vienna.*)
1201. EMPTYING CESSPOOLS, E. A. Brydges.—(*U. Götzenbrügger, Vienna.*)
1202. CALORIC ENGINES, M. P. W. Boulton, Oxford.
1203. PRINTING INK, H. Brackebusch, Berlin.
1204. BEVERAGES, R. Bull, London.

19th March, 1881.

1205. PIANOS, H. Haddan.—(*J. Goetgeluck, Belgium.*)
1206. ELECTRICAL APPARATUS, R. Harper, London.
1207. BRICKS, &c., P. Wood, West Bromwich.
1208. PRESSES, E. Hunt, Glasgow.
1209. UMBRELLA FRAMES, G. Neu, London.
1210. BATHS, J. Bernard, London.
1211. SEWING MACHINES, H. Mills.—(*D. Mills, Philadelphia, U.S.*)
1212. COLOURING MATTERS, J. A. Dixon, Glasgow.—(*O. Fischer, Munich.*)
1213. COPYING PRESSES, G. W. von Nawrocki.—(*O. Michaelis, Berlin.*)
1214. HOLDING APPARATUS, R. Sherwin and G. Evans, Worcester.
1215. TREATING MARINE VEGETABLES, J. Imray.—(*Le Marquis Alexandre de Saint-Yves, Paris.*)
1216. LAMPS, J. Rippingille.—(*Schwintzer & Gräff, Berlin.*)
1217. MEASURING APPARATUS, W. L. Hunt, London.
1218. PERFORATING PAPER, G. W. von Nawrocki.—(*M. Heyman, Berlin.*)
1219. LAMPS, T. Tongue and T. Bladon, Birmingham.
1220. INGOTS, J. Johnson.—(*E. Wheeler, Philadelphia.*)
1221. VALVES, A. Harvey and W. Borland, Glasgow.
1222. SMALL-ARMS, W. H. Monks, Chester.

21st March, 1881.

1223. PUMPS, A. Rigg, London
1224. GLASS, J. Couper, jun., and J. Elcock, Glasgow.
1225. DYEING, J. A. Dixon.—(*C. Rumpff, Elberfeld.*)
1226. PRINTING MACHINES, W. Evans, M. Smith, and D. Braithwaite, Manchester.
1227. CLEANING WHEAT, &c., E. Davies, Liverpool.
1228. CONDENSING STEAM, T. Elcoate, Liverpool.
1229. SHOES, W. H. Halliwell, Brighton.
1230. DOLLS, A. Henderson.—(*J. W. Platonoff, Moscow.*)
1231. KILNS, R. Ballard, London.
1232. ELECTRIC LAMPS, H. Upton, Newcastle-on-Tyne.
1233. WIND MOTOR, L. A. Purper, Paris.
1234. BICYCLES, J. Southgate, London, W. Smith and R. Liddell, Ipswich.
1235. ELECTRIC LIGHT, G. A. Tabourin Marseilles.
1236. ELECTRIC LAMPS, J. A. Berly, London.
1237. DRAUGHTING COATS, W. T. Raynor, Manchester.
1238. INCLINED TRAMWAYS, H. P. Holt, Leeds.
1239. FLYERS, D. Frazer, Newry.
1240. ARMATURES, E. Brewer.—(*T. Edison, Menlo Park.*)
1241. BREECH-LOADING SMALL-ARMS, J. Deeley, Birmingham, and J. S. Edge, Yardley.
1242. FIRE-ARMS, H. A. A. Thorn, London.
1243. CUSHIONS, S. Newington, Ridgeway.
1244. COATING METAL PLATES, R. and J. Lewis, Llanelly.
1245. AXLES, W. M. Riddell, London.

Inventions Protected for Six Months on deposit of Complete Specifications.

1093. GOVERNORS, A. M. Clark, Chancery-lane, London.—A communication from W. E. Gwyer, New York, U.S.—*14th March*, 1881.
1144. REFRIGERATORS, H. J. Haddan, Strand, London.—A communication from J. H. Forshay, New York, U.S.—*16th March*, 1881.
1169. BICYCLE SADDLES, W. R. Lake, Southampton-buildings, London.—A communication from C. H. Veeder, Plattsburg, U.S.—*17th March*, 1881.
1175. BREAKING PIG IRON, W. R. Lake, Southampton-buildings, London.—A communication from T. A. Blake, New Haven, U.S.—*17th March*, 1881.

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

1018. SHIPS' PROPELLERS, R. H. Armit, Craven-street, London.—*14th March*, 1878.
1039. LOOMS for WEAVING, J. Almond, Blackburn.—*15th March*, 1878.
1080. SEWING MACHINES, T. Chadwick and T. Sugden, Oldham.—*19th March*, 1878.
1084. SULPHURIC ACID, W. J. Blinkhorn, St. Helen's, Lancashire.—*19th March*, 1878.
1148. SULPHOCYANIDES, W. E. Newton, Chancery-lane, London.—*22nd March*, 1878.
1347. PORTLAND CEMENT, J. B. White, jun., and A. Glover, Swanscombe.—*4th April*, 1878.
1077. GAS, G. Waller and F. Colyer, Holland-street, Southwark, London.—*19th March*, 1878.
1262. SECURING SAFETY of TRAFFIC on RAILWAYS, E. Tyer, Old-street, London.—*30th March*, 1878.
1624. LOAF SUGAR, C. D. Abel, Southampton-buildings, London.—*23rd April*, 1878.
1064. LOOMS, C. and T. H. Brigg, Bradford.—*18th March*, 1878.
1076. REGISTERING, &c., APPARATUS, E. de Jong, Manchester.—*19th March*, 1878.
1095. REFRIGERATORS, W. R. Lake, Southampton-buildings, London.—*19th March*, 1878.
1097. PNEUMATIC ARRANGEMENTS, J. W. T. Cadett, Camberwell-grove, London.—*19th March*, 1878.
1083. WASHING MACHINES, J. Smith, King-street, and J. Smith, Corporation-street, Wigan.—*19th March*, 1878.
1112. REMOVING MOISTURE, T. J. Smith, Fleet-street, London.—*20th March*, 1878.
1121. VESSELS for BREWING, J. Tenwick, Spittlegate.—*21st March*, 1878.
1122. REGULATING, &c., APPARATUS, J. Siddeley and F. N. Mackay, Liverpool.—*21st March*, 1878.
1248. INSULATORS, J. Oppenheimer, Manchester.—*29th March*, 1878.
1285. IMITATION LEATHER, B. Beer, Berlin.—*1st April*, 1878.
1336. SALT, J. H. W. Biggs, Brown's-buildings, Liverpool.—*4th April*, 1878.

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

974. STEAM ENGINES, P. W. Willans, Granville Park, Blackheath.—*19th March*, 1874.
1013. TRAIN SIGNALLING, E. Tyer, Old Jewry-chambers, London.—*23rd March*, 1874.
1105. SHIPS' BERTHS, J. Dewar, Liverpool.—*30th March*, 1874.
975. CHAINS, A. M. Clark, Chancery-lane, London.—*9th March*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 8th April, 1881.

4656. LUBRICATING APPARATUS, W. P. Thompson, High Holborn, London.—Com. from J. V. and J. J. Renchard.—*12th November*, 1880.
4675. FOLDING COUCH, A. and E. Lloyd, Charlotte-street, London.—*13th November*, 1880.
4688. CIGAR CLIPPER, F. H. F. Engel, Hamburg.—A communication from J. W. Wohlers.—*13th November*, 1880.
4689. WINDLASSES, J. Waters, Port Isaac.—*13th November*, 1880.
4692. STANDS, &c., P. Jensen, Chancery-lane, London.—Com. from E. A. Nilson.—*13th November*, 1880.
4694. REGISTERING, &c., E. Braubach, East India Avenue, London.—*13th November*, 1880.
4697. RIBBING APPARATUS, W. H. Beck, Cannon-street, London.—*15th November*, 1880.
4702. BUTTONS, F. Engel, Hamburg.—A communication from E. Loewenthal.—*15th November*, 1880.
4703. TWISTING MACHINES, J. E. Heppenstall, Milnsbridge, near Huddesfield.—*15th November*, 1880.
4713. BRACES, G. W. von Nawrocki, Leipziger-strasse, Berlin.—Com. from C. M. Römpler.—*16th November*, 1880.
4715. PAPER FOLDING, W. Conquest, Tudor-street, London.—A communication from L. C. Crowell.—*16th November*, 1880.
4722. BRICKS, F. Wirth, Frankfort-on-the-Main.—A communication from C. Grünzweig and P. Hartmann.—*16th November*, 1880.
4736. WEIGHING DEVICES, B. J. B. Mills, Southampton-buildings, London.—Com. from F. W. Minck and M Quenstedt.—*17th November*, 1880.
4749. SHAPING SOAP, J. O'Keeffe and W. Robertson, Liverpool.—*18th November*, 1880.
4754. STEERING GEAR, R. Wotherspoon, Liverpool.—*18th November*, 1880.
4755. ELECTRIC LAMPS, J. A. Berly, Relf-road, Peckham Rye, and D. Hulett, High Holborn, London.—*18th November*, 1880.
4763. TRICYCLES, &c., C. G. Hawkins, Leighton-road, Forest Gate.—*18th November*, 1880.
4770. SAFETY VALVES, P. M. Justice, Southampton-buildings, London.—A communication from J. Barbe.—*19th November*, 1880.
4843. CURTAINS, &c., G. Moore, Oxford-square, Hyde Park, London.—*22nd November*, 1880.
4857. BRACE BUCKLES, T. Walker, Birmingham.—*23rd November*, 1880.
4895. MOTIVE POWER, W. P. Kelly, Mount Brandon, near Graigue.—*25th November*, 1880.
5153. PROPULSION, C. O. Rogers, Old Broad-street, London.—A communication from W. S. Welton.—*9th December*, 1880.
5154. WINDING GEAR, R. Hitchcock, Albemarle-terrace, Taunton.—*9th December*, 1880.
5163. LOOMS, J. Williamson and J. and G. Swindells, Lancaster.—*10th December*, 1880.
5178. HORSE-SHOE NAILS, H. P. Fenby, Leeds.—*10th December*, 1880.
5456. ROTARY PUMPS, G. Waller, Holland-street, Southwark.—*28th December*, 1880.
5461. LITHOGRAPHIC MACHINES, W. C. Kritch, Leeds.—*28th December*, 1880.
5498. CAST IRON, J. J. Shedlock, Uxbridge, London.—*30th December*, 1880.
5504. SULPHATE of AMMONIA, W. L. Wise, Whitehall-place, London.—A communication from Dr. H. Grouven.—*31st December*, 1880.
85. PAPER, &c., W. B. Fitch, Coleman-street, and H. Barton, Queenhithe, London.—*7th January*, 1881.
592. COMBS, &c., T. R. Harding, Globe-road, Leeds.—*10th February*, 1881.
608. GLUE, A. J. Boult, High Holborn, London.—Com. from Dr. Hagen and F. Seltsam.—*12th February*, 1881.
663. TELEPHONIC APPARATUS, P. M. Justice, Southampton-buildings, London.—Com. from H. R. Miller.—*16th February*, 1881.
727. FLUSHING DRAINS, S. H. Adams, Leeds.—*19th February*, 1881.
758. DRYING FABRICS, C. Heap, Rochdale.—*23rd February*, 1881.
813. FASTENING BROOCHES, &c., T. T. Powell, Harrogate.—*25th February*, 1881.
827. TYPE WRITING MACHINES, P. M. Justice, Southampton-buildings, London.—A communication from T. Hall.—*26th February*, 1881.
837. KNITTED FABRICS, F. Caldwell, Loughborough.—*28th February*, 1881.
843. CARDS, &c., H. J. Haddan, Strand, London.—Com. from J. Lewis and F. A. Brown.—*28th February*, 1881.
866. STEAM BOILERS, T. Moy, Farringdon-street, London.—*1st March*, 1881.
875. CONCRETE, &c., H. Jaija, Great Queen-street, London.—*1st March*, 1881.
896. CAMPHOR, W. H. Atkinson, Camberwell-road, London.—*2nd March*, 1881.

Last day for filing opposition, 13th April, 1881.

4708. SOUNDING APPARATUS, R. and J. Jones, Rhyl.—*16th November*, 1880.
4711. TABLETS, C. D. Abel, Southampton-bulldings, London.—A communication from E. Thieben.—*16th November*, 1880.
4716. AUTOGRAPHIC PRINTING, E. Edwards, Southampton-buildings, London.—A communication from O. Steuer.—*16th November*, 1880.
4726. PUGGING MILLS, R. R. Gubbins, Park-road, New Cross.—*16th November*, 1880.
4730. SAFETY VALVES, C. Stuart, Fenny Stratford.—*17th November*, 1880.
4731. STEAM VALVES, C. Stuart, Fenny Stratford.—*17th November*, 1880.
4735. SYPHONS, &c., D. Brown, Huddersfield.—*17th November*, 1880.
4752. CUTTING, &c., STONE, J. Holgate, Burnley.—*18th November*, 1880.
4756. SPRING MATTRESSES, J. B. Rowcliffe, Glossop.—*18th November*, 1880.
4757. TRAMCAR ENGINES, J. Hall, Manchester.—*18th November*, 1880.
4759. STEAM BOILERS, J. Proctor, Burnley.—*18th November*, 1880.
4761. GRATES, &c., H. Thompson, Marquis-road, Islington, London.—*18th November*, 1880.
4766. LOCKS, &c., T. E. Julian, Kennington Park-road, London.—*18th November*, 1880.
4778. DRYING FELTS, E. Dordet, St. Junien, France.—*19th November*, 1880.
4779. ELECTRO-MAGNETIC APPARATUS, F. Harmant, Rue du Faubourg Saint Antoine, Paris.—*19th November*, 1880.
4781. WATCH CASES, W. R. Lake, Southampton-buildings, London.—A communication from Sir A. von Loehr.—*19th November*, 1880.
4782. COUNTING APPARATUS, H. Ferguson, Boyson-road, Camberwell, and H. R. Kempe, Barnet.—*19th November*, 1880.
4784. ALIMENTARY MATERIAL, J. McWilliam, Mansion House-chambers, London.—Com. from A. W. Armstrong.—*19th November*, 1880.
4793. BUTTONS, &c., T. Fairley, Birmingham.—*19th November*, 1880.
4794. BOXES, W. R. Lake, Southampton-buildings, London.—A communication from P. Lehmann.—*19th November*, 1880.
4800. PROPELLERS, E. G. Brewer, Chancery-lane, London.—Com. from R. Smith.—*20th November*, 1880.
4805. CORDS, J. and W. Schofield and J. E. Bentley, Littleborough.—*20th November*, 1880.
4811. GRINDING, R. R. Gubbins, Park-road, New Cross.—*20th November*, 1880.
4818. SHARPENING PENCILS, W. R. Lake, Southampton-building, London.—Com. from F. F. Kullrich.—*20th November*, 1880.
4819. GAS ENGINES, H. L. Müller and W. Adkins, Birmingham.—*20th November*, 1880.
4833. DETECTING APPARATUS, E. H. T. Liveing, Queen Anne-street, London.—*22nd November*, 1880.
4834. DOOR FURNITURE, J. Brownrigg, Windermere.—*22nd November*, 1880.
4849. COOKING APPARATUS, L. W. Leeds, Woburn-place, London.—*23rd November*, 1880.
4858. BREAKING FLAX, W. R. Lake, Southampton-buildings, London.—A communication from G. Milliken.—*23rd November*, 1880.
4887. SPEAKING TUBES, G. Jennings and E. G. Brewer, Stangate.—*24th November*, 1880.
4888. WASHING MACHINES, A. G. Collings and F. Bryant, Wimbledon.—*24th November*, 1880.
4902. LOOMS for WEAVING, J. Lyall, New York, U.S.—*25th November*, 1880.
4909. SHIPS' PUMPS, J. Edson, Boston, U.S.—*25th November*, 1880.
4927. CLOSING STONEWARE JARS, H. Doulton, High-street, Lambeth.—*26th November*, 1880.
4985. SODA, &c., T. Morgan, Cockspur-street, London.—Com. from N. Glouchoff.—*30th November*, 1880.
4997. DOORWAYS, &c., W. Morgan-Brown, Southampton-buildings, London.—Com. from G. B. Thompson—*1st December*, 1880.
5009. CHILLED ROLLS, F. Wirth, Frankfort-on-the-Main.—Com. from C. Haubold.—*1st December*, 1880.
5017. RAILROAD WAGONS, W. Morgan-Brown, Southampton-buildings, London.—Com. from J. Montgomery.—*2nd December*, 1880.
5062. ENGINES, J. J. Miller and G. J. Tupp, Hammersmith, London.—*4th December*, 1880.
5065. METALLIC PLATES, B. Bloomer, Love-lane, Stourbridge.—*4th December*, 1880.

5289. Brakes, G. M. F. Molesworth, Bideford.—17*th December*, 1880.
5307. Rotary, &c., Motion, J. Frearson, Birmingham.—18*th December*, 1880.
5332. Preserving Meat, J. Eckart, München.—20*th December*, 1880.
5349. Castrating Horses, J. Scott, Craigends, Dennistoun.—Partly a com. from G. L. Matthew.—21*st December*, 1880.
5477. Saddle Bars, Sir T. Dancer and E. Chappell, Burton-hill, Malmesbury.—29*th December*, 1880.
355. Treating Rags, &c., C. W. Smith, Aston, near Birmingham.—26*th January*, 1881.
449. Valves, R. Schran, Northumberland-street, Strand, London.—Com. from E. Schenson.—2*nd February*, 1881.
539. Electric Lamps, E. G. Brewer, Chancery-lane, London.—Com. from T. A. Edison.—8*th February*, 1881.
562. Carbon Lamps, P. Jensen, Chancery-lane, London.—Com. from T. A. Edison.—9*th February*, 1881.
652. Friction Apparatus, J. Walter, Leadenhall-street, London.—Com. from M. Hime and Co.—15*th February*, 1881.
748. Drying Apparatus, B. J. B. Mills, Southampton-buildings, London.—Com. from L. A. Fernow.—22*nd February*, 1881.
790. Heating Apparatus, G. E. Vaughan, Chancery-lane, London.—Com. from G. M. Thomson.—24*th February*, 1881.
797. Life Buoys, R. Whitby, Greenwich.—24*th February*, 1881.
876. Cleaning Bottles, W. R. Lake, Southampton-buildings, London.—Com. from J. M. Hoyt.—1*st March*, 1881.
887. Journals, J. Imray, Southampton-buildings, London.—Com. from R. Jones.—2*nd March*, 1881.
888. Drying Fabrics, J. Smith, Thornliebank.—2*nd March*, 1881.
894. Electric Lamps, J. J. Sachs, Sunbury.—2*nd March*, 1881.
899. Valves, &c., W. Wright, Plymouth.—2*nd March*, 1881.
912. Sliding Window Sashes, R. Adams, Great Dover-street, Southwark.—3*rd March*, 1881.
924. Cast Iron Pillars, H. J. Harrison, Liverpool.—4*th March*, 1881.
929. Velocipedes, J. Hopwood, Heaton Norris.—4*th March*, 1881.
938. Colouring Matters, C. D. Abel, Southampton-buildings, London.—Com. from Messrs. Bindschedler and Busch.—4*th March*, 1881.
939. Colouring Matters, C. D. Abel, Southampton-buildings, London.—Com. from Messrs. Bindchedler and Busch.—4*th March*, 1881.
1093. Governors, A. M. Clark, Chancery-lane, London.—Com. from W. E. Gwyer.—14*th March*, 1881.
1144. Refrigerators, H. J. Haddan, Strand, London.—Com. from J. H. Forshay.—16*th March*, 1881.

Patents Sealed

List of Letters Patent which passed the Great Seal on the 18th March, 1881.)

3381. Omnibuses, G. M. F. Molesworth, Northdown Hall, Bideford.—20*th August*, 1880.
3413. Digitoriums, W. and T. H. Lowe, Barnsbury, London.—23*rd August*, 1880.
3806. Buttons, H. J. Haddan, Strand, London.—20*th September*, 1880.
3813. Extracting Gold, J. P. Dunker, Glasgow.—20*th September*, 1880.
3814. Gas Ovens, T. Fletcher, Warrington.—20*th September*, 1880.
3818. Continuous Brakes, A. C. Boothby, Kirkcaldy.—21*st September*, 1880.
3819. Cloth, J. Cook and J. Turner, Manchester.—21*st September*, 1880.
3831. Folding Chairs, G. A. Dallas, Bethnal Green-road, London.—22*nd September*, 1880.
3832. Dynamo-electric Machines, W. Elmore, Blackfriars-road, London.—22*nd September*, 1880.
3836. Lever Escapements, J. Rattray, Dundee.—22*nd September*, 1880.
3838. Bands, S. Hirst, C. Earnshaw, and A. Holroyd, Marsden.—22*nd September*, 1880.
3851. Ploughs, P. M. Justice, Southampton-buildings, London.—23*rd September*, 1880.
3855. Cotton Cloths, J. Winter and T. Ivers, Farnworth.—23*rd September*, 1880.
3860. Steering, &c., J. Whittingham, The Cross, Nantwich.—23*rd September*, 1880.
3869. Gas Engines, J. R. Purssell, Kingston-road, Merton.—24*th September*, 1880.
3944. Looms for Weaving, A. F. Firth and J. Boothman, Bailiffe Bridge.—29*th September*, 1880.
3946. Railway Chairs, W. C. Wood, Barnard Castle.—29*th September*, 1880.
3953. Husking, &c., Grain, H. J. Haddan, Strand, London.—29*th September*, 1880.
4021. Engine Cylinders, H. Eaton, Portsea.—4*th October*, 1880.
4049. Dynamo, &c., Machines, A. W. L. Reddie, Chancery-lane, London.—5*th October*, 1880.
4076. Regulating Apparatus, W. H. Thomas, Parliament-street. London.—7*th October*, 1880.
4344. Lighting, &c., Lamps, G. P. Ganster, Reading.—25*th October*, 1880.
4430. Sewing Machines, S. Keats, Leeds, and A. Keats, Worship-street, London.—29*th October*, 1880.
5272. Sawing Machines, E. Rayner, Liverpool.—16*th December*, 1880.
5302. Reels, W. H. Harfield, Mansion House-buildings, London.—17*th December*, 1880.
5392. Microscopes, J. M. Moss, Patricroft.—22*nd December*, 1880.
5405. Cutter-holders, F. M. Newton, Eton College, Eton.—23*rd December*, 1880.
5446. Ordnance, Sir W. G. Armstrong, Newcastle-upon-Tyne.—28*th December*, 1880.
97. Knitting Machinery, I. Stubley, Leicester.—8*th January*, 1881.
123. Fastening Handles, F. Ryland, West Bromwich.—11*th January*, 1881.
229. Restoring Waste Vulcanised India-rubber, H. H. Lake.—18*th January*, 1881.
274. Watches, W. R. Lake, Southampton-buildings, London.—21*st January*, 1881.

(*List of Letters Patent which passed the Great Seal on the 22nd March*, 1881.)

3863. Damping Tables, J. Harper, Clerkenwell, London.—23*rd September*, 1880.
3865. Illuminating Apparatus, F. Weston, Chryssell-road, Brixton.—24*th September*, 1880.
3889. Lubricants, E. Parr, Bradford.—25*th September*, 1880.
3890. Sewing Books, W. Morgan-Brown, Southampton-buildings, London.—25*th September*, 1880.
3891. Treating Sugar, A. and J. D. Scott and T. R. Ogilvie, Greenock,—25*th September*, 1880.
3903. Condensing Apparatus, T. W. Duffy and T. L. Makin.—27*th September*, 1880.
3908. Soap, P. M. Justice, Southampton-buildings, London.—27*th September*, 1880.
3910. Knife Cleaning, H. Woodward, Regent's Park, London.—27*th September*, 1880.
3912. Roving Frames, T. E. Smith, Royd Works, Keighley.—27*th September*, 1880.
3918. Curing Diphtheria, F. van Sandau, King-street, London—27*th September*, 1880.
3933. Rails, E. Rider, New York, U.S.—28*th September*, 1880.
3939. Thermometers, E. H. T. Liveing, Queen Anne-street, London.—29*th September*, 1880.
3948. Targets, L. J. Crossley, Halifax.—29*th September*, 1880.
3951. Cog Wheels, &c., A. B. Childs, Fenchurch-street, London.—29*th September*, 1880.
3958. Measuring, &c., J. Milner, Alderney-street, Pimlico, London.—30*th September*, 1880.
3959. Paper-making Machines, C. Herbert and J. Loch, Edinburgh.—30*th September*, 1880.
3969. Seeds, A. Steenberg, Copenhagen.—30*th September*, 1880.
3980. Motors, P. Jensen, Chancery-lane, London—1*st October*, 1880.
4018. Exercising Apparatus, J. M. Smith, Southampton-buildings, London.—4*th October*, 1880.
4108. Pickers, F. Mitchell, Openshaw, and J. Mitchell, Southport.—9*th October*, 1880.
4709. Cast Iron Slag Boxes, M. and J. Cornthwaite, Parton.—16*th November*, 1880.
5000. Rag Engine, R. K. Miller, Edinburgh.—1*st December*, 1880.
5159. Straining Paper Pulp, A. Paisley, Lanark, N.B.—10*th December*, 1880.
5180. Alkali Salts, J. A. Dixon, West George-street, Glasgow.—11*th December*, 1880.
5327. Colouring Matters, J. A. Dixon, West George-street, Glasgow.—20*th December*, 1880.
9. Railway Vehicles, H. H. Lake, Southampton-buildings, London.—1*st January*, 1881.

List of Specifications published during the week ending March 19th, 1881.

2227*, 4d.; 2334, 4d.; 2635, 6d.; 2669, 6d.; 2742, 6d.; 2765, 6d.; 2776, 4d.; 2778, 6d.; 2847, 6d.; 2874, 6d.; 2965, 6d.; 2985, 6d.; 3024, 6d.; 3035, 6d.; 3048, 2d.; 3098, 6d.; 3129, 6d.; 3149, 6d.; 3152, 6d.; 3172, 6d.; 3177, 6d.; 3179, 6d.; 3187, 6d.; 3189, 6d.; 3198, 6d.; 3209, 6d.; 3210, 6d.; 3211, 4d.; 3212, 6d.; 3215, 6d.; 3232, 8d.; 3237, 6d.; 3243, 1s.; 3248, 4d.; 3249, 6d.; 3252, 6d.; 3253, 6d.; 3254, 4d.; 3258, 8d.; 3259, 8d.; 3278, 6d.; 3284, 6d.; 3287, 6d.; 3288, 6d.; 3290, 6d.; 3300, 6d.; 3304, 2d.; 3306, 2d.; 3307, 2d.; 3308, 2d.; 3310, 4d.; 3314, 2d.; 3315, 6d.; 3320, 4d.; 3226, 2d.; 3329, 6d.; 3330, 4d.; 3331, 6d.; 3332, 2d.; 3333, 6d.; 3334, 2d.; 3336, 2d.; 3337, 4d.; 3338, 6d.; 3340, 2d.; 3341, 6d.; 3342, 2d.; 3345, 6d.; 3346, 4d.; 3349, 2d.; 3352, 4d.; 3357, 2d.; 3358, 2d.; 3359, 2d.; 3362, 2d.; 3365, 6d.; 3366, 4d.; 3369, 2d.; 3370, 2d.; 3371, 2d.; 3372, 4d.; 3373, 2d.; 3375, 2d.; 3376, 4d.; 3379, 6d.; 3383, 6d.; 3384, 2d.; 3388, 2d.; 3389, 2d.; 3990, 2d.; 3393, 2d.; 3394, 4d.; 4666, 6d.; 4866, 6d.; 5092, 4d.; 5133, 6d.; 5243, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

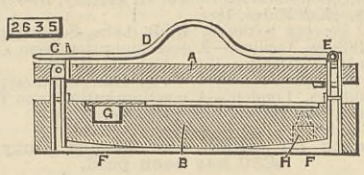
Prepared by ourselves expressly for The Engineer *at the office of Her Majesty's Commissioners of Patents.*

2334. Masks, *W. G. Forster and J. Leighton.—Dated 9th June*, 1880. 4*d.*

In order to produce masks for the face which will allow of the mobility of the features, a mould is made in plaster or other suitable material, and is then immersed or painted over with a solution of india-rubber until a film of sufficient thickness is obtained. This film is dried, and afterwards vulcanised, and can then be withdrawn from the mould.

2635. Presses for Copying, &c., *G. Lowry.—Dated 28th June*, 1880. 6*d.*

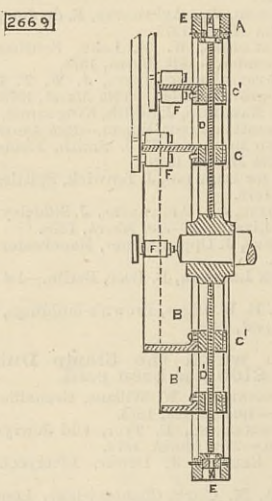
This consists of a method of applying the power to presses by means of springs and levers, or by levers only. The drawing shows an end view of the press closed, without the letter book being shown. A is the



upper plate, and B the lower plate; C is a catch; D is the handle, hinged at E; and F is a spring, the force of which is applied equally to both ends of the plates. G is a recess for water; H is a recess for liquid gum, ink, or other article required.

2669. Producing Variable Reciprocating and Rotative Motion, *G. Jones.—Dated 29th June*, 1880. 6d.

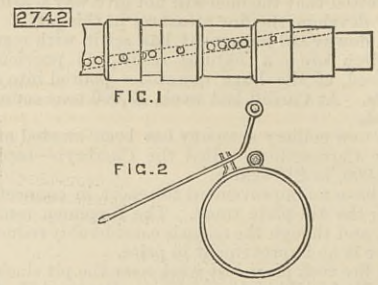
This consists in the application of an adjustable circular drum or drums to any rotative wheel or plate, so that the circular drums may be set out of centre with the rotative motion to produce any required length of reciprocating travel by means of rollers working in guides upon their circumference. A is a fly-wheel or other rotating wheel or plate, upon the face of which are fixed two circular perpendicularly projecting rims or drums B, B1. These drums or rims have lugs C C1 attached to their circumference, which



slide in the slotted arms of the fly-wheel, wheel, or plate. These lugs fit upon suitable spindles D D1 which have a thread cut upon them fitting in one of the aforesaid lugs C1 as a nut, and allowing the lug of the other drum to slide over the spindle. The spindles D, upon which the thread is cut, are brought through the rim of the wheel, where they terminate in the shape of a square head E, sunk in a recess in the rim of the wheel. By the application of a box spanner or key wrench to this square head, the screws D D1 may be revolved, and the circular drums B B1 may be moved excentrically out of centre with the wheel A. The motion of these excentric drums B B1 is made use of by means of the rollers F F on each side of the rim attached to suitable bars or rods G G.

2742. Making Casks or Barrels, *G. D. Terry.—Dated 5th July*, 1880. 6*d.*

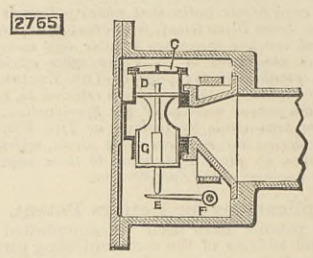
This relates to a machine to be adapted to make casks of different diameters and lengths. Instead of turning the pressure roller solid, it is made of a rod with loose collars secured by set screws, whose points are received in seats or in a V-groove cut spirally in the roller, so as to prevent the collars shifting laterally. By loosening the set screws, the collars may be readily adjusted along the roller to suit any desired number and position of the hoops. To enable the saws to be shifted along their spindle to any point between the spindle bearings and the belt pulley, to correspond to the length of the cask, the spindle is screw threaded, and the saws are fixed upon it between jam nuts and collars. If the machine be driven by hand power, stationary cutters would be used instead of circular saws. Fig. 1 shows a portion of the adjust-



able pressure roller, and Fig. 2 represents the cutters used in lieu of circular saws.

2765. Automatic Cut-off Valves, *G. Fletcher.—Dated 6th July*, 1880.—(*Partly a communication from J. H. Man.*) 6*d.*

This consists of an automatic cut-off valve for steam, air, and gas engines actuated by the difference of steam or other pressures on either side of such valve, and independent of any difference between the pressures on either side of the steam or other port. The cut-off valves on the back of the slide are con-



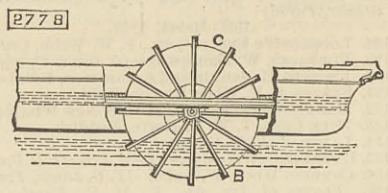
structed of two disc valves C. These valves work in cylindrical cases D, and are in contact with levers E, which are actuated by an ordinary governor moving the spindle F, so that the said disc valves act as throttle valves, one for each end of the cylinder.

2776. Automatic Vacuum Brake Machine, *T. W. Bailey.—Dated 7th July*, 1880.—(*Not proceeded with.*) 2*d.*

A supplementary vacuum chamber is used in connection with the air pump and cylinder by means of two pipes. In the centre of the chamber is a plunger working in guides, and to one end of which an india-rubber bellows-shaped cap is fastened, being also attached to the outside of the chamber. At the other end of the plunger is fastened a spring, also attached to the inside end of the chamber.

2778. Effecting Propulsion in Water, &c., *F. H. Holmes.—Dated 7th July*, 1880. 6*d.*

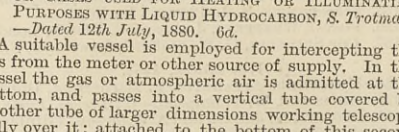
This consists in the use of hollow watertight paddle-wheels of such capacity and buoyancy as to be capable by their floatative power of supporting and carrying above the surface of the water a vessel or frame with its charge, and arranged so that on the said wheels being caused to revolve the vessel or frame is propelled.



In the drawing the wheels are shown submerged to the depth they would be when full loaded. Around the periphery of each wheel is arranged a series of paddles B, which are firmly attached to the arms C of the wheel, or they may be arranged to "feather" in a similar manner to ordinary feathering paddles.

2847. Locomotive and other Steam Boilers, *S. Perkins.—Dated 10th July*, 1880. 6*d.*

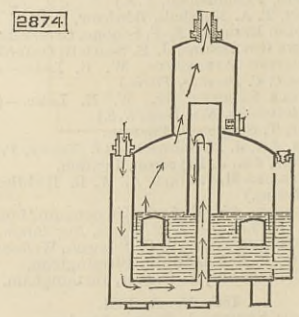
This consists in forming the sling stays of locomotive



and other steam boilers of two or more portions, so as to allow of their sliding one upon the other. The drawing shows one arrangement.

2874. Apparatus for Saturating Atmospheric Air or Gases used for Heating or Illuminating Purposes with Liquid Hydrocarbon, *S. Trotman.—Dated 12th July*, 1880. 6*d.*

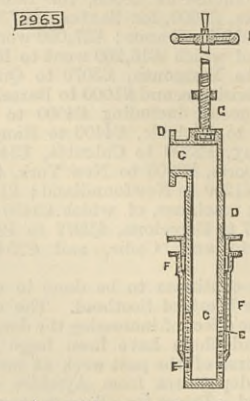
A suitable vessel is employed for intercepting the gas from the meter or other source of supply. In the vessel the gas or atmospheric air is admitted at the bottom, and passes into a vertical tube covered by another tube of larger dimensions working telescopically over it; attached to the bottom of this second tube, into which the gas passes freely, is a disc of the internal diameter of the case or nearly so. This disc is so supported by floats as to be always resting on the surface of the liquid hydrocarbon with which the vessel is filled, whatever its level may be. Thus the



gas, on entering the vertical tube, passes into the outer tube, and thence laterally underneath the disc and through the liquid hydrocarbon to escape at its extreme edge. On this edge of the disc is soldered a flange of suitable depth to prevent the escape of the gas otherwise than through a series of small holes round its extreme circumference, thus attenuating the bubbles or streams of gas and perfecting the saturation.

2965. Strainer Boxes, *R. Norton.—Dated 19th July*, 1880. 6*d.*

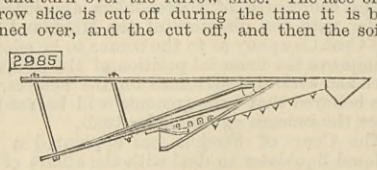
This consists in the application of a covering piece actuated by a screw or other convenient mechanism, so as both to scrape outside the perforations of an ordinary strainer box for the removal of impediments to the passage of the fluids strained, and also for regulating the amount of opening in the strainer box in such way as to enable a pump—applied to it—to suck to a lower level—without drawing air—than it could do with the ordinary strainer box. C is the passage of the bilge suction pipe D. E are perforations in the same pipe of such size as to allow of the passage of water, thin mud, or small particles of matter; F is a



sleeve pipe with a gland and stuffing box, whic sleeve pipe is capable of being moved up and down on the bilge suction pipe, by means of a screw G and the hand wheel H.

2985. Ploughing and Plough Moulds, *R. Sellar.—Dated 20th July*, 1880. 6*d.*

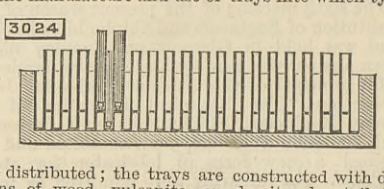
The drawing is a plan view of a swing plough having an improved mould board or breast adapted to cut and turn over the furrow slice. The face of the furrow slice is cut off during the time it is being turned over, and the cut off, and then the soil, is



allowed to fall into the furrow, whence it is pushed and lifted into position so as entirely to fill the space under the furrow slice. The mould boards or breast are provided with a series of cutting blades set at different angles on the exterior or acting side.

3024. Manufacture of Types and Typographic Apparatus, *J. Greene.—Dated 22nd July*, 1880. 6*d.*

The First part consists in means for producing a clear and permanently visible surface upon the legible or sunken letters or characters at the foot of the types when cast from the markers. A Second part relates to the manufacture and use of trays into which types



are distributed; the trays are constructed with divisions of wood, vulcanite, or ebonite, dovetailed or cemented into a skeleton frame, the bottom of such frame or tray being made of ebonite, vulcanite, or other material, upon whose surface the types will slip or slide freely. The drawing shows a transverse section of one of the trays.

3035. Preparation, Packing, and Storage of Fruits and Fruit Juice, *F. Wright.—Dated 23rd July*, 1880. 6*d.*

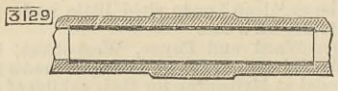
This relates to the application of an antiseptic fluid for the better preservation of delicate or easily-damaged fruits, and of an antiseptic atmosphere to the processes of mixing, filtering, and bottling fruit juice.

3048. Foil of Tin, Zinc, Lead, &c., *F. H. F. Engel.—Dated 24th July*, 1880.—(*A communication from T. Schnitzlein.*) 6*d.*

The foil is produced by bringing the metal in a molten state on to a pair of iron or steel rollers, which are made to revolve, and are adjustable, so as to regulate the thickness of the foil.

3129. Making Joints in Lead Pipes, *S. Bennett.—Dated 29th July*, 1880. 6*d.*

This consists in the use of a hollow core or lining pipe having a tinned surface for the purpose of



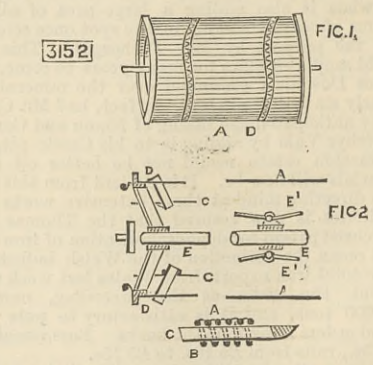
making a joint in or to lead pipes. The drawing shows a longitudinal section of joint made with the hollow core or lining pipe conjoined.

3149. Date Calendars, *D. Ross.—Dated 31st July*, 1880. 6*d.*

A dial bearing the names of the months has a pointer moving over it, such pointer carrying a wheel on its axis, gearing with a pinion, on the axis of which is a disc bearing the days of the week, which can be brought over a set of fixed figures representing the number of days in the month. The pointer wheel also actuates a set of four rollers so as to indicate the year.

3152. Screens for Separating Grain, Seed, &c., *H. Shield and W. M. Crockett.—Dated 31st July*, 1880. 6*d.*

This relates to means whereby the gauge of the mesh may be readily altered to suit different seeds or materials, and whereby the screen may be readily cleaned without the aid of a brush. Fig. 1 is an elevation of circular or rotary screen of straight wires, and Fig. 2 is a detail view showing interior of screen



for actuating wires. A are the screen wires, every alternate one being fixed, and the remainder loose; B corrugations which alter the mesh, same being arranged in a screw-shape round the screen; C double internal coil for moving corrugations; D double external coil; E boss on hollow shaft of the screen, on which are cast lugs for the attachment of the wires E1 which move the coil C.

3172. Purifying, Disinfecting, Drying, and Heating, *W. Lyon.—Dated 3rd August*, 1880. 6*d.*

The object of the invention is to disinfect wearing

apparel, bedding, and other articles without the use of any destructive chemical agent. The apparatus employed consists of a metal chamber with a door arranged to close steam-tight, by which the articles are introduced and withdrawn. To this chamber steam is conducted from the steam space of a high-pressure boiler. The walls of the chamber are made double, and into the space between them steam is also admitted.

3177. EXTINGUISHING FIRE, *N. Jarvie and W. Miller.—Dated 3rd August*, 1880. 6*d.*

This relates to improvements on patent No. 3648, A.D. 1879, and consists in rendering the apparatus less liable to derangement when being conveyed from place to place. For this purpose the acid bottle 12 is placed in a frame attached to the top of the vessel 14 containing the carbonate solution, and its mouth is closed by means of paraffine, wax, or other substance

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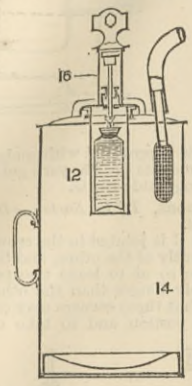

not easily acted on by the acid, by which means the acid cannot be made to get out by shaking. Over the mouth of the bottle is arranged a punch 16, by means of which the wax can be perforated, when the bottle is turned over, allowing the acid to mix with the carbonate solution; or the bottle may be inverted and the punch arranged beneath it, in which case the acid escapes at once without requiring the bottle to be turned over.

3179. UMBRELLAS AND PARASOLS, *F. H. F. Engel.—Dated 3rd August*, 1880.—(*A communication from M. Steib.*) 6*d.*

The spring caps for covering the runner notch and ends of stretchers of the closed umbrella are formed with a curved slot, ending in an enlarged circular opening, and sliding on a pin, such slot producing the turning and arresting of the ferrule automatically by drawing the latter upward towards the stick handle. The ribs and stretchers are attached to the top and runner notch rings by means of tongues formed on their ends, and taking into a bell-shaped ring secured to the rings and provided with slots to allow the passage of the ribs or stretchers, a cap being screwed over the rings to prevent the ribs dropping out. The top notch is fastened to the stick so as to be readily detachable.

3187. MACHINES FOR MOULDING AND PRESSING BRICKS AND TILES, *J. and T. Brittain.—Dated 4th August*, 1880. 6*d.*

This consists of an improved pug mill fitted with knives for forcing the clay (plastic) and delivering it in a straight line with the pug mill shaft, the shaft end terminating several inches before it reaches the end of delivery box of pug end; against this there is a disc wheel fitted with four die boxes for bricks, quarries, or tiles; in these dies there are pistons

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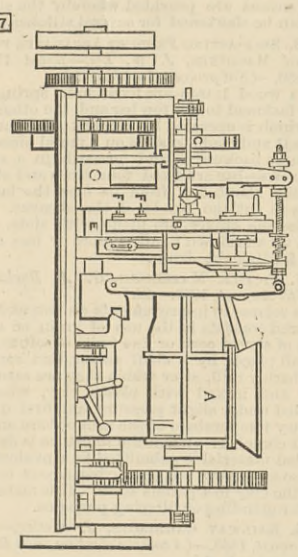

fitted, which dies can be changed to suit form and thickness required, whether front bricks, dust bricks, or quarries. A is the pug mill; B is the disc or mould to receive the largest sizes of dies the machine is capable of filling; C is part of the delivery apparatus which is worked from a cam on shaft E; D is a table on to which the bricks or tiles are delivered; F F are piston stalks in the moulds against which the press levers act when pressing.

3189. SCREW PROPELLERS FOR NAVIGABLE VESSELS, *J. Robertson.—Dated 4th August*, 1880. 6*d.*

This consists mainly and essentially in allowing or causing air or gas to flow in from the atmosphere to

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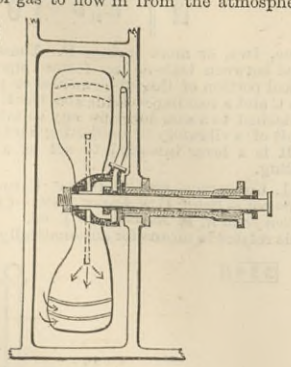

the partial vacuum formed in the forward side and following edges of the blade or blades of the propeller when in motion, and in the ways, ducts, channels, and apparatus for forcing, leading, conveying, and regulating the air onwards to the forward side or sides and following edges of the propeller blades to reduce or destroy the vacuum at the parts or positions on the propeller blades where its existence mainly causes retarding action or waste of the propelling power used. The admission of air to these parts, by reason of its low specific gravity as compared with water and quick-flowing qualities of air, and by the modifications of the propellers and apparatus for conveying and regulating forward the same, readily effect this end, and greatly increases the efficiency of propellers. The drawing is an end elevation of a four-bladed propeller.

3198. EMPLOYING STEAM IN STEAM ENGINES, *W. H. Beck.—Dated 4th August*, 1880.—(*A communication from J. C. and E. Crozet and A. Demenge.*) 6*d.*

This consists in taking steam at high pressure, expanding it down to the ordinary pressure, and in using the work of this expansion to draw away a part of the exhaust steam, and in utilising the mixture thus obtained for working any kind of steam engine. The apparatus consists of an ordinary cylinder A, a

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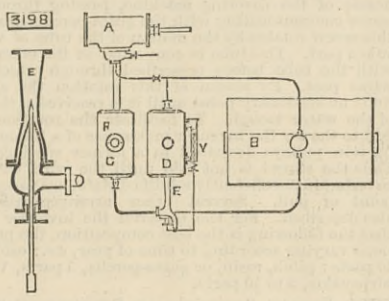

high-pressure steam generator B, a receiver C for exhaust steam, a mean pressure receiver D for the mixture of fluids at high and low pressure, an injector E, as shown in the second figure, to mix the fluids; pipes place this injector in communication with the generator and the two receivers. An equilibrium valve R is placed on the exhaust receiver C, and a regulator V maintains a constant pressure in the mean pressure receiver D.

3209. SPRING MOTORS, *E. A. Brydges.—Dated 5th August*, 1880.—(*A communication from J. Schreiber and F. H. Moldenhauer.*) 6*d.*

This relates to improvements in spring motors, whereby the superfluous power of the wound-up spring is applied for partially rewinding the spring in order to attain an equable distribution of the power applied. A is the spring drum, to which one end of the spring is attached; B is a toothed wheel attached

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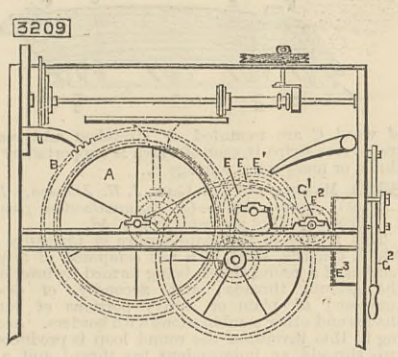
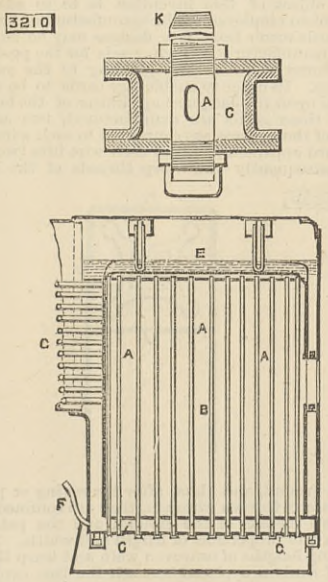


to the drum. On the other end of the shaft of the drum is another wheel gearing with F; wheels E and E^1 are keyed on the opposite end of the shaft of wheel F, the wheel E gears into the wheel B, and the wheel E^1 into the wheel E^2 on the shaft G^1. A pinion is keyed or otherwise attached to the shaft G^1, and is moved through the rack E^3 by means of the lever G^2.

3210. FIRE-BOXES FOR LOCOMOTIVE, MARINE, OR STATIONARY ENGINES, *D. McI. Reid.—Dated 5th August*, 1880. 6*d.*

In order to protect fire-boxes from the effects of the intense furnace heat, and also to absorb and economise the waste heat, a series of vertical tubes A are arranged round the fire-box B, extending from a small tank C under the fire grate up through the fire-box B and crown-plate E. The tank C is fed by pipes F from any convenient part of the boiler. The tank C rests on springs to admit of its yielding with the tubes A as they expand and contract. In front of the

3210



tube-plate there is a double row of tubes, so as to more effectually intercept and absorb the heat of the gases before passing into the boiler tubes G. The top ends of the tubes A are tapered and screw-threaded as shown at K in the second figure, and their bottom ends are screwed where they pass through the top and bottom plates of tank C, lock nuts being fitted over their lower ends. The part of the tube within the tank is perforated to allow of the free circulation of water through them.

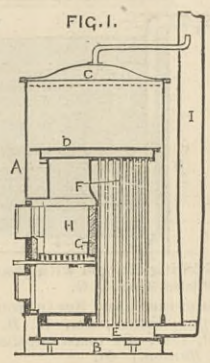
3211. SHIRTS, *L. Davis.—Dated 5th August*, 1880. 4*d.*

The shirt is cut out so as to abolish the shoulder yoke, and the body is strapped like a travelling overcoat, by which means the neck-band cannot slip under a false collar, and the strappings being more in the shape of the body and double, without seams in the wearing places, the wear and tear is greatly reduced. The cuffs are made double, so that when the outer one is dirty it can be folded back and show the under one.

3212. STEAM GENERATORS AND FURNACES, &c., *A. M. Clark.—Dated 5th August*, 1880.—(*A communication from J. B. Culver.*) 6*d.*

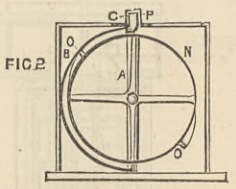
This relates, First, to steam generators wherein the heated gaseous products of combustion can be commingled with the steam for use as motive power or for heating purposes, or the steam and heated products separately used; Secondly, to engines for use with steam or other gases or fluids as the motive power. Fig. 1 is a central vertical section of the generator and furnace, and Fig. 2 is a sectional side elevation of the motor or rotary engine; A is the side of the boiler shell; B the bottom; and C the top. Within the boiler are the upper and lower smoke chambers D E. These are made in the form of hollow discs of circular form, and of a diameter somewhat less than that of the boiler, and are connected by vertical flue tubes F,

3212 FIG. 1.



which are placed closely together, sufficient space being left between them for the circulation of water. At the front part of the boiler the chambers D E are connected by partitions G that form the fire-box H. I is a pipe for carrying off the steam and products of combustion. In Fig. 2, A is a wheel carried by a shaft supported in bearings. The rim of the wheel is

3212 FIG. 2



formed with a broad, flat, outer surface, and upon this outer surface at opposite sides of the wheel are fixed abutments O O. B is the fixed steam way. At the upper end of the steam way is a pipe P for supplying the steam, gas, air, or other motive force: and in this pipe is a tubular valve or gate G, which has an opening at its lower end to the steam way B.

3215. BLEACHING, SCOURING, AND CLEANING, *W. Goode.—Dated 6th August*, 1880. 6*d.*

The fallers employed are made with their lower side concaved, and in it a number of cavities are formed vertically, each of less length than the depth

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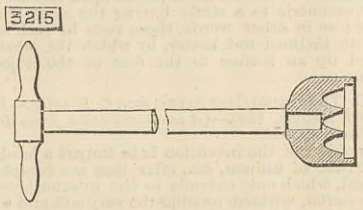
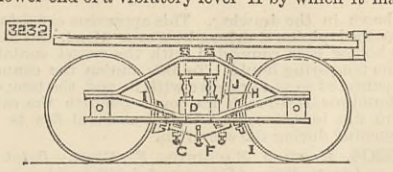


of the faller. The fallers thus formed may be mounted in a dolly tub or bleacher's vat, and cams and levers used to operate them. They effect a greater agitation of the suds or other liquid employed.

3232. BRAKE APPARATUS FOR RAILWAYS, *B. Hunt.—Dated 7th August*, 1880.—(*A communication from W. D. Ewart.*) 8*d.*

The principle of this invention consists in the utilisation of the frictional contact of the brake shoes and wheel treads in inducing the rotation of the wheels to act upon the brake shoes when presented in slight contact therewith, so as to draw or bring the parts into more forcible contact for the purpose of causing the brake shoes to act in turn on the wheels and stop their rotation. To the lower side of an under cross beam D are secured bearings for a rock shaft F, upon which near the ends are fastened the brake carrying frames G, and to it also is secured the lower end of a vibratory lever H by which it may

3232

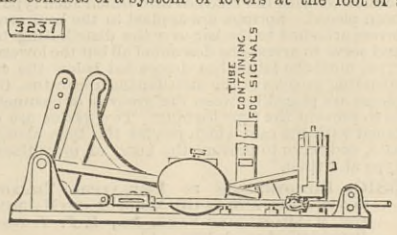


be rocked in either direction. To one side of the cross beam D is secured the lower end of a strong bar-spring J, the upper end of which engages with a lug on the arm H. Each brake frame is provided with lugs in which are set screws with jamb nuts, and operating as adjustable stops, so as to come in contact with the side frames of the car and control the extent of vibration of the brake frames on the rock shaft. In each end of the brake frames is arranged a sliding shaft, carrying at its projecting end a bearer with two parallel arbors, upon one or other of which the brake shoes I take a pivotal bearing according to the direction in which it works. The inner end of each sliding shaft is surrounded by a spring, and it is provided with two nuts, one serving as a stop, and the latter to bear upon the spring; each brake shoe I is recessed centrally at its back side in the direction of its length for the accommodation of the bearing head piece of the sliding shaft, and has also two semi-cylindrical cavities running crosswise for the accommodation of the two parallel arbors, and on one or other of which the brake shoe turns and bears when operating to brake the wheels. The bar spring keeps the brakes out of action. To apply them the upper end of lever H is vibrated, turning the brake frames G on the shaft F just sufficient to throw the brake shoes into frictional contact with the peripheries of the wheels, when by reason of such contact between the parts the moving peripheries of the wheels operate upon the brake shoes to draw them still further round, thus increasing the friction on the wheel and effecting the proper retardation thereof to cause the stoppage of the car.

3237. AUTOMATIC RAILWAY FOG SIGNAL APPARATUS, *H. Whitehead, R. Hodgson, and T. Dodd.—Dated 7th August*, 1880. 6*d.*

This consists of a system of levers at the foot of a

3237

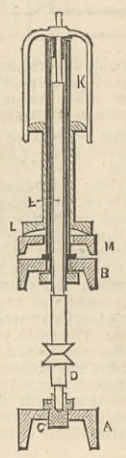


semaphore and connected with the signal. These levers are also connected to slide bars for carrying the fog signals. The fog signals are exploded by means of hammers actuated by the flange of the wheel of the engine.

3243. SPINNING AND DOUBLING COTTON, &c., *E. Hird.—Dated 9th August*, 1880. 1*s.*

The drawing is a side elevation of one of the improved combinations of spindle and elongated tube or collar with a bearing for supporting the top end of the spindle close to the flyer and the hollow loose tube. A is the bottom stationary rail provided with the footstep C for the spindle D to run in; B is a second stationary rail for supporting the elongated tube or collar E, which extends from the stationary rail B

3243



through the long hollow loose tube and the bobbin L which is over it and the travelling rail M which supports and gives the up-and-down motion to the bobbins to the underside of flyer K on the spindle D.

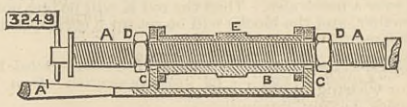
3248. CARBURETTING COAL GASES, *A. Specht.—Dated 9th August*, 1880.—(*A communication from P. Bischoff.*)—(*Not proceeded with.*) 4*d.*

The coal-gas enters a floating chamber, and flows through small pipes inclined downwards upon the volatile hydrocarbon. A thorough mixture of the vapours is thus effected, and the saturated gas passes into the main, and is conducted to the burners.

3249. REGULATORS FOR RAILWAY SIGNAL AND POINT RODS, &c., *J. Bates.—Dated 9th August*, 1880. 6*d.*

This relates to the construction and arrangement of regulators for adjusting or regulating the length of railway signal and point rods and other like connectors. A A^1 are the two ends of a divided connector or rod

3249

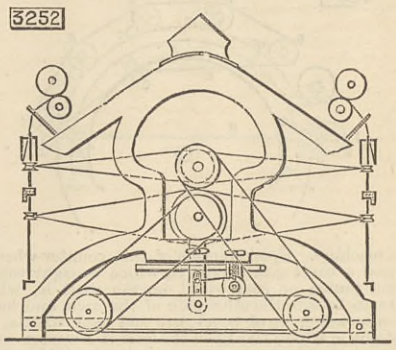


which are made to overlap. The end A only is screw-threaded and passes completely through the regulating or adjusting nut B, which is mounted so as to turn freely between the lugs C formed on the other end A^1 of the connector; D are lock nuts to secure the screwed end when adjusted. The nut B is formed with a hexagonal part E by which it can be turned by means of a spanner.

3252. SPINNING OR DRAWING MACHINERY, *J. Clough.—Dated 9th August*, 1880. 6*d.*

This consists in the method of driving the bobbins on the spindles of fly or throstle spinning or drawing machines at such relative and varying speeds as will cause the yarn or thread to be taken up and wound thereon by the spindles as it is delivered by the front

3252

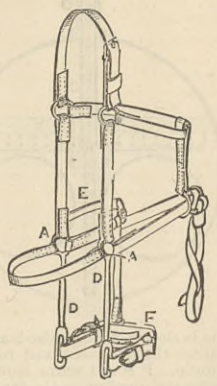


rollers, independently of the motion of the spindles, by a shaft provided with a cylinder or drums, or by other equivalent means, running at the required variable speed and driven by the intervention of any suitable means from the main shaft from which the spindles are directly driven.

3253. HALTER ATTACHMENT FOR THE PREVENTION OF CRIB BITING, *W. Clark.—Dated 9th August*, 1880.—(*A communication from A. Madden and C. Levey.*) 6*d.*

Rigid metal bars D are formed in one piece with a ring A that connects the side or cheek and nose and throat straps of the halter. The under jaw strap E is connected with the side straps, and from it is suspended

3253



a plate F which is connected to the lower end of the bars D. The plate F has in front a number of spikes covered by a spring plate, so that the spikes will not enter the animal unless considerable pressure is applied.

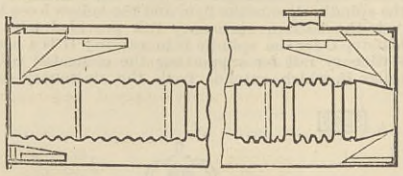
3254. MUSIC STOOLS, *W. Clark.—Dated 9th August*, 1880.—(*A communication from H. Jullien.*)—(*Not proceeded with.*) 4*d.*

The seat is always supported at three points by means of three elevating screws arranged in an equilateral triangle, and passing through nuts with teeth formed on their peripheries, over which passes an endless chain driven by a pinion attached to the central spindle of the stool.

3258. Tubes and Ring-plates for Steam Boiler Flues, &c., *J. A. and J. Hopkinson.—Dated 9th August*, 1880. 8*d*.

This consists chiefly in forming the plate rings or tubes with corrugated and plain surfaces combined, that is to say, with a portion or portions thereof corru-

3258

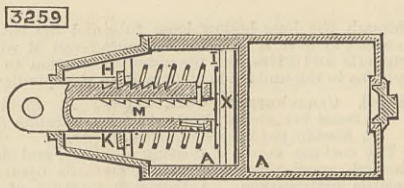


gated, and one or more portions plain or smooth, the plain or smooth portion or portions being designed to receive conical or other forms of circulating water tubes extending across or partly across the flues.

3259. Continuous Automatic Brakes, *W. L. Wise.—Dated 9th August*, 1880.—(*A communication from F. C. Glaser.*) 8*d*.

This consists in the combination and arrangement of the several parts of the brake apparatus, including an automatic block regulator, all in one cylinder to which the main pipe is directly connected. To apply the brake the pressure in the main pipe must be reduced either purposely or by the accidental separation of the train when the pressure under the valve, not being able to escape so rapidly, forces the valve upwards, and puts the two parts A A^1 of the cylinder in communication. The main piston X moves rapidly forward and applies the brake in the usual manner. To release the brake the pressure in the main pipe is restored, which forces the valve down and sets the part A in connection with the atmosphere. The automatic brake-block regulator consists of the pull or push rod K, into which enters the piston rod M.

3259



The rod K has a series of notches in which rest the regulating plates H and I. If through wear the rod K should travel further than the normal stroke of the piston, then the plate H will be stopped at the end of the cylinder, and rising over a tooth or projection will fall into the next notch. On the return of the piston the plate H is again stopped, holding the push rod out, but the piston, acted upon by the spiral spring, returns fully to the end of its stroke, moving the plate I over a notch also. Thus the rod K will be one notch further, and the blocks will be set up a corresponding distance.

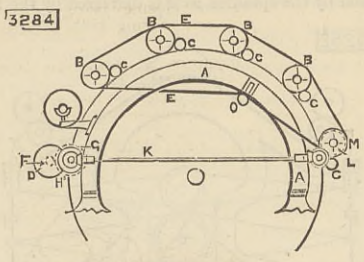
3278. Travelling Trunks, *L. A. Groth.—Dated 11th August*, 1880. — (*A communication from E. Stiebel.*) 6*d*.

The trunk is constructed so as to contain in a small bulk the most necessary furniture for a tent, as well as affording room for wearing apparel and domestic luggage and necessaries, having capabilities of being transformed into bedstead, stool, table, and washstand.

3284. Carding Machines, *H. H. Lake.—Dated 11th August*, 1880.—(*A communication from J. Wood.*) 6*d*.

The workers B, strippers C, and the doffer D are supported on the arch A. Instead of running the belt E for driving the workers around a pulley on the doffer shaft, as is commonly done, a spur pinion F is placed on the doffer shaft, and this gears into a counter-wheel G, which is supported on a stud on the arch of

3284

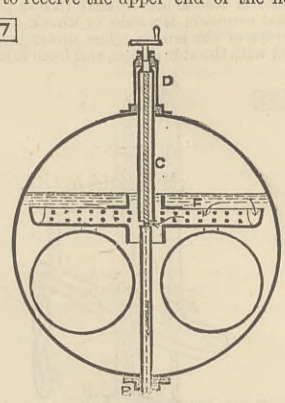


the machine. Upon one side of this counter-wheel is placed a bevel gear wheel H, which engages with a bevel pinion or gear wheel on the shaft K, which extends back to the other side of the arch, and has a corresponding set of bevel gear and spur wheels, the last one of which L is upon the axis of a worker as at M, and thereby motion is given to the said worker directly from the doffer, and thence motion is given to the other workers by a belt E, which may have a tightener O to maintain that speed between all the rest from the driver.

3287. Blow-off Apparatus for Steam Boilers, *S. Watkins.* - *Dated 12th August*, 1880. 6*d*.

The drawing is a transverse section through a double-flued Cornish boiler showing a hood-pipe arrangement. A stand pipe is fixed to the stool B; and C is the hood-pipe; D is a hollow mounting fixed on the top of the boiler to receive the upper end of the hood-pipe.

3287

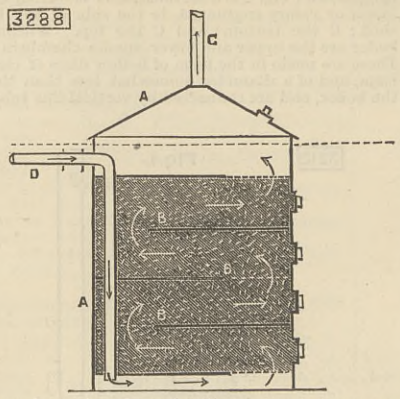


The hood-pipe is shown to be raised and lowered by means of a quick-threaded screwed rod rotated by a wheel and handle. F F are scum troughs extending across the boiler and resting on the flues, and extending also lengthway of the boiler at each side for any desired extent.

3288. Enriching or Purifying Gas, *J. Ireland.—Dated 12th August*, 1880. 6*d*.

The gas is freed from impurities, the brilliancy of the flame increased, its flow regulated to a certain extent, and the cost diminished. For this purpose the coal gas is passed through a combination of charcoal and gasoline, naphthaline, or other product of the distillation of petroleum or shale. The apparatus employed consists of a vessel A, formed with partitions B perforated alternately at opposite ends, and containing charcoal or other vehicle to hold the gasoline. The gas enters through the pipe D, and passes through the charcoal, which cleanses it of impurities,

3288

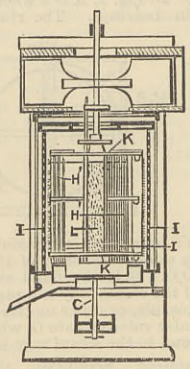


the gas becoming charged with gasoline in its passage, and finally passes out at G.

3290. Smutter and Separator Machines for Treating Wheat, &c., *W. B. Dell.—Dated 12th August*, 1880.—(*A communication from J. S. Leas and S. Hanson.*) 6*d*.

This consists in constructing the revolving beaters of smutter and separator machines of a series of vertical bars or rods alternating with brush surfaces. To the shaft C within the cylinder I are secured two heads K K, between which, at proper intervals, are secured metal strips H^1 H^1, dividing the outer circum-

3290

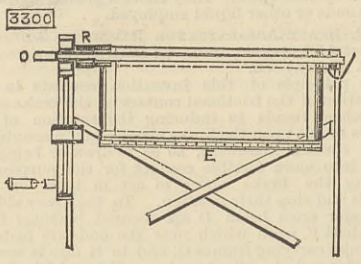


ference into alternate large and small spaces. In each of the small spaces is placed a brush L, and in each of the larger spaces is placed a series of vertical rods I1 I1. Each series of these rods is placed upon the arc of a circle excentric to a circle having the shaft C as a centre; or in other words, these rods in each series form an inclined rod beater, by which the wheat is carried up an incline to the face of the adjacent brush.

3300. Tempering Cast Steel, &c., *C. Kesseler.—Dated 13th August*, 1880.—(*A communication from D. W. Rennert.*) 6*d*.

The object of the invention is to impart a hardness to the tube of cannon, &c., after they are completely finished, which only extends to the interior layers of the material, without causing the very soft and tough cast steel to lose its toughness. The tubes are first heated in a special flame furnace with flat sole or bottom to a red heat, and then placed in the apparatus

3300



shown in the drawing. This apparatus consists of a toothed pinion R driven by a spur wheel, and having a hollow boss connected with the vessel containing the tempering liquid. To this pinion the cannon is connected so as to revolve with it, and the tempering liquid passes through its bore. Beneath the cannon are fire bars E, upon which a charcoal fire is kept burning during the operation.

3304. Washing Machines, *F. Mann.—Dated 14th August*, 1880.—(*Not proceeded with.*) 2*d*.

So as to cause a constant automatic circulation of water through the clothes being boiled, a dome of copper is placed in the vessel containing the clothes, and from its centre a pipe rises to within an inch or so of the top of the vessel, and near the top end several openings or spouts are formed, through which the water constantly flows.

3306. Portable Apparatus for Cutting Pipes or Bars, *J. Ingleby.—Dated 14th August*, 1880.—(*A communication from the Kalker Werkzeugmaschinenfabrik, L. W. Breuer, Schumacher, and Co.*)—(*Not proceeded with.*) 2*d*.

The pipe or bar is enclosed between a sleeve made in halves, which are then bolted together and set concentric with the pipe or bar. In a groove on the sleeve is a ring capable of revolving, and fitted with bevel teeth, with which gears a pinion on an axis mounted perpendicularly on one side of the sleeve. This axis is driven by a handle and causes the ring to revolve, the ring being fitted with a slide rest carrying the cutting tool.

3307. Apparatus for Indicating the Level of Water, &c., *H. R. A. Mallock.—Dated 14th August*, 1880.—(*Not proceeded with.*) 2*d*.

The apparatus is intended to enable the level of water to be ascertained at a distance from the vessel containing it. For this purpose a bell is submerged in the liquid, and from the upper part a small air-tight pipe leads to a pressure gauge in any convenient position.

3308. Distributing and Composing Type, *J. Dittrich and P. Ganty.—Dated 14th August*, 1880.—(*Not proceeded with.*) 2*d*.

To the recessed inclined plates gauging guides are so fitted and arranged as to arrest the progress of misplaced type too large to enter the grooves of channels connected with the recesses into which such type have been placed. Springs are applied to the bent arms or levers attached to the bar over the distributing table, and serve to arrest the descent of all but the lowermost type, until the latter has descended below the corresponding grooves of the distributing apparatus. Guide pieces are placed between the grooves or channels, so as to prevent the type turning. Two plates are combined with the cam which pushes the type along the case, and serve to prevent the entry of more than one type at a time.

3310. Improvements in Insulating Telegraph Conductors, and in the Mode of and Machinery for Manuacturing Same, &c., *E. T. Truman.—Dated 14th August*, 1880. 4*d*.

The object of the invention is to make the stranding and covering of the wire one continuous operation, instead of two as heretofore. The wires are wound on bobbins, which rotate with the disc on which they are fixed, and then led over pulleys, thence through a perforated plate which forms the entrance to a tube passing through a chamber containing the covering material, the tube is perforated to allow the material when hot to pass freely into the interior. The exit of the tube is formed of two plates, or plate and tube to lay the strand. The first plate is perforated in the same way as the entrance plate to the perforated tube, viz.: so that the wires pass each through its own hole; but the second plate has but one hole, and the wires being now covered with the material they are rendered quite solid. They are then, after being slightly twisted by hand, passed into a tube leading to the nozzle of the covering machine, passing through a screw communicating with the gutta-percha chamber this screw rotates by the motion of the tube of which it is a part. This tube is connected at its other end with the tube before prescribed through which the wires pass. By reason of this rotation the strand finds no stationary point until it is received at the end of the water trough. To facilitate the rotation and add to the lay the inventor makes use of a frame with friction pulleys described in a former specification. Thus the strand is not laid until the wire, with its covering in a sufficiently solidified state, has passed the point of pull. Several other arrangements are also described. For the material the inventor finds that the following is the best composition, the proportions varying according to time of year, &c.: ozokerit, 10 parts; pitch, resin, or gutta-percha, 5 parts, Venice turpentine, 5 to 10 parts.

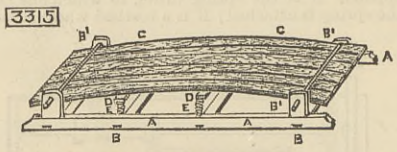
3314. Beating, Scouring, and Purifying Carpets, Rugs, &c., *J. Lea.—Dated 14th August*, 1880.—(*Not proceeded with.*) 2*d*.

A series of levers or beaters are pivotted on a shaft, and actuated by excentrics so as to cause them to strike the carpet which travels underneath them. Brushes are also provided, and revolve in contact with the upper and lower surfaces of the carpet, to which a suitable cleansing or scouring liquid is supplied from suitable tanks. The carpet then passes to a pair of wringing rollers, and is finally dried in a chamber heated by hot air, steam, or gas.

3315. Spring Mattresses, &c., *W. R. Lake.—Dated 14th August*, 1880.—(*A communication from the Erste Oesterreichische Thueren, Fenster und Fussboeden Fabriksgesellschaft.*) 6*d*.

A frame is formed of the longitudinal pieces A and the cross pieces B and B^1; in this frame elastic strips

3315



of wood C are mounted or stretched and rest on transverse strips D, each of which is supported by two, three, or more spiral springs E.

3320. Manufacture of Lace, *J. H. Johnson.* - *Dated 16th August*, 1880.—(*A communication from E. Dubout.*)—(*Not proceeded with.*) 4*d*.

This relates to the manufacture of Chantilly lace, which consists, First, of a net composed of loops or meshes of a round shape, being formed by interlacing the ground threads; and Secondly, of designs composed of plain or heavy portions of various shades and other combinations with borders. According to this invention the round loop is produced by two threads, an independent bar thread, and a fine bar thread, which are wound a certain number of times, and in the same direction around a bobbin thread; then at a given moment the independent bar thread rises to take the thread of the next bobbin, and returns at the same time as another independent bar thread, working upon this latter bobbin, descends to take the first bobbin thread. The heavy portions are obtained by the aid of the ground threads alone.

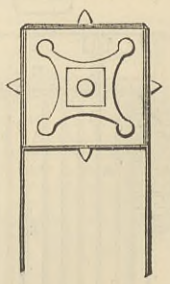
3326. Printers' Quoins, *W. Clark.—Dated 16th August*, 1880. - (*A communication from G. Scott, H. C. Beach, and F. S. Powers.—(Not proceeded with.*) 2*d*.

The quoin is composed of two pieces, viz., a box made in a slightly tapering form upon its sides, and a rack bar. In the top and bottom of the box recesses are formed to admit the end of a pinion key and allow it to revolve, in proper working contact with teeth formed on the inner side of the rack bar.

3329. Manufacture or Ornamentation of Leno, Muslin, &c., *A. Morton.—Dated 17th August*, 1880. 6*d*.

The object of this invention is to so adapt the mechanism employed in the manufacture of leno, &c., that cards made from lace designs may be employed in the manufacture of such goods for the production of patterns thereon corresponding to the said lace patterns. In order to enable lace cards to be used to operate upon the Jacquard apparatus of the looms in which these goods are manufactured, two adjacent cords of the harness are connected to each wire of the Jacquard apparatus, so that each wire lifts two cords, and consequently two warp threads of the leno or

3329



muslin ground, and thus, after the roving or pattern threads are thrown through, they are confined by at least two threads of the ground, and the pattern is kept in due proportion of length and width. To prevent long lengths of unwoven weft and warp threads, a set of cards are placed beneath the lace cards, and are so arranged that the second set prevents the raising of the harness at particular parts, and so causes the warp and weft threads to be woven together at these particular parts.

3330. Cinnamic Acid, &c., *J. H. Johnson.—Dated 17th August*, 1880.—(*A communication from H. Caro.*) 4*d*.

This consists in the preparation of cinnamic acid in dispensing with the use of both benzoic aldehyde and acetic anhydride by employing mixtures containing dichloride of benzylene and a metallic acetate, preferably dry acetate of sodium.

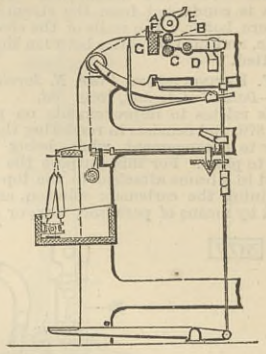
3332. Slates, *S. Jones.—Dated 17th August*, 1880.—(*A communication from R. A. Caffin.*)—(*Not proceeded with.*) 2*d*.

In order to grind or reduce the thickness of slates, they are passed between a series of rollers covered with emery and revolving at a high speed, a lateral movement being also imparted to them so as to prevent scratching.

3331. Machinery for Winding Yarn, *W. Knowles.—Dated 17th August*, 1880. 6*d*.

This relates partly to the method of winding yarn upon tubes or bobbins so as to enable the yarn so wound to cohere and retain its shape without the support of the end flanches of the ordinary bobbin upon which it is usually wound. A is the bobbin, B an intermediate roller, C the driving shaft, and D a weighted lever. The shaft C, which is fitted to revolve in suitable bearings, extends from end to end of the frame and drives a number of bobbins. The inter-

3331

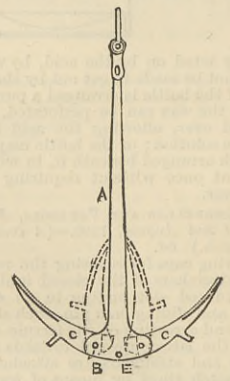


mediate roller is provided with gudgeons which enter grooves in brackets E. The yarn guides F are attached to a traversing guide bar G.

3333. Anchors, *T. E. Norton.—Dated 17th August*, 1880. 6*d*.

Each fluke C is jointed to the crown B of the shank A independently of the other, and the ends are cut off nearly square so as to leave two projecting corners, one preferably longer than the other. The crown is recessed so that these corners may each come against a projecting portion and so take off a considerable

3333



quantity of the strain from the pin. A hole E is made in the crown at right angles to the axis of the flukes when open, through which to place a buoy rope. The connecting pins of the flukes are preferably screwed. When folded for stowing the flukes lie very close against the shank.

3334. Overhead Sewing, *A. Storer.—Dated 17th August*, 1880.—(*A communication from L. and J. Bollmann*).—(*Not proceeded with.*) 2*d*.

This relates to improvements on patent, dated 11th August, 1879, and consists in substituting for the reel and slip clutch for taking up the slack thread, a hooked lever worked by a cam, and arranged so that when the shuttle moves through a certain part of its course the hook seizes the thread and draws it out as a loop, which it afterwards releases. So as to secure the stitching more firmly at each end of the seam, means are provided whereby the stroke of the feed can be shortened for several stitches.

3336. Self-acting Feeding Apparatus for Threshing Machines, *J. W. Lee.—Dated 17th August*, 1880.—(*Not proceeded with.*) 2*d*.

On a wood frame are fixed four springs, one end being fastened to the top bar and the other to a cross-bar, which is operated by a crank shaft, and is driven by a belt and made to slide on a metal piece secured to the frame backwards and forwards in a small circle. To the cross-bar are fixed four tines and also a second cross-bar about 3in. from its face, the latter having knives to cut the bands of the sheaves. The tines, and also the knives, are made with slots, and can be raised up and down to allow more or less corn to pass when feeding the drum.

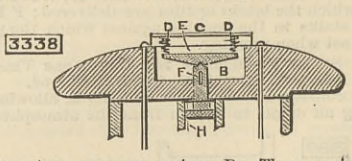
3337. Fictile Materials, *G. A. Buckholz.—Dated 17th August*, 1880. 4*d*.

This relates to improvements on patent No. 250, A.D. 1879, and consists in the use of grain or seeds, small pieces of sieved cork or fine twigs of soft wood reduced to small pieces by a chaff cutter, and rounded in a pearl barley mill, after which they are saturated with water and mixed with plastic clay, when they are moulded under slight pressure and first dried at the ordinary temperature of the atmosphere and then in a heated chamber. When the moisture is driven off the moulded material is submitted to a moderate furnace heat, so as to burn out the carbonaceous material and leave the clay in a porous state. This material may be used for grinding or filtering purposes.

3338. Railway Carriages, *J. Wetter.—Dated 17th August*, 1880.—(*A communication from R. A. Cowell.*) (*Complete.*) 6*d*.

In the drawing, B is end of the bed frame of a car, and which abuts against the next adjoining car; C is a supplemental or yielding platform. This is folded around the upper front and under surface of the portion B. The supplemental or yielding platform C is held in its outward extending position by the force

3338



of one, two, or more springs D. These springs are placed between trats or lugs formed upon the inside vertical portion of the supplemental or yielding platform C and a rocking bar E. The bar E is connected or attached to a cam bar F in any suitable manner to permit of a vibratory or oscillating motion to the bar E. H is a lever intended to act as a lock to the coupling.

3341. Couplings for Railway Carriages, *E. C. Bowen.—Dated 17th August*, 1880.—(*A communication from R. D. Morkill, jun.*) 6*d*.

This relates to means for automatically effecting the

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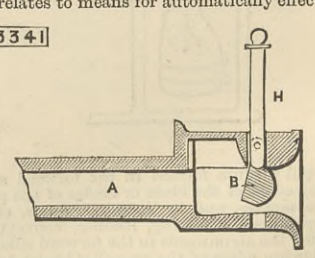


coupling of two carriages by moving them towards each other. The lower inner surface of the draw-bar A is inclined, and its upper interior surface is recessed and contains a pendant block B, which serves to

support a coupling pin H. When the link on the draw-bar of the other carriage enters the opening in A, it forces the block B backwards, and the pin H is free to fall into the link, such link being held in the required position by the block B of the other draw-bar.

3340. DISTILLATION OF ANTHRACENE FROM COAL TAR, &c., *G. Wischin.—Dated 17th August*, 1880.—(*Not proceeded with.*) 2*d.*

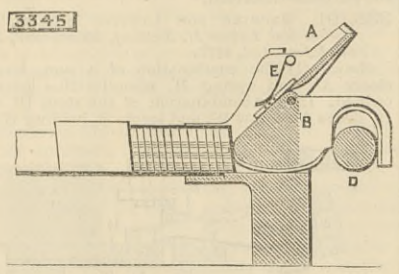
This relates to increasing the yield of anthracene and heavy oils from coal tar without coking the pitch, and consists in adding to the molten pitch creosote oil, anthracene or other hydrocarbon, which is injected into and intimately mixed with the heated pitch in the form of a fine spray.

3342. ABSORBENT AND DEODORISING POWDER, *T. B. Gibbs.—Dated 17th August*, 1880. 2*d.*

The powder is intended to absorb urine and the moisture in excrement, and deodorising the urine and excrement and fixing the ammonia therein, and for deodorising and absorbing the moisture in other putrescent or putrescible and moist matters. It consists of 300 parts by weight sulphate of lime, 99 parts soot or pulverised charcoal, and one part carbolic acid.

3345. DISTRIBUTING AND ARRANGING TYPES FOR PRINTING, *F. Wicks.—Dated 18th August*, 1880. 6*d.*

This relates to means whereby as the types are distributed they are arranged in proper order according to their kind, in proper position, for use in composing machines. The apparatus consists at its upper part of a receiver A, and at its lower part of an inclined guide formed mainly of a continuously-moving "kicker" B vibrating on a centre and actuated by a cam D. Each receptacle is inclined at an angle from side to side,



and also from the front downwards and inwards, to facilitate the manipulation of the letters, and there may be a brake E hung on a pin in the funnel to bear gently upon the types as they pass beneath, so as to prevent them entering the receptacles irregularly. A number of these receptacles corresponding to the different kind of type may be arranged in rows to correspond with the keyboard of the composing machine.

3346. MATRICES FOR PRODUCING STEREOTYPE PLATES, *F. Wicks.—Dated 18th August*, 1880. 4*d.*

For the matrix a paper is used formed of extremely fine and long fibres, so that these fibres become not only closely compacted together, but by extending across a large area cause the paper to approximate the condition of a textile fabric in the quality of continuity.

3349. UMBRELLAS AND PARASOLS, *W. Pickering.—Dated 11th August*, 1880.—(*Not proceeded with.*) 2*d.*

A rotary notch is employed, and as well as the runner is mounted loose on the stick, so that they can yield or revolve together should the umbrella encounter any obstruction tending to turn or twist the frame. In umbrellas with loose covers arranged to be readily removed and replaced, the apex of the cover is held down in its place upon the notch by a removable collar.

3352. REFINING OR PURIFYING ALCOHOL, &c., *W. R. Lake.—Dated 18th August*, 1880.—(*A communication from S. Roessler.*) 4*d.*

This relates to means for removing the matters which impart the objectionable colour and odour often possessed by alcoholic liquids, animal fats, or mineral oils and vegetable wax, and it consists in causing the alcoholic liquids and the fat or other substance to act upon each other.

3357. REGULATING THE SPEED OF STEAM AND OTHER ENGINES, *W. R. Lake.—Dated 18th August*, 1880.—(*A communication from J. B. Sheppard.*)—(*Not proceeded with.*) 2*d.*

A flexible diaphragm is placed in an elliptical case which it divides into two compartments. To its centre is attached a rod, the outer end of which is attached to the throttle valve lever. The diaphragm case has two ports communicating with a valve designed to control the supply of steam to either side of the diaphragm as required.

3358. DIALLING AND SURVEYING, *W. E. Garforth.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

This consists principally of an improved adjustable plumb-bob," for marking the exact position of the centre of the dial on the roof of the underground passage when dialling for mining and tunnelling purposes.

3359. APPLYING SEVERAL COLOURS TO ANY SURFACE SIMULTANEOUSLY, *D. T. Powell.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

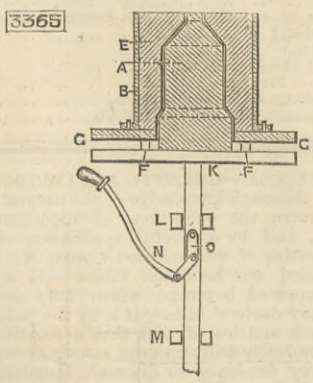
An ink-table divided into two, three, or more channels is attached to the bed of the printing machine. Movable strips are arranged in these channels so as to correspond with the lines of type to be inked, and these strips are supplied with the different colours by means of rollers. The inking rollers then travel over the strips and take up the colours which they supply to the type.

3362. AERATED BEVERAGES, *T. Welton.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

An infusion of malt prepared in the ordinary way is charged or impregnated with nitrogen gas and used as a beverage.

3365. FORMING MOULDS FOR CASTINGS, *H. J. Haddan.—Dated 19th August*, 1880.—(*A communication from H. J. Hand.*) 6*d.*

This relates to the method of forming moulds, which consists in ramming the sand contiguous to the



pattern, and venting the exterior unrammed sand. The drawing shows a vertical section of a machine and flask, with the pattern and sand contained therein. A is the pattern, B the metallic flask which surrounds it having its side equidistant at all points from the pattern A, and having grooves or channels formed with open sides towards the pattern. E is the sand mixed with an agglutinating fluid; F, tapering venting blades or needles, the smaller ends of which are upward. G is a horizontal plate, upon which the bottom of the flask B rests. The pattern A and needles F are fastened at their lower ends to a frame K working smoothly and accurately in a vertical direction in guides L and M by a lever N and link O; or it may be raised by a rack and pinion, a toothed sector or segment, or a cam.

3366. OBTAINING STARCHY AND GLUTINOUS MATTERS FROM INDIAN CORN OR MAIZE, *W. R. Lake.—Dated 19th August*, 1880.—(*A communication from T. A. Jebb and L. J. Bennett.*) 4*d.*

The glutinous matter is separated from the starchy matter of corn or maize in a dry state by subjecting the corn to whipping or beating, whereby the outer glutinous portions of the kernel and the hull are broken into coarse pieces, and the inner starchy portion of the kernels is reduced to flour, when the two can be easily separated by sieves or bolts.

3369. DRIVING PROPELLERS MADE OF TWO SCREWS ON CONCENTRIC SHAFTING, *C. S. de Bay.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

In driving two screws on concentric shafting a hollow shaft surrounds the solid one and is driven in the opposite direction, the solid one being driven by the main engine shaft, and the hollow one by first transmitting the movement of the engine shaft to a shaft placed parallel to and above it, and gearing this auxiliary shaft with the hollow shaft by spur gearing.

3370. WRITING INSTRUMENT, *J. Nadal.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

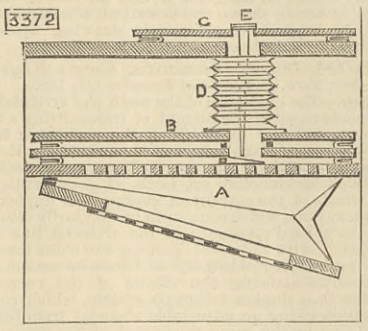
The penholder is tubular, and forms an ink reservoir, through which passes a wire, the lower end passing out through a small hole in the bottom and ending close to the point of the pen. The upper end passes out of the reservoir, and is fitted with a washer fitting over a hole in the top of the holder. When in writing the lower end of the wire rests on the paper, the washer at top is lifted, and allows air to enter the reservoir, thereby causing ink to flow to the pen.

3371. VENT PEG, *C. J. Gladman.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

The tap or vent peg is made with a metal body open at the bottom and closed at top, with a small hole cut near the top of side to admit air. A shoulder is formed round the outside to receive a cap, which terminates in a handle and has a groove cut in the inside, in which works a stop formed on the body just above the shoulder. A hole is cut in the cap to correspond with the one in the body, to admit air to the barrel.

3372. ORGAN HARMONIUMS, *P. Jensen.—Dated 19th August*, 1880.—(*A communication from E. Seches.*) 4*d.*

In this instrument free reeds and organ pipes are combined, the former being arranged in connection with a sounding board with movable sonorous cases. The pedals operated in the ordinary way act on the



bellows A, the air from which issues into the reservoir B of the pipe organ. The reservoir C of the reed harmonium communicates with B by a throat D which allows the air to enter C by means of a guide E fixed to the upper part of C.

3373. HELIOSTATS, *T. Anderson.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

A mirror is attached to a telescope, and can be set at any required angle, so as to reflect the sun's rays in a direction parallel to the axis of the telescope, and such mirror is mounted on a spring-rocking frame, so that by the pressure of the finger it can be made to oscillate from this position. A small screen is also attached to the telescope, on which, through a condensing lens, a portion of the light reflected from the mirror is brought to a focus.

3375. SHOES FOR HORSES, &c., *J. E. Stoker.—Dated 19th August*, 1880.—(*Not proceeded with.*) 2*d.*

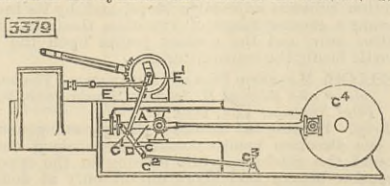
The shoes are cast in moulds and are formed with screwed holes to receive studs or spikes with screwed stems, when desired to give a firm hold on slippery roads.

3376. ASBESTOS SHEETS, &c., *S. Pitt.—Dated 19th August*, 1880.—(*A communication from H. W. Johns.*) 4*d.*

Fibrous or flaked asbestos is deposited to any desired thickness on an apron or sheet, and is coated on each side with a glutinous liquid, so as to make the fibres adhere to one another and form outside surfaces firmly united together, and containing between them a porous or loose centre. The sheet thus formed is attached to a sheet of hair felt, canvas, or paper, and forms an asbestos-lined sheet or felt fireproof.

3379. STEAM ENGINES, *D. Joy.—Dated 20th August*, 1880. 6*d.*

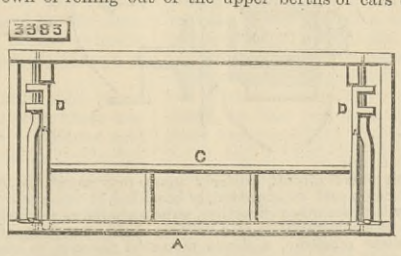
This relates to improvements on patent No. 929, dated 8th March, 1879, and consists partly in various modifications of the valve motion. The motion for the valve is taken from a continuation D of the connecting rod towards the cylinder end outside the centres. The



valve spindle E is connected to a point E^1 on the lever A inside its fulcrum; and in case of want of room below the centre of connecting rod in lieu of producing the lever C from C^1 to C^2 as shown, and connecting it with the fixed nut C^3, the connection may be made from C^1 to a point inside the crank centre C^4.

3383. SAFEGUARDS FOR SLEEPING BERTHS, *J. Wetter.—Dated 20th August*, 1880.—(*A communication from E. A. McMann.*) 6*d.*

This relates to means for preventing persons being thrown or rolling out of the upper berths of cars or



steamboats, and to prevent the berths from closing up and shutting the occupant in in case of accident. A is the front board of the berth, and in it is a narrow opening through which the guard slides when not in use. The guard C is hinged to sliding blocks D moving on vertical rods, and its upper rail has a latching device to hold it in position. The berth has a double bottom, the guard sliding in the spaee between them.

3384. SPILES AND VALVES FOR CASKS, &c., *W. Morgan, R. Crocker, and R. Brett.—Dated 20th August*, 1880.—(*Not proceeded with.*) 2*d.*

The object of this invention is to allow the escape of gas from the barrel and to admit air thereto above the liquid it contains. The spile is of T form, and is hollow, the lower end being connected to the barrel, while at one end of the cross-piece is inserted a porous plug, to allow the escape of gas, and the other end is fitted with a valve opening inwards, which, as the liquid is withdrawn, allows air to enter.

3388. INCREASING THE CIRCULATION OF WATER IN STEAM BOILERS, *J. G. Walton.—Dated 20th August*, 1880.—(*Not proceeded with.*) 2*d.*

The feed pipe is caused to pass into the boiler and traverse the portion where the circulation is considered to be most defective, at which spot the feed-water is made to act somewhat like an injector, and cause a better circulation of the water in the boiler.

3390. CUTTING AND ASSORTING TEA, *D. Whyte.—Dated 20th August*, 1880.—(*Not proceeded with.*) 2*d.*

A large vertical cylindrical vessel is fitted with a wire cloth bottom like a sieve, into which the tea to be cut is placed, and subjected to a rubbing action by means of arms covered with wire cloth and revolving close to the surface of the sieve.

3393. REFRACTORY MATERIALS FOR CONVERTER OR FURNACE LININGS, CRUCIBLES, &c., *H. Wedekind.—Dated 20th August*, 1880.—(*A communication from H. Bollinger.*)—(*Not proceeded with.*) 2*d.*

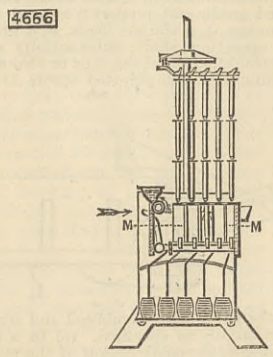
These linings or crucibles are made of asbestos or serpentine, to one or both of which soluble glass is added to secure the requisite plasticity.

3394. INOXIDISABLE ALLOY, *P. de Villiers.—Dated 20th August*, 1880. 4*d.*

This relates to an alloy and to a process for applying the same to steel or other metal, which may be afterwards coated with silver or other metal if desired. The alloy consists of 80 parts tin, 18 parts lead, and 2 parts silver. The steel is placed in a very weak bath of sulphuric acid and distilled water and left for twelve hours, when the surfaces will be perforated with minute holes. The steel is then plunged into a metallic bath of the alloy, and becomes impregnated with it. When withdrawn from the bath the steel, while still hot, is plunged into iced water, so as to regain all the properties of temper it may have lost in the process.

4666. MANUFACTURE OF CANDLES, *W. H. Beck.—Dated 12th November*, 1880.—(*A communication from A. A. Royau.*)—(*Complete.*) 6*d.*

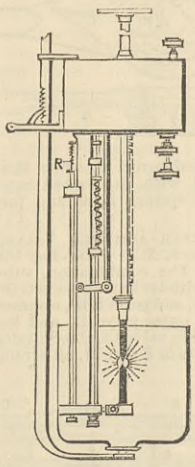
The essential characteristic of this invention is the faculty of passing into the mould carriers and around the moulds currents of cold or hot water, whereby the cast matter in the moulds is rapidly cooled, and the manufactured candles detached from the moulds immedi-



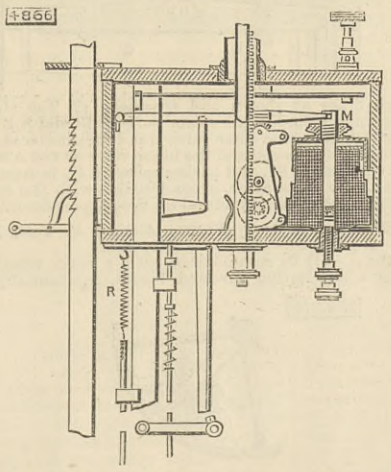
ately afterwards. The drawing shows the arrangement of the moulds. Each consists of a case or mould carrier M of copper, in the middle of which is fixed, by screwing or otherwise, a tin or pewter mould. Into the space surrounding the mould cold or hot water may be admitted at will by pipes arranged at top and bottom of each mould case.

4866. IMPROVEMENTS IN ELECTRIC LIGHTING APPARATUS, *W. R. Lake.—Dated 23rd November*, 1880.—(*A communication from H. S. Maxim.*) 6*d.*

This is an arc lamp the details of which are shown



by the drawings. The action of the carbons is regulated by an electro-magnet, which with a varying



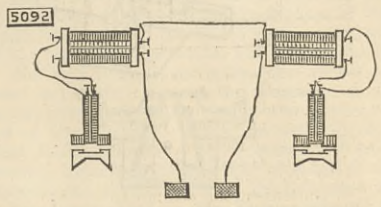
current attracts its core more or less and acts on both carbons. The length of arc is regulated by the tension of spring R.

3389. WRITING INSTRUMENT, *A. P. Hansen.—Dated 20th August*, 1880.—(*Not proceeded with.*) 2*d.*

The writing fluid is contained in a metal tube tapered at one end so as to form a writing point, and the other fitted with a movable cap, by which the entrance of air can be regulated. A wick of asbestos extends down to the hole in the tapered end, and regulates the passage of the writing fluid.

5092. IMPROVEMENTS IN MAGNETO-ELECTRIC SPEAKING TELEPHONY, *H. J. Haddan.—Dated 7th December*, 1880.—(*A communication from S. and M. Barlow.*) 4*d.*

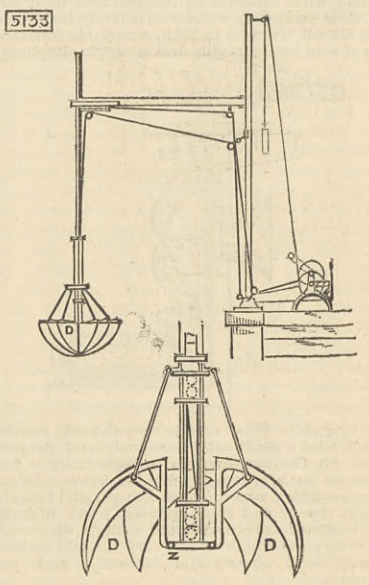
The invention consists simply of the arrangement of



telephones and induction coils in circuit as shown in the figure.

5133. GRAPPLING AND HOISTING APPARATUS FOR REMOVING STREET REFUSE, DREDGING, &c., *W. R. Lake.—Dated 8th December*, 1880.—(*A communication from F. G. Johnson.*)—(*Complete.*) 6*d.*

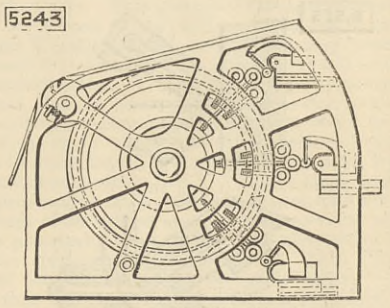
This relates to an automatic grappling bucket constructed and operated so that it will automatically penetrate, grasp, and hoist different materials. D is the bucket, which, when closed, is in the form of a hollow half globe, and it consists of a number of sections attached to carrying arms, each of which at the upper end is bent at such an angle and extended in



such a direction and to such an extent, as shown at Z, as to be terminated and hinged at the centre of the circle, so that as the several sections enter the material to be hoisted, the force employed in working the bucket will be expended in forcing the blades of the bucket into the material. The sections when opened have their upper ends alternately passing over and under each other, the opening and closing being effected by means of two ropes, one serving both to close and hoist the bucket.

5243. PRINTING MACHINES, *T. B. Dooley.—Dated 14th December*, 1880.—(*Complete.*) 6*d.*

This consists partly in the employment of two cylinders for giving the impressions, one, the larger cylinder, adapted to bear several different printing surfaces, and having a space on its peripheric surface in addition to that occupied by or adapted to said



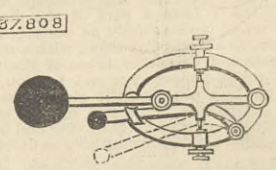
printing surfaces; the other, the smaller cylinder, adapted to bear the sheet to be printed, the said two cylinders so working or geared together that while the said two cylinders are in continued revolution, and the said larger cylinder makes one revolution, the said smaller cylinder makes as many revolutions as there are said printing surfaces, so that one and the same sheet may receive impressions from all the said printing surfaces, and the said smaller cylinder also makes another revolution for discharging said sheet and receiving another sheet.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

237,808. TELEGRAPHIC KEY, *Jesse H. Bunnel, New York, N.Y.—Filed October 15th*, 1880.

Claim.—A telegraphic key lever constructed, substantially as hereinbefore set forth, from a single piece of wrought metal in the form of a cross, of a breadth



greater than its depth or vertical thickness, and provided with trunnions formed upon the extremities of the transverse arms of the cross.

237,814. CONSTRUCTION OF CABLE RAILROADS, *Henry Cagebolt, San Francisco, Cal.—Filed December 11th*, 1880.

Brief.—The ties supporting the slot rails do so through the medium of adjustable brackets. Uses, the commercial flat rail for the slot rails. *Claim.*—(1) In a cable wireway, the adjustable brackets A, adapted to sustain the slot rails attached to and in combination with the ties B, for the purpose set forth. (2) In

combination with a tunnel adapted to contain a cable for an endless wireway, the slot rails H, having a heavy rib O, and a depending web P, substantially as described, for the purpose set forth. (3) The bracket

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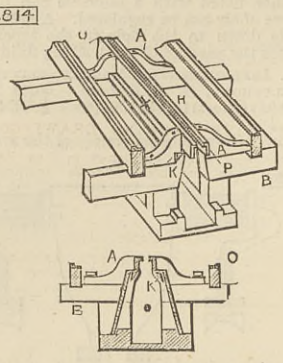
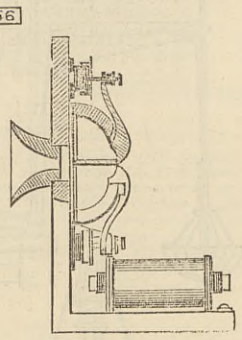


A, provided with lugs K, in combination with the angle iron stringer X, substantially as and for the purpose described.

237,856. TRANSMITTER FOR SPEAKING TELEPHONES, *Webster Gillet, Brooklyn, N.Y.—Filed November 4th*, 1880.

Claim.—(1) The combination, substantially as hereinbefore set forth, of two or more induction coils having their primary wires included in independent local circuits, a variable resistance in each of said local circuits, and a single diaphragm or vibrating plate which acts to vary the said resistances in each local circuit simultaneously and proportionately. (2) The combination, substantially as hereinbefore set forth, of two or more induction coils having their primary wires included in independent local circuits and their secondary wires respectively included in a main circuit common to both, a variable resistance in each of said local circuits, and a single diaphragm or

237,856



vibrating plate which acts to vary the said resistances in each local circuit simultaneously and proportionately. (3) The combination, substantially as hereinbefore set forth, of two or more induction coils having their secondary wires included in parallel branches of a main circuit and their primary wires included in independent local circuits, and a single diaphragm or vibrating plate which acts to vary the said resistances in each local circuit simultaneously and proportionately.

9,575. BRIDGE, *Albert Fink, New York, N.Y.—Filed May 20th* 1880. *Original No. 63,714, dated April 9th*, 1867; *re-issue No. 4093, dated August 9th*, 1870.

Brief.—A triangular truss with wooden top and iron bottom cords and brace connections, by which the said braces may sustain both tension and compression strains. Castings appended to top chord transmit strains from brace to brace directly. *Claim.*—(1) The combination of a wrought iron bottom chord and wooden top board, in a triangular truss with a system of braces connected with both upper and lower chord and with each other in the manner described, so that the braces, placed in a position in the bridge truss where, under a moving load, they may be required to act at one time as struts and at another time as ties, are capable of resisting strains, as well of compression as of tension, substantially as set forth. (2) In a triangular truss, the combination, with a wooden top

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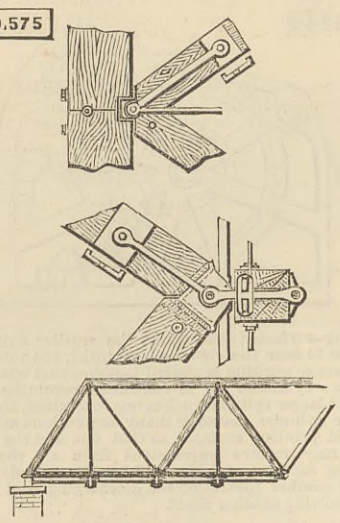

chord and wrought iron bottom chord, of braces having with each other, at the top, a direct connection through which strains are conveyed from brace to brace without passing through an intervening portion of the top chord, substantially as described. (3) The combination, in a triangular truss, with a wooden top cord and iron bottom chord, of a compression brace and a second brace adapted to resist tension as well as compression, a casting placed on the top of said compression brace and on the underside of said top chord and connected with the tension bars or straps of said second brace, so as to form a part of the diagonal bracing of the truss, substantially as described. (4) The combination, in a triangular truss, with a wooden compression brace and the other brace of the truss, constructed to resist compression and tension, of a casting connected by a pin with the tension bars or straps of the last-named brace and upheld by the same, and forming a support for the lower end of said wooden compression brace, substantially as described.

237,951. HORSE-RAKE, *Cornelius Bollinger, Harrisburg, Pa.—Filed September 23rd*, 1880.

Claim.—The head bar, with its pivotted clearers D attached, when operating with a reciprocating

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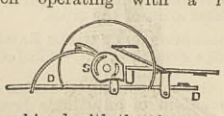

motion, and combined with the circular slotted guide plates S, constructed with journals of the carriage wheels, as herein described and set forth.

237,971. COMBINED TELEPHONE AND AUTOMATIC SWITCH, *Ezra T. Gilliland, Indianapolis, Ind., assignor to the American Bell Telephone Company, Boston, Mass.—Filed September 6th*, 1880.

Brief.—Two telephone posts are separated by an insulating material or space, and on the inside of each post is a V-shaped notch, forming a square recess, in which a ball of conducting material is placed. When the telephone is in a vertical position the ball rolls down against both posts and connects the circuit. When the instrument is raised into a horizontal position for use the ball falls into the notch in one post or the other, and the circuit goes through the telephone. *Claim.*—(1) In combination with a

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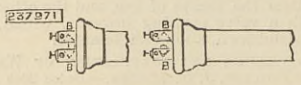
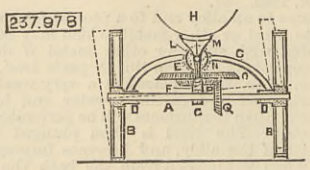


telephone, two posts or parts formed with cavities in their adjacent faces, and a ball which is inserted in said cavities, said cavities having a formation, substantially as described, by which said ball is caused to establish an electrical connection between said parts when the telephone is in one position, and to break said connection when it is in other positions, substantially as and for the purposes set forth. (2) The combination of the telephone, the parts B B, divided by space or insulating material, as described, and the ball D, resting in a chamber or cavities formed in said parts, substantially as and for the purposes set forth.

237,978. TRACTION ENGINE, *Ezra Hoxsie, Blissfield, Mich.—Filed December 29th*, 1880.

Claim.—(1) In a traction engine, the combination, with the axle A, having traction wheels B B, and mechanism for conveying power from the engine to said axle, of the yoke C, connected at its ends to said axle, and provided with a collar E, having a socket, pintle F, having collar G, surrounding said axle, and the boiler H, having a downward projecting stud ter-

237,978

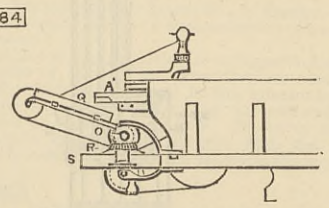


minating in a ball, the several parts arranged relatively to each other, substantially as and for the purpose specified. (2) The combination of the axle A, having traction wheels B B and mitre wheel Q, yoke C, having collars D D E, the latter provided with a socket, pintle F, having collar G, boiler H, having ball and hanger M, shaft L, and the gear N O P, all arranged and operating substantially as and for the purpose herein shown and specified.

237,984. STRAW STACKER, *William H. Latta, Washington, Ohio.—Filed October 11th*, 1880.

Claim.—(1) The combination of a thrashing machine having a curved guide and support S secured to one end, a straw stacker Q, a sliding block R, a pivotted block and an operating shaft, substantially as set forth. (2) The combination of the shoe or shaker of a thrashing machine with the pivotted apron A^1 and a

237,984

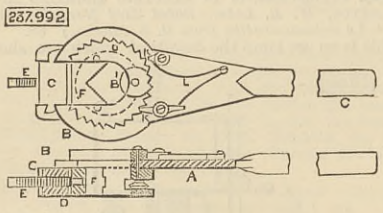


straw stacker, the parts being combined and arranged to operate substantially as specified. (3) In a straw-stacking attachment, the combination of the pivotted block, the shaft O, journalled at one end therein, and an operating mechanism for driving the shaft with the carrier Q, placed upon the shaft, the sliding block R, and curved guide S, substantially as shown.

237,992. PIPE CUTTER, *John Miller, Cambridgeport, Mass.—Filed January 14th*, 1881.

Claim.—The herein-described improved pipe cutter, consisting of a forked handle G A B, forked vise D,

237,992

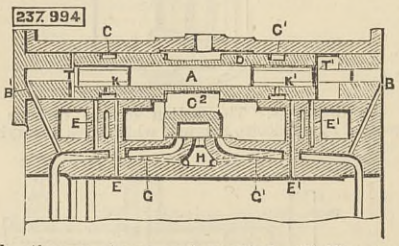


having detachable nut C, screw E, and jaw F, cutter B^1, combined with the forked ratchet H, with its pawls K and springs L, as and for the purpose set forth.

237,994. STEAM-ACTUATED VALVE, *Peter Murray, jun., Newark, N.J.—Filed May 15th*, 1880.

Claim.—(1) The combination, substantially as described, of a cylinder having ports G G^1 and H, the inner valve or rod A, and ports B B^1, communicating with the cylinder, the outer valve D, and its ports C C^1, and channels, a slide valve C^2, the cylinder ports E and E^1, and exhaust ports F and F^1, all arranged in relation to

237,994

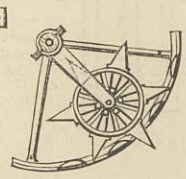


each other as shown and specified. (2) The steam chest and cylinder, the steam ports B B^1 and E E^1, to connect them, the outer valve B and its annular steam channels and ports, and the inner valve or rod A with its channels K K^1, and having collars T T^1, to regulate the throw of the same, in combination with the main valve C, substantially as and for the purpose described.

238,014. TRACTION WHEEL, *Richard H. Yale, New Orleans, La.—Filed July 20th*, 1880.

Claim.—(1) In combination with a main wheel, a spur wheel having pivotted blades, substantially as

238,014



described. (2) In combination with the main wheel, the spur-wheel having the wheel c and pivotted blades, as described.

238,024. STYLOGRAPHIC FOUNTAIN PEN, *Francis C. Brown and Alexander M. Sutherland, New York, N.Y.—Filed October 10th*, 1879.

Claim.—(1) In a stylographic fountain pen the valve C C^1, provided within its top end with spring D, adapted to be adjusted therein and removed therefrom, substantially as and for the purposes described. (2) The combination and arrangement, in a fountain

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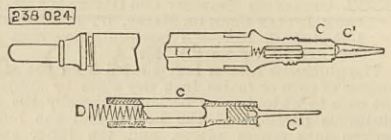

pen, of air tube terminating near the valve, valve with spring, and adjustable needle, substantially as and for the purposes described. (3) The combination, in a fountain pen, of the valve, the spring secured within the top of the valve, and adjustable needle, substantially as and for the purposes described.

238,032. DRILLING DEVICE, *Pearly N. Dixon, Cahoka, Mo.—Filed August 12th*, 1880.

Claim.—1) A drill stock constructed substantially as herein shown and described, consisting of the handle, having a socket and bearing, the shank C, that carries the drill, the coiled spring F, the spool G, the ribbon H, the guide K, and the case I, as set forth.

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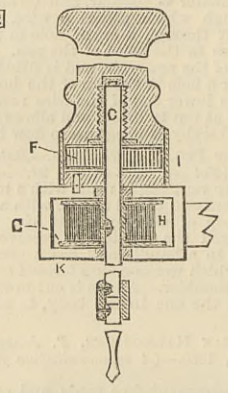

(2) In a drill stock, the combination, with the handle, having socket and bearing, and with the shank C, that carries the drill, of the coiled spring F, the spool G, the ribbon H, the guide K, and the case I, substantially as herein shown and described, whereby the drill will be rotated by alternately drawing upon and slackening the ribbon, as set forth.

238,094. DUPLEX TELEGRAPH, *Georges D'Infreville, New York, N.Y.—Filed December 6th*, 1880.

Brief.—The capacities of the main and artificial lines are made equal at the instant of transmitting a signal by automatically diminishing the resistance in the latter for an instant only, and then restoring it to its normal condition. *Claim.*—(1) The method, substantially as hereinbefore set forth, of counterbalancing the effects of the current of charge in a duplex telegraph system, which consists in momentarily diminishing the normal resistance in the artificial line simultaneously with the act of charging the main line. (2) The method, substantially as hereinbefore set forth, of counterbalancing the effects of the current of charge in a duplex telegraph system, which consists in withdrawing an adjustable rheostat from the artificial line by the same movement of the transmitter

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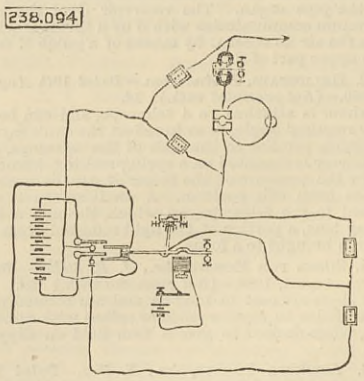

which admits the current of charge to the main line. (3) The combination, substantially as hereinbefore set forth, of a main line, an artificial line, and a key or transmitter provided with two sets of circuit closers arranged to act simultaneously, one to connect the battery with the main and artificial lines, and the other to shunt a portion of the resistance in the artificial line. (4) The combination, substantially as hereinbefore set forth, of a rheostat normally constituting a portion of the artificial line, a shunt circuit passing around said rheostat, and a circuit closer for completing said shunt circuit, which is attached to or operated simultaneously with the lever of the transmitter. (5) The combination, substantially as hereinbefore set forth, of the transmitter arm, the reciprocating weighted shuttle, moving with slight friction between adjustable stops, and by its inertia having a greater range of vibration than the transmitter arm, and the contact points upon the said shuttle facing the transmitter arm.

238,098. MAGNETO SIGNAL APPARATUS, *Thomas A. Edison and Edward H. Johnson, Menlo Park, N.J.—Filed November 11th*, 1880.

Brief.—Turning the handle of the magneto-generator in one direction breaks continously a short circuit around the machine, while turning in the opposite direction breaks said short circuit only at definite intervals. *Claim.*—(1) The combination, with a magneto machine and its main circuit, of a shunt or short circuit, and means for automatically breaking

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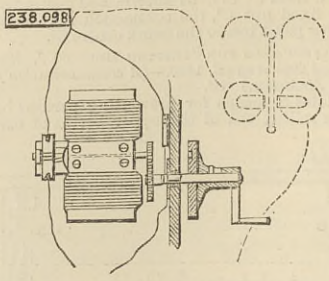

such short circuit entirely upon movement in one direction and intermittently breaking it upon movement in the other direction, substantially as set forth. (2) The combination of a driving shaft of a magneto-electric machine, a sleeve mounted thereon in such manner as to have a determinate longitudinal movement thereon, and a circuit breaker automatically operated by such sleeve, to break a circuit entirely during movement in one direction and intermittently during movement in the other direction, substantially as set forth. (3) The combination, with a magneto machine, of means, substantially as described, for producing a definite audible signal upon rotation of the driving shaft in one direction, and a definite different audible signal upon rotation of the driving shaft in another direction, substantially as set forth.

238,105. MILL FOR ROLLING HOOP IRON, *John Gearing, Pittsburg, assignor to himself and William E. Brandon, Allegheny City, Pa.—Filed July 14th*, 1880.

Claim.—(1) The combination, with a pair of horizontal rolls, of the guide box B, having its ends cut away, as at B^1, and the adjustable slotted guides D, having the vertical friction rolls E, substantially as and for the purpose specified. (2) The combination, with a pair of horizontal rolls, of the guide box B, the

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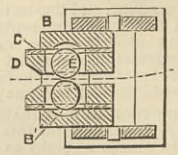
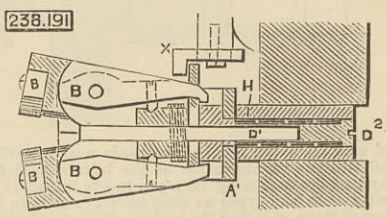


adjustable slotted guides D, having the vertical friction rolls E, and the removable slotted liners C, substantially as and for the purpose specified. (3) The combination, with a pair of horizontal work rolls, of a pair of friction-driven guide and edging rolls capable of a lateral adjustment along the horizontal rolls, to change the place of the pass, substantially as and for the purposes described.

238,191. MACHINE FOR CUTTING SCREWS, *Elihu Wilder and Luther M. Nutting, Manchester, N.H.—Filed June 2nd*, 1877.

Claim.—(1) The combination of a cam, levers B, sleeve A^1, and spring H, whereby the levers are opened. (2) The combination of the stem D^1, spring H, sleeve A^1, screw D^2, and levers B, holding the dies

238,191



B^1, substantially as and for the purpose described. (3) In a screw-cutting machine, the combination of the stock A, levers B, carrying dies B^1, cam, sleeve A^1, stem D^1, monitor and shaft, with the stop X, substantially as and for the purpose described.

238,195. WIRE FOR TELEPHONES, *David Brooks, Philadelphia, Pa.—Filed March 4th*, 1878.

Claim.—The combination of a telephone wire with

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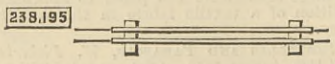

an additional metallic wire running parallel with the said telephone wire, and in close proximity thereto, but insulated therefrom, the wires being connected at each end to complete the metallic circuit, substantially as set forth.

CONTENTS.

THE ENGINEER, March 25th, 1881.

	PAGE
STEEL CASTINGS. No. II.	215
LETTERS TO THE EDITOR—	
THOMSON'S TIDE-PREDICTING MACHINE	216
AGRICULTURAL EXHIBITION IN HUNGARY	215
LINKS IN THE HISTORY OF THE LOCOMOTIVE	216
SOUTH LONDON TRAMWAYS	217
WOOD CENTRED RAILWAY WHEELS	217
HIGH-SPEED LOCOMOTIVES	217
FIRE-BOX ROOF STAYS	217
THE EFFICIENCY OF A TANDEM ENGINE	217
SAFETY VALVES	217
PUMPING MACHINERY, RAJAWELL, CEYLON. (Illustrated.)	218
JORDAN'S PULVERISING MACHINE	218
COLLAPSED BOILER FURNACES. (Illustrated.)	219
CONTRACTS OPEN—	
Giant's Causeway Tramway. (Illustrated.)	219
MOLECULAR ELECTRO-MAGNETIC INDUCTION	220
RAILWAY MATTERS	221
NOTES AND MEMORANDA	221
MISCELLANEA	221
LEADING ARTICLES—	
THE NAVY ESTIMATES	223
THE TELEPHONE, AND WHAT IT MIGHT DO FOR LONDON	224
ENGINEERS BY ACT OF PARLIAMENT	224
PEATY DISCOLORATION OF DRINKING WATER	225
ALGERIA AND THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE	225
THE TEES BRIDGE SCHEME	225
LITERATURE—	
Elementary Theory and Calculation of Iron Bridges and Roofs. By A. Ritter	225
TENDERS—	
Stapleton Sewerage	225
THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS	226
NOTES FROM LANCASHIRE	226
NOTES FROM THE NORTH OF ENGLAND	226
NOTES FROM SCOTLAND	226
NOTES FROM SHEFFIELD	227
NOTES FROM WALES AND ADJOINING COUNTIES	227
THE PATENT JOURNAL	227
ABSTRACTS OF PATENT SPECIFICATIONS. (Illustrated.)	228
ABSTRACTS OF AMERICAN PATENT SPECIFICATIONS. (Illustrated.)	232
PARAGRAPHS—	
Iron and Steel Institute	217
Mr. James Fletcher	217
The Drainage of Birmingham	217
Sanitary Institute of Great Britain	225

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