COLONIAL CONTRACTS.

No. II.

During the last two years a considerable change has been made in the method of letting colonial contracts in this country, especially those from Australia. Pressure has been brought to bear on the legislative assemblies to allow local contractors and merchants to supply the goods and material heretofore purchased through the Agents-General. Even where local contractors have been employed to execute the general works, iron bridges, buildings, and railway material have been, up till recently, purchased through the Government officials, and delivered to the contractors to be fixed in place; but enterprising contractors have seen their way to a more extended profit if they could be allowed to furnish the imported material also. In some cases these contractors act through their own agents in England, while in others they purchase through merchants in the colony, who provide the necessary funds through their London house. This innovation has, in the case of Victoria, almost entirely superseded the old system, but it prevails to a large extent also in New South Wales, South Australia, and Queensland. In some respects only the alteration is advantageous. It makes more persons acquainted with the commodities purchased, and gives that strongest of all incentives, self-interest, to cheapen prices; but it is questionable if it affords such good results to the community, and it has many inconveniences. It limits the competition to those who are not only acquainted with their proper business in the colony, but who have an organisation in Europe, who have a good telegraph code, and who will spend freely on cable messages; while if the purchases be made through one efficient agent in London, these expenses need be incurred but once. In the latter case, also, there is a base of operations in London where details can be arranged by those in authority, while if the purchases are made through merchants of whom the colonial engineer has no official cognisance, he is inclined, in order to protect himself, to set up very rigid conditions on account of quality, which, though justifiable if imposed by an engineer in the country of manufacture, become absurd when communication between engineer and manufacturer is impossible; for however capable the engineer may be, there are always points—possibly trifling—to be adjusted with the contractor, there being no better sign of a strong engineer than his willingness to allow modifications or improvements in his design. There has always been an unwillingness on the part of Colonial Government engineers to allow their representatives in England the necessary latitude in such matters, even when acting under the guidance of eminent engineers employed by the Agents-General for the purpose. So jealous, indeed, have the colonists been of interference, that engineers here prefer to let pass all but the worst extravagances or errors. But in many of the most important orders now sent from the colonies through merchants, even trifling modifications are entirely forbidden, for neither the interposition of the merchant nor of his technical adviser is recognised by the engineer. When driven by force of circumstances to allow slight alterations, the merchant does so at the risk of great loss to his clients in the colony, who may have the altered material rejected, especially if the conditions which have been set aside were inserted to suit some private purpose of the engineer. With a telegraph tariff of 10s. per word, and with technical questions for which no code system can provide, and which in many cases require drawings to explain, prompt communication with the colony is impossible.

In a contract for a steam engine or machinery some peculiar fittings may be specified which are obsolete or manifestly unfit; or, in the case of a bridge or roof, not only the quality of the iron or steel may be described, but a limited list of iron-makers prescribed—a list appropriate, perhaps, for boiler iron, but owing to the unacquaintance of the colonial engineer with changes here, entirely wrong for structural iron; or the list of makers may be so drawn up as to forbid any real competition, and to force the order into the hands of the one intended. The merchant in England may fear to alter conditions like these, lest the goods when they arrive shall be rejected by the engineer. In other cases exactly the opposite occurs. Thus the contractor in the colony and the merchant who is buying for him may, under the keen criticism of the local traders and members of Parliament, be left quite free in their choice of manufacture. In the keen competition between merchants, the lowest prices will be obtained by those who venture furthest among second and third-rate makers, trusting partly to inspection before shipment, and partly to the disinclination of the engineer in the colony to reject what is at all passable because of the loss of time involved, or possibly also trusting to that relaxation of onerous conditions in favour of a special contractor to which we have already referred. Risks of this kind always attend the purchase of engineering material through contractors who have to re-purchase, and whose chance of success in competition depends on their buying cheaply. When an engineer or qualified agent is in direct communication with the manufacturers, he may with propriety invite six or a dozen, according to the nature of the trade, and the number of good firms engaged in it, to tender, for at any rate he knows with whom he is dealing and can limit his choice. But when an engineer in the colony asks six or a dozen contractors, each of whom is free to buy the material where he pleases, the merchant who procures tenders from the cheapest maker will enable his client to obtain the contract. There are, of course, merchants of high standing who desire to maintain their reputation, and who are as particular in dealing only with good makers as official agents would be. But it is obvious that such merchants are, by sheer force of circumstances, beaten out of the field by those who are not so particular. The worst cases are those where the merchant does not buy from a maker at all, but from a factor, whose intermediate profit has to be paid. In their proper place factors have useful and necessary functions to perform; they collect miscellaneous goods, such as tools or hardware, and by their experience in such matters can save their customers much trouble. But when factors are asked to supply engineering works of considerable magnitude, it is generally a sign that the merchant, or engineer who employs him, does not know his business. The ultimate purchaser, namely, the colonial taxpayer, has then four intermediate profits to pay, that of the contractor in the colony, the merchant there through whom the contractor buys, the London merchant, and the factor. The latter, in order to justify his position, has to seek out very cheap manufacturers, and generally favours those of small means, out of whom he can squeeze extra discount. Inferior material is then delivered in the colony, and has in most cases to be accepted. But whatever may be the cause of it, such condonation of inferior work is a precedent difficult to set aside, and the standard of quality is at once lowered. During the last two years there has been in several cases a marked falling off in the character of engineering material imported by merchants, all tending to make mere price the measure of cheapness—a fault which the plan of buying through Agents-General avoids.

Plans and specifications made at a distance from the place of manufacture have other inconveniences. In designing structures, engineers are assisted by books of patterns or sections of rolled iron, for while the ordinary forms of angle or tee iron are common to all makers, there are peculiar shapes or certain sizes of such shapes which may be confined to one maker. The colonies are flooded with the pattern books of ironmongers and merchants whose sections of iron are to a large extent those of Belgian makers, and the intermediate profit of the merchant is earned at the expense of the colonial purchaser, who is led to believe, by implication if not by direct assertion, that he is buying English iron of good quality. An English engineer, while taking full advantage of the various sections available, and in order to ensure good quality, is ready to modify the forms or sizes if it is shown to be necessary; but in regard to structures designed in the colony and made in England, absurd results have arisen from the peremptory orders of the engineer—who has probably been annoyed by modifications on previous occasions for which he saw no sufficient reason—that no variation shall be allowed. But when the work is commenced it is found that the rolls for a particular section of iron selected by the engineer may have been broken up and the expense of cutting new ones may treble the cost of the iron; or the quantity required being very small, the maker may decline to put in the rolls in any reasonable time; or possibly the section required may be made at only one mill in Belgium or elsewhere, where, as above stated, the quality is much inferior to that prescribed in the specification. Such *contretemps* would be by their absurdity impossible where conference could take place between the parties concerned, but by the new system of purchase they are the cause of much misunderstanding and loss. Even greater harm arises from actual errors or oversights in the designs sent to England for execution.

A considerable amount of structural ironwork is now being made in England for the different colonies. Many of the designs are fairly good, some are very bad, and even among the best there are details requiring modification. Bridges and roofs are now being made in this country which are creditable to no one, and the manufacturers, if they are prudent, will abstain from putting name-plates upon them, or in any way allowing their association with such structures to be known. In one case the construction is so peculiar that extraordinary staging and tackle will be necessary to hold it together during erection, in other cases pieces of rolled iron are shown in the design so long as to be rolled in one piece only at great expense and too long to be carried by canal or railway, or in an ordinary ship's hold. An engineer on the spot would allow a division with necessary jointings, and the merchant will probably have to incur the risk of doing so. In another case, that of a roof which has not yet left this country, elaborate smithing and numerous welds are shown on the design, which not only greatly increase the cost, but involve risks of hidden flaws which a more prudent simplicity would have avoided. It may be of service to draw attention to these inconveniences, to show that a system which is good enough when the purchaser is within reach of his market, is absurd when there is no possibility of appeal, and when the loss and confusion which result are hidden from the community who suffer. The remedy is to be sought in a more generous and sensible arrangement between buyer and seller; the colonists must recognise the fact and accept the consequences of it, that they are far from the source of supply, and must employ agents who have technical knowledge at command, and who must be allowed as much latitude of modification as the engineer would have if he were himself in this country.

Not only, however, have the colonial merchants and contractors succeeded in obtaining much of the Government business heretofore transacted through the Agents-General, but the working men also, through the members they elect, have clamoured for a protective tariff on imports from England, which shall place the manufacture of engineering material in their hands. This policy has been most apparent in Victoria, where, indeed, protection has been carried to a pitch of absurdity which has shown an example to be avoided elsewhere. Workmen who have emigrated from this country have grouped themselves together according to the trades they followed here, and demanded employment. Moulders, who were not obtaining wages to their liking in the local foundries, have agitated for the manufacture exclusively in the colony of all iron castings required for public works. Thus contracts for pipes have been let at prices which for every pound paid in wages to the skilled workmen has cost the community probably £20 more than would have been paid for English-made pipes. Engine fitters complain that locomotives are imported which they could make, though obviously, under the disadvantageous circumstances necessarily existing in a new country, only of inferior quality and at greatly enhanced cost. Nay, even steel rails are included in the category of articles to be made in the colony. Succeeding by the aid of loud-tongued orators in Parliament, a considerable number of railway carriages and locomotives have been ordered in Melbourne, but recently, when more rolling stock was needed, and objection was made to its being ordered from England, and the same request urged on behalf of local workmen, it was ascertained that the material already ordered was long in arrear, and that the very manufacturers who had demanded protection were themselves importing the essential parts of the engines from England. Meanwhile the high price of machinery and of almost every useful aid to manual labour is impeding the natural industry of the colony. In a book just published by Mr. C. J. Rome—"An Englishman's Views of the Questions of the Day in Victoria"—the author, who, strangely enough, is in favour of the ultra-democratic legislation which produces the effects he deplores, thus sums up the results of the tariff system:—"In the effort to become a prosperous manufacturing country, Victoria has declared war against every natural gift with which she is blessed by taxing every implement necessary for its production."

It is significant to notice how this policy but repeats that of so backward a country as Russia, where the makers of locomotives and other material obtained a decree that concessions for new railways should be granted only on the condition that the material was made in the country. But having obtained the orders, they could only execute them by themselves smuggling across the frontier axles, tires, pistons, valves, and other fittings by false declarations of kind and purpose; and while this is going on the railways languish for want of engines; agricultural produce cannot reach foreign markets, and important public works more suited to the resources of the country remain unexecuted. In New South Wales, as well as Victoria, the employment of local workmen has been fostered by undue preference; but in regard to locomotives, after eight out of some forty ordered were made, the contract was cancelled. The prosperity of the United States is cited as a justification for a stern protective policy. But in America the extent of country, which affords every kind of material, gives more facilities for miscellaneous manufacturers. But in the colonies, as in America, the real question is obscured by treating it as one of political economy to be argued when really a deeper question is involved. When, with a Parliament elected by manhood suffrage, the working-men voters see that they can influence wages by legislation, and when such voters can prohibit the landed, the professional, and the other non-labouring classes from spending their money as they please, compelling them to buy from a limited class at artificial rates, it is really the first stage of communism, the workmen themselves losing by the prices they pay for everything they buy many times as much as they apparently gain by the absence of foreign competition.

THE SPEZZIA ARMOUR-PLATE EXPERIMENTS.

The Italian authorities having adopted for the barbette towers of the Italia and Lepanto plates of a thickness of 48 cm. (18·9in.), instituted a trial of such plates by means of the 100-ton muzzle-loading gun supplied by Sir W. Armstrong and Co. to the Duilio, the firing charge of this gun being sufficiently reduced for this purpose. The trial of the plates was partly competitive, for although the armour for the Italia has been already ordered from Messrs. Cammell, the order for the Lepanto plates has not been yet given, and experiments are required to arrive at the best description of plate for all future supplies of thick armour. We have spoken of it, however, as competitive in a limited sense, because there has been so little experience with regard to compound armour of great thickness, that neither of the representatives of Messrs. Cammell's nor Brown's firms offer their plates with confidence as fairly representing what they wish to manufacture. Further, we may add that Messrs. Cammell specially requested that samples of their plates might be tested before fulfilling their contract for the Italia. In their present condition the plates to be tried may be described as follows:—The dimensions of all are the same, namely, 3·3 m. × 2·62 m. × 48 cm. (10ft. 10in. × 8ft. 7in. × 18·9in.), the weight of each plate being nearly 31½ tons. Three kinds of plates were tried, one from each of the firms above mentioned, namely, Cammell's, Brown's, and Schneider's.

No. 1, Cammell's, consists of a wrought iron foundation plate, with a steel face applied on the system known as Wilson's patent, the steel being run on the face of the wrought iron, and the whole rolled down from a thickness of about 30in. to 18·9in. The steel, extending to a depth of about 6in. in the finished plate, contains about 0·65 per cent. of carbon. Mr. Wilson, who represents Cammell's firm here, stated before the trial began that he considered that owing to imperfect means the plate was not sufficiently worked, and that to do justice to the system it should have been brought down from 36in. original thickness.

No. 2, Brown's plate, differed from the above in having a thin rolled steel face plate of about 3in. thick attached to the wrought iron foundation plate by molten steel, in place of allowing the molten steel itself to form the face. This is on what is known as Ellis's patent—the object of which is to secure a well rolled steel face. The total thickness of steel was the same as that of Cammell's plate, that is, about 6in., but it was slightly harder, containing about 0·7 per cent. of carbon. The remark as to insufficient rolling applies to this as well as to Cammell's plate. Both of them were bolted on to backing hereafter described, by means of six bolts, each of soft steel screwed into the back of the plates to a depth of 4½in., in screw holes 5¼in. deep, in positions shown in Fig. 10. The diameter of the bolt end was 4½in., on which was a plus thread on the Palliser system; the bolt fitted the hole tight to keep out water, but when clear of the plate was reduced to about 3¾in. in diameter to ensure elongation in preference to yielding in the screwed part. The rear end of each bolt was secured by a washer fixed on a similar screwed thread to the front end, holding against the back face of the backing.

3.—Schneider's—Creusot Company—plate consisted wholly of steel. It is said to contain about 0·45 per cent. of carbon. The face was chilled by lowering it to a depth of 6in. into oil. It was afterwards slightly annealed, so it is said, but no authentic information as to its manufacture is furnished by Messrs. Schneider and Co. This plate was secured by twenty screw bolts, each 4½in. diameter, with a thread ½in. pitch, screwed into the back of the plate to a depth of 2¾in. The position of these bolts may be seen in Fig. 11.

The structure of the target backing and supports may be seen in Figs. 1 and 2. Each plate was set in an iron frame made of three thicknesses of strips of 6in. armour, the width of the frame being about 33in., and the thickness about 18in. These were bolted to the backing as shown in Fig. 3. The supporting frames seen in Fig. 1 were about 2ft. apart from edge to edge. Each plate frame had a long prop at each end, extending from the top towards the front, shown in Fig. 1. On the whole it may be seen that the backing and framing were fairly strong, and had the frames been held together at the corners they would have been very powerful. In the backing it appears as if it might have been some improvement to have placed the oak balks in the second and fourth rows vertical, instead of those in the third row only.

The projectiles were of Gregorini chilled iron. They were about 44½in. long and 17·64in. in diameter, the head being struck with a radius of 1⅝ diameters, and the bottom made to take the original Elswick gas check employed with them. The weight was 896 kg. (1975·3 lb.); with gas check, 907 kg. (2000 lb.) Their quality is better discussed in connection with their effects. Speaking generally, it appeared to us much better than that of the competitive shot of Gregorini iron cast in our own Royal Laboratory, these projectiles resembling much more nearly the Fingspong shot employed in the English competition. We should suppose the iron to be rather soft for chilled metal, but to hold very well together, and therefore to try a hard plate more severely than our own chilled projectiles, which penetrate soft iron admirably, but break easily against a hard face.

On November 16th the firing was commenced. The first three rounds were to be fired under strictly similar conditions, the firing charge being 149 kg. (320·85 lb.) of Fossano progressive powder, which was calculated to give the projectile sufficient energy to perforate 19in. of wrought iron at the distance of the target. The spots aimed at may be seen in Fig. 3. They were struck almost exactly in each case, the shooting being admirable, in spite of a swell causing a considerable heave of the raft on which the gun was mounted, as on previous occasions. The targets stood in the order we have given above, reading from left to right. Cammell's plate was first attacked.

In round 1 the shot struck Cammell's plate on the spot shown in Fig. 4, with a striking velocity of 371·5 m. (1219ft.), having therefore 20,600 foot-tons energy, or 374·7 foot-tons per inch circumference, and a penetrative power equal to 19·28in. of wrought iron. The plate was completely broken through in the thick crack shown in Fig. 4, while hair cracks were developed as shown in thin lines. The shot itself of course broke up, but it had held well together for a chilled projectile. No indentations made by fragments were to be seen round the portion of the head left in the plate, which projected about 5in. It was scored and rubbed smoother than an English shot, and felt very hot to the touch, arguing, as we think, the tenacity and comparative softness which we have attributed to it. The rear part of the shot was broken into four large, two medium, and many small pieces. The plate face was flat, that is, free from bending. The iron frame had yielded outwards to the extent of from 4in. to 6in. near the point of impact—*vide* Fig. 4. One long front support was thrown down, and a number of bolt heads in front broken, and some cut by shot, fragments, &c. The whole plate was set back 3in. at the end struck. In rear one large plate bolt was broken, and several small backing and frame bolts. The depth of the indent could only be guessed by the apparent diameter of the portion of head in plate. This is deceptive, especially with soft shot which set up.

Round No. 2 was fired at Schneider's plate, leaving the centre one—Brown's—to the last. The charge and projectile were as before. The striking velocity was 375·5 m. (1232ft.), having therefore 21,050 foot-tons energy, or 379·8 foot-tons per inch circumference, and a penetrative power equal to 19·49in. of wrought iron. The plate resisted admirably, showing no cracks at all. The shot had behaved much as in round No. 1. The depth of indent could not be easily estimated. The fragment of shot was apparently much larger than that in the Cammell plate, projecting about 6½in., the plate being slightly raised or bulged in the surrounding region. The rear portion of the projectile was broken up into small pieces. The iron frame was started, opening about 5in. near point of impact, as shown in Fig. 5. At the back several small backing and bolt heads were snapped off, but none of the large plate bolts.

Round No. 3 was fired at Brown's plate, and struck near the desired point, Fig. 6. The striking velocity of this shot was about 372·5 m. (1222ft.), having therefore 20,710 foot-tons energy, or 373·8 foot-tons per inch circumference, and a penetrative power equal to 19·33in. of iron. This shot broke up more than those hitherto fired, leaving a smaller portion of the head in the plate projecting about 2½in., the indent being apparently but slight. No deep indentations were made round it, though rather deeper bruises than in the other plates. The plate showed a narrow long crack in the position shown in Fig. A B, due apparently to a sort of wave or bend-back, made by the whole plate at the end struck. Some hair cracks were also developed. The plate had bodily moved back about 2in. and at right bottom—corner struck—about 4in. The face appeared slightly concave in the region of the point of impact. At the rear some small frame and backing bolts had snapped, but no large plate bolts.

Without waiting for subsequent rounds it is well to record impressions of effects, whether right or wrong. At this stage then the steel had stood admirably. Cammell's plate had yielded the most of the three; Brown's had

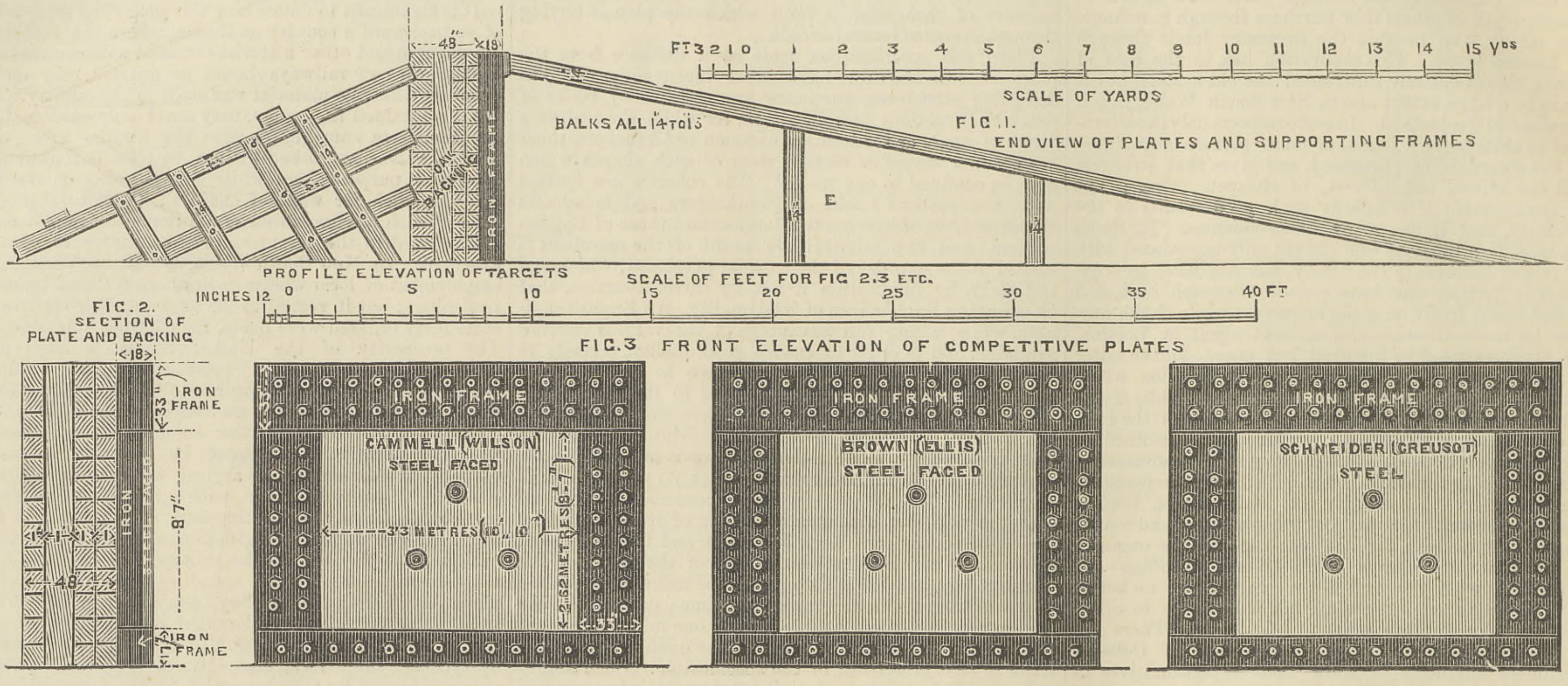


FIG. 6
ROUND No 3
FIRST ROUND AT BROWN'S TARGET

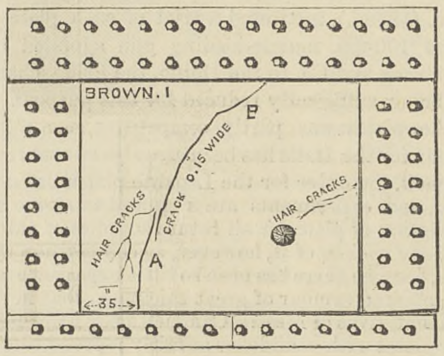


FIG. 9

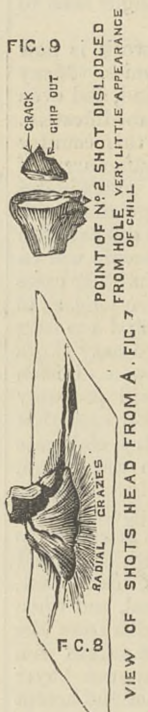


FIG. 8

FIG. 11
BACK OF SCHNEIDER'S PLT

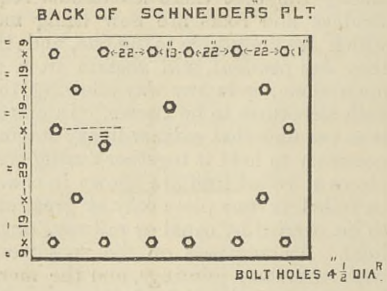


FIG. 4
ROUND No 1
FIRST ROUND AT CAMMELL'S PLATE

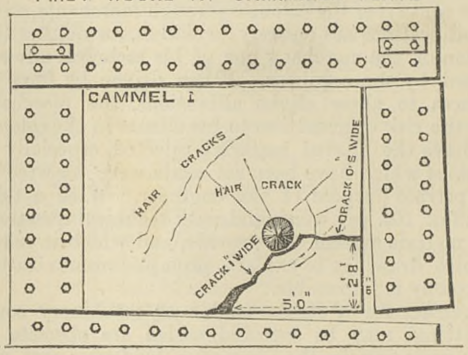


FIG. 7
ROUND No 4
SECOND ROUND AT SCHNEIDER'S PLATE

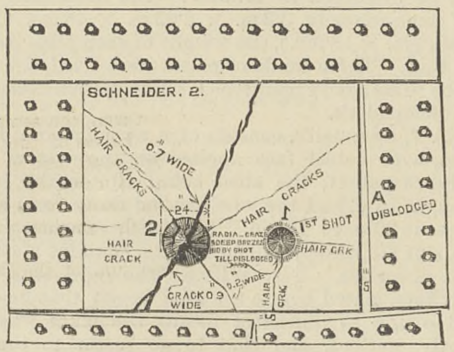


FIG. 10
BACK OF CAMMEL'S & BROWN'S PLATES

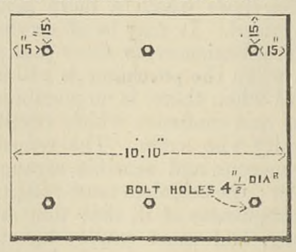
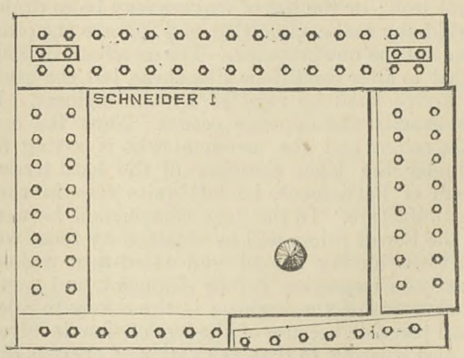


FIG. 5
ROUND No 2
FIRST ROUND AT SCHNEIDER'S PLATE



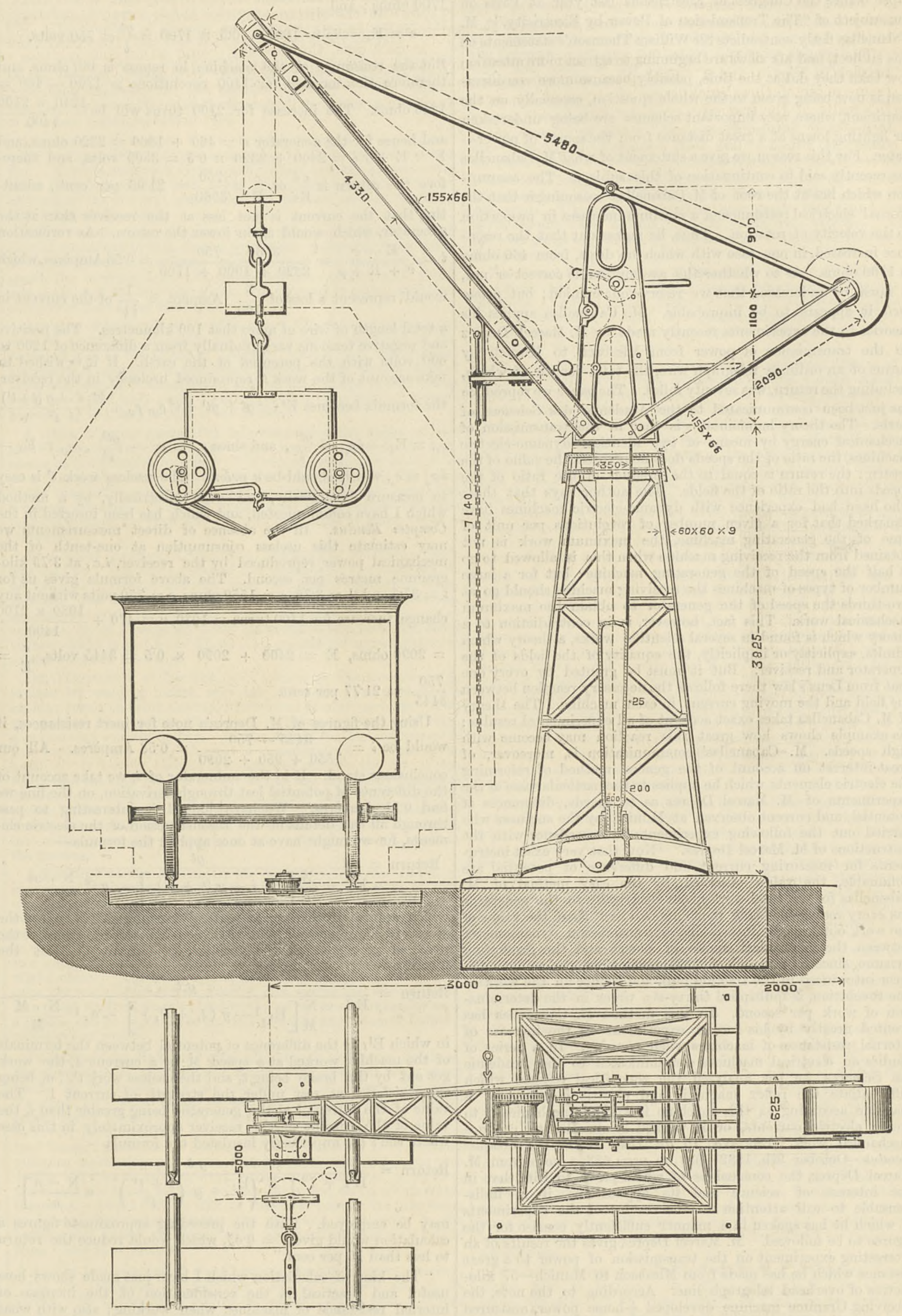
stood very well indeed, having broken its projectile up with much the least penetration of the three. It was suggested that the projectile was an inferior one, but it must be remembered that this plate had the hardest face. The general behaviour of the plate bending bodily while the hard face cracked but broke up the projectile, was very much what might be looked for in a compound plate combining a hard face with a soft tough foundation plate. In their present stage undoubtedly Schneider's plate shows least the destructive effects of the three, but it is to be remembered that steel ought to show at its best at the first blow, and the compound iron under repeated firing. The cracking of the face of the latter ought not to be serious, while more work may be done in the steel than appears. It is proposed to test the plates much more severely the next rounds, the shot having sufficient velocity to penetrate 60 cm. (23·6in.) of wrought iron instead of 48 cm. (18·9in.). In other words, supposing the plates to possess one-fourth greater resistance than wrought iron of similar thickness, they, the shot, is to be a full match for them.

On November 17th the firing was continued. The first round—No. 4 of the series—was directed at Schneider's plate, striking near the bull's-eye at a spot shown in Fig. 7. The striking velocity was 471 m. (1545ft.) giving a total energy of 33,100 foot-tons, or 326·9 foot-tons per inch circumference, and a penetration or perforation of iron equal to 24·7in. This shot struck near the bull's-eye, see 2, Fig. 7, evidently penetrating deep into the plate, the following effects being visible: The portion of the projectile lodged in the target measured about 18in. across, there being a ring of closely marked scores and dents, making a disc of about 2ft. diameter. The plate split vertically across in lines shown in Fig. 7; the plate continued to talk or crackle for many minutes, cracks forming and opening until the main fissure running down the left branch of fork was about 0·9in. wide near the bottom, 0·7in. wide a little above the shot, and the shot had opened into two parts separated about 5in. in the widest part, *vide* sketch Fig. 8; a ring crack also ran partly round the centre mass of the shot. The whole target was heated for about a foot round the edge of the shot, the shot itself being intensely hot. The interrupted character of the main crack near the top, as well as that of the smaller ones, was very characteristic. The right hand fork of this crack was about 0·2in. wide. Hair cracks were opened in the positions shown in the Fig. 7. These appeared to extend to a considerable depth, a very small one on the left edge visibly extending completely through the plate. The head of the shot previously lodged in the plate was dislodged by this blow, and lay in two pieces, shown in Fig. 9. It was evident from the impression or shot hole in the plate that the projectile had turned to an angle of about 10 deg. with the normal, the point being towards the right. The whole projectile had set up considerably, the depth of indent being now measurable, and proving to be only 8½in., which is much less than the appearance of the fragment when sticking in the target indicated. The shot itself was obviously of a very different character from our own service Palliser projectiles, being probably still softer than we have already given the metal credit for, the chill extending only to a depth of about 1in., and the metal yielding as no English service chilled shot will yield. At the same time we are disposed to think that it is a more formidable shot against hard armour, from its tenacity being apparently considerably greater than that of our own. In short, the disappointment we expressed in the behaviour of the Gregorini shot when fired in our English competition in 1877 is in a measure explained to us now in seeing its performances here. The iron appears to be excellent for firing against hard armour when perforation is impossible, and when, therefore, the object is to get the projectile to hold together and deliver all its energy at the point of impact, but it is much too soft to perforate a clean hole through soft iron plates. Thus, our impression is that this projectile would set up, and so fail to give very good results when required to perforate soft iron nearly a match for it, while, on the other hand, our own chilled shot, which perforate soft iron well, would, we think, have broken up badly against this hard armour. We should have expected to see a ring of deep indentations round the broken point of the shot, something like those made by our 38-ton gun Palliser shot when fired against a steel-faced plate in the summer of 1880—see THE ENGINEER, July 30th, 1880. It will be seen that two hair cracks now showed themselves extending from the point of impact of the first round. The side frames were sprung wider open on the left, *vide* Fig. 7. The shot hole will be seen to be of considerably smaller diameter than the shot fragment which was held in it, the edge of the latter having turned over and flattened under the mass of langridge which followed it up, the target being dented and bruised in a circle of impressions beneath it. It may be remembered that a chilled projectile in 1876 behaved in a somewhat similar way here on a larger scale. The back of the target stood well; some small bolts were detached and frames cracked, but no plate bolts were visibly injured.

Such a tremendous shock as this must inevitably perform a great deal of work on a plate. This plate may be regarded as disintegrated to a great extent, but it must be pronounced to have stood admirably. The pieces are all well held in their positions, and whatever might be the effect of a third round on the plate, it can scarcely be doubted that the shot would be kept out of a ship carrying such a plate, and the question may well be asked when a single plate would ever receive three such blows on service. Messrs. Schneider have shown also great judgment in employing a large number of bolts, for it is to be observed that these cracks appear in most cases to extend through the whole plate. What then would become of the portion below the second point of impact if this entire plate had only six bolts?

It will be extremely interesting to compare the behaviour of the steel-faced plates on receiving their heavy blows. Up to the moment at which this was written in Spezzia the Schneider plate compares very well with its rivals. It must, however, be remembered that the thin cracks in a steel-faced plate generally extend no further than the steel face. A steel-faced plate may undulate, and crack its hard face in an immaterial way from a sort of wave motion. The surface of Brown's plate has gone slightly back on a large scale round the points struck, the crack A B looks like a wide concentric wave crack. It almost suggests the rather extravagant simile of ice on water. At present concentric annular cracks, as well as radiating cracks, are found in the steel-faced plates, radiating cracks only in the steel.

COALING CRANE—DANISH STATE RAILWAYS.



COALING CRANE—DANISH STATE RAILWAYS.

THE accompanying engraving shows a crane for coaling locomotives used on the Danish State Railways in Jylland and Fyn. When using these cranes the power of the locomotive itself is applied to hoist the coal up to the necessary height, and the length of the chain is regulated so that the little coal truck is lifted just enough when the middle of the tender is before the crane post. The chain of the crane works over a guiding sheave between the girders, which sheave is cast with a trail for the chain links like sheaves for differential blocks. The sheave is firmly connected to the stop wheel and brake wheel. From the sheave the chain runs down through the hollow crane post, over one pulley at the foot of the crane, another in the middle of the track to the foot block, which is fastened in the middle of the track 50ft. from the crane, and the chain finishes off in a ring, which is hung on to the draw-bar hook of the tender that is to be coaled up. The other end of the chain runs over a pulley in the beam of the crane down to a little winch with worm and pinion and endless chain; this serves to regulate small differences in the length, and to lift the coal trucks for weighing them, and for shifting them from one track to the next when no locomotive is near at hand.

The weighing of the coal is done by the aid of a Denison's crane weighing machine from Tangye Brothers. The coal trucks are of a size sufficient to take one ton, and a brass line on the side indicates how high they can be filled to take half a ton. The coal trucks are made of sheet iron ⅛in. thick. The bottom is made in halves hanging on hinges and counterbalanced by the wheels. The wheels are of hard cast iron, the same pattern as the platelayers' trolley wheels. The halves of the bottom are kept shut by two hooks connected by a shaft, and in turning the hooks loose the fireman empties the coal down into the tender. The filling up, weighing, and getting ready for hoisting of the coal trucks is done by piecework, and the amount paid is about 1·33d. per ton.

We are indebted to Mr. Ossa Busse, jun., of the Danish State Railways, for this information.

GRAVING DOCK AT CAPE TOWN.—On Friday, the 20th of October, the new graving dock at Cape Town was formally opened, the Union Steamship Company's steamer Athenian cutting the riband and taking up her position in the basin. In honour of the governor, the new basin was named the Robinson Dock. The dimensions are 539ft. at coping level, 500ft. at keel blocks, 90ft. wide at coping, 38ft. at bottom altars, and 68ft. at entrance. The depth of water on sill of entrance at low water is 21ft., and at high water 26ft. ordinary spring tides. The blocks are of Paarl granite.

THE MANCHESTER SHIP CANAL.—The proposed Manchester ship canal is supported with remarkable enthusiasm by the people of Lancashire, some evidence of which is found in the numerous publications that have already issued from the celebrated Manchester publishing house of Mr. John Heywood. These include a weekly newspaper of twelve pages containing all the notices and news relating to meetings on the subject and discussing the questions involved. We have also received six pamphlets on the question, entitled as follows:—"Facts and Figures in Favour of the Proposed Manchester Ship Canal," by Mancuniensis. "Manchester Ship Canal: Is it Wanted and Will it Pay," by Cottonopolis. "The Manchester Ship Canal: Why it is Wanted and Why it Will Pay, with observations in reply to recent observations, and including appendix relating to the Bridgewater Navigation Company," by Cottonopolis. "Some Legal Considerations in Relation to the Manchester Ship Canal, and the Duty of Municipal Corporations to Support the Undertaking," by a Manchester Barrister. "The Manchester Ship Canal: the London Daily and Periodical Press on the Question." These are all published by Mr. Heywood, with the exception of the last, which is by Messrs. Joseph Clarke and Son. Mr. Heywood also publishes two maps showing the canal—one a panoramic view, and the other, a map, shows the coal-fields of South Lancashire and West Riding, and the areas and populations of the towns.

THE TRANSMISSION OF POWER BY ELECTRICITY.

M. G. Cabanellas, a well-known Paris electrician, read a paper before the Congress of Electricians last year at Paris on the subject of "The Transmission of Power by Electricity." M. Cabanellas flatly contradicts Sir William Thomson's statements on this subject, and his views are beginning to attract more attention now than they did at the time, possibly because more consideration is now being given to the whole question, especially on the Continent, where very important schemes are being undertaken for lighting towns at a great distance from the source of power—water. For this reason we give a statement of what M. Cabanellas has recently said in continuation of this subject. The assumption which lies at the root of M. Cabanellas' reasoning is that the internal electrical resistance of a machine increases in proportion to the velocity of rotation. Thus, he makes out that the resistance increased, in one case with which he deals, from 460 ohms to 1700 ohms. As to whether the assumption is correct or not, it must be understood that we reserve our opinion; but *prima facie* it appears to be improbable. M. Cabanellas applies his theories to the experiments recently made by M. Marcel Deprez on the transmission of power from Miesbach to Munich by means of an ordinary telegraph wire, the total length of which, including the return, was seventy miles. The paper we reproduce has just been communicated to the Academie des Sciences, of Paris. The theory he maintains is that in the transmission of mechanical energy by means of two identical dynamo-electric machines, the ratio of the speeds does not express the value of the return; the return is equal to the product of the ratio of the speeds into the ratio of the fields. The author says that those who have had experience with dynamo-electric machines have remarked that for a given number of revolutions per unit of time of the generating machine, the maximum work is not obtained from the receiving machine when this is allowed to go at half the speed of the generating machine; but for a large number of types of machines the receiving machine should go at two-thirds the speed of the generator to obtain the maximum mechanical work. This fact, however, is in contradiction to a theory which is found in several scientific works, a theory which admits, explicitly or implicitly, the equality of the fields of the generator and receiver. But it must be granted by every one that from Lenz's law there follows the necessary reaction between the field and the moving current in each machine. The theory of M. Cabanellas takes exact account of all experimental results; his example shows how great this reaction may become with high speeds. M. Cabanellas' communication is, moreover, of great interest on account of the general method of reforming the electric elements which he applies to the particular case of the experiments of M. Marcel Deprez as to speeds, differences of potential, and current observed at Munich by the engineer who carried out the following experiments in accordance with the instructions of M. Marcel Deprez.* Now that very exact instruments for measuring current and difference of potential are obtainable, the value observed by the easy method of M. Cabanellas for the total work given electrically to the generator has every reason for being much more exact than the value of the work obtained by interposing a transmission dynamometer between the mechanical source of power and the generating dynamo, since at a speed of 2200 revolutions per minute the error introduced in the traction pull, and thence in the work of one revolution, is multiplied thirty-six times in the determination of work per second. In this method M. Cabanellas has profited greatly by his former experiment on the increase of internal resistance of machines when running. In a series of studies on electrical machines communicated to the Academie des Sciences, he has analysed the theoretical reasons which differentiate the reflex magnetic and electric elements of a machine according as this machine is worked mechanically to create electric currents, or is worked electrically to produce mechanical work. But *No. 15 du Tome XCV. des Comptes Rendus*—October 9th, 1882—has on page 633 a note from M. Marcel Deprez, the conclusions of which prove to him that in the interest of science and its applications it is indispensable to call attention to the results of the experiments of which he has spoken in a manner sufficiently concise for the figures to be followed. M. Marcel Deprez gives the results of an interesting experiment on the transmission of power to a great distance which he has made from Miesbach to Munich—57 kilometres of overhead telegraph line. According to the note, the receiving Gramme machine developed ½-horse power, measured on a brake at 1500 revolutions per minute, an identical Gramme generator at Miesbach running at 2200 revolutions. M. Marcel Deprez concludes, "That, subtracting the passive resistances of every kind, the ratio of the work reproduced at Munich to the work expended at Miesbach was as $\frac{1500}{2200}$ = more than 60 per cent." "It was," says M. Cabanellas, "a departure from this theory that caused M. Marcel Deprez in this assertion to make an error which is very far from negligible, since I will show that from the results of this experiment the return, instead of being about 60 per cent., was about 20 per cent., that is to say, about one third as much as the author of this experiment imagined. The above-mentioned notes, besides the speeds of the machines, and the work reproduced, gives only the resistances—in repose—of each of the two machines—470 ohms—and the total resistance—line wire and return—of the telegraph circuit—950 ohms. There would not be in this the elements necessary for a numerical estimation, but I find the following series of figures in a recent publication which relates to the experiment at Munich, *Bulletin de la Cie. Internationale des Telephones*:—Power transmitted, ½-horse power; resistance of each machine, 460 ohms; resistance of line, 1000 ohms; speed of generator, 2100 revolutions; speed of receiver, 1400 revolutions; difference of potential between the terminals of the generator, 2400 volts; and between the terminals of the receiver, 1600 volts; current, 0·5 Ampères. It will be seen that the two sources of information present in what they have in common an agreement sufficient to permit both to be taken as the base of an approximate calculation. It is reasonable to take without selection the figures of the most complete source which can be applied, although they are a little different from those of the experiment noted by M. Deprez. Let i = current, E the electro-motive force of the generator, e that of the receiver, r the resistance of the generator when working, ρ that of the receiver, R that of the line, E the difference of potential at the terminals of the generator, E_1 the difference of potential at the terminals of the receiver, t the mechanical work reproduced per second-kilogramme-metre, t^1 the useless work of the receiver through rubbing of the brushes and resistance of the air, g the acceleration of gravity. Neglecting at first the work done uselessly, we have :—

$$E_1 i = gt + i^2 \rho \therefore \rho = \frac{E_1 i - gt}{i^2} = \frac{1600 \times 0{\cdot}5 - 10 \times 37{\cdot}5}{0{\cdot}5^2} =$$

1700 ohms; and

$$e = E_1 - i\rho = 1600 - 0{\cdot}5 \times 1700 = \frac{gt}{i} = 750 \text{ volts.}$$

But the resistance of the machine in repose is 460 ohms, and therefore the increase for 1400 revolutions is 1700 — 460 = 1240 ohms. The increase for 2100 turns will be $\frac{1240 \times 2100}{1400}$ and hence for the generator $r = 460 + 1860 = 2320$ ohms, and $E = E + ri = 2400 + 2320 \times 0{\cdot}5 = 3560$ volts, and therefore the return is $\frac{ei}{Ei}$ or $\frac{e}{E} = \frac{750}{3560} = 21{\cdot}06$ per cent., admitting that the current is not less at the receiver than at the generator, which would again lower the return. As verification $i = \frac{E - e}{r + R + \rho} = \frac{3560 - 750}{2320 + 1000 + 1700} = 0{\cdot}55$ Ampères, which would represent a loss of $\frac{5}{100}$ Ampère $= \frac{1}{11}$ of the current in a total length of wire of more that 100 kilometres. The positive and negative tensions vary gradually from a difference of 1200 to 800 volts with the potential of the earth. If it is wished to take account of the work t^1 reproduced uselessly in the receiver, the formula becomes $E^1 i = gt + gt^1 + i^2 \rho_{t^1}, \rho_{t^1} = \frac{E_1 i - g(t + t^1)}{i^2}$, $e_{t^1} = E_1 - i\rho_{t^1} - \frac{gt^1}{i}$, and since $\rho_{t^1} = \rho_o - \frac{gt^1}{i^2} \therefore e_{t^1} = E_1 - i\rho_o = e_o$, which should be *a priori*. The useless work t^1 is easy to measure dynamically, and even electrically, by a method which I have communicated, and which has been inserted in the *Comptes Rendus*. In the absence of direct measurements we may estimate this useless consumption at one-tenth of the mechanical power reproduced by the receiver, *i.e.*, at 3·75 kilogramme metres per second. The above formula gives us for $t = 37{\cdot}5$ and $t^1 = 3{\cdot}75$, $\rho = 1550$ ohms, $e = 750$ volts without any change, increase for 1400 turns = 1080, $r = 470 + \frac{1080 \times 2100}{1400} = 2090$ ohms, $E = 2400 + 2090 \times 0{\cdot}5 = 3445$ volts, $\frac{e}{E} = \frac{750}{3445} = 21{\cdot}77$ per cent.

Using the figures of M. Deprez's note for inert resistances, it would be $i = \frac{3445 - 750}{1550 + 950 + 2090} = 0{\cdot}58$ Ampères. All our conclusions stand. If in the numerator of i, we take account of the difference of potential lost through derivation, on the line we find 0·51 Ampères. We have judged it interesting to pass through all the details of the reconstruction of the electric elements, for we might have at once applied the formula—

$$\text{Return} = \frac{gt}{E i + \frac{N}{n}\left[E_1 i - g(t + t_1)\right] - a i^2 \frac{N - n}{n}}$$

which applies if the line is perfectly insulated. N, n, are the speeds of the generator and receiver; a is the resistance of the machine in repose at the strength of current i. But the formula—

$$\text{Return} = \frac{g t}{E I + \frac{N}{M}\left[E_{1_I} I - g(t_I + t^1_I)\right] - a_I I^2 \frac{N - M}{M}}$$

in which E^1_I is the difference of potential between the terminals of the machine worked at a speed M by a current I, the work got out by the brake being t_I and the useless work t^1_I, a_I being the resistance at rest under the strength of current I. The value of the current I at the generator being greater than i, the value of the current at the receiver approximately in this case where the $l\, i$ is imperfectly insulated the formula—

$$\text{Return} = \frac{g t}{E I + I^2 \left[\frac{N}{n}\left(\frac{E_1}{i} - g\left(\frac{t + t^1}{i^2}\right) - a \frac{N - n}{n}\right]}$$

may be employed. With the preceding approximate figures a calculation would give I = 0·65, which would reduce the return to less than 15 per cent."

"The kind of calculation which I have just made shows how useful and practical is the consideration of the increase of internal resistance of machines when working; also with what ease it allows a great error to be rectified, and of finding the return which a measure of the power expended at Miesbach will give, a measurement which is particularly easy and exact if, as has been remarked, the generator is driven by a separate gas engine. In fact, when M. Deprez admits that the return is equal to the ratio of the speeds, he implicitly admits the equality of the magnetic fields of the generator and receiver, whereas through the reflex actions of which I have spoken—electric current in movement inducing magnetism—the generating field was more intense than the magnetic field which the same current would develope with the armature in repose or turning with an open circuit, and the field of the receiver was less intense than this field not influenced, so that according to the figures given the field of the receiver in this experiment would be three times less intense than the magnetic field of the generator."

* M. Cabanellas has since acquired proof of the authenticity of these figures.

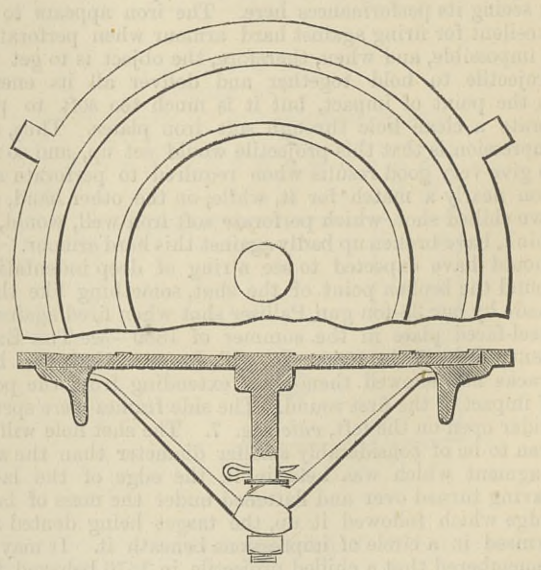
SMITH AND STEVENS' HYDRAULIC BALANCED LIFTS.

The engravings which we give on page 389 illustrate the hydraulic balanced lifts as made under the invention of Messrs. Stevens and Major, by Messrs. Archibald Smith and Stevens, of Queen's-road, Battersea, and as erected by them, amongst other places, at the St. James' Residential-chambers in Duke-street, Piccadilly. There is no doubt that the accidents which have happened with lifts have made architects and proprietors feel that in adopting them they are only removing a certain inconvenience by the introduction of a possible danger. Lifts in general may be roughly divided into two classes—the suspended and the hydraulic ram lifts with direct action. The suspended lift cages may be hung from hemp rope, the life of which is very limited, and as their wear is often internal as well as external, the wear is greater than is apparent. Wire ropes have done good service in lifts, but when made to pass over small wheels they are distressed by constant and violent bending, and have their wires broken. To lessen the danger of accident when a rope breaks the use of four or five has been recommended, but it is argued that if they are all equally tight they will all wear together, and when one breaks the others are not in a condition to accept any additional load, and therefore follow the first. If some are left slack to prevent them wearing, when the tight rope breaks the cage falls upon the next rope with a shock, and very probably breaks that also. This, however, is not necessarily the case, and there need really to be no more accidents from the breaking of ropes than there are in coal mines. Chains are used, but by constant use the links become crystalline. There is no doubt chains behave unexpectedly, and in any case they should be taken off and annealed at least annually. Various forms of safety apparatus have been attached to lifts, but many proprietors allow them to go years uninspected, and they gradually become untrustworthy and in many cases useless. The lift we illustrate is designed to avoid these dangers, and to escape those of the class which belonged to the older arrangement of hydraulic lift like that at the Grand Hotel, Paris.

The following description explains at once the construction of the lift, and its mode of action when worked from an accumulator:—The cage is secured to the top of a solid steel ram, as long as the height of travel, and working in a deep cylinder sunk in the ground. The ram is so proportioned that the pressure of water beneath it will suffice to raise the load together with ram and cage, without the latter being counterbalanced, and without the use of any weights, chains, or overhead gearing. The water used for this purpose may be considered as in two sections—first, that which raised the load; second, that which, assuming the duty of a balance weight, raises the dead weight of ram and cage. To lower the cage, the starting valve, shown below the cage, opens communication between the deep cylinder and a very short cylinder E, which has the same capacity, and receives all the water from it as the ram descends. But the dead weight of ram and cage pressing upon this water drives it over at considerable pressure, which pressure is utilised in the following manner:—Sliding in cylinder E is a ram, carrying upon it a second and smaller ram working in the upper cylinder, the latter holding a quantity of water nearly equal to the second, which has already lifted ram and cage. The pressure due to the returning lift-ram and cage, acting upon the greater area of the ram in cylinder E, drives it upwards together with the smaller ram connected to it, and forces the water in cylinder F into the accumulator, thus restoring for future use the water which was borrowed to lift the dead weight of ram and cage. The same motion which opens valve to raise the cage also opens communication by valve G between cylinders E and F, and the weight of their rams drives the water out of cylinder E, first refilling cylinder F, and the surplus flowing away to the store tanks or drains. Cylinder F is thus automatically charged, ready for a second delivery to accumulator. The valve is worked by a rod or chain passing through the cage, and is within reach at any point of the journey. It is automatically controlled at each extreme, and is so arranged that should a nervous passenger grasp the valve rod, the cage would be immediately brought to rest. When the balanced lift is worked directly off the mains, or from a tank in an elevated position, either of which sources would give a comparatively low pressure, the balance cylinders are modified, so that they increase the pressure of water used beneath the lift ram, and so avoid the use of bulky and heavy rams, which require large and expensive borings. In some towns the water in the mains is under a pressure which would carry it twice or three times the height of the buildings. In such cases, by returning the water from the lift to a tank at the top of the house, the whole of the water may be returned and utilised for domestic purposes; in this way the lift may be worked free of cost. Water is not contaminated by passing through these lifts any more than by the ordinary mains or water meters. No part of the lift is in tension, so that there can be no breaking away, which would lead to a fall or an ascent of the cage. There is no detail which by failing could bring greater strains into action than those provided for in the ordinary usage. The only possible failure is a frost crack in pipes or cylinder, and this would only lead to a slow creeping down of the cage.

LODGE'S SELF-LOCKING COAL PLATE.

This invention, patented by Mr. Lodge, 24, Shirland-road, W., consists of a plate, into the centre of which is cast a stud pin, which carries two loose arms held in place by means of two split



keys. The plate is dropped into its place, and the loose arms fall against the side of stone or ring, &c., and any attempt to remove it from the outside causes it to grip more tightly; it is easily opened from the inside by simply lifting one of the arms and pushing the plate out. It is preferable to use an outer ring, but in the case of a stone, washers are put upon the central stud pin, so as to adjust the arms to the varying sizes of holes cut in the stone, the advantage of which is apparent. It is claimed that accidents are impossible where these plates are used. A considerable number of these plates are now in use, and they are well spoken of.

King's College Engineering Society.—At a meeting of this society held at the college on the 16th inst., Mr. Haskett-Smith read a paper on "Windmills." Some able remarks were made on the same subject by Mr. Evelyn Carey. The paper for next week is "Transmission of Power by Electricity," by Mr. L. B. Atkinson.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty yesterday:—John Keast, engineer, to the Indus; John R. B. Wright, engineer, to the Northumberland, vice Thompson; Bryant G. Little, engineer, to the Cambridge, additional for the Plucky, vice Wright; and Charles A. Harding, assistant engineer, to the Northumberland vice Perham.

RAILWAY MATTERS.

It is reported from Jersey City that August Sieg, the locomotive engineer who was burned on his engine hauling a train carrying 600 passengers, died of his injuries on the night of October the 26th.

According to the *Caspian*, the Persian Government has arranged with a syndicate of French capitalists for the construction of a railway between Teheran and Resht. The Persian Consul in Baku is engaging navvies for the work.

The extension of the Lynn and Fakenham Railway to Norwich, having been inspected and passed by Major-General Hutchinson, will be opened on Saturday, December 2nd, when a train leaving the King's-cross Terminus of the Great Northern Railway will run over it.

It is reported that the Government have decided not to complete the Sibi and Quetta Railway, but to construct instead a new road through the Lower Bolan Pass. This work must, it is thought, be very costly, as it will be necessary to cut galleries along the cliffs in certain places.

The leading railway companies of France are promoting an exhibition, to be held next year in Paris, of all newly-invented appliances calculated to diminish the number and lessen the gravity of accidents, including points and signals, continuous brakes, and intercommunication between the engine driver, guard, and passengers.

The French Minister of Public Works has authorised the opening for traffic of the branch of the State railways from Eygurande to Largnac, nearly 50 kilometres long. Besides the Eygurande Junction on the line between Clermont and Tulle and the Largnac terminus, there are seven stations, viz., Savennes Saint-Etienne-aux-Clos, Singles, Port Dieu, Miallet, Bort, Seignes, and Champagnac-les-mines.

As bearing on the ruthless manner in which railway porters throw passengers' portmanteaus and trunks out of the baggage van, on to corners if possible, the *Baltimore Day* says:—"Fathers often make a great mistake in bringing up their sons to follow their own trade. A Philadelphia trunk-maker was wiser. He had ten sons, and all are now baggage-men on railroad passenger trains. That trunk-maker is getting rich."

The Western Railway Company of France and the Compagnie Générale Transatlantique have arranged to run a fast train every Saturday between Paris and Hâvre, to convey passengers with their luggage to the New York steamer. A stop will be made at Rouen only, and the distance of 228 kilometres will be run through in four hours. A similar special train will also be despatched from Hâvre to Paris on the arrival of the steamer.

The passenger traffic on the New York Elevated roads now exceeds, the *Elevated Railway Journal* says, 250,000 passengers per day, and it has maintained this average for some time. If the percentage increase in the traffic since the opening of the present month is maintained throughout the year, the next annual report will show that considerably more than a hundred million paying passengers will have been carried in the twelve months which it will embrace.

The Pennsylvania Railroad Company has purchased 2000 tin boxes containing a few simple surgical materials likely to be wanted in cases of accident. Some of the boxes are kept on each locomotive, and they each contain one rubber compress, one package of absorbent cotton, six rolls of bandages, one pyramid of pins. With the box are the following simple directions:—When an arm or leg is crushed, causing hæmorrhage, pass compress around limb immediately below the injured part. In case of rupture of a vein, tie it lightly until arrival of the surgeon. The rupture of an artery can be distinguished by the colour of the blood, which is red, and spurts out, while a vein has dark blood, and flows continuously. For wounds on the head or face apply absorbent cotton, and bind with a bandage. The company has set a good example.

The *Brisbane Daily Observer* is indignant, and not without reason, at the flippancy with which some English writers dispose of the affairs of the Queensland colony in a fashion of their own, and says in reply to some incorrect statements respecting construction of lines on the land-grant system, that "at this moment there is before the country and the Parliament of Queensland a proposal to construct a land-grant line from the vicinity of Charleville to the New South Wales border, covering a distance of some 250 miles. This line is admittedly national in its character, and when constructed will be a most valuable artery for securing a large trade that is now lost to the colony. If there is any one colony among the Australasian group that is entitled to take special pride in its railway policy, that colony is Queensland. Considering its age as a separate colony and its limited population, it has shown an energy and vigour in pushing on three main trunk lines into the heart of the interior which is simply wonderful. We have not time to dwell, nor need we, on the grand triumph of engineering skill and daring that has been evinced in making our lines over country that would make the heart of the writer of the article in the *Westminster* quail."

A return has been published containing all accidents and casualties reported to the Board of Trade by railway companies during the six months ending June 30, 1882, together with special reports on certain accidents which were inquired into, and to which we have drawn attention in this column. From this it appears that 522 fatal accidents occurred in that time, against 497 in the corresponding period of last year. Of the killed, 56 were passengers who lost their lives from various accidents, such as collisions between passenger trains, failure of couplings, falling between the carriage and the platform while the train was in motion, &c.; 252 were companies' servants, and the rest were chiefly trespassers, 117, including 31 suicides; 37 were killed while passing over railways at level crossings. The number of injuries not fatal was 2072, as against 2009 in the same period of last year. In the case of companies' servants, the most fruitful causes of accidents were—coupling and uncoupling, to which 194 injuries are put down, 18 being fatal; shunting, which caused 28 deaths and 417 injuries; working on the permanent way, during which 66 were killed and 53 injured; and walking, crossing, or standing on the line on duty, by which 54 met with death and 94 with injury.

A report by Major Marindin on an accident which occurred on the 17th ult., between Tongham and Farnham stations, on the London and South-Western Railway, condemns the light permanent way still in use on some parts of the South-Western Railway. The engine, by its violent oscillation, burst the road for about 50 yards, ran for about 90 yards after finally leaving the rails, and came to a stand with the leading end embedded in the side of the cutting. The whole of the vehicles in the train were in their proper order, and none were upset, although they were zigzagged across the line. Only two passengers are returned as having been injured. From the evidence it appears that, immediately after shutting off steam, the engine commenced to oscillate so violently that it displaced five rails, alternately on the left and right side, breaking several chairs and fastenings under each, then fractured and displaced the sixth rail on the right-hand side, and then broke the next rail on the left-hand side into three pieces, so that it ran off the rails upon this side, finally coming to a stand in the bank of the cutting 139 yards from the first bent rail, and 90 yards from the point where it ran off altogether. The engine was in good order, but owing to its construction, with short wheel-base, and an overhang at each end of between 6ft. and 7ft., it was not, Major Marindin says, suited for very fast running; for any oscillation which might be set up would probably increase the further the engine travelled, when at speed. The speed is considered to be about 45 miles an hour, which, the report says, "is too high a speed for this type of engine to run upon such a weak permanent way as that upon this branch."

NOTES AND MEMORANDA.

It has been found that copper wires transmitting electric currents of high electro-motive force gradually become brittle.

The Isle of Man census returns shows that on April 4th the population numbered 53,492, a decrease, as compared with 1871, of 550. The number of summer and autumn visitors during 1871 was about 75,000; last year the number was about 130,000.

The Royal Society has awarded the Davy medal in duplicate to the Russian Professor D. Mendelejeff and to Lothar Meyer "for their discovery of the periodic relations of the atomic weights," by which Mendelejeff was enabled to predict the existence of the new metal gallium in 1876.

It is stated that certain kinds of wood, although of great durability in themselves, act upon each other to their mutual destruction. Experiments with cypress and walnut and cypress and cedar prove that they will rot each other while joined together, but on separation the rot will cease, and the timbers remain perfectly sound for a long period.

With the six large Edison dynamo machines in the New York central installation, each driven by engines indicating from 120 to 150-horse power, it has been found that if one machine falls in speed, the currents from the other machines short-circuit themselves through the machine which has dropped in speed, and thus overpower the engine driving it.

According to the *Monthly Magazine of Pharmacy*, a pulverulent mineral containing vanadium has recently been discovered in the northern part of the Island of Ceylon. Should this source prove abundant, it may give an additional impetus to the manufacture of those compounds of vanadic acid, and we might hope to see "vanadium ink"—the only really "permanent" writing fluid at present known—an ordinary article of commerce.

A German paper quotes the following from the works of the great Leonardo da Vinci to show how near he came to the telephone in the fifteenth century:—"When one is upon a lake, if he puts the opening of a trumpet into the water and holds the point of the tube to his ear, he can perceive whether ships are moving at a remote distance. The same thing occurs if he thrusts the tube into the ground, for then also he will hear what is going on at a distance."

At a recent meeting of the Paris Academy of Sciences a paper was read on "The Earthquake of the Isthmus of Panama," by M. de Lesseps. The phenomena seem to have been much exaggerated. The character of comparative immunity of the Isthmus, as compared with regions near, is not seriously affected; and in any case, M. de Lesseps says, the construction of a maritime canal without locks is justified. There is no ground for apprehension as to the banks of the canal.

Dr. Fleitmann, of Iserlohn, well known as the inventor of a process for welding nickel, says the *Athenæum*, has published a striking result showing the rapid formation of mineral veins. Two years since, the bottom of a stable pit was rammed hard with common clay containing iron. It has served for storing dung for that period, water being thrown in occasionally to prevent overheating. It having become necessary to remove the pit, it was found that the clay had lost all colour, and was divided by numerous fissures from $\frac{1}{12}$in. to $\frac{1}{6}$in. in width, which were filled with iron pyrites. The iron oxide of the clay was changed by the action of the organic matter and the water containing sulphate of ammonia, into ordinary mundic—sulphate of iron—which deposited itself in the fissures.

According to the *Journal of the Society of Chemical Industry*, success has at last attended the efforts to construct a form of coke oven, of which one is now working experimentally in the Middlesbrough district, by which the old difficulty of at once saving the tar products and obtaining an excellent coke is now likely to disappear. In the above experiments the operations are by no means limited to a small scale on which conditions not realisable on a larger scale might obtain. The plant set up is turning out about 150 tons of coke per week of excellent quality, and saving the bye-products. The plant itself appears to be durable, so far as apparatus for such a process can be expected to be, and without any unusual liability to get out of repair.

In 1863 salt was discovered at Middlesbrough by Messrs. Bolckow, Vaughan, and Co. at a depth or about 1200ft., the salt being about 100ft. in thickness, but the endeavours of Messrs. Bolckow, Vaughan, and Co. to utilise the salt were fruitless, and a company subsequently formed to work the salt also gave it up. It is now, however, being worked. In 1874 Messrs. Bell Brothers proved that the salt extended to South Durham, and from a boring and pumping tackle they put down they are now obtaining brine producing 150 tons of salt per week. The wells consist of two tubes, one inside the other, leaving an annular space, down which water is poured. About 56ft. or 60ft. of the lower part of the tube being perforated, the water dissolves the salt, and thus sinks to the bottom and enters the inner tube, up which it rises to a height from which it is pumped.

At the last meeting of the Chemical Society a paper was read, "On the Oxidation of Cellulose," by C. F. Crop and E. S. Bevan. By the action of boiling 69 per cent. nitric acid, cellulose is converted into an amorphous substance, which swells up, on washing, to a gummy mass. On analysis it gave constant numbers, although obtained from various sources, indicating the formula $C_{18}H_{26}O_{16}$. The authors propose the name oxycellulose. This substance yields a tri-nitric ether. In this and other properties it exhibits undoubted cellulosic characteristics. Professor Thiselton Dyer said that the field which lay in the borderland between vegetable physiology and organic chemistry, and in which these chemists had worked, was regarded by many scientific men with the greatest curiosity. The botanists arrived at various results empirically, and were obliged to make up a sort of spurious chemistry to explain them. Thus in some way cellulose is converted into lignin; the chemist infers that cellulose is related to starch, and some believe that starch is the starting point of plant life. This position is challenged by Strasturger, who thinks that cellulose and starch are formed by the breaking up of proleids.

Though not an engineering material, engineers are sometimes interested in meerschaum, the place most productive of which is known to be near the town of Eski-scheir, in Anatolia, Asia Minor. A recent account by Herr Adler states that the preparation of 100 boxes of meerschaum there takes twelve to fifteen persons two months, and costs about £120. In Eski-scheir the average price of the box of mercantile ware has varied since 1873, between about £6 to £10—last year it was about the former. Refuse ware can be had at about an eighth of the price. There are ten qualities, and each is to be had in four sizes, there being twenty-five to forty pieces of the first size per box, and 450 to 1500 pieces of the fourth—the box is 30in. long, 8in. broad, and 15½in. deep. In the last two decades, the export of meerschaum has considerably increased; from 3000 boxes in 1855 it has risen to 11,100 in 1881. In Constantinople the trade is managed by about fifteen firms, Austrian, Bulgarian, Greek, Armenian, and Turkish, who bring their wares into the Vienna market. The large importation into Vienna may be said to date from between 1850 and 1860, when the production of pipe bowls and cigar tips was greatly increased for export to England, France, and North America; in 1860 a considerable export of pipes to San Francisco was first developed, while large quantities of cigar tips were sent to America and Australia *viâ* Hamburg. Since then the conditions of the trade have altered much, chiefly, the *Times* says, in consequence of the high duties imposed in America. In that country arose, with the aid of emigrant turners from Austria, a home industry, which has successfully competed with the Vienna pipe manufacture—for the products of which America was previously the best customer. With France and Germany, the United States obtain the raw product mainly from Austria.

MISCELLANEA.

A general strike of the ironworkers in the fifth district of the amalgamated associations covering parts of Indiana and Illinois, with St. Louis, had on Monday last commenced, against a 10 per cent. reduction of wages. Several mills were already shut up.

It is reported from Odessa that the Russian Minister of Marine has intrusted the torpedo department with the task of protecting the Crimean coast and the whole Black Sea line with torpedoes. Four new monitors are also being built for the same purpose at Nicolaieff, and two at Sebastopol.

An interesting note on the manufacture of steel from phosphoric pigs at the Creusot Works, by M. Delafond, and published in "Les Annales de Mines," has been translated into English by Mr. Gilchrist, and contains a great deal of useful information on the present position of the basic steel process at these celebrated works.

The total length of the Channel Tunnel boring at Sangatte, a correspondent of the *Times* says, is now rather more than 400 yards. Unusual progress has been made lately, and during seven recent days no less than 73 yards were pierced. Night and day gangs are employed, and the men work the full seven days in the week.

The Royal Commission on Metropolitan Sewage Discharge met on Friday last. Present, Sir P. Benson Maxwell—in the chair—Sir John Coode, Colonel Ewart, C.B., Dr. Williamson, F.R.S., Dr. de Chaumont, F.R.S., Mr. James Abernethy, F.R.S.E., and Dr. W. Pole, F.R.S., secretary. Further evidence was given on the part of the complainants.

At a conference of the chairmen and principal officers of the harbours, docks, and piers authorities of the United Kingdom, held in the Westminster Palace Hotel on the 1st inst., after long previous notice, Colonel Lyne, J.P., chairman of the Newport Dock Company, in the chair, it was resolved,—"That an association should then and there be formed, styled the Harbours, Docks, and Piers Association, the object of the association being to consider all matters affecting the interests of the harbours, docks, and piers of the United Kingdom, either separately or collectively, to watch all Bills brought before Parliament in connection therewith, and to take such action relative to all the above matters as may be deemed advisable, and that a sub-committee be appointed to carry out the purposes of the association," Mr. Robert Capper, general superintendent Swansea Harbour, being hon. secretary.

Mr. S. G. Denton, F.M.S., 25a, Hatton-garden, has just exhibited at the Meteorological Society forty-six newly-made mercurial thermometers, constructed in a special manner, the zero of which has remained constant for over twelve months. The thermometers comprised twenty-three standards and twenty-three clinicals. To prove that they were newly-made, the pieces of enamel stems were sent to the Kew Observatory and marked, previous to having their bulbs blown. They were then constructed into thermometers, graduated and returned to the Observatory, and tested throughout. They were then placed under seal by the superintendent, and remained so for over twelve months, and then again retested, the mean amount of change being only about 0·05 of a degree Fah. A standard thermometer, made by the same process as above, was also shown, it being verified in 1873 and in 1882, the zero being still constant.

The parliamentary report issued by the Board of Trade on its proceedings under the Weights' and Measures' Act, deals largely with questions that have arisen in the Birmingham and Staffordshire district. One of these has been as to the mode of stamping iron weights, which though usually bearing only one verification, are frequently stamped in two places. This double stamping, the report says, has been admitted by the best authorities to be a bad practice, and the Act appears to allow of only one stamping. Serious inconvenience to traders has also arisen in the use of iron and brass weights adjusted with several loose pieces of lead. As to local stamps of verification, of which at one time there were nearly 700 different designs in use, the report states that the local authorities throughout the kingdom now generally adopted the stamp suggested by the Board, but there are some authorities who still prefer their old design.

Some time ago we announced the amalgamation of the two firms, Sir. W. G. Armstrong and Co. and Messrs. Mitchell, shipbuilders. The prospectus is now issued of Sir W. G. Armstrong, Mitchell, and Co., Limited. The capital is £2,000,000, in 20,000 shares of £100 each, of which it is proposed to issue at present 18,500 shares. Of these it is stated 11,850 shares, fully paid, are taken by the vendors, and the remaining 6650 shares are now offered for subscription at par. The company has been formed to take over the businesses and properties of the united concerns of Sir W. G. Armstrong and Co., of the Elswick Works, Newcastle-upon-Tyne, and Messrs. C. Mitchell and Co., of Low Walker, near Newcastle-upon-Tyne, and to carry on those businesses, with the addition of the manufacture of steel, and with such other additions and such modifications as may be found expedient. The board of directors, of which Sir W. G. Armstrong is chairman, is a strong one.

At the last meeting of the Central Board of the Miners' National Union, held at Durham, Mr. Thos. Burt, M.P., the chairman, called the attention of those present to a scheme put forward by Mr. Ellis Lever, of Manchester, to give a premium of £500 to any person who could invent the best portable electric lamp for use in mines. A letter was read from Mr. Lever, jun., stating that in his opinion a portable electric lamp to be used in mines was quite a probable thing. The meeting, looking upon the offer as an important thing, moved the following resolution:—"That this meeting desires to tender to Mr. Ellis Lever its best thanks for his kind and generous offer to pay a premium of £500 to the person who can invent the most useful portable electric lamp to be used in mines. That should Mr. Lever still kindly consent to give the premium of £500 for this purpose, the president and secretary be empowered to correspond with him, and if necessary see him on the subject." It was further agreed that the president (Mr. Burt), the vice-president (Mr. Pultard), and the secretary (Mr. Crawford), should form a sub-committee to assist the praiseworthy object which Mr. Lever wishes to bring about. The question of the amount of safety which miners have in safety lamps has long been a debated question, so that the offer will doubtless create a great interest in mining circles.

The following statement referring to the Forfar sewerage is published, as showing that sewage farming may be carried out at a profit. The Forfar Sewage Farm was laid out by Messrs. Bailey, Denton, and Co., four years ago on the principle of combining surface irrigation with intermittent filtration; and twenty-seven acres have been found sufficient to cleanse the sewage of 13,000 persons. The extent of the farm purchased by the burgh authorities was forty acres, and its cost £4000, with £1500 for laying it out for the reception of the sewage. The following statement of the income and expenditure in connection with the Orchard-bank Sewage Farm, for the year ending 15th October, 1882, as submitted, is from the *Forfar Herald*:—Receipts: Barley, £19s. 3s. 9d.; oats, £24 9s.; carrots, £32 4s. 9d.; Swedish turnips, £109 7s. 1d.; yellow turnips, £25 19s. 4d.; mangolds, £43 6s. 11d.; cabbages and savoys, £27 10s. 6d.; grass and hay, £131 18s. 3d.; sand, £11 3s. 4d. Total, £425 2s. 11d. Expenditure: Railway carriage, cartage, advertising, auctioneer's commission, seeds, &c., £38 1s.; manual labour, horse work, &c., £215 6s. 10d.; tools, repairs, books, &c., £1 14s. 6d., showing a total expenditure of £255 2s. 4d., and leaving a balance of £170 7d., which, with £30 added as rent of a house, £200 7d., or 3 per cent. on the outlay as profit for the year. The sewage from the town is applied to twenty-seven acres, or thereabouts, from which £362 7s. 10d. has been realised, equal to £13 8s. 5¼d. per acre. Thirteen acres are cultivated, which are not manured with the sewage, and the income from this acreage amounts to £49s. 11s. 9d., or £3 16s. 3½d. per acre.

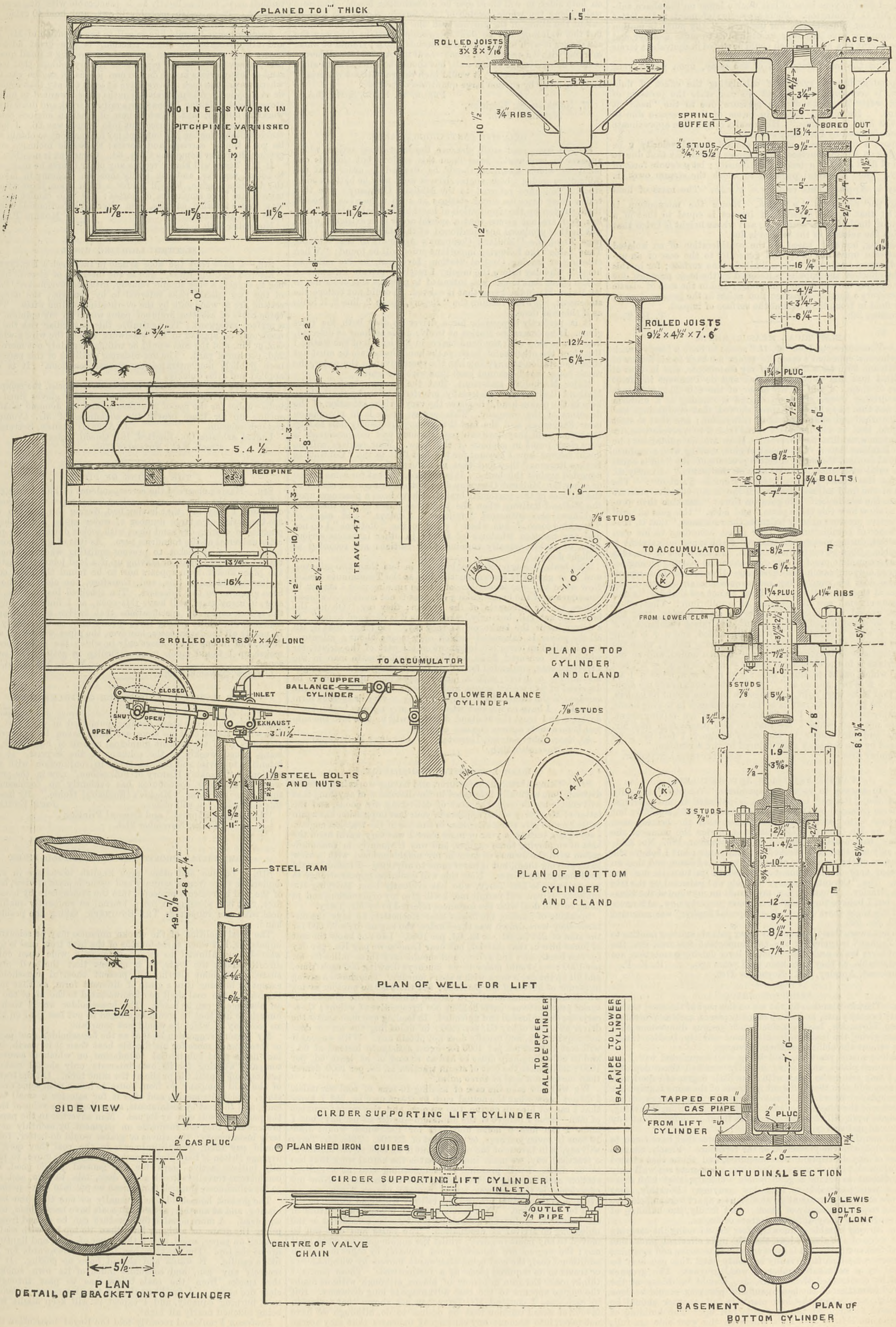
THE MANCHESTER SHIP CANAL.

(For description see page 395.)

HYDRAULIC BALANCED LIFT.

MESSRS. ARCHIBALD SMITH AND STEVENS, BATTERSEA, ENGINEERS.

(*For description see page 386.*)



LETTERS TO THE EDITOR.

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

THE PRESSURE OF FLUIDS IN MOTION.

SIR,—I read in your issue of last week a letter on the above subject by Mr. G. Pinnington. There are some statements in the letter which I do not understand. For instance—"Any pump in motion could mount or have its power so utilised as to cause another and help to mount to a height which could be stated in equivalent terms $\frac{Mv^2}{2g}$." But the main statement of the essay, upon which your correspondent bases a system of calculating the effect of fluid impact, is erroneous, viz., "That we can state the pressure of flowing water in terms of the pressure due to the 'head' it contains." He should say, "in terms of the pressure due to twice the head it contains." His results might then approximate to those obtained by Hawksley's formula.

Suppose a fluid stream of cross section A and velocity v be impinging on a plane surface, and suppose its velocity that due to a head of fluid h. Let ρ denote fluid density; let g denote force of gravity. Then the total pressure to which the stream owes its velocity is $A\rho g h$. This velocity $= \sqrt{g2h}$. The mass of fluid flowing per second is $A\rho\sqrt{g2h}$. Hence the momentum is $A\rho g 2h$; that is, the pressure of impact is equal to that of a column of fluid of cross section A, and whose height is twice that to which the velocity of the stream is due.

Reasoning, however, based on the consideration of an isolated fluid stream must not be applied generally to the case of an unlimited stream impinging upon a limited plane surface; for in this case the effect of the impulse is lessened by the back pressure due to the eddying motion behind the plane; and in the case of elastic fluid pressure a further consideration exists in the greater density of the fluid in front than behind the surface of impact.

November 9th. T. H. T.

ELECTRICAL MEASUREMENTS.

SIR,—Your correspondent "Φ. Π." seems to have a happy knack of proving his opponent's case; he refers me back to his letters of June 9th and 30th for a disproof of my statements, and in that of the 30th I find him quoting Rankine and de Pambour in direct support of them. I said in my letter of the 6th that resistance equals driving power when an engine is running at a uniform speed, but that any change of speed showed that equilibrium had been disturbed and was in process of restoration; and that to start an engine, that is, to change its speed from 0 to n revolutions, its equilibrium must first be disturbed. Here are his quotations; he quotes Rankine thus:—"In a heat engine, moving with a uniform periodical motion, the mean effective pressure of the fluid is equal to the total resistance per unit area of the piston." Exactly so. Now for the second point, quotation from de Pambour: "The action of the fluid adjusts itself until the mean effective pressure balances the resistance." He goes on thus: "Rankine then proceeds to show how this takes place," and adds, "this goes on until the effective pressure exactly balances the resistance," that is, that disturbance of equilibrium can take place, according to his own authorities, during motion, for without disturbance adjustment is impossible. This he contradicts *in toto*. In his letter of the 14th he gives a complete proof of my explanation of starting an engine, but draws a wrong conclusion therefrom—the converse of a schoolboy who does his sum wrong and copies the answer out of the answers at the end of the book. Does he not see that his "small successive efforts" are disturbances of equilibrium? That effort n must exceed resistance x in order to start motion, that the increase of speed caused by this disturbance raises resistance to x' in time t, when it balances n? n' is then added, and $n + n'$ being greater than x', the speed increases again during time t', when the then resistance x^2 balances $n + n'$; n^2 is then added, and so on. His mistake is in the deduction, that $x = n$, $x' = n'$, $x^2 = n^2$, and so on, which ought to stand thus: $x < n$, $x' = n$, $x^2 = n + n'$, $x^3 = n + n' + n^2$, and so on. "Φ. Π." does not answer my argument, that if he were right, governors to engines would be useless, nor does he give me the results of his experiments in towing boats, but simply tells me that I don't know what I am talking about. Perhaps not; but when I see that he also places men like Mr. Browne and Mr. Hoyle in the same category, I feel far more honoured by the company than injured by the accusation.

November 21st. AN ELECTRICAL STUDENT.

PATENT TRICYCLES AND BICYCLES.

SIR,—In answer to your correspondent "Wheeler," the only part of the "Rudge" bicycle that is patented is the bearings. They were patented by D. Rudge 8th February, 1878, No. 526; but as he was anticipated by J. H. Hughes with the bearing now worked by Mr. Bown, of Birmingham, under the name of the "Æolus" ball bearing, patented 19th September, 1877, No. 3531, I can only see that it is worked on sufferance; but I believe the proprietors of the respective patents have joined issue, and that an important case of infringment now awaits its turn in our law courts. The "Coventry Rotary" tricycle was patented by the late James Starley. I cannot lay my hands on my copy of the Blue-Book, but I believe the patent is common property now, as it never passed the three years' stage. The "Special Zephyr" was patented in 1882, No. 520.

I am not aware that there are any other patents existing relating to the "Zephyr" tricycles, as the two important features, viz., the ratchet lever brake and the compound lever driving connection, are not patentable, as they have been used years ago. R. E. P.

Selby-road, Anerley, S.E., November 21st.

BRIGHTON BEACH.

SIR,—The inroads made by the sea on this part of the coast within the last twenty years, and which in many places, such as Worthing, Lancing, Hove, &c., have obtained such serious dimensions that they are giving the local authorities some anxiety, besides taxing to the utmost the abilities of their surveyors.

Residing many years in, and being well acquainted with, the above-named places, and having intently watched these depredations, I may assume to speak with some little degree of experience, and I may add also that different members of the same family have been employed at various times within the last century on the protection of the foreshore, not a hundred miles from Worthing, and whose work till this day is held as the most effective of any previous or past surveyor.

I will mention a few of the ideas and schemes that have come to my knowledge in the protection of the foreshore. Firstly, that no groynes of any description were required, and those that existed were allowed to wash away. Secondly, a concrete sea wall only was sufficient to retain a good beach. Thirdly, that high short groynes were preferable to long low groynes. Fourthly, that immense concrete groynes at great distances apart were sufficient to keep the required quantity of beach. And fifthly, the building of these groynes at many different degrees or angles.

Now, Sir, my humble opinion is, after experiencing the carrying out of some of the above ideas, that the most effectual protection against this encroachment is by every means securing and retaining the beach—of which there really is plenty—and this can only be effected by a sufficient number of wood groynes. The groynes should be constructed thus: Piles, &c., should be driven at the required formation of the beach, and the planking should be done gradually, *i.e.*, when the last plank is full another should be fixed, and so on until the groyne is full up. The building of groynes some 15ft. or 20ft. high, which on the west side are full, while on the east side the feet of the piles are almost showing, is a very faulty method of construction. A groyne, in my opinion, if it acts as a perfect groyne, should be full on both sides. By these means an even foreshore would be obtained; and these groynes should be built at an angle inclining, if any way, to the westward, with a sufficient number of catch groynes.

I think it is a mistake to build large concrete groynes standing up many feet above the beach; admitting they are very serviceable, they should be built gradually, otherwise they will never be full on both sides, or will there ever be a continuous beach. Concrete walls along the whole stretch of the foreshore assist to a great extent the filling of the groynes and the retaining of the beach, but this wall must not be built perpendicular if in this way the sea strikes it with much force, and ascends into a pyramid of water carrying with it a quantity of beach—as at the Aquarium wall here—besides doing damage to the wall, but should be built so as to allow the sea to expend itself. It would then return without materially carrying away by suction large quantities of beach.

FREDK. W. HYDE, A.R.I.B.A.

37, North-street, Brighton,
November 20th.

DELUSIVE CONTINUOUS BRAKES.

SIR,—I have read with pleasure the interesting article which appears in last week's issue upon this subject, but there is one point to which attention should be directed in order that the difficulties under which engine-drivers work may be better understood. You have referred to the Midland Company's rule that trains must enter terminal stations at such a speed as to enable them to stop by the application of hand-brakes only; but, doubtless, you are not aware that a special order is in existence which was neither produced nor mentioned at the official inquiry. Upon page 20 of the "Midland Company's Appendix to the Working Time Table" the following important order will be found: "When entering or leaving Central Station, Liverpool, twelve miles an hour." The day before the inquiry I received private information to the effect that it was not intended to produce this order nor to let Major Marindin know that it existed. I could not believe the statement, but after reading the "Report," page 2, line 3, it looks as if this was done.

It is perfectly impossible for a driver to obey both the rules given. If he enters the station at twelve miles an hour as directed, how can he stop with the hand-brakes in the length of the station? But if, on the other hand, he obeys the hand-brake rule he must not enter the station at anything like the speed given in the order, the result being that he cannot keep time with the train.

Major Marindin's statement, that the vacuum brake on the Midland Railway is "materially interfered with by the leakage hole in the piston-head," deserves the very serious attention of the directors of the company. This vacuum brake is in my opinion most dangerous, and the fact that it very frequently fails to stop the trains until they have run past stations and danger signals is very clear proof in support of this view. Your readers will no doubt ask me how I account for the fact that in the "Continuous Brakes Returns" they find that no failures of any importance are recorded against this brake. It is well known that for some reason or other the Midland Company does not make a correct return of the failures of this particular brake. I have been a passenger upon the Midland Railway when the brake has failed to stop the train, and have also witnessed "failures," "delays," and cases of "breaking loose;" but when I refer to the "Returns" I do not find any mention whatever of them; in other instances serious cases of trains actually running past stations are recorded as "slight delays."

This brake is constructed to leak off in less than two minutes, and it is generally known on the line as the Two-minute Brake. Now when any case takes place of a train running past a station in consequence of the brake leaking off, that is not considered a brake failure by the advocates of the system; they say "Oh no, the brake did not fail, but only leaked-off as it is designed to do." If a driver keeps the brake on, as they say, "too long," that is, till all the power is exhausted—which only means about a minute—that is called an error of judgment on the part of the driver, for which he is censured, fined, or like the unfortunate man in the Liverpool case, suspended from duty for a fortnight. It is no light matter for a driver with a family depending upon him to be deprived of two weeks' wages, and it seems doubly hard when the accident is the result of the company using a very dangerous form of brake. I have no interest whatever in any railway brake, but I do hope and trust the Midland directors will inquire into the subject before some serious disaster occurs.

40, Saxe-Coburg-street, Leicester, CLEMENT E. STRETTON.
November 20th.

ROAD LOCOMOTIVE LEGISLATION.

SIR,—Being a brick manufacturer, and having works in a country district, I am naturally interested in the discussion of anything that will enable me to lower the cost of delivering my goods, and the letter of Mr. Terry which appears in your last impression has again caused me to give some attention to the use of the traction engine. I say again, because a year or more since I was very warm upon the idea of employing these engines, and was frequently in communication with the owners of some in my neighbourhood with a view to employing them, but it never came to anything—I found I could haul cheaper by horses. Now this will doubtless appear strange to you and also to Mr. Terry, who has evidently been studying the subject. If you will permit me, I will give my explanation, and in doing so will deal with the instances referred to by Mr. Terry.

Speaking of hauling the bricks near Rochester, he says the distance they were drawn was three miles, the engine drew 35,000 for the sum of £11 7s. 6d., or 6s. 6d. per 1000. I do not know the cost of horse hire in that district, but near London we pay 10s. per day for one horse, cart and driver, and should cart three miles for 6s. per 1000; we should make three journeys drawing 500 each time, and fill up the day's work with a short journey. This shows a saving in favour of horses of 6d. per 1000; but there is also another saving which must be considered. In carting bricks it is the almost universal practice to use carts holding 500 irrespective of weight; these carts are easily loaded and unloaded. In loading one man assists the driver at a cost of say 6d. per 1000; in unloading the driver does not require help, and usually does not obtain any. With wagons it will cost at least 9d. per 1000 for extra assistance instead of 6d., and in unloading help must be had at a cost of at least 6d. per 1000; this makes the cost of steam traction 1s. 3d. per 1000 dearer than horses in a lead of three miles.

We will now take the case of hauling 10 tons of coal ten miles. I do not know what the actual cost by steam may be, but I know that I cannot hire an engine, two wagons, and the proper number of men—three I believe is the minimum—under £3 per day; but I know I can hire a horse and cart for 10s. which would draw 10 tons in seven journeys, or at a cost of £3 10s. This, Mr. Terry will say, is in favour of the engine; but if we look at the matter in a practical way, we must inquire what is the actual work that has to be done. I will presume it is unloading coal at a railway station and drawing it ten miles into the country. Now my experience is that railway trucks contain nearer 8 tons on an average, and in actual practice the railway truckload would be the load for the engine. With horses I should unload such a truck in six journeys, or for £3. Another point to be considered is the unloading on arrival at destination. The horse and cart can be moved to any point required, whilst the engine gets as close as it can; the wagons are unloaded most probably by other men at an additional cost, the coal being afterwards moved by wheelbarrows or trams to its required place at a further cost. These points, I think, make the gain in favour of horses, although without doubt the engine appears to the best advantage in long distances. But in each case I contend Mr. Terry has not shown that saving in favour of steam traction that he desires to do, although we have not taken into account any contingent expenses that may accrue from damage to roads, water culverts, bridges, &c.

In drawing comparisons, Mr. Terry brings out the duty of the horse most unfavourably. He says each wagon and load weighing $3\frac{1}{4}$ tons would require four horses to enable that load to be drawn ten miles. Now this is an absurdity, and I should have supposed it to be a misprint, only he has twice mentioned it in his letter. An ordinary country wagon is about the most unsuitable conveyance that can be adopted, and if we are to attempt economy let us adapt our plant to its requirements. In my own case I use spring tumbril carts, built as lightly as is practicable with due regard to strength. These weigh probably 12 cwt. and hold 40 cubic feet; the width of tire is $2\frac{3}{4}$in.

Another point I would like to call to the attention of Mr. Terry and all advocates of steam traction, is the great advantage horses have over the steam engine in conveying a small quantity per journey; in ordinary practice it is very seldom that we can send as many bricks in one day to one job as an engine can draw, where we get one such job we have at least twenty that could not be so supplied. About twelve months since I wanted to unload a steam boiler weighing 3 tons from a railway truck and draw it to my works $2\frac{1}{4}$ miles distant. Two owners of traction engines came to see me about it; their price put into figures was £6. I had no tackle suitable for the job, but sent my foreman out to obtain some; he got a timber carriage and horses; the whole inclusive cost of getting the boiler home was £1 0s. 6d. Comment is needless.

If Mr. Terry will kindly reduce any other figures he may possess to actual practice, and can really show an economy in favour of the traction engine, he will confer a boon upon those who, like myself, are large employers of horses; but who cannot see their way to use traction engines, even after all objectionable bye-laws have been abolished. MORRIS PARKS.

November 20th.

ELECTRIC LIGHTING RISKS.

SIR,—I have read the able article in this week's ENGINEER on "Electric Lighting Risks," and in the interests of electric lighting beg to suggest a very simple remedy, hitherto overlooked, for one of the two special risks referred to by you, viz., the danger of setting fire to woodwork by the overheating of line wires. Two or three coats of asbestos fireproof paint would in my opinion prove a perfect safeguard. To neutralise this particular risk the paint need only be applied to the woodwork under the wire a width of 6in. or 8in. and the cost would be trifling, certainly not more than $2\frac{1}{2}$d. per lineal yard. The fire-resisting qualities of this paint have been publicly demonstrated on several occasions. It is easily applied and dries quickly.

As to the risk to workmen from electric shocks, the company I represent was the first to introduce asbestos gloves lined with india-rubber for the use of electricians, and the demand which has sprung up for these proves the soundness of Mr. Crompton's recommendation. J. ALFRED FISHER, Secretary.

United Asbestos Co., Limited, 161, Queen Victoria-street, E.C., November 20th.

THE CASTING OF PIPES.

SIR,—Having observed the correspondence in THE ENGINEER in reference to the advantages of casting water pipes with sockets up or down, I may say that having had, during the last ten years, the inspection of a large number of water pipes, I find that the practice of casting dry sand pipes with socket down is now practically universal at the foundries here. As it is of great importance to have a sound socket to prevent splitting when driving, if a turned and bored joint, or staving up if a lead joint, the casting of the pipes socket down appears now to be found the most certain method of obtaining this, and, therefore, the older method has been given up by the founders. The specified instructions, however, in many cases, still leave this open, as I find in going over thirty-five copies of specifications that twelve of these specify socket down, whilst twenty-three specify to be cast vertically only. In nearly all the latter cases, however, the pipes were cast socket down, and in one or two cases only in which the pipes were cast socket up I found much more difficulty in getting the sockets sound. W. J. MILLAR, C.E.

Glasgow, November 20th.

THE HARBOURS AND TRADE OF FOLKESTONE.

SIR,—Permit me to correct a slight inaccuracy which appears in the article under the above heading published in your last issue. The writer states that no steps are being taken to preserve the gleanings from the ancient municipal records of Folkestone, now being issued weekly in the columns of the *Express*. It is my intention to revise and re-issue them in conjunction with a new edition of "Mackie's History of Folkestone," now in the press—a work which your contributor has evidently no cognisance of, though he mentions "Mackie's (English's) Guide." By inserting this correction you will oblige. JOHN ENGLISH.

"Folkestone Express" and General Printing Works, November 21st.

COMMERCIAL PROFIT FROM HOUSEHOLD FIRES.

SIR,—London and other large English towns are in such a deplorable state from a sanitary and æsthetic point of view, because of the foul ingredients projected into the atmosphere by household fires, that it is pleasing to see a journal so eminently qualified to deal with the subject as THE ENGINEER, taking the problem in hand.

The total abolition of the smoke nuisance may be scientifically impossible, but when three-fourths of the heat from coal is usually wasted, and allowed to escape through a wide open chimney directly above the grate, it is evident that the evil may be abated. Without altering the present cheerful household fire, except by burning it in a grate of different form, so that most of the heat of the coal shall be communicated to the air of the room, an abatement can be made. The householder would then make himself so hot that he would be obliged to put less coal on his fire, an economy of which he would not complain.

My present suggestion is, that as the householder now pays two or three times more for his fireside heat than it is worth, in that fact lies a good substantial foundation on which a commercial company working for its own interests only should make sure profits, and benefit the public at the same time. Let the travellers of the said company go from house to house with some excellent stove, explain its merits, and offer it for sale for a small sum at once, and the rest by instalments, according to the value of the coal the purchaser will save by its use. Men advertise in the papers at present that they sell furniture on payment by monthly or quarterly instalments; the stoves or grates would do better, for they would pay their own instalments in the coal they save. The average Briton is too unintelligent and heavy to move, to personally initiate active steps for the general public good, but if commercial travellers knock at his door, talk to him, and appeal to his selfishness, sluggish motion can be put into him—perhaps.

The present household fire is usually at one time too hot and blazing, and at another, after fresh coals have been added, too cold and dead. A more equable temperature can be gained from it by piling the grate to a higher level than its top bar with coal, then putting on paper, wood, and a thin layer of coal, and lighting the fire at the top. The fire then has to burn downwards for hours, like a candle. It wants and should have no poking. It leaves scarcely any ash, and consumes much of its own smoke, for the smoke from the coals below has to pass through the clear fire above. A fire lit at the top two hours ago is before me now, burning equably, and I expect it will keep alight without being touched nearly all night.

Professor Frankland recently told the Royal Institution that he had cheap household fires at home with inexpensive alterations in his grates, but he omitted to give the particulars.

London, November 21st. W. H. HARRISON.

THE FELL ENGINES ON THE RIMUTAKAI INCLINE, NEW ZEALAND.*

By Mr. R. F. Alford.

The four Fell engines about to be described have been working for about five years, with great success, on the Rimutakai Incline, between Wellington and Featherstone, New Zealand. They were built for the New Zealand Government railways in the years 1875 and 1876, on the advice of Messrs. Hemans and Bruce, consulting engineers to the Government, and of Mr. John Carruthers, engineer-in-chief in the Colony, at the works of the Avonside Engine Company, Bristol, then under the management of Mr. J. C. Wilson, who left the designing to the managing clerk and chief draughtsman, Mr. H. W. Wiedmark, to whom the credit of their success is chiefly due. The gauge adopted for the New Zealand Government railways is 3ft. 6in.; the portion over which the Fell engines run is laid down with steel rails, 70 lb. per yard, of the Vignoles pattern, on cross sleepers 9in. by $4\frac{1}{2}$in., with 3ft. centres, and 12in. by $4\frac{1}{2}$in. sleepers at joints. The centre or horizontal rail is 70 lb. per yard, placed on longitudinal sleepers 12in. by $4\frac{1}{2}$in., and having its centre raised $6\frac{1}{2}$in. above the face of the ordinary rails.

Before proceeding to describe the arrangement of the Fell gear, it may be well to make a few general remarks on the leading dimensions and features of the engines generally :—It was requisite to obtain the greatest strength with the least load; therefore, the frames, cross-stays, and all the motions of both engines are made of steel, and the cylinders are as lightly proportioned as the exigences of the case admit. The boilers, which are of best Yorkshire iron, with copper fire-boxes, are clothed with felt, the cleading being supported on iron rings, so as to avoid the heavier wooden covering; the arrangement of boiler and tanks is, generally speaking, the same as in an ordinary side tank engine with trailing bogie, or radial axles, and only differs in a few minor points, such as the crown of the fire-box sloping back to an incline of 1 in 15, so as to keep an equal depth of water over it when on the incline. There are double regulators in the dome, and the heating and fire-grate area is calculated to supply four cylinders instead of two. The tanks present few features worthy of notice; they are made with false bottoms at the leading end, with opening so as to allow the inside gear to be approached for cleaning and oiling, which could not otherwise be managed, owing to the want of space. A number of trays or receptacles for oil are inserted, so as to prevent grease dripping on to the central rail, or getting on to the periphery of the horizontal gripping wheels. The sand boxes, of which there are four pairs, are arranged as follows :—The leading pair form a casing for the steam and exhaust pipes of the outside cylinders, while the trailing pair are cast iron sunk in the tanks over the pair of wheels they are intended to serve. The two pair that supply the Fell wheels are on the top of the tanks and form the sides of the manholes through which the tanks are supplied with water. As through the great amount of gearing there would be great difficulty in arranging ordinary cylinder blow-off cocks for the four cylinders and their steam chests, W. H. Wiedmark's patent cylinder cocks were used. These are all worked from one steam cock on the front of the barrel of the boiler, on the right-hand side of the engine, corresponding with the blower, which is on the left. Some changes have been made in the cab from the original form since the engines have been at work, as it was found that in running up the incline with a heavy load the suffocation in the tunnel was very excessive. This has been met by boxing in the footplate more completely, so as to give the driver and stoker as much protection as possible.

The ordinary coupled wheels of these engines are worked from the outside cylinders, which are entirely separate and independent of the inside or Fell engines, and one chief point in arranging the gearing was to provide means for working both engines separately, or from the same handles at will, so as to give the driver perfect control over the machinery of both, and enable him to use one without the other when running over a comparatively level road, yet at the same time to make the stopping and starting on the incline as simple as possible. The engine is supported on four coupled wheels 32in. diameter, having a fixed wheel base of 6ft. 9in., the centre of which coincides with the centre of the Fell system, and a pair of trailing wheels 30in. diameter, which are given lateral play, by being fixed in Wiedmark's patent radial axle-boxes. The distance from the centre of the fixed wheel base to the centre of the trailing wheels is 10ft. $10\frac{1}{2}$in., so that to pass round a five-chain curve without more grinding on the flanges of the coupled wheels than is incident to their own fixed wheel base of 6ft. 9in., it would be necessary to allow a play of $\frac{13}{16}$in. each way in the guides of the trailing wheels; this is met by the travel of 2in. each way, or 4in. total play given. Perhaps in a future engine, it might be well to lessen the incline on the top of the boxes, as experience seems to show that with the inclined planes of one in eight they do not adjust themselves to the curve as easily as could be desired, especially when the engine is pushing two or three loaded trucks up the incline with the radial end forward, and at the same time dragging four or five trucks at the other end. The author is not aware why this plan has been adopted, as the engine is not provided with Straddle's draw gear at the leading end, though it is at the trailing; neither has he positive information as to the reasons that induced the authorities to divide the train, and place the engine between the carriages, unless it be due to the fact that these engines broke the drawbars of the old rolling stock; but as new drawbars of much stronger section have been sent out, that reason hardly seems to hold good. The engines were intended to work at a boiler pressure of 120 lb. per square inch, three-fourths of which gives 96 lb. mean pressure in the cylinder. Lately, the general working pressure of engines in New Zealand has been raised to 150 lb., and has also been applied to these engines, which gives at the same ratio a mean pressure of 120 lb. per square inch.

The leading dimensions and particulars are :—

Coupled wheels	32in. diameter.
Tractive power	9·408 at 96 lb. pressure.
Tractive power	11·760 at 120 lb. pressure.
Trailing wheels	30in. diameter.
Fell or inside cylinders	12in. by 14in.
Fell wheels	22in. diameter.
Tractive force	8 797 at 96 lb. pressure.
Tractive force	10·996 at 120 lb. pressure.
Total combined tractive force	18·205 at 96 lb. pressure.
Combined tractive force	22·756 at 120 lb. pressure.
Heating surface :—	
Fire-box	74 square feet.
Tubes	783 square feet.
Total	857 square feet.
Grate area	13 square feet.
Capacity of tanks	614 gallons of water.
Capacity of coke-box	36 cubic feet.
Weight of engines, empty	$27\frac{1}{4}$ tons.

	Lead.	Drive.	Rad.	Total.
In running order, tanks empty	12·11	12·17	5·7	30·15
Tanks and coke-box half full	13·0	13·6	6·6	32·12
Tank and coke-box full .. .. : ..	13·8	13·14	7·7	34·9

Which gives load on coupled wheels available for adhesion :—

Tanks empty ..	56·896 lb. at 1-6th or 373 lb. per ton ..	9·482
Half full	58·912 lb. " " " ..	9·818
Tanks full	60·704 lb. " " " ..	10·117

The wheels are placed inside the frames, and have steel axles, with crucible cast steel cranks shrunk and keyed on the axles, which cranks form the bearing journal of the coupled wheels; there is 3ft. 3in. between the wheels, and the tires are $5\frac{1}{4}$in. wide, to suit the 3ft. 6in. gauge. The steel main frames are 4ft. 3in. apart, and $\frac{3}{4}$in. thick, being strongly stayed by vertical plates $\frac{7}{16}$in. thick, and horizontal plates $\frac{9}{16}$in. thick, which take the guides for the vertical axles of the Fell engines.

Passing now to some of the points where the two engines may be said to overlap one another, there are two regulators in the dome which are worked by handles at the back of the fire-box shell, so as to give the engine-driver power to shut off steam from either the outside engines, or the Fell engines, independently of each other. But at the same time, it was considered advisable to be able to work both with the same handle, so as to regulate the steam at any moment by one movement instead of two. This is accomplished by having the handles for both regulators side by side, so that, while they can be moved separately, they are connected by a screw arranged to adjust the relative positions of the handles, with a catch for throwing them out of gear with each other. Much the same plan is followed with the reversing gear. The link motion for the outside engines is worked by a screw, and the valve motion for the Fell cylinders is actuated by a leader and quadrant; but when it is wished to work both together the catch is raised from the quadrant and held back by a small catch at the top of the handle, while a catch on the opposite side of the handle is dropped into a fork in the prolonged end of the screw quadrant, so that both shall be worked by the screw.

The blast is arranged with a centre nozzle for the exhaust steam from the Fell cylinders, while an annular space forms the exhaust for the outside cylinders. This allows of a good blast when either engine is worked alone, also giving good results when the engines are combined, though from the nature of the case the draught must somewhat vary, as the engines, not being in any way geared together, sometimes the full blast of both engines will come at the same moment and sometimes at intermediate periods. The valve gear for the centre engines had to be specially arranged, as it appeared impossible, or nearly so, to get excentrics on the driving axles. The author believes the gear is unique of its kind, and he has never seen any similar to it, though he understands it is covered by a former patent. The lap and lead of the slide valve is obtained, as in Waelschaert's gear, from the crosshead of its own piston, though not in quite such a direct manner, as it is first taken to a rocking shaft, and then transmitted to the valve lever; the slot link, from which the travel is obtained, is worked by a rod from the rocking shaft of the opposite engine. The diagram from this motion is very good indeed; unfortunately, the author has not the notes taken from the ports of the engine. The next point, which only requires a few words in passing, is the arrangement of the motion bars and slippers, which are placed horizontally so as to take the thrust from the vertical wheels. The slippers are let into the guide bars instead of lapping over the edges. The cross-head pin is oiled from a syphon screwed into its centre, having a hole bored so as to supply oil to the brasses, the slippers being oiled from boxes placed on the guide bars. Passing now to the driving and coupled vertical axles of this system, the right and left-hand engines are connected so as to get over the dead point and keep the cylinders in beat with one another, by spurs on the under edge of the rolling discs of the driving wheels, while the coupled wheels are connected by coupling rods on the lower halves of the crank pins, and also secondary ones at right angles to the cranks half way down the axles. In starting with one cylinder on the dead point, this throws the strain for driving both the vertical wheels on the opposite side through one set of teeth. Mr. Fell proposes in any future engines to put straight vertical axles, doing away with the secondary coupling rod, and to move the leading wheels a couple of inches further forward, so as to allow of spur wheels on these axles as well as on the driving axle. This arrangement, though it would increase the spur gearing, would have the great advantage of only transmitting half the pressure through each, and dispensing with the crank shafts, which are a point of great weakness in these engines, as the pressure from the springs is transmitted through them to be distributed between the driving wheels at the bottom and rolling disc at the top, while the axle is not supported by its bearing in the same way as those in an ordinary cylinder engine, where comparatively little weight is on the centre of the crank axles, they having chiefly to contend with the torsion from the cylinders, while with the Fell engine these have both the torsion from the coupling rod and the pressure from the springs; besides which, dispensing with these two coupling rods would give more room and get rid of working parts and friction.

To return to the engine as it is made, the oiling of the connecting rods and both pairs of coupling rods is effected by syphon cups in the crank pins. A moment's thought will show that they cannot be put on the rods themselves. The oil for the bearing of the axle boxes of the vertical axles is supplied through tubes connecting them with oil cups, placed on the sides of the frame. The axle-boxes themselves are of brass, while the axle-box guides are of cast steel, the top guides being supplied with liners, so that they may be easily adjusted so as to move freely but without lateral play.

The springs for the gripping gear are tightened up by right and left-handed screws, having nuts, which are coupled to the spring buckles by pins. The pressure is put on or relieved by a handle on the left hand side of the footplate, working through worm and spur wheels. Seventy revolutions of the handle after the wheels touch gives a compression on the springs of 7·16 tons, which is divided between the rolling discs and gripping wheels in the proportion of four tons to the top and 13·6 to the bottom; so there is a pressure of 6·13 tons on each bottom wheel and two tons on each top disc. This it was considered would be enough to keep the spurs together and avoid any tendency to part; nevertheless, a stud was put through the guard to the top axle-box, as an additional security. It has been found in practice that the pressure is not quite sufficient, and the original studs were bent and have had to be replaced by stronger ones. In a future engine the springs could be placed a little higher, which would overcome the necessity of relying on the check stud in any way. In putting the pressure at 17·6 tons, the author has used what was about the limit one man could well put through the compression gear, which of course might be easily altered by simply changing the worm and spur wheels, or by altering the pitch of one of the screws. The former would be the preferable plan, as it would not be well to put a finer thread on these screws, which are 3in. diameter and $\frac{7}{16}$in. pitch. The springs are amply strong enough to bear a greater load, and even if they were not, might be easily changed for stiffer ones. The pressure of 6·58 tons on each wheel gives 27·32 available for traction for the four wheels, which is ample to take up the pressure which was originally contemplated, as dividing it by six we get 4·55 tons, or 10·119 lb. as against 8·797 tractive force for 120 lb. boiler pressure; but there is not sufficient with the 150 lb. boiler pressure now worked at, which gives, as we saw earlier in this paper, 10,996 lb. of tractive force. A volute spring allows the centre gear a certain amount of play where the engine sways from side to side, at the same time tending to keep the engine central.

To get the utmost efficiency it is necessary to take every precaution to prevent oil either getting on the rails or on the periphery of the wheels, especially the centre ones—for which purpose oil trays have been arranged to catch the oil as completely as possible, and such oil as gets down from the lower vertical axle-box is collected by a copper tray and passed into the wheel, from which it can be let out by a plugged hole arranged for that purpose in the bottom. It was mentioned that the sand boxes for the Fell vertical wheels were placed on the tanks; the sand is led down by copper pipes to a sand injector, and steam is admitted through pipes. It will be at once seen that the sand could not be applied in the ordinary manner, as it would not remain on the vertical face of the raised centre rail; while by the blast being directed so as to throw it between the rail and the revolving wheel, it cannot help taking some effect. How far the steam may act as dew on the rail, or whether it simply makes the sand damp, the author has not been able to learn. Neither has he any information as to whether the sand gets blown into the lower axle-boxes, though they are so completely boxed in that it appears very improbable much would find its way in. At the same time it is a point on which a grain of practice is worth any amount of guess-work; and the author would be extremely glad if any one can give him any information of a case where sand is applied to wheels in a similar manner, and what effect it produces on the axles or shafting as the case may be, or whether a more suitable plan of sanding the rails could be adopted.

In the brake gear cast iron slippers are made to grip the line, and are actuated by right and left-handed screws at the end of the lever, which have play in the sleeves, so as to permit of their rocking backwards and forwards, while the power is transmitted through four keys which slide in grooves, the whole being worked from the right-hand side of the footplate by a handle of the same construction as for the outside brake, which is on the left-hand side of the engine. India-rubber pads or springs are used as far as possible to take up the jar through the levers, and to save the thread of the screw.

Before bringing this paper to a close, the author wishes to quote a few lines from a paper of Mr. Maxwell's, on New Zealand railways, read before the Institution of Civil Engineers on November 23rd, 1880, in which he mentions these engines.* The author found from trial that, under favourable circumstances, one engine took 63 tons, thus :—

	Tons.	Cwt.
Four loaded trucks, in front	19	10
Four loaded trucks, behind	39	0
One brake van	4	10
Total	63	0

From the records of a number of trips in ordinary working, two examples have been selected. The loads were above the average. Australian Newcastle coal was used, which was found by analysis to consist of—

Fixed carbon	55·36
Volatile matter	31·69
Water	3·00
Ash	10·05
Total	100·10

The distance run was 201 chains, and the vertical lift was 861ft.:

	Tons.	Cwt.		Tons.	Cwt.
Load nine vehicles	36	10	Load eight vehicles ..	24	19
Goods	19	11	Goods	31	14
Engine	36	0	Engine	36	0
Total	92	1	Total	92	13

In the first example the rails were dry, the time occupied on the journey was thirty minutes, and the fuel consumed was—coal, $4\frac{1}{2}$ cwt., and coke 3 cwt.; in the second example the rails were greasy, the time on the journey was thirty-two minutes, and the fuel consumed was—coal, 5 cwt., and coke $3\frac{1}{2}$ cwt. In both cases a pressure of 150 lb. per square inch was maintained in the boiler. In ordinary practice a gross load of about 53 tons, exclusive of engine, is sufficient; with it the engine can stop and start on five-chain curves, and attain a speed of about six miles an hour. A load of 14 tons 5 cwt. has been drawn up the incline without making use of the horizontal driving wheels. The engines have ample steaming capacity, and a boiler pressure of 150 lb. is maintained. From this it appears that the engines work satisfactorily, and probably, on a slight alteration in the compression gear, would overcome the difficulty arising from the slip caused by the tractive force being higher than the adhesion, owing to the increased working pressure of the engines.

* Read before the Society of Engineers, 2nd October, 1882.

* See "Proceedings" Institute Civil Engineers, vol. lxiii. page 54.

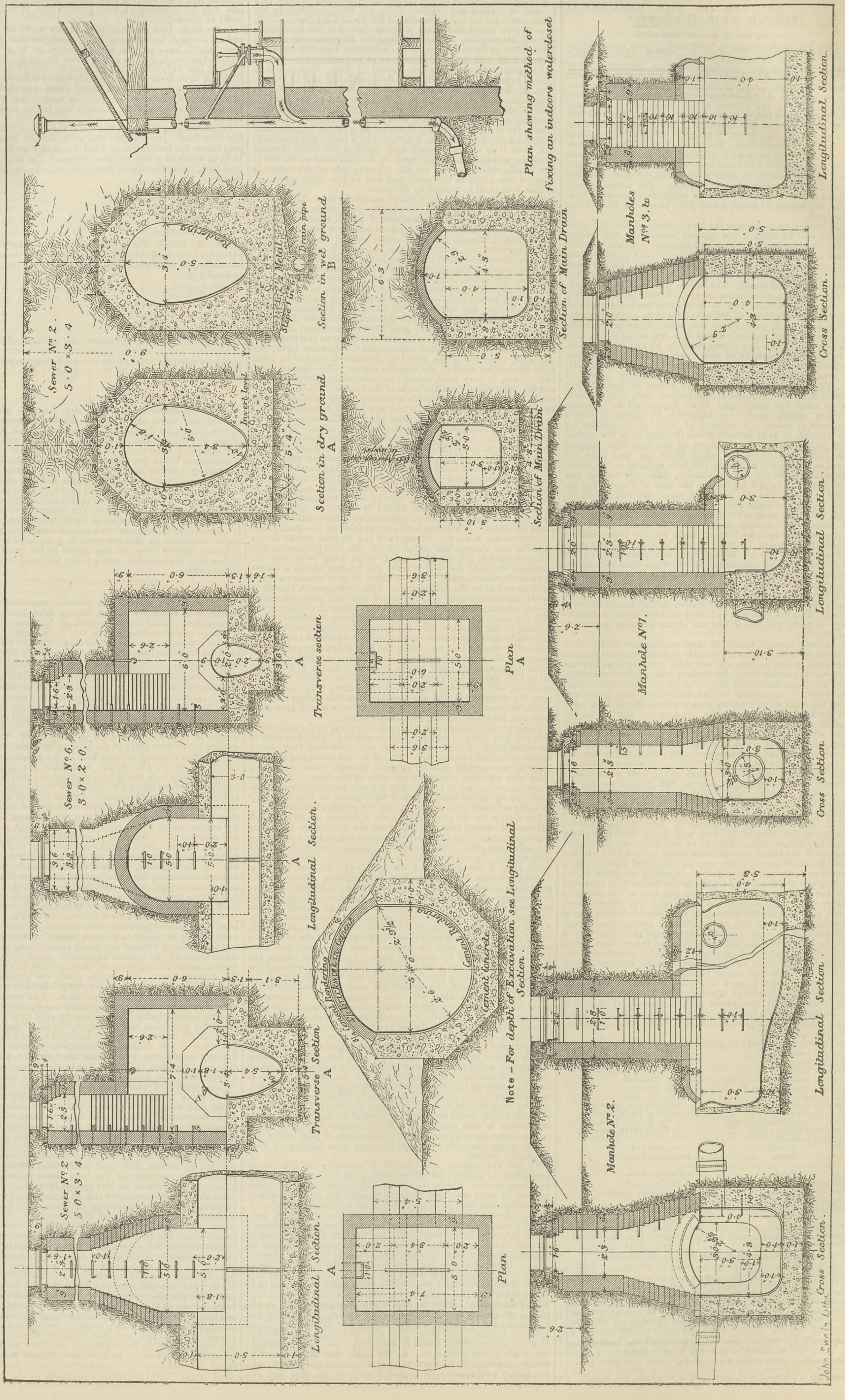
A Broken Cylinder.—An unusual machinery accident has happened at the ironworks of Messrs. John Bradley and Co., of Stourbridge. While the works were in full swing, the cylinder of the large engine suddenly gave way with a crash. Considerable damage was done, and one or two weeks' "play" will be necessary until the broken cylinder has been replaced by a new one.

The Exhaust Injector.—On the 11th inst. the members of the Manchester Association of Employers, Foremen, and Draughtsmen had an opportunity of inspecting, on the premises of Messrs. Geo. Fraser, Son, and Co., a feed-water injector, which is actuated solely by the exhaust steam from the engine. The injector is the invention of Messrs. Davis, Hamer, and Metcalfe, and the perfectly successful operation of the apparatus by steam drawn from the ordinary exhaust pipe was a matter of considerable surprise to many of the visitors. Afterwards a paper descriptive of the injector was read before the members, at their ordinary meeting held in the Mechanics' Institute, by Mr. A. S. Savill, who, before explaining the invention, said it seemed to have been the opinion of engineers that it would not be possible to work an injector with steam at atmospheric pressure; that an injector must have a pressure of steam to work at, and that with the exhaust injector, this pressure must be got up in the exhaust pipe, which of course would act as a back pressure on the piston of the engine, under which conditions there would not be much if any economy in the adoption of an exhaust injector. This reasoning had, however, been proved entirely wrong, and the injector he had brought before them did not in any way put on back pressure, but, on the contrary, reduced or altogether removed it. The injector was simply fixed in a vertical position to a branch from the main exhaust pipe, and to start the injector all that was necessary was to turn on the steam and water. With regard to the apparatus itself, the most important point was its automatic action. As soon as the first puff of steam from the cylinders had cleared out the air from the exhaust pipe, the injector commenced to work, and kept on until the engine ceased to give out steam, re-starting again as the engine re-started without any manipulation being required. In the construction of the injector there were, as in the ordinary types, three nozzles—the steam nozzle, the combining or mixing nozzle, and the delivery nozzle. The steam nozzle was similar to the one in the Giffard injector, but of a very large bore, and inside was fixed a small spindle to concentrate the steam. The chief feature, however, was the combining nozzle, which was constructed to start the injector automatically. The nozzle was split from its smallest bore for rather more than half its length, one half being solid with the nozzle itself, and the other half arranged to work freely on a hinge, by which it was enabled to enlarge or contract its area. The delivery nozzle was very similar to that of a Giffard injector. When not working, the hinged flap in the injector was open, and a large area was presented for the egress of steam and water. When steam and water were turned on some condensation took place, which instantly formed a partial vacuum, into which more steam and water were drawn until such a vacuum was formed that steam was attracted with a velocity so great as to impart to the water sufficient speed to enter the boiler, the flap being at the same moment sucked down, and forming to all intents and purposes a solid nozzle. Results from actual experience had shown that by one of these injectors the feed-water entering at 66 deg. Fah. and a minimum delivery of 960 gallons per hour, the temperature had been raised to 190 deg. Fah. The injector was capable of feeding against 70 lb. to 75 lb. pressure, but when the pressure was above this an arrangement was attached for supplementing "live" steam from the boiler, which in addition further increased the temperature of the feed-water. In the discussion which followed the injector met with general commendation, the results which had been seen in actual working being admitted as surprising, and Mr. Gresham, who has long been connected with the manufacture of injectors, said he considered the exhaust injector as great an advance upon the present methods as the introduction of the Giffard was upon the methods then in vogue. He thought, however, that automaticity might be carried too far, and that the exhaust injector would scarcely be suitable for locomotives, as it only delivered its feed when the engine was working. Mr. Savill in reply, however, stated that by connecting the injector with the boiler steam it could be worked when the engine was standing, and that, although it did not seem a very nice arrangement for locomotives, it had been worked successfully on a locomotive both when it was running and when it was standing.

SEWERAGE OF ADELAIDE—TYPE DRAWINGS OF SEWERS, MANHOLES AND HOUSE CONNECTIONS.

MR. OSWALD BROWN, M.I.C.E., ENGINEER.

(For description see page 396.)



TO CORRESPONDENTS.

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

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

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

G. L. (Oldham).—*Certainly not.*

SPIRIT LEVEL.—*There are no vacancies in the drawing offices at Woolwich Arsenal—at least, none for outsiders: nor is the pay high or the position good.*

D. H. R. (Alleyn Park).—*If you think proper you can consult a file of Indexes at our publishing office and find what you want, if it has appeared in* THE ENGINEER. *An engraving of a Tower bridge appeared in* THE ENGINEER *for* 29*th of March,* 1878.

L. B. (Bath).—*We have no doubt that you would be quite competent to take the position of assistant engineer on road, railway, or bridge work, and you might expect a salary of* £200 *a year. But your competence does not make it more easy for you to obtain employment, which, in fact, you are not likely to obtain without interest.*

T. S. H.—*Box's practical treatise "On Mill Gearing" is a very useful book, but it assumes a certain amount of practical familiarity with the subjects treated. It is published by Messrs. E. and F. N. Spon. For further information see "The Elements of Machine Design," by W. C. Unwin, published by Longmans and Co.; and "Mills and Millwork," by Fairbairn, also published by Longmans and Co.*

T. L.—*When a locomotive is running, that portion of the tread of the tire which is in contact with the rail at any instant of time is at rest, while the corresponding point on the flange on the same radius is moving in the opposite direction to that at which the train is running. The speed being* 60 *miles an hour, or* 88*ft. per second, and the diameter of the wheel over the tread* 6*ft., and over the flange* 6*ft.* 2*in., the point in the flange will move backwards at the rate of* 1·59 *miles per hour.*

MACHINERY FOR CONDENSING MILK.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers give me the names of makers of milk condensing plant? E. S.

Warwick, November 21st.

PORTABLE STOVES.

(*To the Editor of The Engineer.*)

SIR,—I shall be obliged to any of your readers who will give me the address of an agent or firm for the American sitting-room portable stoves on wheels. S. C. W.

Manchester.

MATERIAL FOR WATERPROOFING STONE.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers tell me of a solution, or other means, by which I can render a porous slab waterproof? The said slab covers part of a coal cellar, and at present lets the rain through. W. H. P.

Acton, W.

BOOKKEEPING FOR ENGINEERS.

(*To the Editor of The Engineer.*)

SIR,—I am desirous of securing a really good treatise on bookkeeping by double entry, more especially adapted to the purposes of engineers and ironfounders. If any reader can furnish me with the address of any firm of publishers who issue this class of works, I shall esteem it a great favour. ENQUIRER.

Cornwall, November 20th.

CONDENSING WATER.

(*To the Editor of The Engineer.*

SIR,—(1) I am about putting down an engine 50-horse power working to 150-H.P. I have a well in the yard, about fifty yards away from the engine bed, and with a fall of 5ft. Will any reader tell me the best possible way of condensing the steam? Will the above well do, or would it be better to sink another one nearer the condenser? Perhaps some of your readers will oblige me with the benefit of their experience. (2) How long will it take to empty a reservoir, a quarter of an acre, 3ft. deep, through a pipe with 3in. bore? FOUNDRY MANAGER.

Mansfield, November 21st.

A CORRECTION.

(*To the Editor of The Engineer.*)

SIR,—I observe that in the list of Abridgments of Specifications of Letters Patent published in last week's ENGINEER, that No 1505 is described as "Not proceeded with." It appears the wrong number is given for the specification described, for No. 1505 has been proceeded with, as you can see by the copy of specification I forward by this post.

ARCHBD. ELLIS.

13, High-street, Lewes, Sussex, November 15th.

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Nov. 28th, at 8 p.m.: Paper to be read with a view to discussion, "American Practice in Heating Buildings by Steam," by the late Mr. Robert Briggs, M. Inst. C.E.

SOCIETY OF ARTS.—Wednesday, Nov. 29th, at 8 p.m.: Third ordinary meeting, "Some Points in the Practice of the American Patent-office," by Sir Frederick Bramwell, F.R.S. R. E. Webster, Q.C., will preside.

THE ENGINEER.

NOVEMBER 24, 1882.

THE IRON TRADE OF THE UNITED STATES.

THE latest reports from the United States indicate that a time of trial is at hand in the iron-making districts of North America. The price of iron and steel has been steadily falling for some time, and rails have now dropped to 42 dols., or £8 10s. per ton. At this price manufacturers hold that they lose money instead of gaining it, and many steelworks are to be closed, among others those of the Joliet Iron and Steel Company, near Chicago; operations will cease there on the 1st of December. The North Chicago Works will shut on the 15th of the same month, and it is estimated that before Christmas 20,000 men in the Chicago district alone will be out of employment; Pittsburgh and its neighbourhood will follow. It is difficult to overrate the importance of the impending crisis in the United States. If we examine the conditions under which these events take place, it will be seen that the mere fall in prices is not sufficient to account for them. It is a serious thing—not to be lightly done—to close a great steelworks. The loss incurred when an enormous plant is idle is very heavy, and so long as any money is to be had to go on with, or a hope can be entertained of better times coming, manufacturers will prefer to keep making rails, &c., for stock, rather than close their works altogether. On this point, as on most others, the American ironmasters have nothing to learn, and it may be taken for granted that causes are influencing their policy other than a drop in values. In New York it is held that the main causes of depression are over-production and heavy importations, but there is more than this. The truth is that there will soon be no market at all for rails at any price in the United States, and some months at least must elapse before they will again be wanted. With the falling off in the demand for rails the steel trade of America must go. In this country, if rails are not wanted ship and boiler-plates may be in demand. But America does not build iron ships, and the prosperity of her iron-making districts hangs exclusively on the demand for rails. The trade in bridges even depends for its existence to a great extent on the construction of railways; and there is no reason to doubt that in closing their steel works the ironmasters of Chicago are adopting the only course open to them. We do not hear a word about wages, and we are led to conclude that even if these were reduced to starvation point the trade in rails could not be galvanised into the semblance of life.

To understand why these things are, it is necessary to know something of the American railway share market, and the method of operating adopted by financiers who are famous, or rather notorious. The railway system of the United States has recently been growing by leaps and bounds—on paper. It is said that 9000 miles of new lines have been opened during the last twelve or eighteen months; many more, indeed, than were wanted; but the lines constructed are but a percentage of those whose formation has been proposed, and which are in process of construction. For a long time past the American Railway Share Market has been carefully manipulated. Syndicates have been formed, and new lines suggested, and put before the public by every advertising resource known. The syndicate then go to the world and borrow money on first mortgage bonds, the mortgage being given on property which has practically no existence. Some of the funds thus obtained may be used in commencing the lines mortgaged, and then shares may be sold and more money got; but in some cases no attempt whatever has been made to make the railway. We need hardly say that men of experience would not touch first mortgage bonds or debentures of the type to which we refer, but unfortunately those who have a little money and want high interest, clergymen, doctors, widows, half-pay officers, and others, are easily won, and their savings are handed over to unprincipled speculators. This system of operating has been pushed further, perhaps, than it ever was before during the last two years. The syndicates, however, have been compelled by mere force of circumstances to enter into contracts for the construction of some of the proposed railways, and as a result heavy orders for steel rails have been given out, and the rail mills of the United States had more to do than they could manage. But there is a limit. The game has been played out for the time. It has been found impossible, on the one hand, to raise more money on the debenture and first mortgage system, and, on the other, contractors have pressed for payment. Money must be had, and the speculators have been driven to sell stock in really good railways, old-established, and held in repute. If our readers have recently watched the money market, they will have seen that American railway shares have fallen continually. The market has been glutted with shares, because speculators have found themselves driven to their wits' end to find cash to complete contracts. It would appear, however, that the end has nearly been reached, and the result is an entire cessation in the demand for rails, followed by the closing of iron and steel works, and, in all probability, a great deal of that domestic trouble which invariably follows rash speculation on a great scale.

The free trade party in the United States see, in the threatened destruction of a great industry, an excellent opportunity for advocating their principles. They assert that protection means high wages, and that high wages mean high prices; that, in a word, the construction of railways has ceased because rails cost too much. It does not appear, however, that free trade or protection have anything at all to do with the matter. The high price of rails did not deter speculators from scheming or the public from putting their hands in their pockets. The truth is simply that lines have been proposed which could not possibly pay, and were not intended to pay anyone but the contractor who made them and the speculators who promoted them. The railway market has resembled a huge bubble. It was inflated and it has burst; but the end would have been just the same had rails been obtainable at £5 per ton. Rails have been ordered and made which were really not wanted, and the makers possibly knew this very well while they were making them. It is not a question of price that is concerned. If it were, we should have heard of reduction in wages, not of the closing of works. It is not so long since rails could be bought in the States for about their present price; but works were kept open all the same because there was a legitimate demand. The rail mills of the United States are being shut now, not because rails are too dear, but because no one will buy them at any price. There is no reason to suppose that this will much, if at all, affect the iron trade in this country. The stock of rails in the United States is very large, and the export of rails from Great Britain to North America has long ceased to possess any importance whatever. The closing of the Joliet, and half-a-dozen other steel works in the States, will not sell a single extra ton of rails in this country. Nor will the cessation of American railway construction affect us. We can regard the progress of events with equanimity. It is just possible that the people of the United States may be taught a very important lesson. "Booms" may be very good things, whether in railways, in pork or wheat, or even in wooden nutmegs; but it is doubtful if, in the long run, "booms" pay. It is very hard to leave off "booming" just at the right time.

THE SOCIETY OF ENGINEERS.

THE President and Council of the Society of Engineers have taken a very important step. They have arranged that during the winter season a series of lectures shall be given in the Hall of the Society, Westminster-chambers, on engineering subjects. Thus, during December, January, and February, Mr. Henry Adams will lecture on strains on ironwork every Thursday evening. On Mondays in the same months Mr. Walmisley will lecture on land surveying and levelling; and during February, March, and April, Mr. Peregrine Birch will lecture on water supply and drainage. This is the first time that any English engineering society has undertaken educational work in the strict sense of the word, and we have no doubt that the experiment will succeed. Nothing more is required than competence on the part of the lecturers; and this the Council will, it is certain, take great precautions to secure. The fees charged are very moderate, and the hours during which lectures will be delivered will, we understand, be specially selected to suit the convenience of the junior members of the profession, for whose benefit the lectures are specially intended. It would be difficult to overrate the importance of the results which may accrue from this movement. There is a large class of engineer students, articled pupils, draughtsmen, and others, in Westminster and its neighbourhood, who have very few opportunities of acquiring information. It is not to be supposed that all these young men are thirsting for knowledge; but a good many of them are. Now it need scarcely be explained here at any length that the articled pupil has, as a rule, to pick up his information the best way he can. He has certain opportunities afforded him in his master's office of acquiring practical information; but no engineer undertakes to teach theory, or to fill up details in the practical instruction which he directly or indirectly imparts. The pupil is therefore driven to books. We do not for a moment wish it to be thought that we underrate the value of reading as a means of instruction; but it is not too much to say that good lectures are of the greatest possible assistance to the reading man. They clear up difficulties, direct the current of thought on the right road, and prevent time being wasted in the bye-paths of literature, to an almost incredible extent. Indeed, the value of lectures as a means of education is now fully recognised by every college in the kingdom; and we repeat that the Society of Engineers, in providing lectures at extremely moderate fees for engineer students, has taken a very important step.

Some persons may, perhaps, ask what is the Society of Engineers? and it will be well to answer the question at once. The Society of Engineers was established more than a quarter of a century ago, and it has not received the attention which it has really deserved. The causes are multifarious. In the first place, the Society had, in one sense, a bad start. It originated as a small engineers' club, whose meetings were held at Putney. It was soon found that social meetings and the discussion of scientific subjects did not quite satisfy the aims of the new or old members; and the club was merged in the Society of Engineers. If it had started at once as an engineering society it would have done better. The club, as a club, included in its ranks numbers of men who were not engineers, although they liked science; and these gentlemen, it is needless to say, became of necessity members of the young society. Their purses were always open and their influence always ready to aid the undertaking; but it was felt that the Society was not exclusive enough, and that the fact that a man was a member was in no sense a guarantee that he was also an engineer. As time rolled on, however, all this was changed; although the amateur remained on the list, amateurs ceased to be elected as members. Death, too, was busy in the ranks, and removed many who, engineers or not, could ill be spared; while others retired on paying life subscriptions, and ceased to take any active part in the proceedings. The Society is now, and has been for several years, at least as exclusive and as careful in investigating the qualifications of would-be members as any kindred body in the kingdom—the Institution of Civil Engineers not excepted. It is not our purpose to write a history of the Society, our object is to consider some of the causes which have prevented it from taking a leading place. One prominent obstacle in the way of success has been the difficulty encountered in getting suitable accommodation for its meetings. This is not peculiar to the Society of Engineers. It is a want almost universally felt by scientific bodies in the metropolis. Thus, the Iron and Steel Institute, the Institution of Mechanical Engineers, and the Society of Telegraph Engineers, are indebted to the courtesy of the Institution of Civil Engineers for accommodation. For a considerable period the meetings of the Society of Engineers took place in the Lower Hall, Exeter Hall, and the Society prospered. In its ranks were included some of the best-known and ablest men in the profession; and it was felt that the point had been reached when it was expedient that the Society should get a Royal Charter; in other words, that it should be Incorporated. Unfortunately, jealousy was excited where it was least anticipated. The application for a charter was opposed, and in consequence refused. The Society was compelled to fall back on an Act of Parliament, which practically gives all the advantages of a charter, but without its prestige. About this time the proprietary of Exeter Hall found that it was impossible to accommodate the Society any longer, and the Council had to seek for a new meeting-place. After much trouble nothing better could be obtained than a large room in the Westminster Palace Hotel. This was a distinct misfortune; the prestige of the body was injured. After the lapse of a considerable period the Council succeeded in obtaining the present offices, including a large room capable of seating about ninety; but this room has the defect that it is high up in one of the lofty buildings known as Westminster-chambers, and it is not unfrequently filled to overflowing. It is to be hoped that the Society may ere long succeed in obtaining the accommodation which it ought to have.

The Society of Engineers was established "for the discussion of scientific and other subjects of general interest," but the "other subjects" have long disappeared from its debates. A prominent object invariably kept in view by successive Councils was that the Society should be of use to the junior members of the profession; that, in a word, it should be in a large sense educational. The reading and discussion of papers can hardly fail to be instructive; but the Society of Engineers supplemented these by their summer excursions. These are, we may point out, practically unique. During the summer months, on three or more days, conveniently arranged as to dates, the members, accompanied by such friends as they may please to take with them, visit places of interest, careful arrangements having been made beforehand for their reception. We may cite as examples the visits paid this year to the works of the Anglo-American Brush Electric Light Company and to Portsmouth Dockyard, both of which have been already noticed in our columns. Now it is quite true that the Institution of Mechanical Engineers and the Iron and Steel Institute also visit places of interest. But these excursions are ponderous affairs, absorbing the greater portion of a week and involving long and costly journeys. The cost of an excursion of the Society of Engineers is represented by a single day and an outlay of a few shillings; and the benefit derived is very great in an educational point of view, because, as a rule, manufacturers and others have manifested the utmost courtesy, and spared no trouble to make their visitors comfortable, and to enable them to comprehend what they saw. The officers of her Majesty's dockyards have been especially courteous in this respect.

Thus, then, it will be seen that the Society in now undertaking the work of lecturing is only carrying one step further the object which it has always had in view. In doing as it is about to do it clashes with the interests of no other society, for no other society has attempted to do what the Society of Engineers will, we hope, carry through successfully. Fully impressed as we are with the importance of extending facilities for technical education, we wish the Society of Engineers every success; and we would add a word of warning to the lecturers, and even to the Council. The work which they have undertaken will be judged by its results. The lectures cannot possibly be too good. They must not only be thoroughly sound, but they must be strictly impartial. The lecture-room is not the place in which to ride hobbies. They must also be made as attractive as possible. Lectures made up out of books will not do. The lecturer must understand his audience; enter into their wants; and help them to overcome difficulties, and sufficient time should always be allowed at the close of each lecture for queries to be put to the lecturer, and difficulties stated and cleared up. We have no reason to think that all the necessary conditions will not be complied with. But caution, tact, and enterprise will be necessary to place the means of instruction about to be supplied where they ought to stand, namely, among the first. We need not, we think, just now pursue the subject further. Those who desire more information will do well to apply to the Secretary, Westminster-chambers. Those who wish to know what the Society has done in past times may look over its "Transactions," which deserve a place in every engineer's library.

THE SCIENCE OF INVENTION.

In Great Britain and Ireland about 5000 inventions are patented every year; in the United States nearly five times as many. France and the rest of Europe probably bring up the grand total of inventions patented in the course of twelve months to 40,000. For every invention protected, at least 100 never get beyond the paper stage, while many more do not take any form outside the inventor's brain. Shall we go too far if we say that 4,000,000 of inventions, all more or less novel, are made every year? This is a stupendous total. Furthermore, it must not be forgotten that all men do not invent—probably not 10 per cent. of the adult population even of the United States possess the faculty of invention. With such facts before us it is tolerably clear that the work of invention is, to those who are competent to invent at all, comparatively easy. In other words, inventors are prolific of schemes, and this is further demonstrated by the enormous number of patents taken out by such men as Edison. Out of a total of four millions of inventions, it is evident that a very large number indeed must be worthless. The records of the Patent-offices go a long way to prove this even of patented inventions, hosts of which are abandoned every year. There are political economists who hold that if the cost of patents were greatly reduced in this country the nation would be the gainer. We think otherwise; but for the moment we need not directly contest the point. Our object is to show that the great mass of inventive force available is wasted, because it is ignorantly expended by those who exert it; and the ignorance results almost entirely from the absence of proper training. We do not now allude to that species of training which imparts a knowledge of the laws of nature. We have not in mind the perpetual motion man or any of his congeners. We are dealing with the men who invent without method or reason. Sir W. Armstrong once said at a meeting of the British Association that some men could no more help inventing than a hen could help laying eggs, and in a sense the proposition was quite true. But were such men educated, their labours would not be wholly wasted.

Some men make money by inventing and others do not. We cannot call to mind a single instance in which a disappointed inventor admitted that his invention was to blame for this; but this is beside the mark, although as an interesting fact it is worth noting. The dispassionate outsider, who can use his eyes and his head, sees that the men who are successful are something more than inventors. They possess another faculty, which is best expressed by the word shrewdness. Not only can they invent, but they know precisely what to invent. It is in this that the great secret of success lies. It is in this that the whole art and mystery of making money is to be found. Clever men have wasted large fortunes and long lives in inventing things which the world did not want, and which, however ingenious, were about as satisfactory to the general public as the gift of a printing machine would be to a North American Indian. Multitudes of illustrations of this might be supplied if it were necessary. One will suffice. Dozens of patents have been taken out for boat-lowering apparatus; we have never heard that any inventor has made his fortune in this line. It may be conceded that all these inventions are ingenious and satisfactory in their action; but in so far as the making of money by the inventor is concerned, this is a secondary matter. The primary matter is that shipowners do not want boat-lowering apparatus, and so the inventions are at a discount. The invention could do the shipowner no pecuniary good of any kind; on the contrary, he might be of the two a little poorer of its adoption. Therefore he will have nothing of the kind, and to invent and patent boat-lowering and disengaging apparatus is simply waste of time, brains, and money. We may contrast this with another nautical invention, never, so far as we are aware, patented. We allude to the use of double topsails, and in large ships topgallant sails. This invention consists in dividing the sails we have named in halves and putting in a third yard. Thus a topsail which, if single, might be 40ft. high and 50ft. wide, is, under the new system, divided into two sails, each 20ft. high. The immediate result is that the yards can be made lighter as the strain on them is less, and the sails can be handled in sections, so to speak, by about one-half the number of men previously required. This appealed at once to the shipowner's heart. A 1600-tons ocean clipper will now carry ten A.B.s, ten apprentices varying in age from fifteen to twenty-one, a captain, two mates, cook, and steward; with single topsails at least ten more men must have been carried. The man who hit on the plan of dividing topsails not only knew how to invent, but what to invent. But the great mass of inventors do not know. They hit on an idea, they work it out, perhaps very cleverly, and then they discover that the one thing essential is lacking, namely, a market. Then they find fault with the world, with about as much reason as the traditional pedler who was disappointed because he could not sell straps in the Highlands. There are exceptional men who possess sufficient genius to persuade the world that it wants something which it had not dreamed of wanting before, and then supplies this want; but such men are not numerous.

We would not have it supposed, however, that the wants of the world are always expressed clamorously. If this were the case, the inventor's path would be smooth. On the contrary, its wants are expressed, as a rule, in very vague and obscure terms, if they are made known at all. The inventor is in much the same position as the veterinary surgeon who has to prescribe for the ailments of dumb animals. The science of inventing lies in a great measure in knowing what it is good to invent. The inventor's skill is manifested in picking out a weak place in the world's arrangements, and saying, "You think you are very well off in certain respects, but I assure you you are not, as you will admit if you will try my invention." Then the world wakes up, to find that it had an unsatisfied want, although it did not know it, and the inventor is blessed. For example, it is certain that the British public never dreamed that it wanted umbrellas until umbrellas were shown to it. We all know the result. Apart from what may be classed as cosmopolitan inventions, like umbrellas, are the far more important schemes which concern individual branches of manufacture. Here there was at one time an enormous field for invention which can hardly be said to exist now. Take, for example, the stocking frame. It was a stroke of genius even to suggest the knitting of stockings by machinery. This was at the moment in itself a distinct inventive effort. It required no ordinary perspicacity to see that it might be worth while to construct machines to do that which was already done so well and so cheaply by hand, that it is more than likely that the entire existing demand was at the time readily satisfied. This acumen is a gift which a few persons possess, but the great bulk of inventors can only acquire it by training. We find, for example, that it is almost impossible to take a man possessed of inventive powers through a manufactory of any kind which he sees for the first time without setting his busy brain inventing. In the course of a few hours he will scheme out half a dozen improvements of all kinds in the methods of carrying on the various processes which he has witnessed, and without exception it will be found that every one of these inventions is either old or worthless. The inventor, under such circumstances, sets the faculty of making mechanical combinations against the skill and experience acquired during years of work by those in charge of the factory he has just seen; and not only of these men but of hundreds of others who do the same thing in precisely the same way elsewhere, and of course he loses. What chance, for example, would the most clever mechanician living, who has never been inside a cotton factory, have of effecting a substantial improvement in the construction of a spinning or doubling frame?

There are in this world plenty of professional inventors—men who are known for their power of scheming novel mechanical combinations to produce new effects. Such men are continually applied to for aid by manufacturers and others. We could name several inventors of this kind. One, still alive, is reported to be able to design a machine, or set of machines, which will effect the most intricate operations that can be conceived. He has, it is said, never been beaten yet, nor failed to meet the demands made upon him by manufacturers; but we never heard that he had of himself discovered that anything was wanted by a manufacturer or an engineer—in a word, he initiates nothing. Again, there are manufacturers who are entirely devoid of inventive ability. They cannot scheme the simplest combination of moving parts; but they can discover in a moment that if they could do something which they do not do, it would be to their advantage. They resort to the inventor, who is perhaps astonished to find that such things are in demand, but he supplies the demand and is paid. Now, the perfect inventor is he in whom are combined the two qualities which we have just spoken of—namely, the power of seeing that an improvement in a machine or a process is wanted, and the means of supplying the improvement. As we have said, there are a few men who seem to possess this combination of characteristics as a species of heaven-born gift. But there are at least ten men who can invent for the one man who knows what is wanted or what is likely to be wanted. This arises from lack of training. In other words, there is a science of invention which may be taught; a knowledge of this science will keep the inventor from wasting his time, and will turn his efforts into useful directions. It cannot possibly be acquired, however, without much hard work. When a man has had a good general education, to which is added a special training in mechanics or chemistry—the two great fields for the exercise of inventive ability—he may, if he knows that he can invent well, take up some special branch and make himself master—as far as he can—of it by reading. His next step will be to consult the records of the Patent-office, and ascertain what has been done by his predecessors. Having got thus far, he will perhaps be in a position to see that a process may be cheapened, a valuable bye-product got, a new and improved result obtained, and so on. Finally he will invent the means of achieving the desired end, protect this, and introduce it to the trade concerned. It is more than probable that this man will make some money by his invention. We may contrast this practice of the science and art of invention with the man who goes about the world inventing this, that, and the other, not because he knows the things invented are wanted, but because he *thinks* they are. He may have lived fifty years without discovering that the holes in the lids of tea-pots ought to have plugs fitted to them to prevent the escape of the aroma of the tea; but the truth dawns on him one morning, he rushes off to his patent agent, files his specification, and is indignant because the world will not at once take his word for it that it wants plugs for its tea-pot lids. A single hour, nay, a single moment has changed the whole current of his thoughts on this matter, but he is incapable of perceiving that he himself did yesterday that which he blames all the rest of mankind for doing to-day. Contrast such a one with the inventor who knows his business and avails himself judiciously of his gifts. Such a man, possessed of all that high training can give him, besides natural shrewdness, knowledge of the world, tact in dealing with his fellow men, makes a study of the work of invention. He has no doubt many more or less wild schemes, but these represent his relaxations, the poetry of his life, perhaps. He reserves them for himself or a very select circle of intimate friends, to whom he will say, "If I could do so and so," just as Archimedes said if he had a fulcrum he would move the earth; but he never talks to business men in this way—with them he is practical and matter of fact. He not only knows what he proposes to do, and how to do it, but succeeds in persuading his hearers that he knows, which is a different thing and a great art in itself. He inspires confidence whenever he gets a hearing; and he throws no chance away in order to get just the kind of hearing he wants. It is not to be supposed that such a man will of necessity make a fortune by inventing. On the contrary, he usually takes care that the work of inventing shall not interfere with the earning by other means of a more or less satisfactory income. But it may be safely taken for granted that he will lose no money by his inventions, and that he will probably make a good deal. Our readers may rest assured that there is no royal road to wealth running through the Patent-office. The power of invention is like that of singing or painting; it requires to be trained, developed, directed into proper channels, and used with judgment and skill. It is quite true that inventors have now and then made lucky hits, just as people have drawn prizes in a lottery, but the number of them is so small that their existence may be neglected. There is a science of inventing, but it is a science, a knowledge of which is confined, we fear, to a select few; while the number of those who practice the art in a happy-go-lucky fashion, or with an ignorant and painful intensity of feeling, is very great. Poets, painters, novelists, have ere now died of want, notwithstanding the possession of great genius. This may, we fear, be said of many inventors. The cause of failure is the same in both cases. Watt, Arkwright, Stephenson, Crompton, and

Roberts rolled into one could not succeed if the combination lacked that business capacity and mental training which appear to be wholly wanting in the great body of English inventors at all events.

BOILER EXPLOSION AT THE BOWLING IRONWORKS.

The Bowling Ironworks is perhaps the last place in the world where we should expect a boiler to give way; but on the 25th of October the flue of a Lancashire boiler collapsed, causing the death of a man. Mr. John Waugh, engineer to the Yorkshire Boiler Insurance and Steam Users' Company, prepared a report for the coroner, and a copy of this report lies before us. The boiler was 7ft. diameter and 28ft. long, with two flues 2ft. 9½in. diameter. The shell was $\frac{7}{16}$in. and the flues ⅜in. thick. The right-hand furnace collapsed, the shell being still intact, and the left-hand furnace was only slightly flattened, the first and second ring seams of the left-hand furnace being sprung for a length of 3ft. 3in. The right-hand furnace collapsed at the second ring seam, and the rivet seam was ruptured. Fifteen of the rivet holes on the furnace crown in this seam were drawn oval without fractures, showing either that the quality of the iron was exceptionally good, or that the plates at this seam had been overheated owing to the boiler being short of water. The other rivet holes, right and left of those on the crown, are fractured to the edge of the plate. Mr. Waugh explains that after the collapse he found one water gauge shut off and the other nearly so, and he assumes that the fireman was in consequence deceived, and did not know how short the boiler was of water. To say the least it does not appear to us that any such conclusion is justified by the facts. The gauge cock was not actually shut, and besides, even it were, it does not follow that it had been closed for any considerable period. But furthermore, the boiler, so far as we gather from the report, was not at work; steam was only being got up, so that whatever water was in the boiler to begin with was there at the time of the collapse, and there is no reason to doubt that when the fires were lighted the boiler had plenty of water in it. Mr. Waugh tried the blow-off valve and found it tight. It is well that on this point there should be no mistake. The flue gave way under a pressure of only 30 lb., and there is really not a line in Mr. Waugh's report to show that the boiler was short of water. There were three safety valves all in good order loaded to 60 lb. and 65 lb. Mr. Waugh is apparently not quite satisfied himself with the theory that the boiler was short of water, for he goes on to say:—"It appears that William Jowett put a fire into the exploded boiler about four o'clock on the afternoon of the explosion, the water being cold, or say 55 deg. Fah., no fire having been in the boiler since the previous Saturday. Jowett left about five o'clock; the steam gauge then showed about 10lb., or a temperature of 195 deg. Fah. Walker came on duty when Jowett left. About ten minutes to six, Walker, in reply to an inquiry made by Brewer, said he had above 30 lb. of steam, or a temperature of 250 deg. Fah., that is to say, in two hours the whole body of the water, and the boiler, weighing about twenty-six tons, was raised 200 deg. This treatment of the boiler, viz., too rapid firing, whilst bearing only very remotely upon this accident, I must remark, for the benefit of steam users generally, that it is a practice far too common, and in every case attended with danger to life and limb. It should therefore be discontinued. There is no doubt at all that the deceased met his death from the fact that the boiler he was firing so vigorously was short of water, the plates of the collapsed furnace becoming thereby overheated, and yielding to the pressure of the steam, some 30 lb. on the square inch, rupturing the second ring seam of the right-hand furnace, through which the steam and water rushed out." We do not quite see that Mr. Waugh is justified in assuming that the boiler was being very hard fired. It would contain about 14½ tons of water, and its own weight would, multiplied by the specific heat of iron, equal at most another ton and a-half. Thus we have, say, 16 tons of water to be raised in temperature through 200 deg. This represents 7,168,000 units, and allowing that one pound of coal represents 8000 units, we have, say, 9 cwt. burned in two hours, on about 38 square feet of grate, representing a rate of combustion of some 23 lb. per square foot per hour, which is in no way excessive. It will be seen that Mr. Waugh has made a mistake in his temperatures, 195 deg. being nearly that of steam of an *absolute* pressure of 10 lb. on the square inch. The true temperature was 240 deg., the absolute pressure being 25 lb., of which, of course, only 10 lb. is shown by the gauge. During the last hour the pressure only rose 20 lb., or one pound in three minutes, which does not at all indicate hard firing. We do not think under the circumstances that Mr. Waugh has explained satisfactorily why the flue collapsed. We may add that ⅜in. plates are much too thick for a furnace crown, and if our readers will call facts to mind, they will find that it is the thick furnace crowns and flues that give trouble. Thin plates are not easily overheated.

THE GAS ENGINE TRADE.

The manufacture of gas engines is assuming considerable proportions in the Manchester district. Messrs. Crossley Bros. have partially completed a large new works which are to be driven entirely by gas engines supplied with Dowson gas. Messrs. L. Sterne and Co., of Glasgow, are laying out works for the manufacture of heating apparatus and gas engines at Hollinwood, and in connection with these new works we may add that it is rumoured in the engineering trades' union circles, there is an intention to introduce the American system of working hours, viz., from seven to twelve in the forenoon and one to six in the afternoon, except Saturdays, when in some cases work does not cease until four in the afternoon. Should, however, any such attempt be made, it will meet with the most determined opposition on the part of the Amalgamated Society of Engineers. Another new engineering works specially laid out for the manufacture of gas engines has been opened in Manchester by Messrs. Ashbury, Sumner, and Co., who are also bringing out a new gas engine—Sumner's patent—which is termed the "Manchester reversible gas engine." At present the firm have only constructed their first experimental engine, and it is rather too early to speak definitely as to its merits. We had, however, had an opportunity of seeing it at work this week, and it gave very satisfactory results, whilst its compactness of construction and the simplicity of the working parts commend it. We may add that in this engine the gas and air are drawn into a chamber and mixed before they pass into the cylinder. The mixed air and gas is admitted to the cylinder by a cam motion, and after they have been ignited, the resulting products are emitted by an exhaust valve placed beside the inlet valve also worked by a cam motion. The two cam motions are placed side by side on one revolving boss carried by a revolving shaft so connected that the inlet and outlet valves can be simultaneously set to correspond to the motions of the piston, whether the engine be running in one direction or another. The revolving shaft is geared by helicoidal wheels to—but below the evel of—the crank shaft, and is arranged longitudinally on the engine. The revolving shaft also operates the igniting slide, and in such a manner that it can be readily set for the motion of the engine in any direction. Manufacturers of other descriptions of gas apparatus are also busy on the introduction of new appliances. Mr. Thomas Fletcher, of Warrington, is extending his premises to three times their present capacity. One of the most noticeable features at the works was the complicated character of the castings which Mr. Fletcher employs, and which it is his special aim to construct in one piece. To effect this great ingenuity has been displayed, and we recently noticed one casting for a greenhouse boiler with five conical internal tubes crossing each other from side to side, which was cast all in a piece, the mould being built up in a ten-part box.

A PETROLEUM ENGINE.

A Professor Schottler recently made some experiments with an engine constructed by a Hanoverian firm, in which the motive force was furnished by petroleum. In his report published in the *Wochenschrift des Vereins Deutscher Ingenieure*, the general plan of the engine is described as being similar to that of the gas-motor on the system of Wittig and Hees. The petroleum flows from a closed reservoir through pipes, in which there are two slide valves and one cut-off valve. It unites with the air introduced by the pump cylinder. The explosive mixture is compressed and then forced into the working cylinder, where it is ignited. The principal measurements of the engine used in the experiments were as follows:—Diameter of working cylinder, 8in.; diameter of pump cylinder, 6½in.; stroke of both, 14$\frac{3}{16}$in. In four trials the maximum force obtained was 4·5-horse power; the greatest number of revolutions was 130 per minute. The consumption of petroleum per hour for each horse-power was 1¾ to 2½ pints. In this estimate of the consumption of petroleum, the quantity used for the kindling flame is not included, as it is fed from a special reservoir. The consumption for this purpose is, however, so small as to be of no real importance. The petroleum used has a density of 0·675. The value is calculated at the rate of 1⅛d. per lb. weight, and it is stated that this petroleum engine costs no more to work than a gas engine. In regularity of working, the engine was found during the experiments to be superior to a gas engine. It is, of course, not demonstrated whether this greater regularity would always exist. Though the petroleum engine would require cleaning oftener, the operation would, it is considered, be less troublesome than in the case of an engine worked by gas; the petroleum soot remaining loose. The requirements of lubrication and cooling do not essentially differ from those of the gas engine. In commenting upon the above facts the *Metallarbeiter* remarks that even if the petroleum engine does not seriously compete with the gas engine, yet there are many cases in which its special advantages may be found useful. On the other hand, the storage of quantities of petroleum is attended with risks of fire which may, it is considered, restrict the use of the new invention. It is expected that further improvements will still be made, more particularly affecting the complete utilisation and entire combustion of the petroleum which passes through the engine.

THE PROPOSED GENERAL RESTRICTION OF THE OUTPUT OF COAL.

This movement, which was mooted at the recent conference held at Manchester, it is said is now likely to become pretty general. The scheme was to first secure an advance of wages, and having done that, to restrict the output so as to force up prices and curtail supplies. At the conference held at Rotherham on Monday last, a resolution was carried to the effect that an effort should be made to endeavour to get a general system of restriction adopted, and the conference, which was fixed to be held on the 5th December, was adjourned to the 18th December or some later day. The officials of the Yorkshire Miners' Association are taking a very active part in the movement. It may be stated that from reports received by the supporters of the movement, that the scheme is said to be likely to be tried; although the Durham miners stood aloof from the demand for an advance, their miners' council have decided to take the opinion of the men on the question of restriction, and it is on their account that the Leeds conference is to be adjourned. It is expected that the opinion of the men will be laid before a meeting of their miners' council at Durham on the 16th December. North Wales is reported to have decided in favour of restriction; North Staffordshire will also support it. Lancashire and Cheshire have agreed by votes at their council meetings to support it. A number of the lodges in Northumberland are said to be in favour of it, whilst Yorkshire will give it very strong support. It is stated that the feeling in favour of restricting the output is, generally speaking, very strong, and that only some little discussion has taken place at the various conferences with regard to the way in which it shall be carried out, and it is now decided to recommend the men to work five days per week and no more than eight hours per day. The movement will, if put in force, be watched with great interest by both the public and those interested in the working of the mines.

NORTH-EASTERN RAILWAY PROJECTS.

Disappointment will be the feeling of those who had hoped that the North-Eastern Railway Company would propose to carry out works sufficient to enable it to meet the wants of the great district of which it has almost a monopoly of service. The company makes no proposal of moment. It wishes to add to its possessions a short line on the northern bank of the river Tyne—the Wylam Railway—and one on the Wear—the Hylton line—and thus to increase its monopoly of the North. It proposes to make four or five "railways," as they are described in the notice of application, but really sidings and junctions, and it desires Parliamentary powers of purchase over a few properties in Newcastle, Darlington, and in one or two other districts, but beyond this its proposals are mere routine. There are three great attempts shadowed forth to invade the district of the North-Eastern, and this is the alternative scheme that has been spoken of—one that must mean bitter disappointment to those who have been hoping that the North-Eastern Railway Co. would take a liberal view of its responsibilities to the great counties that it holds in its sway. None of our railways show so large an increase of traffic as the North-Eastern Railway does, and that traffic is likely to increase still more, so that there is room for large extensions, especially of some of the branches which are at the present time burdened with traffic. There was in the past a neglect of the claims of Hull, and the result is seen in the new line over which the Midland Railway proposes to have running powers now, and that policy of neglect may bring about a still greater loss to the North-Eastern. It is the one great railway in the kingdom which has the monopoly of the service of a district that is our greatest mineral store, and with such a valuable point it ought to make its service the best, and its response to the wants of the district the most ready, if it wishes to preserve the monopoly of service that it now has, and that it seems desirous of increasing.

LITERATURE.

Report on Fuel for the Army. Quartermaster-General's Office, Washington, U.S.A. 1882.

This is an octavo pamphlet of eighty-five pages, containing principally a great number of tables of the performance of various American coals. They constitute a record of experimental tests of various fuels used by the United States Army. The tests were made in 1879-80-81 and 1882 by Mr. L. M. Zuncker, a mechanical engineer, educated at the Polytechnic School, Carlsruhe, and have been published by authority of Major-General M. C. Meigs, Quartermaster-General. The tests were similar in character to those with which all English engineers are familiar. They were carried out with two vertical boilers of peculiar construction; one is known as Snyder's Little Giant boiler, and as it is very ingenious in construction we shall illustrate it on the first convenient opportunity. It consists of a central vertical drum, to which are secured a number of U-shaped pipes, both ends of the U opening into the drum, one end near the bottom, the other near the top. The drum and pipes are put into a plate iron casing, in the bottom of which is the grate; the drum and pipes constitute the boiler proper. The other boiler was designed by General Meigs, and is simply a Messenger boiler, the top ends of the pipes in the fire-box opening in the side instead of in the crown. The performance of the two boilers seems not to have differed much. The best result obtained with the Little Giant was an evaporation from and at 212 deg. of 8·42 lb., with a semi-bituminous coal supplied by the Standard Coal Company. The worst result was had with Weber coal from Utah, which evaporated only 3·19 lb. of water per pound of coal. English coal—West Hartley — evaporated 5·11 lb. only, and Scotch splint 5·27 lb. The same coals with the Meigs boiler evaporated 8·68 lb. as the best performance, Weber coal evaporating 4·73 lb., while West Hartley evaporated 7·04 lb. and Scotch splint 7·61 lb. It thus seems that the Meigs boiler is better suited to flaming coal than the Little Giant is, while that does very well with anthracite and semi-bituminous coal. We cannot say whether copies of the pamphlet can be obtained in this country; if so they will be found worth purchasing by those who are interested in the performance of coals.

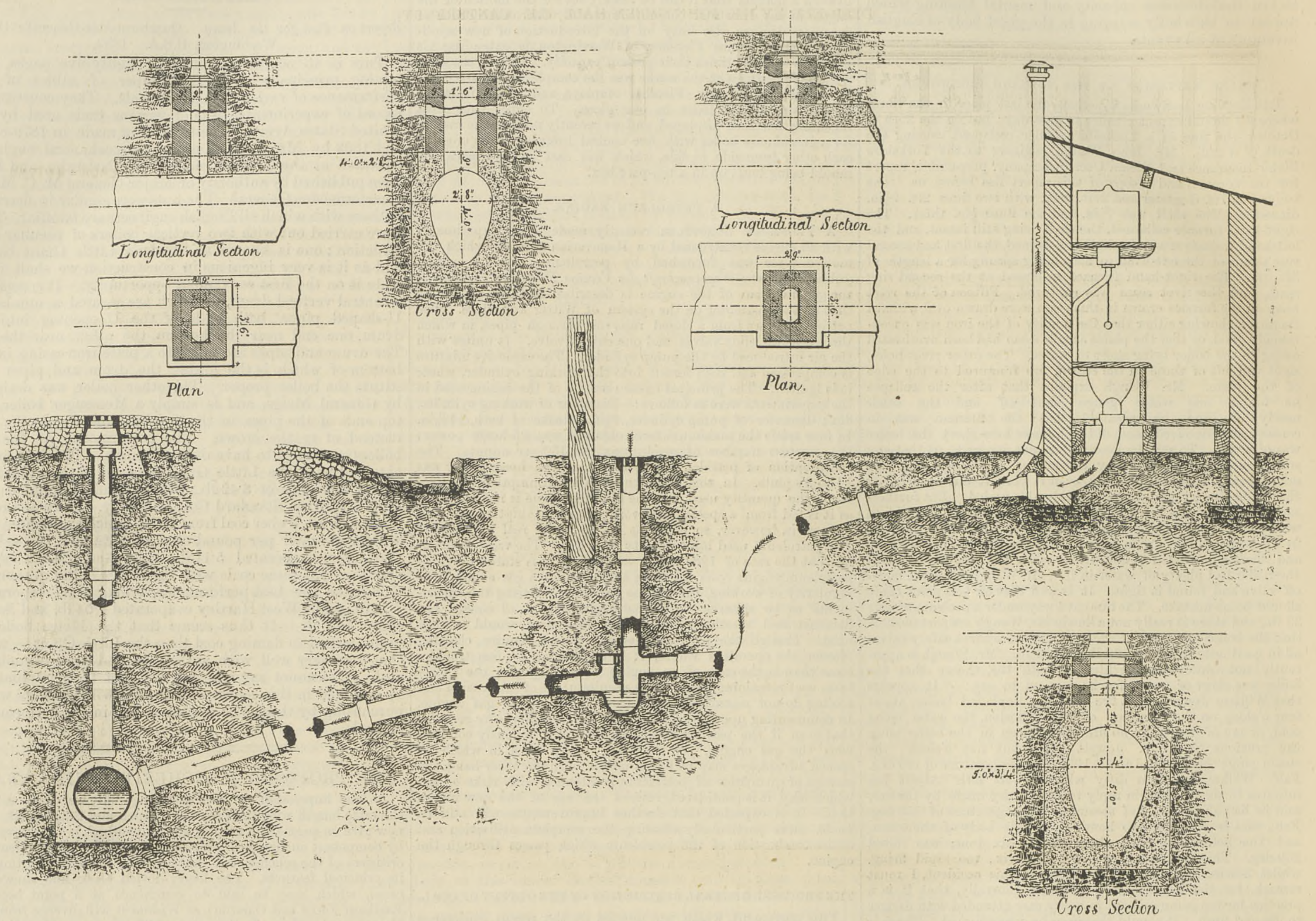
THE PROPOSED MANCHESTER SHIP CANAL.

In our impression for Oct. 6th, page 261, we dealt at considerable length with the proposed Manchester Ship Canal. We now give on page 388 a map of the route which is most favoured by competent authorities. We shall reserve for the moment our criticism of the scheme, and content ourselves with pointing out its principal features. The heavy dotted black line shows the canal, which may be said to commence at a point between Eastham Ferry and Garston; at Widnes it will diverge from the Mersey, and will run to the south of Warrington. Here the first lock will be. Thence it will be continued to the junction of the Irwell and Mersey, where will be the second lock. From this point the Irwell will be canalised, and the third and last lock will be at Barton. The proposed position of the docks is clearly shown on the map.

Electric Lighting in the City.—On Tuesday, at a special meeting of the City Commission of Sewers, held at the Guildhall, the Streets Committee brought in a report on the notices from electric lighting companies of their intention to apply to the Board of Trade under the Act of 1882, to enable them to light the City by electricity. The committee instructed Colonel Haywood, the engineer, to obtain the opinion of some eminent electrician as to whether it would be practicable to lay in the same tube the conductors of various companies for lighting by different systems of electricity without the conductors so laid injuriously interfering with each other, and also whether the conductors laid in a district by any one company could, if their usage by that company be discontinued, be made available for any other company using a different system. They now submitted a lengthy report from Mr. W. H. Preece, of the General Post-office, on these points. His opinion was that, except in a subway of considerable size, it was impracticable to maintain the conductors of different companies in the same tube. As to the other point, he observed that while there might be cases where the conductors of one company might be available for another, there could not be a case where they were properly available unless the two companies employed the same system and utilised the same central station for the generation of their electricity and the distribution of their force. Mr. Innes moved that it was advisable to allow all further experiments to be conducted at the risk of the lighting companies, and not at the expense of the ratepayers. This was carried by 31 votes to 26, the minority being in favour of supply by the Commission.

Lincolnshire Floods.—The following is from a report by Mr. John Evelyn Williams, M.I.C.E., to the General Commissioners for drainage by the river Witham:—The rainfall during September was 370 tons per acre, or 40 per cent. in excess of the average of the preceding ten years. Between the 30th September and the 25th October, the rainfall again reached 370 tons per acre, 153 tons per acre of which fell in the 24 hours preceding 9 a.m. on the latter date. On the 11th of October the water level in the river Witham was only 5ft. 5in. at Bardney, and on the 24th of October, with a rainfall of 182 tons per acre in the interval, the water level had risen to 13ft. 9in. In the 24 hours following, with a rainfall of 153 tons per acre, the water rose 4ft. 9in., or to 18ft. 6in. at Bardney, and an interior bank, the right bank of the Barlings Eau, now yielded to the pressure of the flood waters. The rainfall of 370 tons per acre during September was followed by a rainfall of 461 tons per acre during October, the latter being 80 per cent. in excess of the average of the preceding ten years. In the first half of the present month there has been rain, more or less, on twelve days; the total fall being 144 tons per acre. During the flood three of the four openings of the Grand Sluice were in full operation, and also a portion of the old Navigation Lock, or fourth opening, now under re-construction. The period of suspended discharge at the Sluice was, however, prolonged by the extraordinary high tides during the last week in October. On the 28th of that month the tide rose to 20ft. 2in. above the sill of the Grand Sluice, or 5ft. above the maximum level of the flood waters. The same tide rose to 25ft. 2in. above the sill of Hobhole Sluice, or 15ft. 2in. above the maximum level of the flood waters on the land side of the sluice. The extraordinary high tides, coincident with the period of maximum rainfall, formed a conjunction of circumstances highly prejudicial to the rapid depression of the flood waters. The maximum flood levels in the east and west fens respectively, were considerably lower than those previously recorded, and the pumping engines at Lade Bank performed their duty with ease and smoothness. The works under your jurisdiction have successfully withstood the pressure thrown upon them."

THE SEWERAGE OF ADELAIDE, SOUTH AUSTRALIA.



As our readers in England will no doubt be interested in learning what is being done in sanitary engineering in the colonies, we publish this week some type drawings of the sewers recently constructed for the drainage of the city of Adelaide, the capital of the colony of South Australia.

Adelaide, and its suburbs included in the drainage scheme, contain 65,000 inhabitants distributed over an area of 4000 acres, but the population is rapidly increasing and the drainage scheme has very properly been designed for future wants; thus the capacity of the works is greater than might seem necessary to an eye accustomed to the slower growth of population natural to an old country. Adelaide possesses waterworks affording a constant supply under high pressure, derived from two storage reservoirs having an aggregate capacity of 1000 million gallons. The consumption varies from 15 gallons per head per diem in winter to seventy gallons on hot summer days. A very large number of meters are in use. The sewers have been designed on the assumption that the use of water-closets will be general, and that the excreta of the whole of the population will be received into the sewers, together with the greater part of the water supplied by the waterworks after it has become fouled by use. The sewers are also intended to receive such portion of the rain as may fall upon roofs and upon paved yards and courts, and provision is made for draining the subsoil of the town.

The general surface drainage of the district and of all roads and streets is carried off by a separate system of drains. The larger sewers are of the usual oval form, and are constructed entirely of cement concrete. The smaller sewers are formed by glazed stoneware socket pipes, of which a large quantity were imported from England. All joints have been made with Portland cement, and where necessary the pipes have been surrounded with cement concrete or puddle. Ventilating shafts have been provided on all lines of sewer every 100ft. apart. In wide streets the ventilating shafts are furnished at the surface of the road with a cast iron grating, beneath which is an iron basket to catch stones, &c.; every grating is removable, and each ventilator serves, therefore, as a lamphole. In narrow streets the ventilators are carried up by means of 6in. shafts above house-tops in suitable positions.

On the oval sewers the manholes are as shown by the drawings, and are spaced every 600ft. apart. On the pipe sewers the manholes are circular, 4ft. 6in. internal diameter at the bottom, tapering towards the top; they are entirely of cement concrete, cast in position around a collapsible iron frame, which could afterwards be withdrawn from the interior. These manholes exist at all intersections of streets and at every change of direction, straight lines only being allowed between manholes.

The destination of the whole of the sewage is a sewage farm situated about three miles from the town. The main outfall sewer is of peculiar form, as shown by the illustration. The invert of the outfall sewer has been kept as high as possible in order that the sewage might be delivered upon the farm well above the surface of the ground, to facilitate subsequent distribution. Hence for a considerable distance the sewer stands partly above ground, and is covered by a bank of earth. As the sewer along this portion of its course follows the main line of railway, and is constructed within the railway fence, to avoid the purchase of property, it was necessary to avoid making a wide and unsightly bank of earth, and therefore the vertical dimension of the sewer was reduced by adopting the form shown at page 392, which would have been unsuitable for an underground sewer supporting any considerable superincumbent weight. The form adopted was also found to be cheap. For the disposal of the sewage an area of 480 acres of land has been secured. Considering the nature of the Australian climate, it is highly probable that this area will be sufficient for many years, but the sewer delivers the sewage at a sufficient elevation to command a much larger area—indeed all the country surrounding the farm—so that future extensions can be easily carried out, or sewage can be supplied to the neighbours. The ground is a light loam overlying a sandy subsoil. The design of the farm provides that fifty acres are to be underdrained to a depth of 6ft. for the purpose of intermittent downward filtration, the object being to avoid the necessity during rain of flooding the crops grown upon that portion of the farm worked by broad irrigation.

The filter will be capable of continuously receiving and purifying the maximum flow of sewage, which is calculated at 3700 cubic feet, or 23,000 gallons per minute. A main drain of this capacity has been constructed beneath the filter, the outfall from which is into the sea. This drain is constructed of cement concrete with a half brick arch, this form being found the cheapest after due consideration. The minor drains are of perforated stoneware pipes. One third of the whole filter has been already completed, that area being sufficient for the present flow of sewage, which is small, owing to the comparatively few house connections as yet made. The surface of the filter bed is laid out in ridges and furrows, and is divided into six areas, each of which receives its dose of sewage in regular rotation. Except during rain, however, the whole of the sewage has been hitherto needed for the crops growing upon the rest of the farm. The farm has now been in operation about sixteen months, and the results are very encouraging, no difficulty having been yet experienced in disposing of the produce at satisfactory prices. About fifty cows are at present kept on the farm, their milk and butter finding a ready sale. The design for the works of the farm comprises accommodation for 200 cows and a butter and cheese factory on the American plan; this is now being constructed, and will probably prove very remunerative, because, owing to the dryness of the Australian climate, and consequent scarcity of green fodder for a considerable period of the year, butter realises very high prices.

The important point of the proper construction of house drains and connections with the sewers has received due attention. Efficient supervision of these matters has been rendered the more easy by the fact that the district is new and as yet thinly built upon, and by the control of everything in connection with the sewers as well as with the waterworks being placed in the hands of one authority, namely, the Hydraulic Engineer's Department of the Ministry of Public Works. To ensure the work being properly done, regulations have been issued accompanied by illustrated directions; these we have recently reviewed.* The principle adopted is that every house drain shall be thoroughly self-ventilated and constructed in accordance with one uniform plan. The house connections, so far as they are situated beneath the public streets, are constructed by and at the cost of the Department, which also for a fee of 20s. provides and fixes on each house drain near the boundary of the premises a "disconnector trap." This trap prevents the passage of gas from the sewer to the house drain, and at the same time admits air to the latter. At the upper end of every house drain and of every branch thereof a ventilating pipe is fixed and carried up a suitable height above the adjacent buildings. Soil pipes are required to be fixed on the outside of the house wall and carried up of full diameter above the roof for ventilation. The traps of indoor closets are further required to be furnished with a 2in. ventilating pipe branching into soil pipe above the highest inlet into same, see page 392. All waste pipes from baths, sinks, &c., are brought outside the house wall or caused to discharge over the grating of a properly trapped and ventilated gully.

The accompanying drawings sufficiently explain the foregoing remarks. All work in connection with house drains must be done under the supervision of the department, which also maintains in good order free of cost the disconnector trap at the boundary of the premises, and periodically inspects the whole of the fittings in each house. Iron pipes are largely used for house drains, and are much liked on account of greater facility in laying. They are cast in various lengths up to 9ft., and are three-sixteenths of an inch thick for 4in. pipes, and a quarter of an inch thick for 6in. pipes, with socket joints caulked with lead like water mains. Special castings are provided for bends, &c., and all are coated with Dr. Angus Smith's composition.

* These regulations can be obtained of Messrs. Spon.

The estimated cost of the whole scheme is £300,000, which is equal to £2 per head of the population calculated for. Of this amount, over £200,000 has already been spent, of which £24,000 was paid for land and compensation, and £26,000 for works upon the sewage farm. The cost of a survey and plan of the district to a scale of 40ft. to the inch is also included in the above total. That the above cost is not extravagant will be seen when the following prices are taken into consideration :—

Labourers' wages per day of 8 hours..	6s. 6d. to 8s.
Masons..	10s. 6d. to 12s.
Portland cement, per cask	17s. 0d.
Bricks, per 1000	60s. 0d.
Broken metal for concrete, per cubic yard	10s. 0d.
Cement concrete, per cubic yard	35s. 0d.
Brickwork in cement, per cubic yard	60s. 0d.

The whole of the works have been carried out from the designs and under the supervision of Mr. Oswald Brown, M. Inst. C.E., late hydraulic engineer to the South Australian Government, assisted by Mr. E. C. Bowyer Smyth.

TENDERS.

ROADMAKING AT HOYLAKE AND WEST KIRBY.

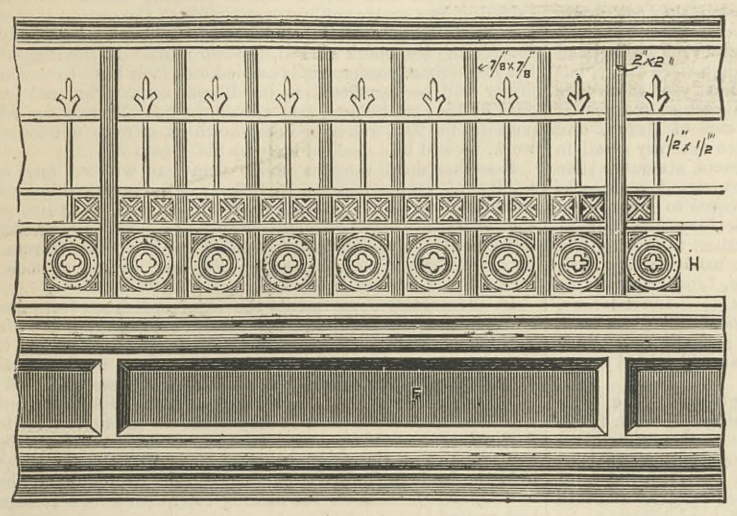
TENDERS for roadmaking at Hoylake and West Kirby for the Wirral Rural Sanitary Authority. Charles H. Beloe, M. Inst. C.E., 13, Harrington-street, Liverpool, engineer. Quantities supplied.

Contractor.	Amount of tender. £	s.	d.	Time required.
J. Nuttall, Bootle	1558	7	3	3 months.
Mr. Garnett, Liverpool	1472	4	3	6 months.
R. A. Aldred, Hoylake	1373	13	8	6 months.
Wm. Harrison, West Kirby	1340	0	0	4 months.
G. P. Jones, Hoylake	1334	0	0	3 months.
J. Taylor, Widnes	1300	0	0	4 months.
P. Walkden and Co., Bootle	1259	0	0	5 months.
E. Taylor, Hoylake	1241	16	11	6 months.
Fawkes Bros., Birkdale	1185	18	5	6 months.
Holme and King, Liverpool—accepted	1091	8	11	4 months.
MacCabe and Co., Kirkdale	1045	16	5	6 months.
Engineer's estimate	1248	8	0	

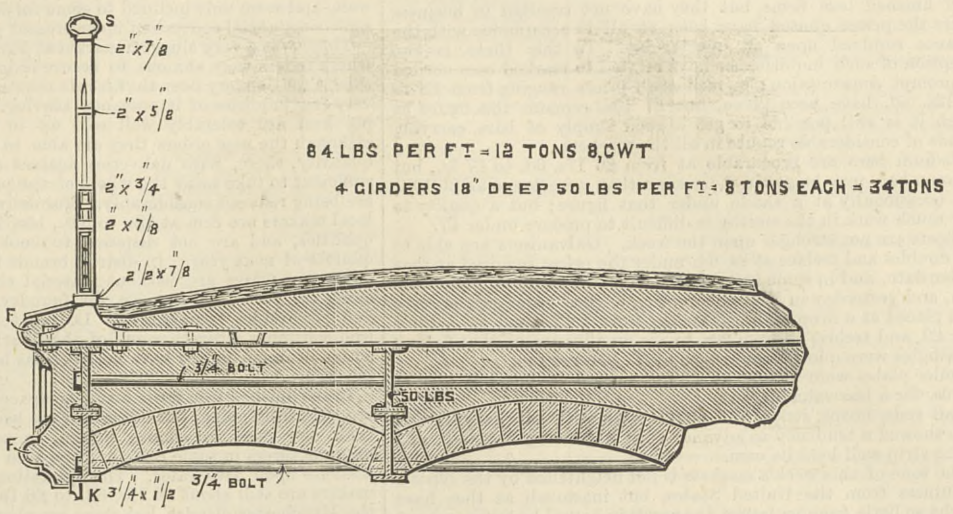
A RAILWAY UP THE DRACHENFELS.—The construction of a railway on the Righi principle from Königswinter up the Drachenfels is looked upon as assured, and the work is expected to be commenced during the present year. According to details published in the *Central Blatt für Bau-Verwaltung*, the line will have a total length of 1660 yards with an ascent of 240 yards. At the lower portion of the line the rails run on a level for fifty-five yards, so that the gradient for the portion of the line which is on an incline is at the rate of 1 to 6·7—or about 15 per cent., the extreme gradients are 1 to 5, or 20 per cent.—for a length of 101½ yards and 1 to 5·5=18⅕ per ccnt.—for a length of 200 and 330 yards. The curves which occur have radii of 196¾ and 245¾ yards. The line is a single one with a gauge of 39·37in. The means of propulsion and the terminal arrangements allow a maximum traffic per hour of 500 persons in each direction. The work is entrusted to the "Deutsche Local-und Strassenbahn Gesellschaft," of Berlin.

CONTRACTS OPEN—NEW BRIDGE AT CANTERBURY.

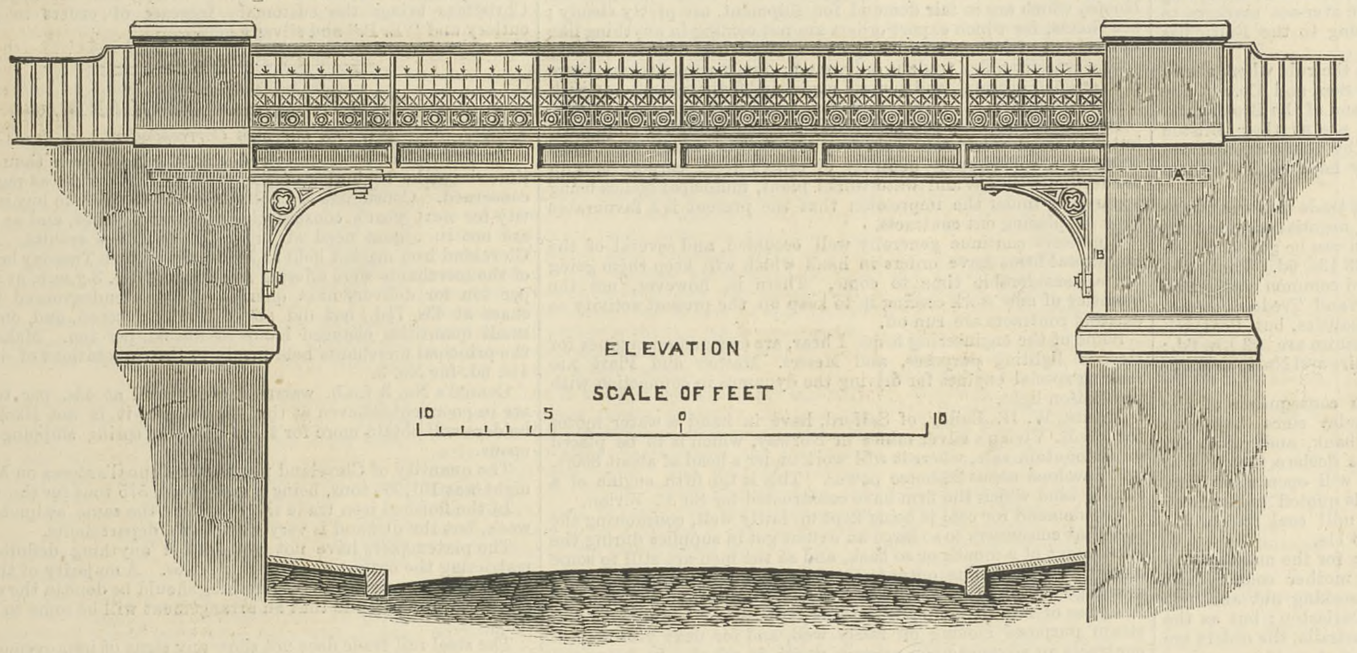
DESIGNED BY MR. JOHN GREEN HALL, C.E., CANTERBURY.

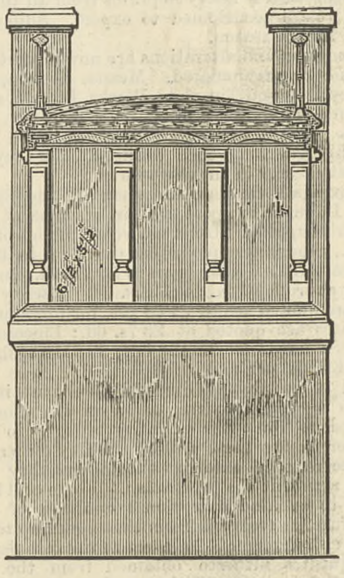


DETAIL TO 1" SCALE



SECTION TO 1" SCALE





SECTION TO 1/4" SCALE

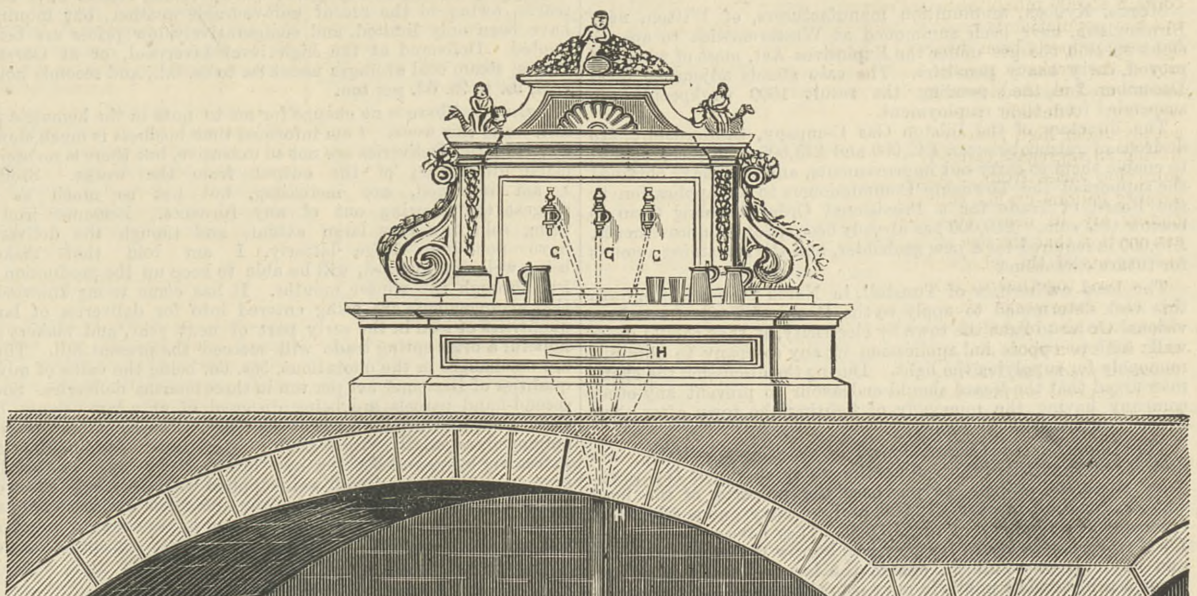
CONTRACTS OPEN.

NEW BRIDGE AT CANTERBURY.

We illustrate above a new iron bridge to connect the Dane John with St. George's-terrace—in lieu of the present brick bridge—in the city of Canterbury, for the Mayor and Corporation of the said city, according to the drawings prepared by Mr. John Green Hall, Assoc. M. Inst. C.E., architect, Canterbury. All the brickwork, stonework, and asphalte—with the exception of the 4½in. arches between girders and the concrete over the same—as well as the removal of the present bridge, will be done by men employed by the Mayor and Corporation, or by a separate contractor. The arches between the wrought iron girders to be constructed by the contractor, as shown, of 4½in. brick rings in cement; the bricks to be red, well-burnt kiln bricks of an uniform colour, closely jointed, built on proper close boarded centres, and pointed on the underside in a neat and correct manner. The concrete over the arches and at the sides of girders shown in detail to be of cement concrete, in the proportion of one of cement to five of washed broken gravel and sand, the concrete to be well mixed with the cement before the water is added, and the concrete brought to a proper consistency, and put in its place in such a manner as the architect shall direct. No concrete shall be put over the arches until the ironwork is fixed and other parts finished; the architect will determine how and when the concrete shall be put in. All the cement to be of the kind called Portland, and the sand and gravel to be washed clean; no stones for the concrete shall exceed the size of 1½in. either way. All the concrete shall be carefully put in, packed between and round the girders and other ironwork, as shown. Execute all requisite cuttings, both rough and fair, and execute all bricklayer's work, as before specified, for the due performance of the works. The York stone templates for ends of iron girders will be provided by the Mayor and Corporation, or by another contractor. Proper close boarded centres are to be provided for the arches, with proper rough quarterings as supports for same. The Mayor and Corporation will make provision for blocking off the road on either side, and for stopping the traffic during the work. The eight brackets shown at A and B to be of sound English oak, properly wrought, framed, and fixed with moulded end, as shown; to be 6½in. by 5½in., provided for and built in, as shown, and to receive two coats of oil before fixing and two afterwards, and to be perfectly free from sap, and other defects. All castings to be of equal quality to good, soft, grey Staffordshire iron, from the second melting, cast sound and clear, and free from air blows, flaws, twisting, &c. The wrought iron to be of equal quality to the best Staffordshire, to sustain a tensile strain of 22 tons per square inch before fracture, and 10 tons before loss of elasticity, and to extend 8 per cent. of its length before breakage. The sections must be rolled particularly true and uniform in thickness, and the edge smooth—not jagged. All joints, seatings, connections, &c., must be planed and fitted accurately together. Sealed tenders to be sent to Mr. Rest W. Flint, Town Clerk, Canterbury, on or before the 4th of December.

GOUGY'S BEER ENGINE.

We illustrate herewith the arrangement of apparatus as made by M. P. F. Gougy, of Paris, for many years, though not known much in this country, by which the counter or bar pumps are made unnecessary, and under which carbonic acid may be passed into the casks instead of air at a vent peg, thus keeping up the flavour of the beer or other liquor. In our engravings H is an air pump, worked generally by hand, but in large breweries where they have steam for other purposes, is then worked by steam, for compressing air in the accumulator B to a pressure, say, of 28 lb. per square inch or above; C, air gauge; D, a casing in several parts, containing an air cock for the pump, an air cock for the regulator, and a connection for the air gauge. These cocks are made so that they do not leak; the regulator at D serves to maintain a constant pressure on the beer contained in the casks. This regulator works automatically, and is necessary to obtain a good result, as otherwise with the pressure falling in the accumulator it would fall also on E is a distributing air pipe of metal; F, flexible pipe, in gutta-percha or india-rubber, and conducting the air to upper part of the cask; G, pipe connected to the cock at the bottom of the cask. This pipe is connected to pewter pipes that pass through a large pipe in lead containing ice to cool the beer, as generally the



the beer; instead of that, the pressure in the accumulator being sometimes four or five times more than is necessary to make the beer flow from the cellar, provides a large reserve of air, and thus allows the attendant to draw a large quantity of beer without being obliged to work the pump. In most cases air is pumped in the accumulator in quantities sufficient for a day. cellars are not cool enough—all drink being served very cool, as beer loses much of its good flavour if warm. Recently M. Gougy has made some alterations. For instance, the casks are generally put upright; the refrigerator has been modified to allow to alter the coolness of the beer by simply turning the key of the tap right or left.

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

(*From our own Correspondent.*)

NUMEROUS inquiries for quotations have this week reached the chief finished iron firms, but they have not resulted in business where the prices quoted have been at all in accordance with the advance resolved upon at quarter-day. To this there is the exception of such inquiries as have related to marked bars needed for prompt consumption; in such cases prices ranging from £8 to £8 12s. 6d. have been given, but £7 10s. remains the figure at which it is still possible to get a good supply of bars carrying brands of considerable repute in all the markets.

Medium bars are procurable at from £6 17s. 6d. to £7 5s., but common bars may be got in more cases than a week ago at £6 10s., and occasionally at a shade under that figure; but a quality to bear much work in the smithy is difficult to procure under £7.

Sheets are not stronger upon the week. Galvanisers are able to buy doubles and trebles at 2s. 6d. under the prices required at that earlier date, and in some instances to-day—Thursday—in Birmingham, and yesterday in Wolverhampton, a good order might have been placed at a drop of 5s. Doubles were to be had at a little over £9, and trebles at from 20s. to 25s. in advance of that figure; but singles were quoted unchanged at £8 10s. per ton.

Boiler plates were strong at £9 for a good brand; but easy at £8 10s. for a less valuable sort.

Nail rods, hoops, strips, and angles were without change. Gas strip showed a tendency to advance with a growing demand; and baling strip well held its own.

The tone of this week's markets is not heightened by the reports of dulness from the United States, but inasmuch as they have bought so little from us lately, the result in actual business was not appreciable; and the conviction was all but universal that spring will bring with it heavy inquiries from all the over-sea markets to which we are accustomed to export. Shipping to the Baltic has ceased for the season.

Extensions and alterations are now almost the rule where sheets are made or manipulated. Messrs. Halton, Son, and Co., of the Bradley Iron and Tin-plate Works, Bilston, and of the Broadwater Iron and Tin-plate Works, Kidderminster, are at their Bilston Works engaged in alterations necessitated by the concentration and the growth of their business, and they hope to have them completed early in the new year.

There is a little more movement in the pig trade this week than last. Inquiries are projected in advance of negotiations for next quarter's supplies. Good native all-mine iron can be got at within £3 10s., though the quotations range up to £3 12s. 6d. Part-mine sorts vary from £3 5s. down to £2 7s. 6d., and common cinder iron is easy at from £2 5s. to £2 2s. 6d. Barrow and Tredegar hematites are quoted strong at £3 10s. for forge qualities, but Pentyrch hematites are quoted at £3 7s. 6d.; Lincolnshire are £2 13s. 6d.; North Staffordshire, £2 12s. 6d.; and Derbyshire and Northamptonshire, £2 10s. per ton.

Coal is in slightly diminished output in consequence of the colliers working so irregularly on the Monday since they have resolved to limit the quantity brought to bank, and prices are stronger in the same ratio. Colliery owners declare that if this practice extends amongst the miners they will open more pits, and so augment the production. Forge coal is quoted to-day from 7s. 6d. to 8s., and exceptional qualities of mill coal realise 9s., while furnace sorts rise from that figure up to 11s.

The encouragement held out in the colonies for the manufacture of requisites hitherto obtained from the mother country has brought some Australian buyers to England, seeking nut and bolt machinery. Purchases are being made at Darlaston; but as the deliveries are needed for February next in Australia, the orders are being somewhat widely split up between the makers there and at Wednesbury.

The Staffordshire and Worcestershire rivet makers have resumed work at a 10 per cent. advance, for which they have been on strike for three weeks.

The business for the manufacture of bolts, nuts, and rivets hitherto carried on by Mr. G. B. Smith, of Brookfields, Birmingham, is being converted into a limited liability company, with a capital of £15,000.

Messrs. Kynoch, ammunition manufacturers, of Witton, near Birmingham, have been summoned at Westbromwich to answer eight specific charges under the Explosives Act, most of which, if proved, carry heavy penalties. The case stands adjourned until December 2nd, and pending the result 1600 workpeople are suspended from their employment.

The directors of the Bilston Gas Company, Staffordshire, are desirous of raising between £42,000 and £45,000 additional capital to enable them to carry out improvements, and they have obtained the support of the Township Commissioners to an application to the Board of Trade for a Provisional Order enabling them to borrow this sum. £10,000 has already been spent in improvements, £15,000 is required for a new gasholder, and the remaining amount for future extensions.

The local authorities of Tunstall, in North Staffordshire, have this week determined to apply to the Board of Trade for a Provisional Order to light the town by electricity, if they should deem well; and to oppose an application by any company to obtain a monopoly for supplying the light. During the discussion the chairman urged that the Board should endeavour to prevent any other company having the monopoly of lighting the town after their experience with the gas company.

The Improvement Commissioners of Wellington, Salop, are desirous of themselves controlling the water supply of the town. They therefore propose to purchase the property of the local waterworks company for £12,000, and to carry out a scheme of extension at a further cost of £13,000. They have applied to the Local Government Board for power to borrow the needed £25,000, and Major Hector Tulloch, one of the inspectors of the department, has just held a public inquiry into the proposal. The extension scheme was opposed by a portion of the ratepayers who desire that the old reservoir should be enlarged, instead of two additional ones being erected, which would effect a saving of £2000.

Wellington is troubled concerning its sewage. The town surveyor reports that the sewage scheme now in operation was constructed without any regard to the ventilation of either the main sewers or the house drains, and that the accumulation of gases which results is a matter of serious moment. The surveyor has been instructed by the Improvement Commissioners to prepare an estimate of the cost of proper ventilation.

On Wednesday a town's meeting was held at Shrewsbury, under the presidency of the mayor, to further consider the desirableness of inviting the Royal Agricultural Society to hold their exhibition there in 1884. It was shown that the subscriptions already received amounted to £3200, and that the total amount required as a guarantee fund was £5000. Resolutions were passed urging the public to subscribe liberally, and it was determined to make a canvass of the town and county.

I regret to have to record the death of Mr. Gilbert Hamilton, one of the principals of the old engineering firm of James Watt and Co., Soho, Birmingham.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The struggle continues between buyers and sellers as to which will first be compelled to come into the market, but the advantage seems to be on the side of buyers. Although makers have still generally plenty of work in hand, the prolonged absence of new orders is causing some anxiety to manifest itself with regard to business, and there is less firmness in holding for prices. Makers, however, do not show any great pressure to sell, and any material giving way in the market is confined chiefly to merchants who are offering second-hand iron at low figures, and in some cases are open to quote for delivery into next year at 6d. or so under current rates. Consumers, on the other hand, being mostly well covered for current requirements, are in a position to wait, and seem only inclined to come forward when they can obtain some substantial concession upon present prices.

There was a very sluggish market at Manchester on Tuesday, and where sellers were anxious to secure orders prices were easier, but except for delivery over the first six months of next year there were very few inquiries of importance stirring. Lancashire makers of pig iron are tolerably well sold up to the end of March, and although the new orders they are able to secure are very small in quantity, these, with deliveries against contracts, are more than sufficient to take away the whole of the present output, and stocks are being reduced considerably. For delivery equal to Manchester local makers are firm at 49s. to 50s., less 2½ for forge and foundry qualities, and are not disposed to book further than the first quarter of next year. In district brands there has been very little doing, but prices are without material change, Lincolnshire averaging 49s. for forge and 50s. for foundry, less 2½ delivered here, and Derbyshire brands about 1s. per ton more. Middlesbrough iron continues altogether out of this market, and the only transaction of importance I have heard of has been an odd sale at a very low figure.

In the finished iron trade business is exceedingly dull. The forges are kept fully going, but old orders are being rolled off much faster than new ones are coming in, and to secure good specifications manufacturers in some cases are prepared to make substantial concessions upon late rates. The quotations of the principal local makers are still about £6 12s. 6d. to £6 15s. for bars delivered into the Manchester district, but there are plenty of good brands to be bought at £6 10s., and common qualities as low as £6 5s. per ton. Hoops, which are in fair demand for shipment, are pretty steady; but sheets, for which export orders are not coming in anything like so freely as of late, are easier by at least 2s. 6d. per ton.

The brass foundry trade is only quiet; for marine fittings there is a lessened demand, and general engineers' fittings meet only with a limited inquiry.

Iron founders of pipes and heavy castings are fairly employed, but it is upon work taken at very low figures, which seem to be bringing a considerable quantity of orders from corporations in connection with gas and waterworks plant, municipal bodies being apparently under the impression that the present is a favourable time for placing out contracts.

Engineers continue generally well occupied, and several of the large local firms have orders in hand which will keep them going for a considerable time to come. There is, however, not the quantity of new work coming in to keep up the present activity as existing contracts are run off.

Some of the engineering firms, I hear, are engaged on engines for electric lighting purposes, and Messrs. Mather and Platt are making special engines for driving the dynamos in connection with the Edison light.

Messrs. W. H. Bailey, of Salford, have in hand a water motor for Sir R. Vivian's silver mines in Norway, which is to be placed on a mountain side, where it will work under a head of about 800ft. and develope about 20-horse power. This is the fifth engine of a similar kind which the firm have constructed for Sir R. Vivian.

The demand for coal is being kept up fairly well, considering the fact that consumers to so large an extent got in supplies during the excitement of a month or so back, and as the men are still to some extent restricting the output, there is no great accumulation of stocks going on. It is chiefly in house-fire coals that supplies are in excess of requirements, other classes of fuel for ironmaking and steam purposes moving off fairly well, and for next year's slack contracts an advance upon present prices is asked. In house-fire coals there has been a little giving way upon the advance asked at the commencement of the month, but prices generally are being very fairly maintained. At the pit mouth they average about 10s. to 10s. 6d. for best coals; 8s. up to 9s. for seconds; 7s. to 7s. 6d. for common house coals; 6s. 6d. to 7s. for steam and forge coals; 4s. 9d. to 5s. 3d. for burgy; 3s. 6d. to 3s. 9d. for common slack; and 4s. to 4s. 3d. for the better sorts.

Shipping has been only quiet; for one thing vessels have been scarce, owing to the recent unfavourable weather, but inquiries have been only limited, and comparatively low prices are being quoted. Delivered at the high level Liverpool, or at Garston Docks, steam coal averages about 8s. to 8s. 6d., and seconds house coal, 9s. to 9s. 6d. per ton.

Barrow.—There is no change for me to note in the hematite pig iron trade this week. I am informed that business is much slower than of late. Deliveries are not so extensive, but there is no appreciable diminution of the output from the works. Stocks, I am informed, are increasing, but not so much as to suggest the blowing out of any furnaces. Bessemer iron is being sold to a very large extent, and though the deliveries have not been large latterly, I am told that makers being well sold forward, will be able to keep up the production of iron through the winter months. It has come to my knowledge that arrangements are being entered into for deliveries of large quantities of iron in the early part of next year, and makers are hopeful a brisk spring trade will succeed the present lull. There are no changes in the quotations, 56s. 6d. being the value of mixed qualities of Bessemer net per ton in three months' deliveries. Some second-hand parcels are being disposed of at a lower figure, but these I am told are for present delivery. Steel makers are well employed, especially with regard to steel rails. Shipbuilders are extremely busy, and booking new orders every day. The smaller branches of industry are all well supplied with work. The iron ore trade is steady, 13s. to 14s. being the quotation for average qualities. Coal is in steady consumption, and prices show an indication towards an improvement. Manufacturers are consuming a great deal, but on shipping account the demand is weak.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

AT Rotherham, on Monday, a conference of Yorkshire miners was held to resume consideration of how the output of coal could be most efficiently restricted. About 120 delegates were present. Mr. E. Cowey, Sharlston, President of the Yorkshire Miners' Association, was in the chair, and Mr. B. Pickard acted as secretary. Mr. W. Parrott, of Barnsley, was also present. The question was discussed for over four hours, and the resolution come to was as follows:—"That the delegates appointed at the previous conference be empowered by this conference to try and secure a general regulation of labour at the Leeds conference, and that the same be as follows, viz., five days per week and eight hours per day." The Leeds Conference was originally fixed for December 5th, but the miners of Durham desire that the Conference should be adjourned until the 18th, in order that they may be able to send delegates. It is also expected that South Wales will be represented, and if Northumberland should also send delegates the decisions of the Conference will affect the whole of the mining counties of England.

The agitation for 10 per cent. spreads apace. At Barnsley, on Saturday last, the colliery enginemen of South Yorkshire passed resolutions expressing regret that they had not got an equal advance at the same time. According to the enginemen's story their position is rather hard. Their wages are made to fluctuate with the remuneration of the miners, and they say that when the miners' wages "drop," theirs drop with them; but when they rise they are left at the old rates. The enginemen object to be governed by a class over whom they have no control, and there seems reason in their objection.

As a result of the successful agitation of the colliers' delegates, unionism is once more becoming more powerful. The Yorkshire Miners' Association is again establishing itself firmly in the mining districts. At Thorpe Hesley, Messrs. Newton, Chambers, and Co.'s colliers resident in the locality have formed a branch. At another meeting, held at Parkgate, Mr. B. Pickard urged restriction of the output as the best means of securing the advance already gained. As a matter of fact, restriction of the output is already in operation. Less coal is being brought to bank than at any time, considering the hours worked, for two years. If the suggestion of the Rotherham conference is carried out, it is hard to see how the miner will be benefitted by his 10 per cent. The coal getter is paid by the coal he gets, and though he has 22s. now for what he once did for 20s., yet if he does one-third, or even one-fourth, less work, he will be a decided loser by his "gain."

Bessemer steel remains pretty firm but without any upward tendency. Quotations are as follows:—Best marked brands, with extra mixture of foreign irons for spring purposes, £14 10s. per ton; special marked brands for cutlery purposes, £9 10s.; No. 1 Bessemer billets—cut ends—£6 12s. 6d. to £6 15s.; common, from £5 to £5 15s. Leading makers are very busy and decline to book orders forward at the rates of the day.

In the cutlery departments the chief orders are from Australia and South Africa. Advices from the West Coast are not assuring. The "little wars" in the interior prevent produce coming in from the various markets, West African being the leading quality in the market, always commanding a sale; and those who held stocks have taken advantage of the short supply, and profited accordingly. The South American trade continues to improve very briskly, particularly the old Spanish settlements, which require very large quantities of all classes of cutlery. Many French contractors have held the trade in these settlements, but the Birmingham, Sheffield, and London merchants are making strenuous efforts to regain the lost ground.

Files, edge tools, and saws fairly active, and the approach of Christmas brings the customary increase of orders in general cutlery and "E. P." and silver goods.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

BUSINESS has been quieter during the past week than at any time since the beginning of the year, at least as far as pig iron is concerned. Consumers are not at present disposed to buy in quantity for next year's consumption at current prices, and as makers are not in urgent need of orders, no business results. At the Cleveland iron market held at Middlesbrough on Tuesday last some of the merchants were offering small lots of No. 3 g.m.b. at 43s. 9d. per ton for delivery next quarter. Buyers endeavoured to purchase at 43s. 7½d., but did not generally succeed, and only very small quantities changed hands at 43s. 9d. per ton. Makers and the principal merchants held firmly to their quotations of 45s. and 44s. 6d. for No. 3.

Connal's No. 3 f.o.b. warrants are offered at 43s. per ton, but are in poor request even at that figure, and it is not likely that holders will obtain more for them until the spring shipping season opens.

The quantity of Cleveland pig iron in Connal's stores on Monday night was 101,566 tons, being a decrease of 575 tons for the week.

In the finished iron trade the prices are the same as quoted last week, but the demand is very weak in all departments.

The platemakers have not yet settled anything definite as to restricting the output or advancing prices. A majority of the firms are, however, anxious that something should be done in the matter, and it is quite possible that an arrangement will be come to before long.

The steel rail trade does not show any signs of improvement yet. There is very little demand, and only very low prices are obtainable; the output is, however, being maintained.

Ironfounders are not at present fully supplied with work, and the orders they are taking are at prices which leave a very small margin for profit.

The continued rough weather has prevented vessels from entering and leaving the port. Consequently the exports are so far comparatively insignificant. Up to Monday night the amount of pig iron shipped was 43,761 tons, and of manufactured iron 13,645 tons.

Shipbuilding continues very brisk on the Wear. Messrs. Short Brothers, of Pallion, Sunderland, who have a great number of orders on hand, have purchased a piece of land adjoining their yard, and are about to make room for three additional slips. This will bring up the number of their berths to a total of eight.

The Cleveland Bridge and Engineering Company, Limited, of Darlington, have now been established for six years, and have made satisfactory progress. They have in hand at present numerous orders for bridge and engineering work, and they have just decided to enlarge their works.

It has been definitely settled to amalgamate the firms of Sir W. G. Armstrong and Co. and Charles Mitchell and Co. The capital is to be two millions, in 20,000 shares of £100 each, and 6650 of the shares are offered to the public. The works at Elswick and Low Walker are to be reconstructed, with a view to provide for the manufacture of steel and the building of war vessels.

On Saturday, the 18th inst., Sir J. W. Pease, M.P., sat at the Town Hall, Middlesbrough, and heard statements from the employers and operatives with regard to their respective claims for an advance and for a reduction of 7½ per cent. in wages. There was a good attendance of employers and operative representatives. There was a long discussion as to the period over which the award should extend, and it was finally arranged that the decision should be binding for four months, terminating on the last Saturday in February, 1883, subject, however, to one month's notice of change from either side, to terminate at or after the expiration of such period. The arbitrator, in the course of an address on the advantages of arbitration and sliding scales, supplemented his views as already published with the following remarks:—He said that in his opinion their previous scale broke down very much in consequence of the long period embraced in the ascertainment of prices. He had been told that there would be no difficulty in having a monthly or bi-monthly ascertainment. He thought Mr. Dale's scale of one and sixpence above shillings for pounds had been eminently one subject to modification. There was not necessarily a hard-and-fast proportion line between labour and prices through all time. The one and sixpence had been lowered to ninepence and raised as high as four shillings. Therefore, the ratio did alter with prices. When manufactured iron went up to £10 or £11 a ton, one and sixpence above shillings for pounds was not the figure then in vogue; and when iron fell down to its lowest—about the time of Mr. Lefevre's award—one and sixpence was deviated from on the other side. Between these two points he thought they might find a basis on which to erect a sliding scale. The eighteenpence of 1880 was a factor which might bear alteration according to the price of iron, and that price might be ascertained more frequently than every three months. The more they eliminated the speculative element from wages the better the men would be satisfied, and the better the masters ought also to be satisfied. It is expected that the award will be given in about a week.

There are now six large shipbuilding and engineering works on Tyneside lighted by electricity.

The death is announced, at the early age of fifty-one, of Mr. John George Chapman, of the firm of Wooler, Chapman, and Co., coalowners, Darlington. He was also a director and large shareholder in the Tees Bridge Ironworks, and in the Bowesfield Ironworks, Stockton. Mr. Chapman resided at Middleton One-row, near Darlington, where he built himself a handsome villa a few years since. He was universally respected for his great business capacity and his genial disposition. He leaves a widow and three sons.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

The prospects of next year's parliamentary work and that of contract and construction in Wales are very hopeful. In addition to the important railway from Risca to the Cardiff Docks, there will be the Rhondda and Swansea Bay Railway; important railway sidings by the Marquis of Bute at Roath and Treforest, to take off the strain on the dock railways; the Bute Dock extension; the Barry scheme, and a railway by the Taff Vale Railway Company in the Merthyr parish, with extra sidings and extensions at points in Cardiff district.

The flourishing character of the coal trade is also prompting other movements. Land is being treated for in the Cardiff moors for several industries, one notably for copper works, and negotiations are going on to establish shipbuilding at Cardiff, principally iron, for which purpose it is not impossible but that neighbouring ironworks would erect additional mills, so as to supply steel plates.

The movers in the Barry scheme appear determined to go on with their undertaking. An influential coalowner writing to a local newspaper points out that one of the strongest inducements they have is the high dividend of the Taff. This may be, but the determination expressed to select the Ogmore, failing the Barry scheme, and thus shunt a large traffic from Cardiff altogether, is not a praiseworthy one.

Several important consignments of rail, sheet, and merchant iron have left this week to various destinations, principally Iquique, Pernambuco, and Amsterdam. The most important cargo was for Port Moody—2395 tons—from Newport, Mon. From Neath several cargoes of bar iron have been sent of late to Bristol and Highbridge.

Generally the iron trade may be considered good; with one exception tin-plate works are dull, and prices remain unremunerative. Pontnewynydd Works, Mon., have been started by a Bristol firm. Nantyglo and Blaina are doing satisfactorily, and the last report shows an improving condition. Dowlais, Rhymney, and Tredegar, Ebbw Vale and Blaenavon, are all in full operation, and at Tredegar the mishaps at the initiatory stage have been well atoned for, and everything was going along well.

The examination of candidates for certificates of competency under the Mines Act of 1872 will be held at Cardiff, on January 23rd, 24th, and 25th.

Excellent work was done at the Mardy Colliery a few days ago, by Mr. Thomas, jun. It was necessary to "rip up" a shaft from lower workings into the 4ft. shaft, and this was done so skilfully that there was not the deviation of half an inch when the juncture was effected.

The Grangetown, or, as it is better known under its new designation, the Penarth Steelworks, Cardiff, now in liquidation, will be disposed of by auction next week.

The coal trade is brisk, and the export last week was fully up to average from all ports. Much more would have been done with better weather. Still, orders on hand are good, both for house and steam coal, and prices firm. Small coal continues in demand, and the increase of the Coppée ovens—which is one of the best utilisers — together with the briskness of the patent fuel trade, may be expected to keep up prices for small for a considerable time to come.

Prospectings are going on in virgin coal districts that will be affected by the proposed new line from Risca to Cardiff. There is a large extent of lower coals in Monmouthshire that will come into notice after the Rhondda coals have passed their meridian.

Meetings of house and steam coal delegates will take place in a day or two to determine on the application of Leeds for co-operation on wages questions.

The Pontypridd, Caerphilly, and Newport Railway is getting on with more vigour, and the connecting bridge with the Taff is advancing. I see that this company is going in for additional power in connection with Nixon's Navigation Colliery, and with the Brecon and Merthyr Railway. This will be a bid for a large amount of mineral traffic apart from the Rhondda.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

There is a want of animation in the pig iron trade, and the warrant market has been comparatively idle during the week. It is usual at the present season for the demand from abroad to get contracted, in consequence of the closing of the navigation in different parts of Europe and America. There have been no shipments of pig iron to Russia since last report; a fair quantity has been sent to the United States, and only a small consignment to Canada. The advices from America have not been quite so favourable this week, and their nature has tended to deepen the feeling of depression, which is to a certain extent due to speculative causes. The foreign shipments as a whole are not unsatisfactory, but there is a remarkable decrease this week in the arrivals of Cleveland pig iron at Grangemouth, only 639 tons having been received, as against 4780 in the preceding week, and 6930 in the corresponding week last year. The stocks in Messrs. Connal and Co.'s Glasgow stores show a reduction in the week of close upon 1200 tons.

Business was done in the warrant market on Friday forenoon at 49s. 11d. to 49s. 10d. cash, and 50s. 1½d. to 50s. 1d. one month, the afternoon quotations being as nearly as possible the same. On Monday transactions were effected at 49s. 8d. to 49s. 4d. cash, and 49s. 11d. to 49s. 8d. one month in the morning, while in the afternoon the prices were 49s. 4d. to 49s. 3d., and back to 49s. 6½d. cash and 49s. 9d. to 49s. 9d. one month. The prices on Tuesday forenoon were 49s. 7d. to 49s. 2½d. cash, and 49s. 9d. to 49s. 6½d. one month; and in the afternoon the market was flat at 49s. 2d. to 48s. 10½d. cash, recovering to 49s. Business was done on Wednesday at 48s. 11d. to 49s. 3d. cash, and 49s. 1½d. to 49s. 6d. one month. To-day—Thursday—the quotations were 49s. 4d. to 49s. 9d. cash, and 49s. 11d. one month.

Although the warrant market has been dull, the makers have in most instances been getting full quotations for their special brands, as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 64s. 6d.; No. 3, 54s. 6d.; Coltness, 69s. and 56s. 3d.; Langloan, 68s. and 56s. 3d.; Summerlee, 64s. and 54s.; Calder, 63s. 6d. and 58s.; Carnbroe, 57s. 6d. and 52s.; Clyde, 54s. 6d. and 52s.; Monkland, 51s. and 49s. 6d.; Quarter and Govan, each 50s. 9d. and 49s. 6d.; Shotts, at Leith, 66s. and 56s. 6d.; Carron, at Grangemouth, 53s.—specially selected, 57s. 6d.—and 52s.; Kinneil, at Bo'ness, 50s. 6d. and 49s.; Glengarnock, at Ardrossan, 57s. 6d. and 51s. 9d.; Eglinton, 52s. and 50s.; Dalmellington, 52s. 6d. and 51s.

The malleable iron trade is very active in the West of Scotland, and its prosperity will be still further ensured by good shipbuilding contracts which have just been placed on the Clyde. The utmost animation continues to mark the different branches of the manufactured iron trade.

A very good business has been done in coals in the course of the week, although the collieries are not yet sufficiently well supplied with railway plant. Five cargoes of coals were despatched from Leith, and a large number ready for sea have been detained by stormy weather. The trade is fairly brisk at the Fife ports, although the pressure there would appear to be slackening. Probably this is also a result of the bad weather at sea, as much as of the prospect of the Baltic ports being closed at an early date. Prices are quoted f.o.b. at Burntisland, 7s. 6d. up to 8s. 3d. per ton. Close on 6000 tons of coals have been shipped at Grangemouth; while the departures from Glasgow and the Ayrshire ports have been on an extensive scale. In the West the f.o.b. prices are well maintained, while rather better rates are obtained for household qualities, which are more in request on account of the wintry weather now being experienced. Coal freights are, on the whole, good to almost all parts of the world.

The Scottish Miners' Association has been dissolved. There has been a large falling off in the membership, and there were no funds to meet claims that were made upon the executive, the members of which have therefore given in their resignations. The success which attended this association has at no time been very satisfactory. Its dissolution leaves the miners of the West of Scotland altogether without a trade organisation, but it is understood that an effort will be made shortly to start a new society.

The colliers in the employment of the sale coalmasters have now pretty generally obtained the advance of 6d. per day, and it is promised at an early date in some places where the concession has not yet been made. The men are working steadily in the West. Those employed by the ironmasters have not received the increase, nor are they likely to do it, unless a considerable rise should occur in the values of pig iron.

In Fifeshire the masters have been much inconvenienced by the men working short time, with the object of compelling them to give a further advance of wages of 5 per cent., to make 15 in all. The masters threatened to prosecute the men for a breach of the rules, and although the latter profess to repudiate these rules, they have resolved to give up the practice of restriction in the meantime. The complaint of the employers was that by the men's action the cost of production had been increased, making it more difficult than ever to advance wages further. The restriction now having been put an end to, the men, through their secretary—Mr. Weir—have renewed their demand for the full 15 per cent. of an increase. The state of the trade does not to an outsider appear to warrant a further advance at present.

At a meeting of the Mining Institute of Scotland held at Hamilton a few days ago Mr. Jas. M'Creath, M.E., Glasgow, read a paper "On the Sucking Power of the Common Pump, and on some of the Shocks that occur in Pumping," while Mr. Ralph Moore, her Majesty's Inspector of Mines, described a self-tipping cage he had seen working in America.

Metropolitan Sewage Discharges. — The Royal Commission on Metropolitan Sewage Discharge met on Tuesday and Wednesday at No. 11 Committee-room, House of Commons. There were present—Sir Benson Maxwell—in the chair—Sir John Coode, Colonel Ewart, C.B., Prof. Williamson, F.R.S., Dr. de Chaumont, F.R.S., Dr. Stevenson, Mr. James Abernethy, F.R.S.E., and the secretary, Dr. W. Pole, F.R.S. Further evidence was given on the part of the complainants.

South Kensington Museum.—Visitors during the week ending Nov. 18th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 7718; mercantile marine, Indian section, and other collections, 2367. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1165; mercantile marine, Indian section, and other collections, 447. Total, 11,967. Average in corresponding week in former years, 12,999. Total from the opening of the Museum, 21,476,543.

The *Boston Herald* gives the salaries of servants on the Vanderbilt roads as follows:—Engine drivers are paid 3 cents per mile, and firemen receive one-half that rate. Passenger conductors are paid 80 dols. per month, and in some instances 10 dols. more. As the engineer has control of the brakes the old-fashioned brakeman is displaced by "trainmen," who help ladies to seats and also assist them in coming and going. These men receive 50 dols. per month, but the man on the last car receives 5 dols. additional, as his responsibility is greater. In case of any delay he must go on the track to flag approaching trains, and may be left behind. Baggagemen are paid 60 dols. per month, and ticket agents—except in cities—50 dols. This class is poorest paid of all railway officials, as they are closely confined and serve long hours, but there are so many women ready to accept such work that women's pay becomes the standard. The track boss is paid 45 dols. per month, while switchmen and flagmen have only 36 dols., and yet this is one of the most responsible positions on the road.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

14th November, 1882.

5416. Lubricator Attachments, P. M. Justice.—(*R. J. Hoffmann, Binghamton, U.S.*)
5417. Bolts and Nuts, R. Howarth, Wolverhampton.
5418. Fastening Buttons to Boots, &c., W. Morgan-Brown.—(*J. Davis, Lynn, Essex, U.S.*)
5419. Marking, &c., Card Games, G. F. Redfern.—(*Mr. Klein, Vienna.*)
5420. Caps for Securing the Ends of Ribs of Umbrellas, C. A. Allison.—(*Messieurs Guyon et Dyroff, Paris.*)
5421. Thermo-electric Generators, H. Woodward, London.
5422. Electrodes, H. Woodward, London.
5423. Steering Vessels, W. Pepper, Kingston-upon-Hull.
5424. Lithographic Presses, R. B. Hayward, London.
5425. Envelopes, R. B. Hayward, London.
5426. Lamps for Railways, J. Thomas, London.
5427. Tricycles, W. J. George, Birmingham.
5428. Steam Packing, H. W. Johns, New York.
5429. Storing, &c. Grain, K. J. Dance, London.
5430. Bottles, S. M. Bixby, New York, U.S.
5431. Picture Frames, &c., A. J. Boult.—(*C. G. Grandjean, Espalion, France.*)
5432. Musical Instruments, W. Booth, Rochdale.
5433. Washing, &c., Wearing Apparel, S. Hulme, Manchester.
5434. Plain, &c., Lace Edging, R. J. Joyce, London.
5435. Heating and Ventilating, C. R. Stevens, Lewisham.
5436. Putty, G. A. Biddis, Newbury.

15th November, 1882.

5437. Preserving Milk, M. and O. Pohl, Liverpool.
5438. Conduction, &c., of Electric Currents, R. E. B. Crompton, London.
5439. Spindle Mountings, R. N. Cottrill, Bolton-le-Moors.
5440. Self-emptying Centrifugal Machines, E. A. Brydges.—(*O. Anderson and T. Hansen, Copenhagen.*)
5441. Stones for Lithographic Printing, P. Stuart, Edinburgh.
5442. Extracting Salt Crystals from Fluids, J. Maynes, Manchester.
5443. Cigarettes, J. Clarkson, Apperley Bridge.
5444. Web Printing, &c., Machines, T. Sowler and W. Pattison, Manchester.
5445. Ornamental Tiles, &c., J. Wetter.—(*J. B. Boulenger, France.*)
5446. Deodorising, &c., F. J. Austin, Hounslow.
5447. Sliding Gasaliers, G. and E. Atkins, Birmingham.
5448. Anchors, J. H. Kidd, Wrexham.
5449. Rolling Mills, F. Asthower and T. Bicheroux, Annen, Germany.
5450. Filtering, W. P. Thompson.—(*A. H. Horsnell and W. Murphy, Montreal, Canada.*)
5451. Sewing Machines, W. R. Lake.—(*E. A. Wilkinson, New York, U.S.*)
5452. Preventing the Displacement of Keys used in Securing Rails, L. Williams and D. Edwards, Cardiff.

16th November, 1882.

5453. Railways, E. N. Molesworth-Hepworth, Manchester.
5454. Pulverising Sand, &c., J. Nicholas, Illogan.
5455. Valves, J. Wetter.—(*J. J. Godet, Paris.*)
5456. Hammocks, A. Pratt, New York, U.S.
5457. Hydraulic Pressure Valves, H. Berry, Gloucester.
5458. Automatic Door Fastener, T. Scourfield, Bow.
5459. Sounding, &c., Depth of Sea, W. J. Mackenzie, Glasgow.
5460. Chairs, W. Keen, London.
5461. Pencil-cases, W. R. Lake.—(*C. W. Livermore, Providence, U.S.*)
5462. Chucks for Lathes, W. R. Lake.—(*J. A. Wiedersheim, Philadelphia, U.S.*)
5463. Envelopes, E. Edwards. — (*J. Marzari, A. Manucci, and A. D. Noce, Florence.*)
5464. Machines for Spinning, J. B. and T. H. Dewhurst, and R. Cornthwaite, Skipton.
5465. Utilising the Residues from the Refining of Cotton-seed Oil, J. Longmore, Liverpool.
5466. Making Soap, W. P. Thompson.—(*W. West, U.S.*)

17th October, 1882.

5467. Basting Meat, &c., whilst Cooking, J. Reynolds, Worcester.
5468. Wheels of Carriages, &c., W. Fraser, London.
5469. Actions for Pianofortes, W. H. Squire, London.
5470. Metallic Bedsteads, &c., S. B. and S. I. Whitfield, Birmingham.
5471. Bleaching, &c., Cotton, J. C. Mewburn.—(*A. Bozzi, Paris.*)
5472. Surface Coverings, S. Hawksworth, Scarborough.
5473. Self-recording Lever Weighing Machines, T. Williams, jun., London.
5474. Printing Machines, W. W. Taylor, Ripon.
5475. Looms for Weaving, G. R. Snowden and O. Ball, Bradford.
5476. Ships' Hatches, R. T. Pawley, Cardiff.
5477. Motor Engines, C. Cizzio, London.
5478. Mules for Spinning, J. E. Heppenstall, Milnsbridge, near Huddersfield.
5479. Tobacco, J. Howard.—(*E. Howard, Gasport, U.S.*)
5480. Facilitating the Tipping of Railway Trucks, P. G. B. Westmacott, Newcastle-upon-Tyne.
5481. Potash and Soda, A. M. Clark.—(*J. B. M. P. Closson, Paris.*)

18th November, 1882.

5482. Mills for Grinding Grain, R. Young, Glasgow.
5483. Pianofortes, W. Fischer, Leipsic.
5484. Anti-fouling Composition for Ships' Bottoms, J. and T. Kirkaldy, London.
5485. Transit Instruments, J. L. Clark, London.
5486. Rendering Fabrics Water Repellent, &c., C. B. Warner, London.
5487. "Slaying Warps," R. L. Hattersley and W. Greenwood, Keighley.
5488. Administering Injections, T. Dolby, Dulwich.
5489. Screw Bolts and Nuts, T. Hancock, Wolverhampton.
5490. Packing Pipe Joints, G. Wheeler, Newbury.
5491. Boots, J. Wetter.—(*M. Ronckin, Lille, France.*)
5492. Electric Light Switches, C. Maynard, London.
5493. Bulking, &c., Tea, B. Tydeman, Erith.
5494. Recording Amounts of Monies Received, S. H. and J. C. Boswell, Norwich.
5495. Electric Arc Lamps, W. B. F. Elphinstone and Baron Elphinstone, Musselburgh, N.B., and C. W. Vincent and J. Cottrell, London.
5496. Stoves, S. Slater, Oldham.
5497. Saggers, J. Johnson.—(*J. Bapterosses, France.*)
5498. Treatment of Duff Coal, &c., J. Jameson, Newcastle-upon-Tyne.
5499. Railway Sleepers, W. E. Pedley, London.
5500. Ladies' Dress Bodice Forms, S. Stott.—(*C. I. Haley, New York, U.S.*)
5501. Self-acting Buckets, G. M. Key and J. Lowrie, London.

20th November, 1882.

5502. Proportional Reducing Valves, A. W. Quinlan, Glasgow.
5503. Obtaining Motive Power, L. L. Hollier and G. Asher, Birmingham.
5504. Incandescent Electric Lamps, A. Swan, Gateshead.
5505. Cocoa and Chocolate, S. P. Wilding.—(*G. Stollwerck, Cologne.*)
5506. Rotary Gas Engine, J. C. Mewburn.—(*C. D. Goubet, Paris.*)
5507. Preparing Asbestos for Spinning, J. C. Mewburn. (*E. Deffrennes-Bettremieux, France.*)
5508. Producing Architectural Ornaments, L. A. Groth.—(*C. G. Mineur, Stockholm.*)
5509. Production of Magnesium, &c., L. A. Groth.—(*R. Gratzer, Hanover.*)
5510. Motor Engines, J. Maynes, Manchester.
5511. Appliances for Saving Life at Sea, F. Wolff.—(*S. A. L. Kluxbüll, Copenhagen.*)
5512. Barbed Wire, O. W. Malet.—(*F. B. Malet, Christchurch, New Zealand.*)
5513. Dyeing Cotton Wool, W. E. Gedge.—(*P. T. Richard, Paris.*)
5514. Cast Tubes of Gold, &c., T. Morgan.—(*E. I. Levavasseur, Paris.*)
5515. Erasing Pencil Marks, L. Wolff, London.
5516. Handles for Use in Carving Meat, H. H. Lake.—(*P. J. Carmien, Issy, near Paris.*)
5517. Ornamental Nails, &c., A. J. Boult.—(*C. E. Bailey and W. R. Talbot, Providence, U.S.*)
5518. Distribution of Electricity, C. D. Abel.—(*L. A. Brasseur, Brussels.*)
5519. Integrating Apparatus, J. Imray.—(*B. Abdank-Abakanowicz and C. Roosevelt, Paris.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

5407. Filters, J. Wetter, New Wandsworth.—A communication from J. Grant, Boston, U.S. — *13th November*, 1882.
5428. Steam Packing, H. W. Johns, New York, U.S. —*14th November*, 1882.
5467. Basting Meat, &c., whilst Cooking, J. Reynolds, Henwick Lodge, near Worcester.—*17th November*, 1882.

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

4632. Dyeing Cotton Fabrics, J. Clare, Greenfield.—*13th November*, 1879.
4634. Preserving Meat, &c., A. M. Clark, London.—*13th November*, 1879.
4711. Cutting Barbs on Fence Wire, A. M. Clark, London.—*19th November*, 1879.
4644. Water Gauge Valves, F. H. F. Engel, Hamburg.—*14th November*, 1879.
4842. Tricycles, &c., T. Bayliss, J. Thomas, and J. Slaughter, Coventry.—*26th November*, 1879.
4856. Type Composing, &c., Machinery, R. Winder, Bolton.—*27th November*, 1879.
4974. Feeding Bottles, J. Thompson, London.—*4th December*, 1879.
4677. Making Eyeletted Luggage Labels, C. Keith, Inverness.—*17th November*, 1879.
4681. Steam Engines, W. Whittle, Smethwick.—*18th November*, 1879.
4747. Crushing, &c., Substances, J. Imray, London. —*21st November*, 1879.
4763. Moulding Glass Articles, C. W. Siemens, London.—*22nd November*, 1879.
4796. Electric Lighting Apparatus, T. E. Gatehouse, London.—*25th November*, 1879.
4674. Steam Boilers, W. F. Goodwin, Stelton, U.S.—*17th November*, 1879.
4822. Pulleys or Drums, T. James and J. Jackson, Reading.—*25th November*, 1879.
4829. Pistons and Pump Buckets, A. Oldham, Dukinfield.—*26th November*, 1879.
4732. Rope, &c., Making Machinery, G. F. James, Salford.—*20th November*, 1879.
4736. Close or Open Fabrics, W. Campion, sen., Nottingham.—*21st November*, 1879.

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

4260. Knitting Machinery, S. Lowe and J. W. Lamb, Nottingham.—*8th December*, 1875.
4026. Making Plumbers' Traps, W. R. Lake, London. —*19th November*, 1875.
3091. Instrument for Directly Verifying Compass Indications, D. McGregor, Glasgow.—*17th November*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 8th December, 1882.

3290. Cleaning, &c., the Stems and Leaves of Fibrous Plants, J. G. Jebb, London.—A communication from D. Burr.—*11th July*, 1882.
3300. Hoist, Lift, &c., B. Williams, Cardiff.—*12th July*, 1882.
3302. Roller Mills, T. Bouwens and T. Voss, London. —*12th July*, 1882.
3308. Dyeing Cotton in the Loose State, G. W. von Nawrocki, Berlin. — A communication from G. Jagerburg.—*12th July*, 1882.
3314. Table or Stand for Invalids, T. Hansell, St. Albans.—*12th July*, 1882.
3325. Folding Bedsteads and Flexible Sacking, A. C. Henderson, London.—A communication from E. F. Boyer.—*13th July*, 1882.
3326. Tricycles, &c., F. Beauchamp, Edmonton.—*13th July*, 1882.
3335. Telephones, S. Yeates, Dublin.—*14th July*, 1882.
3337. Temples for Weaving, J. Holding, Manchester. —*14th July*, 1882.
3341. Tenon-cutting Machinery, J. G. Hirst, Leeds. —*14th July*, 1882.
3352. Iron and Steel, J. M. Bennett, Glasgow.—*14th July*, 1882.
3354. Crude or Pig Iron, J. M. Bennett, Glasgow.—*14th July*, 1882.
3356. Varnishing Sheets of Paper, &c., W. R. Comings, London.—*14th July*, 1882.
3361. Metallic Glazing Bar, &c., T. Hughes, Market Drayton.—*15th July*, 1882.
3374. Wire Netting, D. Peres, London.—A communication from F. Hentze.—*15th July*, 1882.
3382. Electric Light Appliances, H. J. Haddan, London.—Com. from H. Seymour.—*17th July*, 1882.
3387. Filing Saw Blades, L. A. Groth, London.—A communication from J. P. Hansen.—*17th July*, 1882.
3390. Candle Holders, C. Keibel, Folsong, Germany. —*17th July*, 1882.
3404. Holding and Grinding Tools for Cutting Metal, R. Rawlinson, Salford.—*18th July*, 1882.
3430. Application of Telephones or Microphones to Pipes or Vessels Containing Liquids, &c., for Detecting Leakage Therefrom, A. Ross, London. —A communication from T. Bell.—*19th July*, 1882.
3505. Centrifugal Machines for Manufacturing Sugar, J. H. Johnson, London.—A communication from M. Weinrich.—*24th July*, 1882.
3517. Burglar-proof Safes, &c., W. Corliss, Providence, U.S.—*25th July*, 1882.
3544. Electric Regulator and Meter, W. Laing, London.—*26th July*, 1882.
3574. Engine Governors, W. R. Lake, London.—A communication from J. Judson.—*27th July*, 1882.
3673. Manufacture of Wrought Iron and Steel Rods, E. Deeley, Walsall.—*2nd August*, 1882.
3708. Removing Particles of Straw, &c., from Wool, H. J. Haddan, London.—A communication from G. Fernau and Co.—*4th August*, 1882.
3713. Electric Arc Lamps, E. G. Brewer, London.—A communication from the Société Anonyme des Ateliers de Construction Mécanique et d'Appareils Electriques.—*4th August*, 1882.

3823. Endless Band Knives, T. Clark, London.—A communication from J. A. Kay and D. Beath.—10th August, 1882.
3826. Knitting Machines, A. M. Clark, London.—A com. from I. W. Lamb.—10th August, 1882.
3836. Cutting Cloth, Leather, &c., E. Dredge, London.—11th August, 1882.
3954. Treating Peaty Turf, &c., P. J. Friedrichs, London.—A communication from G. W. Stuvinga. —18th August, 1882.
3986. Connecting or Disconnecting Rail or Tramway Rolling Stock, F. Barnes, Reading.—19th August, 1882.
3993. Door-mat, Boot, and Shoe Cleaner, J. Hopewell, Salford.—19th August, 1882.
4089. Hammerless, &c., Guns and Rifles, W. Anson, Aston.—26th August, 1882.
4619. Stays or Corsets, R. A. Young and R. Neilson, Bristol.—28th September, 1882.
4667. Locks for Portmanteaus, &c., J. Jackson, jun., and C. Sheekey, London.—30th September, 1882.
4679. Hack Caps for Protecting Bricks from Rain, J. D. Lampard and F. Coppen, London.—2nd October, 1882.
4771. Producing Electric Light, O. G. Pritchard, Penge.—7th October, 1882.
4793. Manufacture of Envelopes, &c., E. Sturge, London.—9th October, 1882.
4872. Bridles for Horses, &c., J. G. Heinisch, Belgard, Germany.—13th October, 1882.
4879. Pigment, J. B. Freeman, Tottenham.—13th October, 1882.
4897. Charging Cartridges, W. Smethurst, Brynn, and J. Collins, Bolton.—14th October, 1882.
4907. Hosiery Stitching Machines, H. Clarke, Leicester.—16th October, 1882.
4986. Manufacture of Iron in Blast Furnaces, C. Cochrane, Stourbridge.—19th October, 1882.
5008. Filters, F. G. Lynde, Melton Mowbray.—21st October, 1882.
5015. Electro-magnetic and Magneto-electric Engines, C. F. Varley, Bexley Heath.—21st October, 1882.
5016. Electro-magnetic and Magneto-electric Engines, C. F. Varley, Bexley Heath.—21st October, 1882.
5017. Electro-magnetic and Magneto-electric Engines, C. F. Varley, Bexley Heath.—21st October, 1882.
5047. Locomotive and Portable Engines, W. P. W. Boulton, Tew Park, Oxford, and E. Perrett, London.—23rd October, 1882.
5060. Producing, &c., Electric and Magnetic Currents or Forces, J. S. Fairfax, London.—24th October, 1882.
5107. Indicating Excessive Variations of Temperature, W. T. Goolden and C. F. Casella, London.—27th October, 1882.
5111. Timepieces, C. D. Abel, London.—A communication from F. Reuleau.—27th October, 1882.
5122. Electric Current Generators and Motors, S. P. Thompson, Bristol.—27th October, 1882.
5126. Telephonic Apparatus and Electric Call Bells, H. G. Ellery and J. T. Gent, Leicester.—27th October, 1882.
5145. Straightening Rails, L. Richards, Dowlais.—30th October, 1882.
5153. Antiseptic, &c., C. M. Pielsticker, London.—30th October, 1882.
5167. Telephonic Receivers, H. Alabaster, South Croydon, and T. E. Gatehouse, London. — 30th October, 1882.
5169. Decorating Dry and Unglazed Earthenware, &c., C. Barlow, Hanley.—30th October, 1882.
5171. Conveying Merchandise, &c., Sir H. Bessemer, London.—30th October, 1882.
5173. Fasteners for Wearing Apparel, &c., J. N. Aronson, London.—31st October, 1882.

(*Last day for filing opposition*, 12th *December*, 1882.)

3359. Artificial Cream, J. V. den Bergh, London.—15th July, 1882.
3364. Artificial Bodies for Exhibiting Dresses, &c., A. Child and E. G. Childs, London.—15th July, 1882.
3370. Automatically Indicating Fire, &c., E. Edwards, London. — A communication from B. Carré.—15th July, 1882.
3375. Obtaining Motive Power, H. Robinson, Manchester.—15th July, 1882.
3380. Electrical Haulage, W. E. Ayrton and J. Perry, London.—17th July, 1882.
3385. Electric Arc Lamp, L. A. Groth, London.—A communication from C. Jürgensen.—17th July, 1882.
3388. Attachments for Boots and Shoes, G. Rate and T. Chattaway, Leicester.—17th July, 1882.
3394. Coverings for Boilers, E. K. Leadbetter, Upton. —17th July, 1882.
3405. Manufacturing Eyeleted Healds, W. R. Harris and J. G. Cooper, Manchester.—18th July, 1882.
3408. Looms for Weaving, R. L. Hattersley and J. Hill, Keighley.—18th July, 1882.
3417. Mineral Water Bottles and Stoppers, J. C. Cook, London.—18th July, 1882.
3420. Dynamo-electric Machines, W. P. Thompson, London.—A communication from P. Payen and A. Sandron.—18th July, 1882.
3433. Operating Microphones, P. Justice, London.—A com. from F. V. Rysselberghe.—19th July, 1882.
3440. Drying Coffee, F. H. F. Engel, Hamburg.—A communication from F. Klée.—19th July, 1882.
3456. Closing the Mouths of Bottles, &c., C. E. H. Cheswright, London.—20th July, 1882.
3465. Accumulating and Distributing Electricity, L. M. H. Somzée, Brussels.—21st July, 1882.
3466. Generating Electric Currents, &c., C. A. Carus-Wilson, London.—21st July, 1882.
3520. Arc Electric Lamps, A. L. Lineff. London.—25th July, 1882.
3534. Dynamo-electric Machines, &c., O. W. F. Hill, Gunnersbury.—25th July, 1882.
3539. Producing Fabrics for Protective Purposes, &c., J. Jowitt & G. Page, London.—25th July, 1882.
3551. Pumps, W. R. Lake, London.—A communication from A. Burckhardt and F. Weiss.—26th July, 1882.
3553. Constructing Lubricating Bosses, &c., W. R. Lake, London.—A communication from P. Decauville.—26th July, 1882.
3590. Roller Mills, A. W. L. Reddie, London.—A com. from H. F. St. Requier.—28th July, 1882.
3593. Treating Grain and Flour, A. W. L. Reddie, London.—A communication from H. F. St. Requier. —28th July, 1882.
3599. Sewing Machine Needles, &c., J. Darling, Glasgow.—29th July, 1882.
3689. Regulating the Transmission of Electrical Energy, &c., W. R. Lake, London.—A communication from M. Levy.—2nd August, 1882.
3715. Dressing Waste Silk, S. C. Lister, Manningham.—4th August, 1882.
3726. Producing Fac-simile Copies, T. H. Taylor, Manchester.—4th August, 1882.
3734. Conveying Grain, &c., L. E. Mansfield, Paris. —5th August, 1882.
3735. Pulverising Minerals, &c., R. J. Cunnack, Helston.—5th August, 1882.
3760. Turbines, J. McConnell, Ballymena. — 7th August, 1882.
3796. Fixing Swing Looking-glasses, &c., W. J. Hinde, London.—9th August, 1882.
3862. Valves for Steam, &c., D. Hancock, London.—12th August, 1882.
3972. Utilising Heat in Slag, &c., G. H. Blenkinsop, Swansea.—19th August, 1882.
4057. Ammonia and Bone-black, E. P. Alexander, London.—A communication from H. Y. and E. B. Castner.—24th August, 1882.
4063. Retaining Heat, &c., J. Cavargna, Manchester. —24th August, 1882.
4139. Pressing Woollen, &c., Fabrics, J. Burras and W. Renton, Leeds.—30th August, 1882.
4436. Base Material for Paint, G. E. Church, Providence, U.S. — A communication from A. E. Brockett.—18th September, 1882.
4598. Utilising Heat, &c., H. Gruson and R. Handrick, Buckau, Prussia.—27th September, 1882.
4836. Walls of Cupola Furnaces, &c., J. Toussaint, Upper Saltley.—11th October, 1882.
4922. Setting, &c., the Spokes of Wheels, R. Adams, London.—16th October, 1882.
4951. Automatic Registering Apparatus, J. M. Hart, London.—18th October, 1882.
4982. Gas-heated Furnaces, C. Madge, Swansea.—19th October, 1882.
4990. Moulds for Casting Hollow-ware, J. V. Hope, Wednesbury.—19th October, 1882.
5102. Studded Chains, T. H. Ward, Tipton.—26th October, 1882.
5127. Bottle Envelopes, A. W. Abrahams, London. —27th October, 1882.
5144. Cocks or Valves, W. H. Moseley, Derby.—30th October, 1882.
5193. Composition for Preventing the Passage of Heat, &c., W. T. Whiteman, London.—A communication from R. Ebert and J. Lee.—31st October, 1882.
5195. Automatic Weighing and Package Filling Apparatus, W. T. Whiteman, London.—A communication from C. C. Clawson.—31st October, 1882.
5235. Increasing the Draught in Chimneys, P. A. Bayle, Paris.—2nd November, 1882.
5241. Electric Time-ball Apparatus, W. R. Lake, London.—A communication from the Standard Time Company.—2nd November, 1882.
5273. Breech-loading Small-arms, A. Henry, Edinburgh.—4th November, 1882.
5320. Reeling Silk, &c., W. R. Lake, London.—A com. from J. M. Grant.—7th November, 1882.
5335. Tool-holders, J. F. Allen, Brooklyn, U.S.—8th November, 1882.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 17*th November*, 1882.)

2345. Gas Motor Engines, S. and H. N. Bickerton, Ashton-under-Lyne.—18th May, 1882.
2346. Overmantels of Chimney-pieces, G. H. Haywood, London.—18th May, 1882.
2358. Strap or Belt Fasteners, B. Marsden, Manchester.—19th May, 1882.
2361. Velocipedes, G. D. Macdougald, Dundee.—19th May, 1882.
2367. Filtering Air and Collecting Dust, &c., J. S. Brandstaetter, Liverpool.—19th May, 1882.
2370. Electric Arc Lamps, J. Brockie, London.—19th May, 1882.
2372. Manufacturing Syrup from Date Fruit, T. Webb, London.—19th May, 1882.
2382. Axles, J. Gordon, jun., Dundee.—20th May, 1882.
2384. Signalling Apparatus, W. E. Langdon, Derby. —20th May, 1882.
2397. Detecting the Safe Closing of Windows, &c., by Electricity, B. Coyle, Dublin.—22nd May, 1882.
2402. Tubes, B. Rhodes, London.—22nd May, 1882.
2405. Knocking Up Sheets of Paper, T. H. Hewson, London.—22nd May, 1882.
2431. Producing Motive-power, W. Muir, New Cross. —23rd May, 1882.
2453. Hubs for Vehicle Wheels, H. A. Bonneville, London.—24th May, 1882.
2454. Rotary Cutters, H. A. Bonneville, London.—24th May, 1882.
2475. Reaping Machines, T. Culpin, London.—24th May, 1882.
2477. Domestic Fireplaces, J. Smith, Liverpool.—25th May, 1882.
2524. Central Buffer and Coupling Gear, W. R. S. Jones, Putney.—27th May, 1882.
2529. Digging or Cultivating Machines, W. Doubleday, Chelmsford.—27th May, 1882.
2569. Electric Lamps, T. E. Gatehouse, London, and H. R. Kempe, Barnet.—31st May, 1882.
2607. Floorings for Bridges, W. H. Lindsay, London. —2nd June, 1882.
2624. Water Gauges, &c., H. Slater, Derby.—5th June, 1882.
2634. Pleating Machines, C. G. Hill, Nottingham.—5th June, 1882.
2712. Electric Lamps, W. R. Lake, London.—9th June, 1882.
2747. Rigging of Sailing Vessels, W. H. Hall, Kew. —10th June, 1882.
2765. Printing Machines, &c., J. H. Johnson, London.—13th June, 1882.
2879. Printing Machines, J. H. Johnson, London.—19th June, 1882.
3021. Detaching Hooks, J. King, Pinxton.—27th June, 1882.
3342. Producing Alkali Salts from Sulpho Acids, F. Wirth, London.—14th July, 1882.
3347. Making, &c., Fire-clay or Stoneware Sanitary Socketted Pipes, P. Noel, Cardiff.—14th July, 1882.
3791. Extinguishing Fire, P. M. Justice, London.—9th August, 1882.
4025. Working Gear, &c., K. W. Hedges, London.—22nd August, 1882.
4036. Winding Coils of Wire upon the Armatures of Dynamo-electrical Machines, W. B. Espeut, London.—23rd August, 1882.
4084. Arc Electric Lamps, P. R. Allen, London.—26th August, 1882.
4088. Regulating, &c., the Flow of Fluids, J. C. Stevenson, Liverpool.—26th August, 1882.
4093. Harvesting Machines, J. Howard and E. T. Bousfield, Bedford.—26th August, 1882.
4109. Gas Lamps, F. H. Wenham, London.—28th August, 1882.
4351. Utilising Steam and Heated Air as Motive Powers, J. M. X. Terlinden, Brussels.—12th September, 1882.
4501. Embroidering Machines, A. M. Clark, London. —21st September, 1882.

(*List of Letters Patent which passed the Great Seal on the* 21*st November*, 1882.)

2277. Producing Pictures on Glass, &c., H. J. Haddan, London.—15th May, 1882.
2400. Preserving Sauces, C. Bourdon, Paris.—22nd May, 1882.
2406. Tricycle, H. Hazard, London.—22nd May, 1882.
2408. Coiling Wire, H. H. Lake, London.—22nd May, 1882.
2438. Cases for Millstones, E. Edwards, London.—23rd May, 1882.
2439. Pasting together Shoe Uppers, A. J. Boult, London.—23rd May, 1882.
2441. Compressing Fodder, &c., J. Wetter, New Wandsworth.—23rd May, 1882.
2446. Stems for Lucifers, &c., F.-H. V. Byrt, London. —24th May, 1882.
2461. Manufacturing Flour, W. R. Lake, London.—24th May, 1882.
2463. Raising, &c., Fabrics, T. Stead, Leeds.—24th May, 1882.
2468. Bell Alarms, W. P. Thompson, London.—24th May, 1882.
2480. Electrical Insulating Compound, F. Field, Beckenham.—25th May, 1882.
2481. Looms for Weaving, W. Thompson, Blackburn. —25th May, 1882.
2515. Hay-making Machines, S. H. Dening, Chard.—26th May, 1882.
2517. Treating Fousel Oil, J. K. Field, London.—26th May, 1882.
2521. Hydraulic Lifts, J. M. Day, W. R. Green, and H. C. Walker, London.—27th May, 1882.
2525. Manufacturing Felt Hats, &c., J. C. Bramall, Woodley, W. G. Bywater, and J. Teale, Holbeck.—27th May, 1882.
2530. Domestic Fireplaces, H. Ransford, Brighton. —27th May, 1882.
2537. Presses for Compressing Gunpowder, W. R. Lake, London.—27th May, 1882.
2541. Architectural Work, P. Ross, Harrow.—30th May, 1882.
2548. Furnaces of Steam Boilers, J. A. MacLellan, Glasgow.—30th May, 1882.
2552. Steering Quadrants or Tillers, J. Cook, jun., Washington, and W. Prosser, Newcastle-upon-Tyne. —30th May, 1882.
2564. Barges, &c., E. Moxon, Tunbridge Wells.—31st May, 1882.
2587. Catches for Ratchet Wheels, J. F. Davies, Blackburn.—1st June, 1882.
2589. Screw Buttons, F. Wirth, Frankfort-on-the-Main.—1st June, 1882.
2709. Treating Gases Containing Ammonia, F. J. Bolton and J. A. Wanklyn, London.—9th June, 1882.
2711. Rolls for Rolling Mills, J. Tinn, Bristol.—9th June, 1882.
2781. Electric Lighting Apparatus, W. R. Lake, London.—13th June, 1882.
2836. Nitric or Nitro Compounds, W. R. Lake, London.—15th June, 1882.
2837. Water Taps or Valves, G. and G. C. Chisholm, Stirling.—16th June, 1882.
2989. Composite Cartridge Cases, G. Kynoch, Witton.—23rd June, 1882.
3049. Artificial Stone, R. Searle, London.—28th June, 1882.
3063. Refining Saccharine, &c., D. MacEachran, Greenock.—29th June, 1882.
3151. Sewing Machines, F. Wirth, London.—4th July, 1882.
3177. Horseshoes, W. Lake, London.—5th July, 1882.
3527. Coupling Clutches, E. J. Sterling, Brooklyn, U.S.—25th July, 1882.
3623. Lamp Burners, H. W. Hayden, Waterbury, U.S. —31st July, 1882.
3810. Looms and Dobbies, J. and J. H. Shorrock, Darwen.—10th August, 1882.
3969. Glazing or Fixing Sheets of Glass, J. Chaffin, Bath.—19th August, 1882.
4247. Utilising Pneumatic Pressure as Motive Power, W. R. Lake, London.—6th September, 1882.
4295. Iron and Steel, W. W. Chipman, London.—9th September, 1882.
4569. Furnace Linings, Firebrick, and Illuminating Gases, S. Pitt, Sutton.—26th September, 1882.

List of Specifications published during the week ending November 18th, 1882.

1346*, 4d.; 2038*, 4d.; 1282, 6d.; 1432, 6d.; 1619, 6d.; 1650, 2d.; 1653, 4d.; 1685, 6d.; 1699, 6d.; 1707, 4d.; 1712, 4d.; 1713, 6d.; 1722, 2d.; 1729, 2d.; 1733, 2d.; 1734, 8d.; 1727, 2d.; 1741, 6d.; 1476, 6d.; 1747, 6d.; 1748, 1s. 2d.; 1749, 6d.; 1750, 2d.; 1752, 4d.; 1753, 4d.; 1756, 2d.; 1757, 6d.; 1759, 4d.; 1760, 6d.; 1761, 2d.; 1762, 6d.; 1763, 1s.; 1764, 2d.; 1765, 2d.; 1767, 6d.; 1777, 8d.; 1778, 6d.; 1780, 2d.; 1783, 2d.; 1784, 10d.; 1785, 6d.; 1788, 6d.; 1789, 6d.; 1792, 8d.; 1793, 1s.; 1795, 6d.; 1796, 2d.; 1797, 2d.; 1890, 6d.; 1802, 2d.; 1803, 6d.; 1804, 6d.; 1805, 6d.; 1808, 6d.; 1810, 2d.; 1811, 2d.; 1812, 6d.; 1814, 2d.; 1815, 6d.; 1816, 4d.; 1819, 6d.; 1820, 6d.; 1821, 4d.; 1824, 6d.; 1825, 6d.; 1826, 4d.; 1828, 2d.; 1829, 2d.; 1830, 6d.; 1831, 6d.; 1833, 6d.; 1834, 4d.; 1835, 2d.; 1836, 6d.; 1839, 2d.; 1842, 6d.; 1843, 2d.; 1840, 4d.; 1857, 4d.; 1858, 4d.; 1862, 8d.; 1881, 10d.; 1885, 2d.; 1887, 2d.; 1897, 6d.; 1931, 6d.; 2047, 6d.; 2214, 6d.; 2255, 6d.; 2936, 6d.; 3100, 6d.; 3330, 10d.; 3348, 6d.; 3446, 6d.; 3644, 6d.; 3676, 4d.

*** 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.*

1282. Breech-loading Fire-arms, *L. Gye, London.—16th March*, 1882. 6*d*.

This consists, First, in the construction of the locking of fire-arms with the hammers working horizontally in place of vertically; Secondly, the combination of two hammers working horizontally at different levels, each acting upon a firing pin inclined either upwards or downwards, to bring its forward end in a line with the centre of the barrels of a double-barrelled fire-arm.

1432. Flushing Tanks, *W. Bartholomew, Lambeth.—24th March*, 1882. 6*d*.

This relates to a means for automatically discharging the contents of the tank when full.

1516. An Improved Manufacture of Material for Electrical Insulations, *J. Imray, Chancery-lane.—29th March*, 1882.—(*A communication from La Société Anonyme des Cables Electriques, Systeme Berthoud Bovel et Cie., Paris.*) 4*d*.

The invention relates to an insulating material composed as follows:—A quantity of siccative linseed oil is heated to boiling point in a metal vessel; the oil is constantly stirred, and gradually becomes transformed into a solid elastic mass similar to caoutchouc. Colophonium is mixed with the oil just when it is being transformed into a solid state.

1526. An Improved Method of and Apparatus for Transmitting and Printing Telegraphic Messages, *W. R. Lake, London.—29th March*, 1882.—(*A communication from A. F. Johnson and F. B. Johnson, Brooklyn, New York.*) 10*d*.

According to this invention each letter or character has its corresponding magnet or the receiving instrument, which is brought into circuit by the passage through the transmitting instrument of the perforations on the prepared message that represents that letter, and the said magnet has connected with its armature a lever carrying a type of the said letter, and is operated by each pulsation of the magnet to print the said letter on a message strip which is passed through the said receiving instrument. A separate line wire is therefore provided between each station for each letter or character used. Other improvements are also described and claimed.

1556. Improvements in and Relating to the Generation, Storage, &c., of Electricity, *J. S. Williams, London.—30th March*, 1882. 1*s*. 4*d*.

This relates to the combination with an electric generator of a reservoir designed to store electricity, and provided with discharging terminals, so that the said electricity can be used as and when required. Also to methods of and conductors for distributing the current. There are forty claims.

1527. Improvements in and connected with Railway Signalling, *H. Morris, Manchester.—29th March*, 1882. 6*d*.

This relates to improvements on the inventor's patent No. 1796, 26th April, 1881, and consists in the application of a tilting rail to be used in combination with the swinging arm of the signal, together with the application of electricity to sound a bell on the engine tender when the signal is at block. The tilting rail is fixed to a sleeper, and so arranged that it falls below the rail level when the signal is "all clear." If otherwise it rises at one end and makes contact with an antifriction roller on the tappet under the tender, thereby operating the bell.

1611. Improvements in Electro-magnetic and Regulating Apparatus for Use in Electric Lamps, *W. R. Lake, London.—3rd April*, 1882.—(*A communication from E. Weston, Newark, New Jersey, U.S.*)—(*Not proceeded with.*) 2*d*.

The inventor employs a hollow spool of metal between the flanges of which a number of convolutions of coarse copper wire are wound. Suspended in the spool is an iron core attracted to an iron shell, which encloses the top and side of the spool. This in connection with a train of wheels, a rack bar, and fan wheel, regulates the carbons.

1614. Improvements in Magneto or Dynamo-electric Machines, *W. R. Lake, London.—3rd April*, 1882.—(*A communication from G. Weston, Newark, New Jersey, U.S.*) 6*d*.

This invention relates to that class of electric generators which have an armature wound with a number of coils, the ends of which are united to form an endless wire, and from which loops are taken off at the junctions of the originally separate sections of wire on the armature, and are united to separate segments of the commutator. The object is to avoid short circuiting of any coils between any two adjacent segments. The invention is carried out by winding the armature with two or more independent endless wires, which are so connected by loops to the commutator segments as to avoid having any two adjacent strips of the commutator connected to loops from adjacent coils of the same wire on the armature.

1616. Improvements in the Machinery for the Production of Electric Currents, *W. B. Brain, Cinderford, Gloucestershire.—3rd April*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to dispense with commutators. The inventor winds wire round the induction core, the wire remaining stationary and the core revolving inside. The field magnets may be similar to Siemens', Edison's, or Gramme's.

1619. Improvements in the Manufacture of Carbon Conductors for Electric Lamps, &c., *W. R. Lake, London.—3rd April*, 1882.—(*A communication from H. S. Maxim, Brooklyn, New York.*) 6*d*.

This relates to apparatus for making carbon filaments from plastic materials. It consists of an hydraulic or steam press cylinder with pistons. Below this is another cylinder like a pipe press, into which a plunger attached to the piston passes. A pipe leading into this cylinder conducts the plastic material into it. At the bottom is a nozzle fitted with a die. The pressure of the cylinder forces the plastic material out through the nozzle in a thread-like form, the size and shape of which can be varied at will. In this way a continuous length of filament can be turned out.

1626. Improvements in Electric Light and Power Apparatus, *J. Munro, West Croydon.—4th April*, 1882. 8*d*.

This relates to improvements in apparatus for generating or producing electric light and power, and for distributing the same. The inventor claims amongst other things, First, a generator for feeding storage batteries, so constructed that the inductor revolves while the induced coils are stationary; Secondly, a rotary distributor for dealing out currents intermittently to a series of lines with secondary batteries to reunite the currents; Thirdly, a method of charging secondary batteries by the currents in lightning rods, in the ground, and in thermo piles actuated by solar or other heat. There are twenty claims in all.

1647. Improvements in the Manufacture of Incandescent Electric Lamps, *St. G. Lane Fox, Westminster.—5th April*, 1882. 6*d*.

This relates to the construction of the ends of the carbon filaments and a method of thickening them, so as to reduce their resistance and prevent breaking of the platinum or other conductors. The present is an improvement on patents Nos. 3494, August 28th, 1880, and 225, 18th January, 1881, and consists in causing carbon to be deposited on the end of the filament by forming an arc between the connections of the filament with the platinum wire and a pencil of carbon immersed in a medium of coal-gas.

1650. Marine Steam Engines, &c., *J. Penn, Greenwich.—5th April*, 1882.—(*Void.*) 2*d*.

The objects of the invention are improvements relating to marine steam engines, and to means of and apparatus for purifying the water drawn from the condensers before it is returned to the boilers.

1653. Travelling Bags, Trunks, &c., *T. A. Mitchell, Chislehurst.—5th April*, 1882. 4*d*.

This consists in constructing the bags, &c., with a lining or protective layer of thin sheet steel.

1685. Apparatus for Filtering or Purifying Air Escaping from Millstones, &c., *E. Fiechter, Liverpool.—6th April*, 1882.—(*A communication from G. Baier, Ulm, Wurtemberg.*) 6*d*.

This consists essentially, First, in a double cylindrical or preferably slightly inverted conical-shaped filter caused to be violently shaken at intervals when the air is not passing; Secondly, in apparatus for intermittently shaking same.

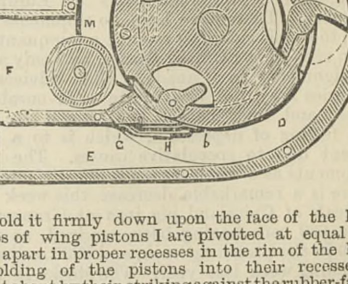
1699. Apparatus for Producing Motive Power, *A. Wilson, Handsworth.—8th April*, 1882. 6*d*.

This consists essentially in causing heat generated in the working cylinder of gas engines by explosion or combustion, and not converted into power by expansion of gases in such cylinder, to be recovered and utilised in producing combustible gas for subsequent use in the said cylinder.

1701. Rotary Motors, *W. J. Gurd, Sarnia, Canada.—8th April*, 1882. 6*d*.

In the drawing D is the annular water way formed between the face of the hub and the inner face of the case. It begins at the induction opening E, and leads around the hub into the eduction opening F. G is an abutment dividing the annular water way between the induction and eduction openings. H is a spring plate secured to the face of the abutment, and with its free end pressing upon the leather flap B, so

1701



as to hold it firmly down upon the face of the hub. A series of wing pistons I are pivotted at equal distances apart in proper recesses in the rim of the hub. The folding of the pistons into their recesses is brought about by their striking against the rubber-faced wheel M, which is journalled across the eduction opening F, just in advance of the abutment.

1707. Apparatus for Drying Organic Substances, &c., *B. H. Remmers, J. Williamson, and W. Fairweather, Glasgow.—11th April*, 1882.—(*Not proceeded with.*) 4*d*.

The apparatus comprises a series of endless carrying webs or bands fitted over each other within a drying house or chamber, and mounted either on chains or wire ropes at each side passing over driving wheels, or carried direct by driving and supporting rollers.

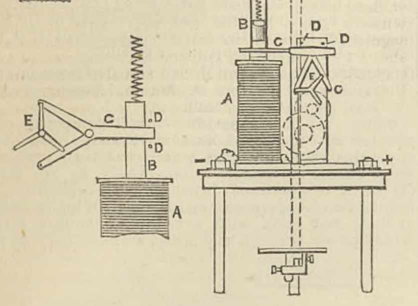
1712. Lamp Burners, *W. Lighbody and T. Rowatt, Edinburgh.—11th April*, 1882. 4*d*.

This consists, First, as applied to double wick burners with inner and outer domes, in substituting a single slot for the double slots hitherto used in each; Secondly, in arranging a perforated air regulator or rarefier where it surrounds the wick tubes, trianglewise relatively with the latter.

1713. Improvements in Electric Arc Lamps, *J. Brockie, Brixton.—11th April*, 1882. 6*d*.

The inventor does away with the definite connection of the regulating armature with the disengaging brake, and gears it to the latter by simple friction or the friction of magnetism, as in the figures, so that the armature B is free to take up various positions in relation to brake lever C and yet to control it. D D regulate the play of C. Solenoid A is in a shunt across the arc, and when the latter's resistance is

1713



irregular, core B vibrates and works escapement wheel E, which advances one tooth or more, and allows the carbons to approach until the arc regains stability.

1722. Manufacture of Metallic Pens, *W. Morgan-Brown, London.—12th April, 1882.—(A communication from B. Lawrence, New York.—(Not proceeded with.)* 2d.

The object is the production of a double-ended metallic pen with two nibs or points, one at each end, in such a manner that when completed for use it can be broken apart in the middle, and thereby constitute two pens.

1729. Measuring Liquids, *J. Wetter, New Wandsworth.—12th April, 1882.—(A communication from A. Javan.)—(Not proceeded with.)* 2d.

This relates to the employment of a graduated barrel, or a barrel communicating with a graduated tube.

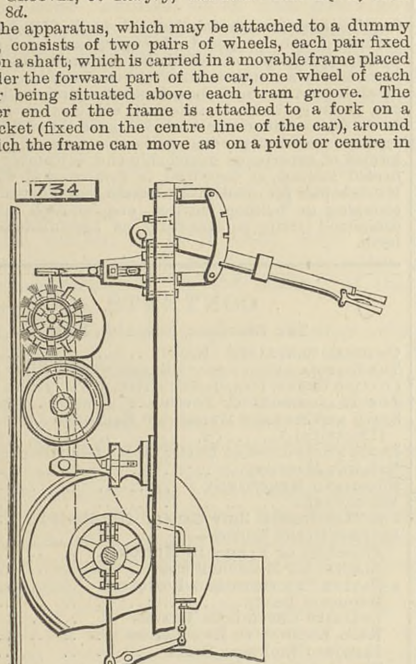
1733. Fountain Pens, *W. R. Lake, London.—12th April, 1882.—(A communication from M. C. Stone, Baltimore, U.S.)—(Not proceeded with.)* 2d.

The main object is to construct a fountain pen which is entirely automatic in its action, the nib being supplied with ink from a reservoir by means of capillary attraction, and in which the nib may be renewed at pleasure.

1734. Cleaning and Clearing Tram Rails and Grooves, *J. Remfry, Calcutta.—12th April, 1882.* 8d.

The apparatus, which may be attached to a dummy car, consists of two pairs of wheels, each pair fixed upon a shaft, which is carried in a movable frame placed under the forward part of the car, one wheel of each pair being situated above each tram groove. The after end of the frame is attached to a fork on a bracket (fixed on the centre line of the car), around which the frame can move as on a pivot or centre in

1734



such a manner that the frame has free motion vertically, so that it can be lifted or let down, and also horizontally to the right or left when the car is going round a curve. The foremost wheel on each side revolves over the groove, slightly above the level of the rail, and has a series of holes round its circumference, into which cast steel cutters are fixed, or the wheel may be made with arms carrying brushes composed preferably of steel wire.

1737. Aerostat, *A. J. Boult, London.—12th April, 1882.—(A communication from J. Jouanique, Marseilles.)—(Not proceeded with.)* 2d.

The object is so to construct an aërostat—that is to say, a vessel for navigating the air—that the same may be caused to ascend and descend without the loss of the gas which imparts buoyancy thereto, the quantity of ballast required being greatly reduced, or the use thereof being altogether dispensed with; the aërostat being provided with a rudder which will allow of its course being changed, and the construction of the whole being such as to protect the operator against the weather.

1741. Filling and Closing Bottles, *J. J. Varley, London.—12th April, 1882.* 6d.

This relates to the method of filling and closing bottles having screw stoppers by the employment of a filling apparatus provided with a key for holding the stopper while the bottle is filled, the said key being adapted so that it can be lowered and turned to screw the stopper into its seat in the mouth of the bottle.

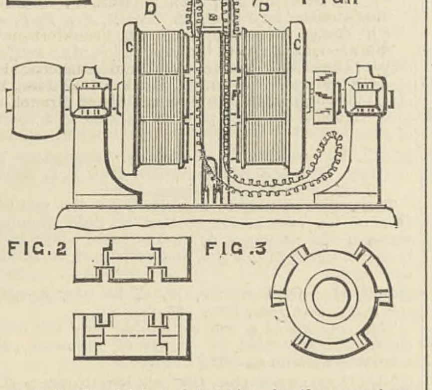
1746. Economisers, or Apparatus for Heating Water, &c., *T. Sykes, Manchester.—12th April, 1882.* 6d.

This relates to the employment of a series of compound pipes or tubes, consisting of two or more pipes or tubes which are formed by casting or otherwise, through the interior of which the water to be heated is caused to circulate.

1747. Improvements in Dynamo-electric Machines, *D. A. Chertemps and L. Danden, Paris.—12th April, 1882.* 6d.

This relates to a self-exciting machine in which the antagonistic effects of contrary currents causing irregularities in the currents produced are destroyed. Hollow electro-magnets D D[1]—Fig. 1—are made fast to rotating discs C C[1]. Between these is situate the stationary armature composed of a block of wood E pierced with holes in which are fitted bobbins F, consisting of a core of iron, and composed of several tubes fitting one within the other, the inner ones being coated with paper before driving them into place. The commutator is constructed so as to receive the alternate currents from the exciting bobbin of the armature, and transmit them as continuous currents to the field magnets. It is composed of two hollow cylinders each with a closed end, their peripheries being so cut away as to permit of their interlocking to their full length. The number of interlocking parts depends on the number of electro-

1747



magnets in the field and bobbins in the armature. Figs. 2 and 3 show the commutator. Fig. 2 is an end view, and 3 a side view, the parts being separated.

1748. Pneumatic Brake Apparatus for Railways, *F. W. Eames, Leeds.—12th April, 1882.* 1s. 2d.

This relates to improvements on patent No. 1058, dated 11th March, 1881, and consists partly in the employment of a tapered plug valve or cock, which is mounted horizontally in a box or case connected with the two systems of brake pipes, and also with the main ejector and with the open air.

1749. Roofing Tiles, *C. Major, Bridgwater.—12th April, 1882.* 6d.

The object is to construct roofing tiles with serrated or steplike bodies to divide the rain-water into streams; also to arrange projecting ribs or fillets on the upper outside edges, and similar ribs or fillets on the under lower edges, so that the bottom of one series overlaps the other in a secure manner.

1750. Manufacture of Sheet Lead, *W. Burr, Long Ditton.—13th April, 1882.—(Not proceeded with.)* 2d.

This consists chiefly in directly casting the sheets of almost the ultimate thickness required, so as to demand but little subsequent lamination or treatment.

1752. Manufacture of Sulphuric Acid, *W. Weldon, Burstow.—13th April, 1882.—(A communication from the Société de la Manufacture de Javel, Paris.)* 4d.

This consists, First, in distributing the nitrous compounds employed in the manufacture of sulphuric acid by introducing only a portion of them into the first of the series of chambers employed, and introducing either another portion or other portions of them in a subsequent chamber, or into one or more subsequent chambers; Secondly, feeding the Gay-Lussac towers employed in the manufacture of sulphuric acid, with sulphuric acid having dissolved in it a slight proportion of nitrous compounds.

1753. Manufacture of Sulphide of Sodium and Sulphide of Potassium, *W. Weldon, Burstow.—13th April, 1882.—(A communication from H. Helbig, Aussig, Germany.)* 4d.

This consists in obtaining sodium sulphide by heating with water under pressure either black-ash alone, or a mixture of black-ash and alkali-waste, or a mixture of black-ash, alkali-waste, and sodium sulphate, and in obtaining potassium sulphide by similarly heating with water under pressure either potash, black-ash alone, or a mixture of potash, black-ash and alkali-waste, or a mixture of potash, black-ash, alkali-waste, and potassium sulphate.

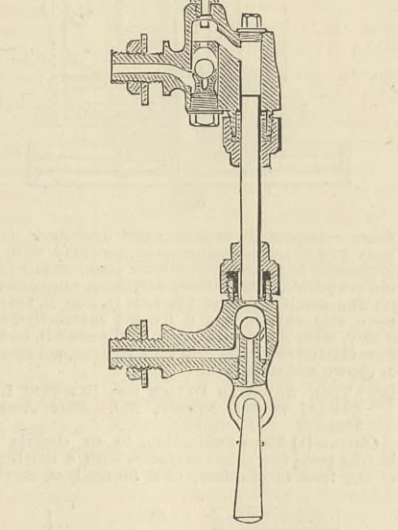
1756. Pneumatic Brakes, *J. Wetter, New Wandsworth.—13th April, 1882.—(A communication from P. B. Michel, Paris.)—(Not proceeded with.)* 2d.

This relates to the construction and arrangement of apparatus to be placed under every vehicle.

1757. Water-gauges, *J. Thurlow and A. Sykes, Wakefield.—13th April, 1882.* 6d.

A suitable valve, such as a ball valve, is employed at the top and bottom of the gauge respectively, and so arranged that on the breakage of the glass tube the valves are automatically forced into seats by the pressure of the steam and water in such a manner that the openings leading to the glass tube are closed,

1757



and the escape of steam and water thereby shut off. On the tube being replaced the upper valve is moved back to its normal position by any suitable means, which will depend upon the form of valve employed, and the equilibrium being thus restored, the gauge will be again put in operation.

1758. Billiard Marking and Checking Apparatus, *P. Mara, Putney, and J. Winson, London.—13th April, 1882.* 4d.

This relates to the construction of an improved billiard marking and checking apparatus, whereby the marking points scored automatically registers or records the number of games played.

1760. Improvements in the Construction and Arrangement of Dynamo Machines, &c., *J. B. Rogers, London.—13th April, 1882.* 6d.

The inventor mounts upon a spindle one or more series of coils, and revolves them as one body on one or both sides of a fixed armature. No brushes are used.

1761. Keys for Locks, *F. Petit, London.—13th April, 1882.—(Not proceeded with.)* 2d.

The lever or lifting part of the key, which acts to raise the tumblers or to throw the bolt, folds down through a slot into the tubular part or barrel of the key, and in order to prevent dirt of any kind getting into the wards or working parts of the key, it is protected by introducing it into a tubular case when out of use.

1762. Manufacture of Wire, *J. Westgarth, Warrington.—13th April, 1882.* 6d.

This relates to the manufacture of a wire of double-headed or rail section, twisted so that such double-heads form a double thread or worm round the web which forms the core of the wire.

1763. Manufacture of Iron and Steel, *H. C. Bull, New York.—13th April, 1882.* 1s.

The invention consists of a direct process for the manufacture of iron and steel from the ore, and to a special arrangement of blast furnace having a novel construction of refractory lining for the crucible, also a special arrangement and construction of heating stoves; to a special arrangement and construction of gas producers, and their accessory parts and connections.

1764. Bicycles, *G. Rixon, Wellingborough.—13th April, 1882.—(Not proceeded with.)* 2d.

This relates to a means of supporting the seat.

1767. Disengaging Ships' Boats when Lowered or Hoisted Out, *the Honourable F. G. Crofton, Kingstown, Ireland.—13th April, 1882.* 6d.

This relates to means for simplifying the operations when the boats are lowered by the ordinary davit arrangements, and also when boats are hoisted out by the derrick or crane gear.

1765. Two-wheeled Vehicles, *W. King, near Leighton Buzzard.—13th April, 1882.—(Not proceeded with.)* 2d.

This relates to the application of brakes.

1777. Increasing or Reducing the Diameters of the Ends of Metallic Tubes, *S. Fox, Leeds.—14th April, 1882.* 8d.

This consists in altering the diameter of the end of a metallic tube whilst hot, by the use in conjunction for holding such tubes of rollers acting upon its ends, such rollers being mounted on a chuck on a lathe headstock or equivalent, and being caused while acting on the tube end to travel relatively to the tube in a path that is resultant of two motions, viz., a circular motion concentric with the tube under treatment, and a motion inclined or perpendicular to the periphery of the said tube.

1778. Apparatus for Burning Coke, *J. Cropper, Brimington.—14th April, 1882.* 6d.

This relates to the construction of an oven with a chamber for heating air.

1780. Shoes for Horses, &c., *J. H. Johnson, London.—14th April, 1882.—(A communication from J. Moore, Paris.)—(Not proceeded with.)* 2d.

This consists essentially in providing the heel part of the shoe with a pad or cushion of india-rubber or other elastic material, for the purpose of deadening the shocks and consequent jarring of the horses' legs produced when travelling upon a hard road.

1783. Percussion Caps, *T. Spencer, Birmingham.—14th April, 1882.—(Partly a communication from O. Adams, New York.)—(Not proceeded with.)* 2d.

This relates to a means of constructing percussion caps whereby they are uninjured by exposure to water or to a damp atmosphere.

1784. Hot Air or Caloric Engines, *M. P. W. Boulton, Tew Park, Oxford.—14th April, 1882.* 10d.

This relates to modifications of patents No. 495, dated 7th February, 1879, and No. 5299, dated 17th December, 1880.

1785. Ventilating Apparatus, *T. Rowan, London.—14th April, 1882.* 6d.

This consists in the use of apparatus for ventilating sewers, drains, water-closets, or the like by the employment of a stove or heating apparatus in communication with the sewer, drain, or water-closet pipe, and with an upshaft or chimney.

1788. Caloric or Hot-air Engines, *M. P. W. Boulton, Tew Park, Oxford, and E. Perrett, Westminster.—14th April, 1882.* 6d.

This relates to the combination of a hot-air or caloric engine with an alternately acting heater.

1789. Treating the Magmas from the Waste Liquors in Wool Washing, *W. H. Beck, London.—14th April, 1882.—(A communication from C. Violette and A. Buigine, Lille, and A. Vinchon, Roubaix.)* 6d.

According to this process the waste liquors resulting from the combings and washings of wools are treated with chloride of calcium, and the magmas obtained by filtration are saponified by lime under a pressure of from six to eight atmospheres.

1792. Ventilators, *A. W. Reddie, London.—14th April, 1882.—(A communication from A. Huber, Cologne.)* 8d.

This consists of a vertical shaft of cylindrical or tapering form, fitted at its upper end with a truncated pyramid having five or more sides and independent upright wind-boards placed at the angles thereof, and being also provided with a shallow pyramidical hollow cover supported on uprights at a suitable distance therefrom.

1793. Velocipedes, *J. White, Coventry.—14th April, 1882.* 1s.

The chief object is to so construct sociable tricycles in which two persons ride abreast of each other that the pedalling may be effected by one or both of the riders without producing a jibbing action.

1795. Machines for Making Nut and Bolt Blanks and Rivets, *A. M. Clark, London.—14th April, 1882.—(A communication from A. Marland and T. Neely, Pittsburgh, U.S.)* 6d.

The machine is composed of a forming die and four principal tool-carrying parts, viz., two crossheads carrying hollow compressing mandrils, through which mandrils the punches are adapted to move; a crosshead carrying the main punch and the transversely moving knife, all of which are preferably operated through connecting-rods, yokes, and levers from suitably constructed and arranged cams upon a single main driving shaft.

1796. Steam Boiler and other Furnaces, *C. R. Wymer, Be vedere.—15th April, 1882.—(Not proceeded with.)* 2d.

This relates to steam boiler and other furnaces constructed with closed ashpits, into which air is blown by steam blast.

1797. Marking Lawn Tennis Courts, *G. J. Piercy, Bournemouth.—15th April, 1882.—(Not proceeded with.)* 2d.

This relates to the employment of strips of metal which are coloured.

1800. Braces, *C. D. Abel, London.—15th April, 1882.—(A communication from J. W. Holtring, Barmen, Germany.)* 6d.

This relates to the construction of braces, whereby they are enabled to adjust themselves perfectly to every movement of the body.

1802. Obtaining Motive Power from Falling or Flowing Liquids, *G. Wilson, Brixton.—15th April, 1882.—(Not proceeded with.)* 2d.

This consists in providing a rotary screw, worm, or helical device of such construction and arrangement as to be most readily acted upon by falling or flowing liquids, and at the same time to be of such nature as to be unlikely to become clogged or choked by the passage of the operating liquid or by virtue of small stones, refuse, or similar obstructions carried thereby into the apparatus.

1803. Improvements in Manufacturing Incandescent Lamps, &c., *A. R. Leask, London.—15th April, 1882.* 6d.

This relates to a tool or gauge for measuring the terminal wires of incandescent lamps, and an improved method of fixing the filament to such wires by means of this and another tool.

1804. Traction Engines, *H. G. and W. Woodbridge, Chipping Sodbury.—15th April, 1882.* 6d.

The important points or features of this invention are, the method of propelling the engine by means of an arrangement composed of links and shoes, which form also the tracks for wheels, and at the same time exert the power of the engine on the periphery of the wheels.

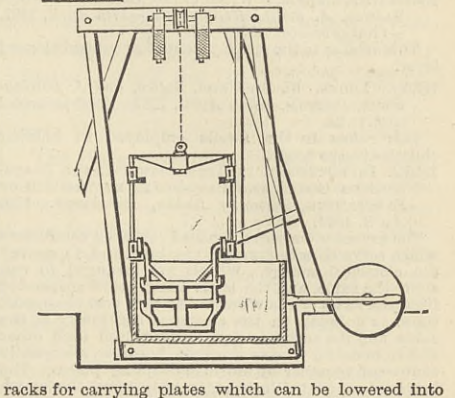
1805. Locks or Fastenings for Hand Bags, &c., *A. Budenberg and A. Timpé, Manchester.—15th April, 1882.* 6d.

A central lock or fastening is employed and two side bolts operated by the locking or fastening mechanism, which bolts engage in two staples near the bend of the top of the bag frame, so that by one action the bag is securely fastened at the centre and near the ends, and by turning the key all the fastenings are locked.

1808. Pickling and Swilling Metal Plates, *J. R. Turnock, Carmarthen.—15th April, 1882.* 6d.

The invention consists essentially in the combination of pickling and swilling pots which have an oscillating to-and-fro movement given to them, with

1808



racks for carrying plates which can be lowered into the pots and held stationary therein whilst the pots are oscillated to and fro. The drawing is a vertical cross section of the apparatus.

1810. Spindles of Doubling and Twisting Frames, *W. Holms, Glasgow.—17th April, 1882.—(Not proceeded with.)* 2d.

The object is to effect the driving of the vertical spindles of doubling and twisting frames by positive action.

1811. Prevention of Collisions at Sea, *H. O. A. E. Grunbaum, Stratford.—17th April, 1882.—(Not proceeded with.)* 2d.

This relates to the employment of two collision plates and suitable machinery connected therewith.

1812. Tricycles, &c., *W. Morgan, Birmingham.—17th April, 1882.* 6d.

This relates to improvements in the driving gear.

1814. Automatic Alarm to Prevent Ships from Grounding, *L. A. Groth, London.—17th April, 1882.—(A communication from J. Nilsson, Stockholm.)—(Not proceeded with.)* 2d.

This relates to the employment of a projecting arm, which upon touching the ground causes a bell to ring in the engine-room.

1815. Automatic Obturator for Breech-loading Ordnance, *L. A. Groth, London.—17th April, 1882.—(A communication from L. Freyre, Sevilla, Spain.)* 6d.

This obturator embodies two notable features which distinguish it essentially from other systems: First, that the pressure of the gases does not operate directly upon the obturating ring, but upon a circular wedge in the shape of a truncated cone, which causes the obturating ring to expand; Secondly, that the expansive movement of the said ring, as well as the force which acts to expand it, are limited at will.

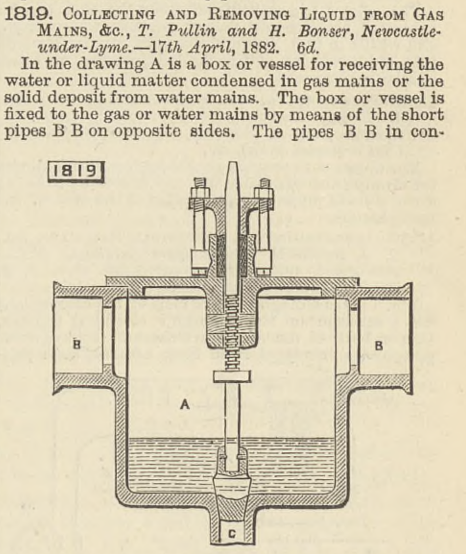
1816. Treatment of Vegetable Fibres for Textile Manufactures, *C. D. Abel, London.—17th April, 1882.—(A communication from E. Frémy and V. Urbain, Paris.)* 4d.

This consists partly in subjecting vegetable fibres, such as flax, hemp, ramie, and the like, whether in their natural state or in the form of tissues or waste products, to the action of hot solutions of caustic alkalies, or of alkaline carbonates, or of lime, or of mixtures of these, either under atmospheric or higher pressures, whereby the vegetable cement that binds the fibres together is dissolved, and the fibres are separated from the woody parts.

1819. Collecting and Removing Liquid from Gas Mains, &c., *T. Pullin and H. Bonser, Newcastle-under-Lyme.—17th April, 1882.* 6d.

In the drawing A is a box or vessel for receiving the water or liquid matter condensed in gas mains or the solid deposit from water mains. The box or vessel is fixed to the gas or water mains by means of the short pipes B B on opposite sides. The pipes B B in con-

1819



nection with the gas or water main are situated near the top of the vessel, so that the condensed water or deposit collects in the said box or vessel as the gas or water passes through it. C is the outlet or exit pipe for the water or deposit at the bottom of the box. To this pipe a lead or other pipe is connected by which the liquid or silt accumulated in the box or vessel may be conducted to a sewer or other receptacle.

1820. Apparatus for Saving Life in Collieries, *D. R. Jones, Carmarthen.—17th April, 1882.* 6d.

This consists in the combination of a compressed-air receptacle, with an expansible bag or intermediate air chamber, a mouthpiece, and air conduits provided with valves or cocks.

1821. Manufacture of Silicious Copper and Silicious Bronze, *J. C. Mewburn, London.—17th April, 1882.—(A communication from L. Weiller, Angoulême, France.)* 4d.

This relates to a process of producing silicious copper and silicious bronze, by introducing into melted copper or bronze a mixture containing substances which, by their reactions in the midst of the molten mass itself, will furnish the silicium and sodium necessary for the formation of the silicious compounds.

1824. Distilling Apparatus, *W. T. Y. Dicey, Brockley.—17th April, 1882.—(A communication from C. Bilroth, Vienna.)* 6d.

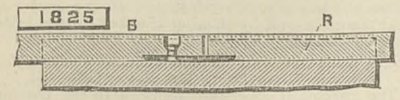
This relates to that class of still in which a continuous distillation of spirit from wash is effected.

1826. Refining Metals and Metallic Alloys, *W. A. Barlow, London.—17th April, 1882.—(A communication from J. Seyboth, Vienna.)* 4d.

The object is to purify and improve metals and metal compositions by adding to them while in a molten state salts suited for this purpose, closely mixed with charcoal in certain proportions.

1825. Pistons, *G. W. von Nawrocki, Berlin.—17th April, 1882.—(A communication from P. Laugenstein, Prague.)* 6d.

The object is to prevent the metallic packing rings from becoming leaky through wear, and consists partly in the arrangement of the packing plates B, which are



fastened at and below one end of the ring R, and extend under the other end of the ring. Other modifications are shown.

1828. Appliance for Securing Sliding Window Sashes, *A. Smith, Huddersfield.—17th April, 1882.—(Not proceeded with.)* 2d.

This relates to the employment of a counterbalanced lever.

1829. Looms, *W. McNichol, Batley, and J. Hollingworth, Dobcross.—17th April, 1882.—(Not proceeded with.)* 2d.

This refers to the swells employed in holding shuttles in the boxes.

1830. Improvements in Mechanism used for Transporting Goods and Passengers by the Aid of Electricity, *Fleeming Jenkin, Edinburgh.—17th April, 1882.* 6d.

The inventor employs strained cables or conductors which serve both to suspend the load, and to convey the electrical energy. Wheels are arranged to run along the cable, and the loads hang below suspended from the axles of the wheels. At each post or support there is a break in the electrical continuity of the cable, and the sections are insulated from each other and from earth. The sections are, however, electrically connected together by movable coupling pieces. The loads are connected together in trains, and the length of a train is about that of a section. A train passing any movable coupling piece moves it and throws it out of action, and the current then passes by a conductor on the train itself. The current is conveyed through an electrometer, which drives the wheels and propels the train. The current is derived from a dynamo machine. The inventor calls his system "telpherage."

1831. Reducing and Purifying Metals, *R. S. Ripley, London.—17th April, 1882.* 6d.

This relates to a method of and apparatus for reducing and purifying metals directly from their ores by gaseous fuel.

1833. Lixiviating Vegetable and Animal Materials, *C. Heckmann and E. Hausbrand, Berlin.—18th April, 1882.* 6d.

This consists in the process of treating materials containing extractive substances by means of evaporable liquids, being dissolvents of the latter, and which are made to act on the material at first in the state of vapour, in order to produce a softening of the extractive substances, and subsequently in condensed state, for the purpose of dissolving and extracting them.

1834. Manufacture of Block Ice, *W. W. Nightingale, Southport.—18th April, 1882.* 4d.

This relates to the arrangement of the boxes with the moulds.

1835. Protection for India-rubber and Ink-Erasers, *A. Schroll, London.—18th April, 1882.—(A communication from F. Frocschel, Nurnberg.)—(Not proceeded with.)* 2d.

This relates to the employment of a small box to hold the rubber or ink-eraser.

1836. Artificial Stone, *W. Walker, New York.—18th April, 1882.* 6d.

This relates to the manufacture of artificial stone composed of sand, cement, sulphur, and potash.

1839. Driving Gear for Tricycles, &c., *S. J. Collier, Manchester.—18th April, 1882.—(Not proceeded with.)* 2d.

This relates to tricycles or other velocipedes which are driven from crank shafts by means of endless chains, and stud wheels, and the object is to enable the rider to vary the speed of his driving wheel or wheels, as circumstances may require, whilst the crank shaft and pedals revolve still at the same speed.

1842. Subjecting Eggs under Partial Vacuum to Action of Preserving Substances, *H. H. Doty, London.—18th April, 1882.* 6d.

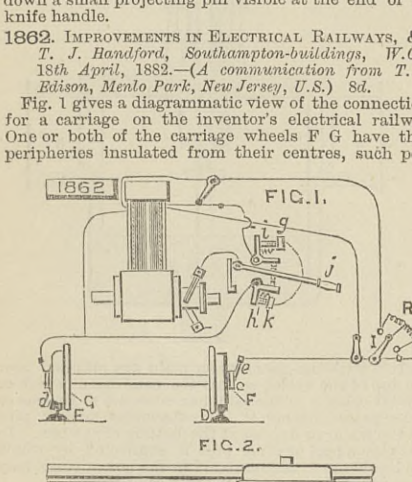
This relates to apparatus whereby the eggs can be subjected, together with melted paraffine, to a vacuum, and whilst in that vacuum the eggs can be lowered into and raised out of the melted paraffine or other similar substance.

1843. Pocket-knives with Self-opening Cork-screw, *W. Brierly, Halifax.—18th April, 1882.—(A communication from H. Buettner, Neustadt, Germany.)—(Not proceeded with.)* 2d.

The object is to provide pocket-knives with a device for opening automatically the cork-screw by pressing down a small projecting pin visible at the end of the knife handle.

1862. Improvements in Electrical Railways, &c., *T. J. Handford, Southampton-buildings, W.C.—18th April, 1882.—(A communication from T. A. Edison, Menlo Park, New Jersey, U.S.)* 8d.

Fig. 1 gives a diagrammatic view of the connections for a carriage on the inventor's electrical railway. One or both of the carriage wheels F G have their peripheries insulated from their centres, such peri-



pheries being connected with spiders, upon whose centres *c d* brushes *e f* bear. Each carriage carries an electro-dynamic motor, the armature of which is mechanically connected with the axles of the carriage. Rails D E are insulated from each other, and one or both from earth. The current from a dynamo machine used as a generator passes the rail D, say, and from thence by the wheel rims and connections to the armature, and afterwards to rail E. To reduce speed the resistances R and contact arm I are provided. A hand lever J, capable of resting in three positions, together with elbow crank levers *g* and *h* drawn by springs upon contact *i* and *k*, acts as a current reverser. Fig. 2 shows the connections of a carriage, together with means for disconnecting the armature from the driving axles, so that it can continue to turn when the carriage is still. Fig. 3 illustrates the arrangement adopted for the machines employed to supply current to each section of the railway.

1849. Printing, *W. R. Lake, London.—18th April, 1882.—(A communication from P. Reed, Passaic, and J. Eastwood, Belleville, U.S.)* 4d.

The invention consists in the employment of a solution containing soluble pyroxyline for the purpose of "setting" or "fixing" the design or colour in connection with what is known as topical printing, which is effected by means of pressure or by bringing a surface having a "colour" or "ink" applied to it, in contact with another surface upon which the impression is intended to be made.

1857. Bricks and Tiles, *W. Blyth, Barton-upon-Humber.—18th April, 1882.* 4d.

The clay is pressed through a die specially made in the shape of the tile, and is received on rollers made so that the tile wing travels in a groove, the middle part of the rollers being so hollowed as to receive the body of the tile.

1858. Lamps for Burning Oils or Spirits, *A. Leefe, Islington.—18th April, 1882.* 4d.

This consists in so constructing the burner and parts combined therewith that by causing part of the ring, or parts surrounding the burner to open upon a joint or hinge (or to slide away so as to expose the burner), a light can then be readily applied to the wick to light the lamp from below, without removing the glass or any of the separate parts of the burner.

1881. Breech-loading Small-arms, *W. Tranter, Birmingham.—19th April, 1882.* 10d.

This refers principally to breech-loading small-arms of the kind known as drop-down guns, and this part of the invention consists mainly of the construction and combination of parts for cocking the hammers of the said guns, by the raising of the breech ends of the barrels from the break-off for loading.

1885. Tricycles, &c., *A. H. Griffiths, Birmingham.—20th April, 1882.—(Not proceeded with.)* 2d.

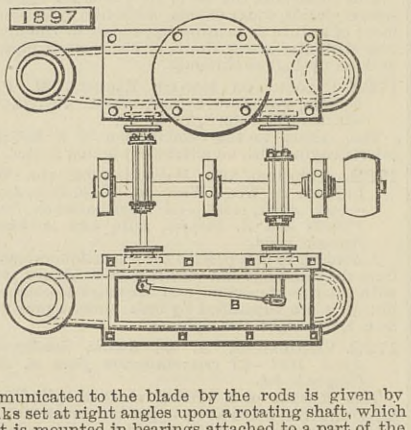
This relates to the construction of the propelling mechanism.

1887. Compound Marine Steam Engines, *J. W. Richardson, Newcastle-upon-Tyne.—20th April, 1882.—(Not proceeded with.)* 2d.

The engines are arranged for expanding the steam three times, or in other words, for working it through three stages or with triple expansion, there being two cylinders for the third or final stage, so that such cylinders may be made of moderate size.

1897. Pumps, &c., *A. Browne, London.—20th April, 1882.—(A communication from C. F. Osborne, Cape Town, South Africa.)* 6d.

The invention relates to a movable blade or vane B placed longitudinally, either vertical or horizontal, or inclined in an enclosed chamber of suitable form. The blade or vane receives oscillating or rocking motion, which may be communicated to it by rods passing through glands, guides, or stuffing boxes in the side or sides of the chamber or box. The motion



communicated to the blade by the rods is given by cranks set at right angles upon a rotating shaft, which shaft is mounted in bearings attached to a part of the chamber or box, and carries two or more pulleys or vane wheels, for the purpose of giving to the shaft rotary motion to be obtained by a belt or band from a motive power engine.

1931. Manufacture of Hoes, Adzes, and Mattocks, *R. P. Yates, Birmingham.—22nd April, 1882.* 6d.

This consists in making a depression in the blank or "mould" between that part from which the eye is to be made and that part from which the body is to be made, and at the same time forming the rib which joins the eye; next plating or drawing out the steeled part of the mould to form the body, and afterwards forming the eye from the unsteeled part of the mould.

2047. Bridges, *W. W. Wynne, Hornsey.—1st May, 1882.* 6d.

A portion or portions of the bridge are formed capable of being lowered into and below the subjacent water by means of hydraulic or other suitable power, in order to admit of vessels passing through the opening or openings thus formed in the bridge and over the portion so lowered.

2214. Grinding, &c., Grain and other Materials, *W. Korth, Belfast.—11th May, 1882.* 6d.

This relates partly to improvements on patent No. 5037, A.D. 1881, and consists in the completion of the process of grinding grain and other materials by what is known as the half-high grinding or three-break roller mill system.

2255. Manufacture of Looped Fabrics, *J. and H. Kiddier, Nottingham.—13th May, 1882.* 6d.

The inventors claim the construction and employment of two screws at each end of a rotary knitting machine, operating singly or in combination, and carrying adjustable stops to regulate the traverse of thread carriers.

2936. Soap Sheets, *G. F. Redfern, London.—20th June, 1882.—(A communication from H. Buczkowski, Vienna.)* 6d.

This consists essentially in passing woven fabrics or paper—preferably from a continuous roll, maintained in a stretched condition by stretchers or rollers—through a soap solution, cleansing both sides of the fabric or paper from surplus soap, and winding it upon a rolling apparatus or conducting it directly to a cutting machine, the saturated fabric or paper becoming dry during its passage from the cleansing rollers to the rolling apparatus or cutting machine.

3100. Sewing Carpets, &c., *W. R. Lake, London.—30th June, 1882.—(A communication from A. Neustadt, San Francisco.)—(Complete.)* 6d.

This relates to a sewing machine which is adapted to roll or travel upon the edges of the two strips of carpeting or other fabric stretched between suspending hooks or supports, and while travelling from one end of the material to the other end lays over its frayed or ravelled edges and sews the two pieces together.

3330. Improvements in Electric Lighting, &c., *S. Pitt, Sutton.—13th July, 1882.—(A communication from E. T. Starr, Philadelphia, and W. J. Peyton, Washington, U.S.)* 10d.

This relates to improved methods of laying conductors for electric light or power distribution, by which these wires may be laid underground with other conductors; also to rheostats or variable resistance devices to be used in regulating the speed of motors or otherwise, and various other improvements. There are twenty claims.

3348. Treatment of Skim Milk in the Manufacture of Artificial Cream, Butter and Cheese, *H. J. Haddan, Kensington.—14th July, 1882.—(A communication from D. H. Burrell, New York, and W. Cooley, Waterbury, U.S.)* 6d.

This consists partly in the production of an artificial cream composed of oleaginous substances mechanically blended or otherwise incorporated with milk, the oleaginous material being in a state of minute and even divisions and each particle encased in a coating of milk.

3383. Making Ice, *H. J. Haddan, Kensington.—17th July, 1882.—(A communication from T. S. Rankin, Washington, U.S.)—(Complete.)* 6d.

This relates partly to machinery for the manufacture of ice by the evaporation of fluid ammonia, wherein the ammonia is re-condensed after it has been converted into a gas, and reclaimed to be used over again.

3443. Medical Battery, *W. R. Warren, Brooklyn, U.S.—20th July, 1882.* 4d.

This consists of a can containing zinc and copper electrodes, separated by sheets of bibulous paper saturated with an exciting fluid.

3445. Apparatus for Drying and Cooling, *H. J. Haddan, Kensington.—20th July, 1882.—(A communication from F. H. C. Mey, Buffalo, U.S.)—(Complete.)* 6d.

This relates to improvements in the general construction of the apparatus.

3446. Steam Engine Governors, *H. J. Haddan, Kensington.—20th July, 1882.—(A communication from F. H. Ball, Erie, U.S.)—(Complete.)* 6d.

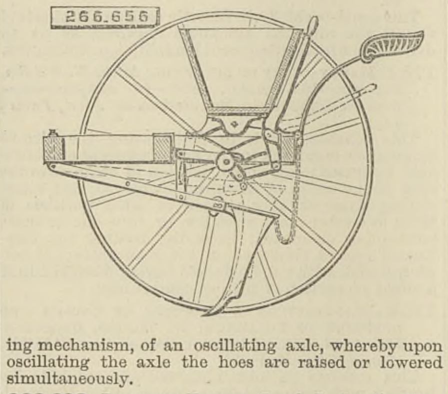
This relates to a centrifugal governing device mounted upon the main shaft.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

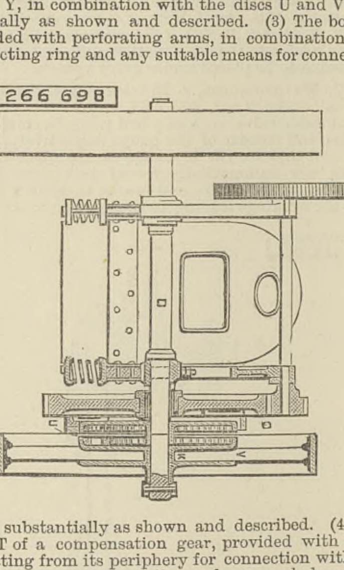
266,656. Seeding Machine, *E. Fowler Stoddard and William H. Nauman, Dayton, Ohio.—Filed February 23rd, 1881.*

Claim.—In a seeding machine, the combination, with the hopper, the hoes, and drag-bars and connecting mechanism, of an oscillating axle, whereby upon oscillating the axle the hoes are raised or lowered simultaneously.



266,698. Traction Engine, *Frank F. Landis, Waynesborough, Pa.—Filed October 22nd, 1882.*

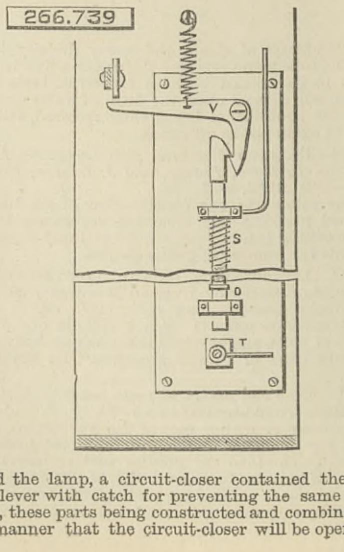
Claim.—(1) The combination of the driving gear wheel Q, the body T of a compensation gear, and means for connecting them with the toothed discs, and pinions connecting respectively the axle and the driving wheel, substantially as shown and described. (2) The body T, having projecting arms, and sheet of metal Y, in combination with the discs U and V, substantially as shown and described. (3) The body T, provided with perforating arms, in combination with connecting ring and any suitable means for connecting



them, substantially as shown and described. (4) The body T of a compensation gear, provided with arms projecting from its periphery for connection with the motive power, substantially as shown and described. (5) The combination of the axle D, hub X, revolving upon said axle, having a flanged internally-toothed disc V, with the disc U, keyed to the shaft D, and body T, revolving upon the hub and pinions, substantially as shown and described.

266,739. Shunting Device for Electric Lamps, *Edward Weston, Newark, N.J.—Filed June 7th, 1882.*

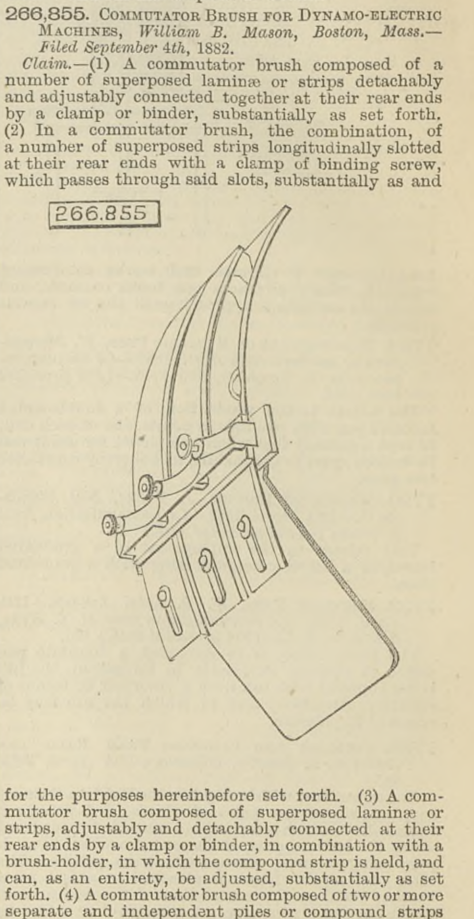
Claim.—(1) The combination, in an electric lamp having main and shunt magnets, with a moving part of the feed mechanism, of a normally-open circuit



around the lamp, a circuit-closer contained therein, and a lever with catch for preventing the same from acting, these parts being constructed and combined in such manner that the circuit-closer will be operated by contact therewith of the said moving part of the feed mechanism, due to an abnormal increase in the attraction of the shunt magnet, as set forth. (2) The combination, in an electric lamp having main and shunt magnets, with a moving part of the feed mechanism, of a contact-plate T, pin O, spring S, lever V, adapted to engage with and hold the said pin up against the force of spring S, and circuit connections, as described, these parts being constructed and arranged in such manner that a movement of the feed mechanism beyond the normal range will trip the lever V and cut the lamp out of circuit.

266,855. Commutator Brush for Dynamo-electric Machines, *William B. Mason, Boston, Mass.—Filed September 4th, 1882.*

Claim.—(1) A commutator brush composed of a number of superposed laminæ or strips detachably and adjustably connected together at their rear ends by a clamp or binder, substantially as set forth. (2) In a commutator brush, the combination, of a number of superposed strips longitudinally slotted at their rear ends with a clamp of binding screw, which passes through said slots, substantially as and



for the purposes hereinbefore set forth. (3) A commutator brush composed of superposed laminæ or strips, adjustably and detachably connected at their rear ends by a clamp or binder, in combination with a brush-holder, in which the compound strip is held, and can, as an entirety, be adjusted, substantially as set forth. (4) A commutator brush composed of two or more separate and independent piles or compound strips formed of superposed detachably and adjustably connected laminæ, as described, in combination with a brush-holder provided with separate and independent clamping or holding devices, one for each pile or compound strip, substantially as hereinbefore set forth.

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The Engineer, Nov. 24th, 1882.