THE MACHINE GUN COMPETITION.

We take this opportunity of making some more general observations on the machine guns undergoing trial before reporting the next series of trials. First, it is perhaps specially necessary to do justice to the Gatling gun, as owing to peculiar circumstances its performance has not been at all equal to what it has achieved in previous trials. It may be observed that there were entered three patterns of Gatling in the trial, two with ten barrels and one with six. Of these, the long ten barrelled gun has the firing handle placed in prolongation of the axis as shown in Fig. 1 of our January 21st description. This is intended to be an improvement on the side position shown in a larger gun in Fig. 5 herewith. The advantage consists in the fact that by this means the handle can be made to turn the barrels with it revolution for revolution, whereas the side position was arranged to give only one revolution of the barrels for two complete turns of the handle. The new position on the axis, therefore, provides for much greater speed. It is, however, much more awkward to work, and as a matter of fact, causes an operator to run at higher speed than he is aware of, and thus to jam the cartridge cases. It is easy to conceive that any one changing from one gun to the other specially feels the difficulty. Another matter that has told against the Gatling is the shape of the cartridge adopted, which is the bottle-necked pattern with solid case. The form being slightly conical does not suit the feed motion, and this specially tells against the Gatling, which has one stream of supply to all its barrels instead of one to each. On the other hand, while the form of cartridge told against the Gatling, the fact that the cartridges were all newly made and in excellent condition prevented its showing the advantage it possesses of supporting the case for a longer time than most other systems. The different guns were fired by the committee at Enfield previous to coming to Shoeburyness, and this question was specially investigated. Some cartridges which were not new, but which were apparently by no means in bad condition, happened to be used during the firing there, and it was discovered that there was a very slight delay in the explosion of the charge. In one or two instances this told against the Gardner; in one instance, indeed, the bullet received so small a share of the explosive pressure, that it was left in the bore of the barrel, a casualty which is much more serious than a case flying out in a burning condition. It appeared on investigation when the guns were fired at such a rate that the handle made one revolution in half a second, that the cartridge in the Pratt-Whitney gun was only supported for about one-fifteenth of a second of time, and that of the Gardner (proper) for about one-eleventh of a second, while that of the Gatling was said to have been supported as long as nearly one-third of a second. This comparison, however, which we give as we received it, we consider must be modified. It doubtless applies to the guns taken in conjunction with the firing results obtained on the particular occasion referred to. In the nature of things it would be unjust to apply it to the present firing. Take for example, the Gatling with axial action. If its handles were made to revolve in half a second, each cartridge would pass through the disc controlling the action, and perform its circle in half a second. Now, if that disc be examined it would be found that the cartridge case is supported for about one-fourth part of its revolution. Consequently it would under these circumstances be supported for one-eighth of a second of time. Its firing results would no doubt be enormously beyond those obtained at Enfield at a slower rate, but we are considering it in connection with the firing results we have here. The ten-barrelled Gatling, for example, fired fifty rounds in three seconds, or we may say made five revolutions in three seconds, or one revolution in three-fifths of a second. At this rate its cartridges would each receive support for about three-twentieths of a second. It is thought that the

FIG. 1

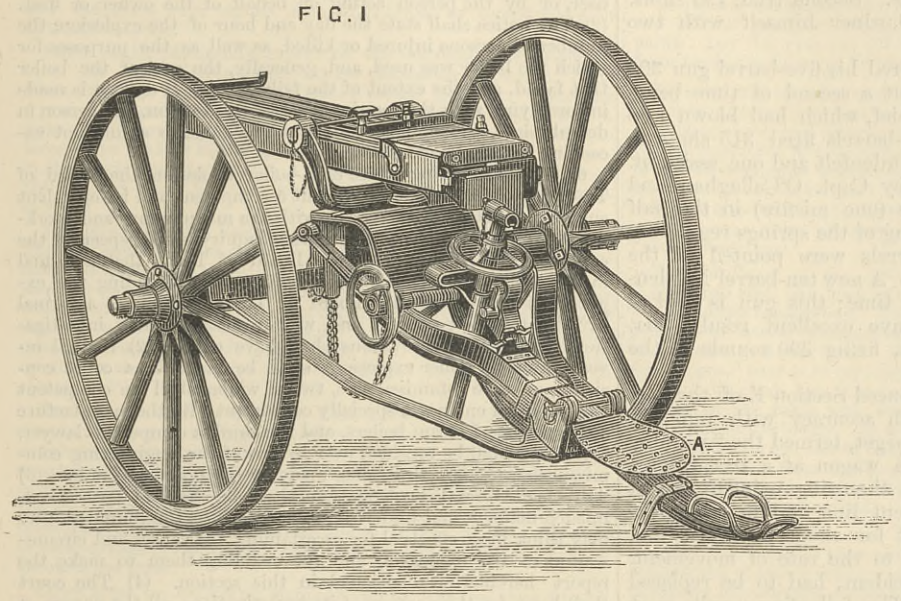


FIG. 2

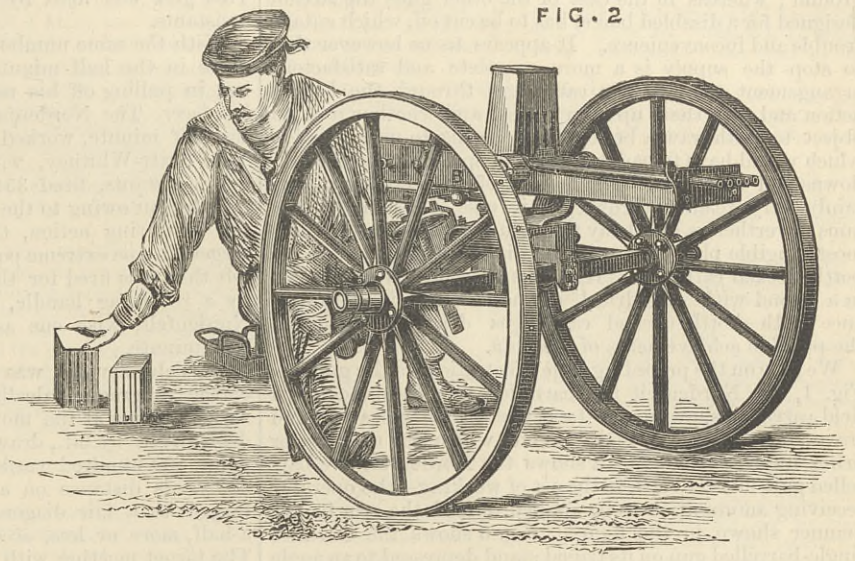


FIG. 4.

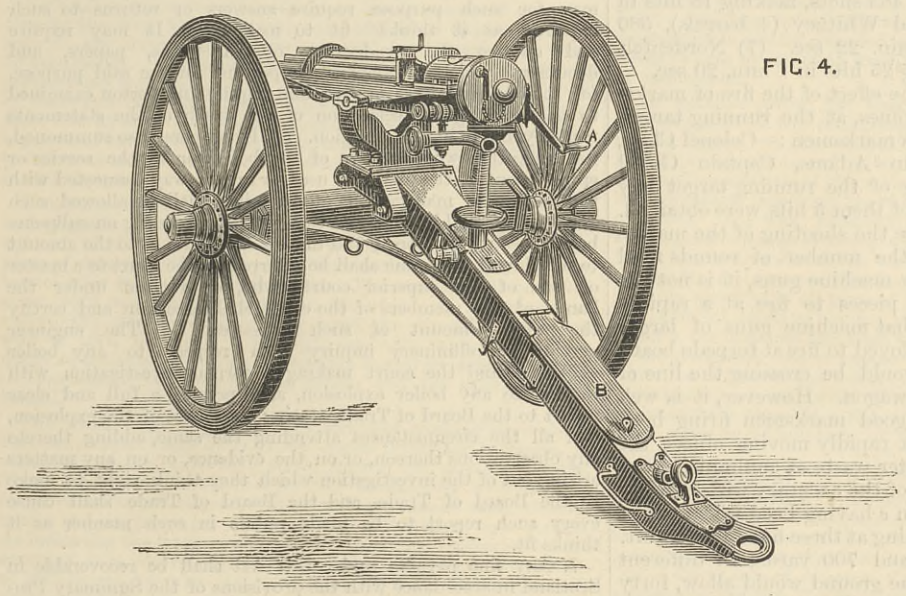


FIG. 5.

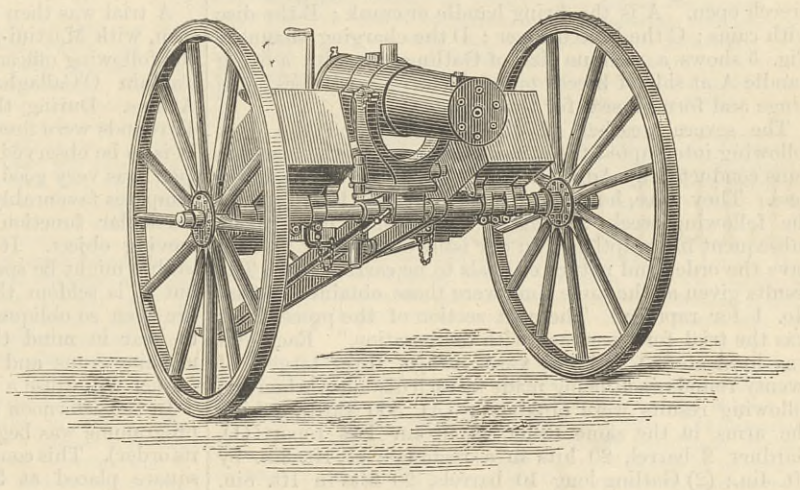


FIG. 6.

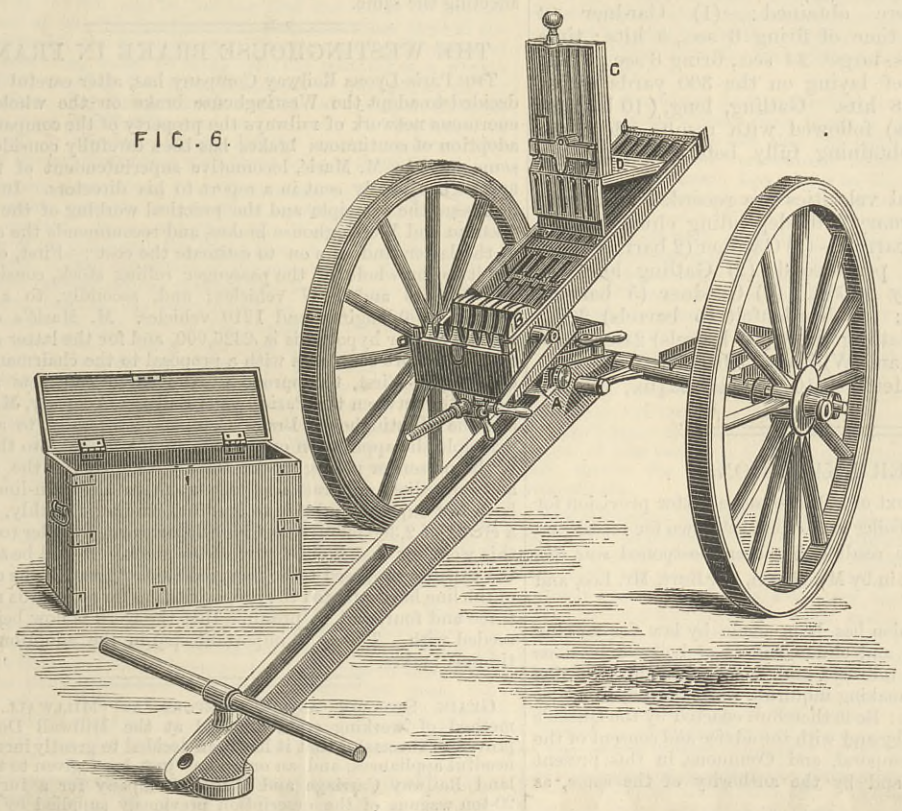
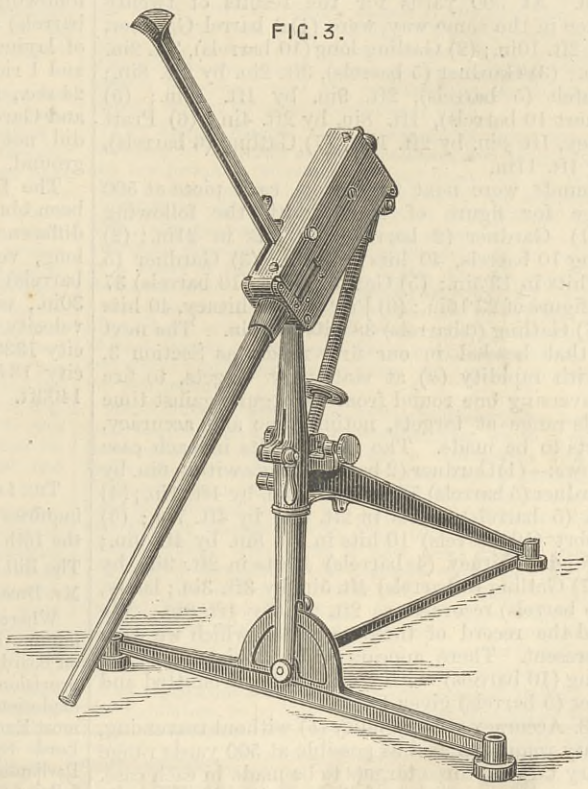


FIG. 3.



Nordenfelt supports its cartridges well, for it is almost certain that a slight pause is made at the end of the forward stroke. Nordenfelt himself claims that an operator can suit this to the requirements of any case, but this is too great a refinement to be of much practical value. It is also claimed for the Gatling that a lock can in case of injury be readily withdrawn, and the firing continued as before, the cartridges for the disabled barrel never advancing into it, but being thrown out unfired on the ground ; whereas in the case of the other guns the stream designed for a disabled barrel has to be cut off, which entails trouble and inconvenience. It appears to us however that to stop the supply is a more complete and satisfactory arrangement than to run cartridges through the breech action and pick them up afterwards; and whether it is an object to withdraw a broken lock seems to us a question which would have to be determined by special trials of breakdowns and accidents. The hopper of the Gatling is certainly very readily thrown up in case of a jam, but the jams nevertheless did delay the firing very seriously. The most tangible plea for the Gatling is the bad effect of the bottle-necked cartridge. If it has fired forty-four rounds in a second with cylindrical, unquestionably its performance with bottle-necked cartridges does not represent the possible achievements of the gun.

We give on the preceding page illustrations of the guns :—Fig. 1, the Nordenfelt five-barrelled gun mounted on a field carriage, showing the breech end with elevating and traversing screws. A is the step on which the operator or firing number sits. Fig. 2 shows the Nordenfelt five-barrelled gun, muzzle view, in the act of working—the operator receiving ammunition to be applied to feed the arm in the manner shown in the figure. Fig. 3 shows the Gardner single-barrelled gun on its tripod stand depressed to an angle of 60 deg. with the horizon, as might be required in the defence of a wall. This is a singularly awkward position, because the cartridges have to descend the groove at an angle of 30 deg. We saw them, however, do this very well at Shoeburyness on the last day of the trials we now have to record, in a two-barrelled arm. The single-barrelled arm is perhaps more strongly recommended by Gardner himself than any other pattern. It is termed a rifle of position rather than a machine gun. Mr. Gardner thinks it more convenient. It might be used in almost any position. Fig. 4 shows the Gardner five-barrelled gun with breech open. A is the firing handle or crank ; B the disc with cams ; C the breech cover : D the charging channels. Fig. 5 shows a medium size of Gatling gun with a firing handle A at side of breech on a field carriage ; B rises on its hinge and forms a seat for the operator.

The severe weather of January 18th and the days following interrupted the competitive trial of the machine guns conducted by Admiral Boys' Committee at Shoeburyness. They were, however, resumed at the latter end of the following week, and have been pushed on without subsequent interruption. In our issue of January 21st we gave the order and nature of trials to be carried out. The results given at the same time were those obtained in trial No. 1 for rapidity. The next section of the proceedings was the trial for "accuracy with deliberation." Each gun was fired at 300 and 500 yards range, three targets of twenty rounds each being made at each distance, when the following results were obtained :—At 300 yards, taking the arms in the same order as in our last report (1), Gardner 2 barrel, 20 hits in a rectangle of 1ft. 3in. by 3ft. 4in.; (2) Gatling long 10 barrels, 20 hits in 1ft. 8in. by 1ft. 4in.; (3) Gardner 5 barrels, 20 hits in 1ft. 5in. by 1ft. 10in.; (4) Nordenfelt (5 barrels), 20 hits in 1ft. 10in. by 1ft. 4in.; (5) Gatling short 10 barrels, 20 hits in 2ft. 1in. by 1ft. 6in.; (6) Pratt and Whitney 4 barrels, 20 hits within a rectangle 10in. by 1ft. 9in.; (7) Gatling 6 barrels, 20 hits in 1ft. 4in. by 1ft. 4in, It may be seen that the figures of merit not being yet worked out the results of the best twenty rounds are given in the above rough form. At 500 yards for the results of twenty rounds, taken in the same way, were (1) 2 barrel Gardner, 2ft. 9in. by 2ft. 10in.; (2) Gatling long (10 barrels), 3ft. 2in. by 1ft. 10in.; (3) Gardner (5 barrels), 3ft. 2in. by 2ft. 8in.; (4) Nordenfelt (5 barrels), 2ft. 9in. by 1ft. 10in.; (5) Gatling (short 10 barrels), 1ft. 8in. by 2ft. 4in.; (6) Pratt and Whitney, 1ft. 8in. by 2ft. 1in.; (7) Gatling (6 barrels), 4ft. 7in. by 1ft. 11in.

Forty rounds were next fired from each piece at 500 yards range for figure of merit, with the following results :—(1) Gardner (2 barrels) 40 hits in 21in.; (2) Gatling long 10 barrels, 40 hits in 17in.; (3) Gardner (5 barrels) 40 hits in 13·5in.; (5) Gatling short (10 barrels) 37 hits with a figure of 23·16in.; (6) Pratt and Whitney, 40 hits in 17in.; (7) Gatling (6 barrels) 38 hits in 26in. The next trial was that headed in our first report as Section 3, accuracy with rapidity (*a*) at stationary targets, to fire without traversing one round from each gun against time at 500 yards range at targets, noting time and accuracy, three targets to be made. The best results in each case were as follows:—(1) Gardner (2 barrels) 2 hits within 6in. by 2ft.; (3) Gardner (5 barrels) 5 hits in 4ft. 1in. by 1ft. 1in.; (4) Nordenfelt (5 barrels) 5 hits in 2ft. 6in. by 4ft. 7in.; (5) Gatling short (10 barrels) 10 hits in 4ft. 8in. by 4ft. 9in.; (6) Pratt and Whitney (4 barrels) 4 hits in 2ft. 9in. by 1ft. 1in.; (7) Gatling (6 barrels) 4ft. 5in. by 3ft. 3in.; lastly, Gardner (5 barrels) recorded as 2ft. 2in. by 1ft. 8in. We have copied the record of these scores at which we were were not present. There appears to be a mistake, as the Gatling long (10 barrels) with axis handle is omitted and the Gardner (5 barrels) given twice.

Section 3. Accuracy with rapidity (*b*) without traversing, to fire eighty rounds as fast as possible at 500 yards range at stationary targets, three targets to be made in each case. The best results were as follows :—(1) Gardner (2 barrels), 74 hits in 10ft. by 3ft. 9·6in.; (2) Gatling long (10 barrels), 80 hits in 8ft. by 6ft. 8·4in.; (3) Gardner (5 barrels), 80 hits in 6ft. 11in. by 5ft. 9in.; (5) Gatling short (10 barrels), 80 hits in 7ft. 6in. by 6ft. 9in.; (6) Pratt and Whitney (4 barrels), 80 hits in 3ft. 2in. by 3ft.; (7) Gatling (6 barrels), 79 hits in 14ft. 2ft. by 7ft. 7in. The Nordenfelt record is omitted in this series.

On February 2nd the trials recommenced, the stage of the trial being that headed—Section 3. Accuracy with rapidity (*c*) with automatic or hand scattering motion for thirty seconds at a row of targets 9ft. high, 81ft. long, at 200 yards range. The Gatling 6-barrels had been now withdrawn from the competition, having failed to fire 1000 rounds without jamming. The results were as follows :—(1) Gardner (two barrels), first trial, 182 shots in the half minute, but owing to the gun being placed wrongly some of the shots were off the targets. Second trial, 199 shots. This gun was fired by Mr. Gardner himself with two assistants.

With the same numbers he fired his five-barrel gun 305 shots in the half minute, about a second of time being lost in pulling off his neckerchief, which had blown into his face. The Nordenfelt five-barrels fired 315 shots in the half minute, worked by Nordenfelt and one assistant. The Pratt-Whitney, worked by Capt. O'Callaghan and two assistants, fired 354 shots (one misfire) in the half minute, but owing to the yielding of the springs regulating the scattering action, the barrels were pointed off the targets in one extreme position. A new ten-barrel Nordenfelt then was fired for the first time; this gun is worked by a revolving handle, and gave excellent results, Mr. Nordenfelt, with one assistant, firing 390 rounds in the half minute.

On February 3rd was commenced Section E of the part of the programme dealing with accuracy with rapidity, namely, firing at the moving target, termed the "running deer," 12ft. by 6ft., drawn in a wagon at a trot, from a point 800 hundred yards from the firing point to one at 400 yards distance on a different line, and exposing the targets to a fair diagonal shot for about a minute and a-half, more or less, according to the rate of movement. The target meeting with an accident, had to be replaced by a smaller one 10ft. by 5ft. The following results were obtained :—(1) Gardner (2 barrels) fired 170 rounds, obtained 7 hits. The time occupied in crossing was rather short, probably under 1 min. 20 sec. (2) Gatling long (10 barrels), fired 273 shots, making 11 hits in 1 min. 50 sec. (3) Gardner (5 barrels) 245 shots, 14 hits in 1 min. 50 sec. (4) Nordenfelt (5 barrels), 178 shots, making 11 hits in 1 min. 24 sec. (5) Gatling short (10 barrels), 483 shots, making 18 hits in 1 min. 24 sec. (6) Pratt and Whitney (4 barrels), 580 shots, making 13 hits in 1 min. 22 sec. (7) Nordenfelt (10 barrels), 310 shots, making 25 hits in 1 min. 20 sec.

A trial was then made of the effect of the fire of marksmen, with Martini-Henry carbines, at the running target, the following officers acting as marksmen :—Colonel Close, Captain O'Callaghan, Captain Adams, Captain Gould Adams. During the crossing of the running target only 41 rounds were fired, but out of them 5 hits were obtained. It is to be observed that, while the shooting of the marksmen was very good, and for the number of rounds fired compares favourably with the machine guns, it is not the particular function of these pieces to fire at a rapidly moving object. It is true that machine guns of larger calibre might be specially employed to fire at torpedo boats, but it is seldom that they would be crossing the line of fire even so obliquely as this wagon. However, it is well to bear in mind that, with good marksmen firing both machine guns and rifles at a rapidly moving object, the former will cause a much greater waste of ammunition.

In the afternoon Section *d*, of the accuracy with rapidity programme was begun (Section *e* having been taken out of its order). This consisted in firing at three fixed targets 6ft. square placed at 300, 500, and 700 yards, in different directions, as wide apart as the ground would allow, forty rounds to be fired at each target. The time and number of hits to be noted. In quoting from the programme it is desirable to explain that there were three targets in all, one at each range, and that the guns opened fire first at the most distant one, so as to represent the conditions of firing at an advancing enemy. The guns were laid on the 700 yards target before the signal to fire was given. The following results were obtained :— (1) Gardner (2 barrels) at 700 yards ; time of firing 6 sec., 5 hits ; time of laying on 500 yards target 24 sec., firing 6 sec., 6 hits and 1 ricochet ; time of laying on the 300 yards target 24 sec., firing 5 sec., 8 hits. Gatling, long, (10 barrels) and Gardner (5 barrels) followed with results which we did not succeed in obtaining fully before leaving the ground.

The following initial velocities are recorded as having been obtained on February 3rd, depending chiefly on the difference of length in barrel :—(1) Gardner (2 barrels) 30in. long, velocity 1385ft. per second; (2) Gatling long (10 barrels) 32in., velocity 1408ft.; (3) Gardner (5 barrels) 30in., velocity 1364ft.; (4) Nordenfelt (5 barrels) 26in., velocity 1368ft.; (5) Gatling short (10 barrels) 24in., velocity 1339ft.; (6) Pratt and Whitney (4 barrels) 26in., velocity 1349ft.; (7) Nordenfelt (10 barrels) 32¼in., velocity 1409ft.

BOILER EXPLOSIONS.

The following is the text of a Bill to make better provision for inquiries with regard to boiler explosions, set down for reading on the 16th instant, but the reading has been postponed *sine die*. The Bill is being brought in by Mr. Mason, Mr. Burt, Mr. Lee, and Mr. Broadhurst :—

Whereas special provision has been made by law for making inquiry into the causes and circumstances of boiler explosions on board ships and on railways, and it is expedient that like provision be made for making inquiries with respect to boiler explosions in other cases : Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

1. This Act may be cited as the Boiler Explosions Act, 1881.
2. This Act shall extend to the whole of the United Kingdom.
3. In this Act the term "boiler" means any closed vessel used for generating steam, or for heating water, or for heating other liquids, or into which steam is admitted for heating, steaming, boiling, or other similar purposes. The term "court of summary jurisdiction" means any justices of the peace, metropolitan police magistrate, stipendiary magistrate, sheriff, sheriff substitute, or other magistrate or officer, by whatever name called, who is capable of exercising jurisdiction in summary proceedings for the recovery of penalties.
4. This Act shall not apply to any boiler used exclusively for domestic purposes, or to any boiler used in the service of her Majesty, or to any boiler on board a steamship having a certificate from the Board of Trade.
5. (1) On the occurrence of an explosion from any boiler to which this Act applies, notice thereof shall, within twenty-four hours thereafter, be sent to the Board of Trade by the owner or user, or by the person acting on behalf of the owner or user. (2) The notice shall state the day and hour of the explosion, the number of persons injured or killed, as well as the purposes for which the boiler was used, and, generally, the part of the boiler that failed, and the extent of the failure. (3) If default is made in complying with the requirements of this section, the person in default shall, on summary conviction, be liable to a fine not exceeding twenty pounds.
6. (1) On receiving notice of a boiler explosion the Board of Trade may, if it thinks fit, appoint a competent and independent engineer, practically conversant with the manufacture and working of boilers, to make a preliminary inquiry with respect to the explosion. If it appears to the Board of Trade that a formal investigation of the causes and circumstances attending the explosion is expedient, the Board of Trade may direct a formal investigation to be held ; and, with respect to such investigation, the following provisions shall have effect : (2) Formal investigations of boiler explosions shall be made by a court consisting of three commissioners, two of whom shall be competent and practical engineers specially conversant with the manufacture and working of steam boilers, and the third a competent lawyer. The court shall be presided over by one of the engineering commissioners, the selection being made by the Board of Trade. (3) Any such formal investigation shall be held in open court, in such manner, and under such conditions, as the commissioners may think most effectual for ascertaining the causes and circumstances of the explosion, and for enabling them to make the report hereinafter mentioned in this section. (4) The court shall have, for the purpose of its investigations, all the powers of a court of summary jurisdiction when acting as a court in the exercise of its ordinary jurisdiction, viz. :—(*a*) The court, or any one appointed by it, may enter and inspect any place or building, the entry and inspection whereof appears to the court requisite for the said purpose. (*b*) It may by summons under its hand require the attendance of all such persons as it thinks fit to call before it, and examine for the said purpose, and may for such purpose require answers or returns to such inquiries as it thinks fit to make : (*c*) It may require and enforce the production of all books, papers, and documents which it considers important for the said purpose. (*d*) It may administer an oath, and require any person examined to make and sign a declaration of the truth of the statements made by him in his examination. (*e*) Every person so summoned, not being the owner or user of the boiler, or in the service or employment of the owner or user, or in any way connected with the working or management of the boiler, shall be allowed such expenses as would be allowed to a witness attending on subpœna before a court of record ; and in case of dispute as to the amount to be allowed, the same shall be referred by the court to a master of one of the superior courts, who, on request under the hands of the members of the court, shall ascertain and certify the proper amount of such expenses. (5) The engineer making a preliminary inquiry with respect to any boiler explosion, and the court making a formal investigation with respect to any boiler explosion, shall present a full and clear report to the Board of Trade, stating the causes of the explosion, and all the circumstances attending the same, adding thereto any observations thereon, or on the evidence, or on any matters arising out of the investigation which they think right to make to the Board of Trade, and the Board of Trade shall cause every such report to be made public in such manner as it thinks fit.
7. Any fine payable under this Act shall be recoverable in Scotland in accordance with the provisions of the Summary Procedure Act, 1864—27 and 28 Vict. c. 53—and of any Act or Acts amending the same, and in Ireland within the police district of Dublin metropolis, in accordance with the provisions of the Acts regulating the powers and duties of justices of the peace for such district, or of the police of such district elsewhere in Ireland in accordance with the provisions of the Petty Sessions (Ireland) Act, 1851—14 and 15 Vic. c. 93—and any Act amending or affecting the same.

THE WESTINGHOUSE BRAKE IN FRANCE.

The Paris-Lyons Railway Company has, after careful inquiry, decided to adopt the Westinghouse brake on the whole of the enormous network of railways the property of the company. The adoption of continuous brakes has been carefully considered for some years by M. Marié, locomotive superintendent of the line, and he has finally sent in a report to his directors. In this he discusses the principle and the practical working of the Smith's vacuum and Westinghouse brakes, and recommends the adoption of the latter, and goes on to estimate the cost :—First, of applying it to the whole of the passenger rolling stock, consisting of 800 engines and 5447 vehicles; and, secondly, to a limited portion—300 engines and 1210 vehicles. M. Marié's estimate for the former hypothesis is £326,000, and for the latter £88,000, and the report concludes with a proposal to the chairman of the company :—First, to approve of the three contracts annexed herewith, between the Paris-Lyons Railway Company, M. Henry, and the Westinghouse Brake Company ; secondly, to adopt in principle the application of the Westinghouse brake to the whole of the passenger rolling stock ; thirdly, to authorise the effective and immediate application of this brake to all main-line trains, both fast express, and also to omnibus trains; fourthly, to open a credit of 2,300,000 francs to his department, in order to execute this work for that limited part of the stock. It will be seen that the expense proposed to be incurred is very great. The directors of the line have adopted the propositions as far as regards numbers three and four, and we presume that the work is now being proceeded with. This is an important step in the adoption of continuous brakes.

Grain Storage and Transport at Millwall. — The method of working grain adopted at the Millwall Docks has proved so successful that it has been decided to greatly increase the needful appliances, and an order has just been given to the Midland Railway Carriage and Wagon Company for a further 500 20-ton wagons of the description previously supplied by them to this company. The leading feature of this system is the employment of railway wagons or bins, each of about 20 tons capacity, which are, in fact, travelling granaries; these receive the grain from the importing vessel, and are run back into sidings. Upon application being received the delivery of the grain to craft, vans, or railway wagons, is made at any convenient site. The wagons have numerous outlets each side suitable for the sacking and weighing of the grain. The entire dock is thus available for receipt and delivery, instead of such operations being confined to the limited space of an ordinary granary.

RAILWAY MATTERS.

A RISE of £1 per ton in rails makes a difference of £25,000 per year to the North-Eastern Railway Company.

IN consequence of the success of the tramways in Sydney, meetings have been held in several country towns, agitating for their establishment in those towns.

DURING the past year the London, Chatham, and Dover Railway Company carried 29,000,000 passengers, which is an increase of 1,300,000 since 1871. The train miles made in 1880 were 3,500,000 and the gross sum earned was £1,171,000, as compared with £749,000 in 1871.

FROM Major Marindin's report on the collision which occurred upon the 13th of December, at the locomotive junction, Nine Elms, on the London and South-Western Railway, when the 4 p.m. up passenger train from Kingston came into collision with a light engine standing upon the up Windsor waiting to cross into the locomotive yard, it seems that the collision resulted from a failure in the block working, due to a mistake in the signalling between the Queen's-road junction and the locomotive junction signal-cabins.

THE North-Eastern Railway Company possesses 1459 locomotives. The maximum number daily in steam has been 960, and the engineer and locomotive superintendents estimate that they ought to have 50 per cent. more engines than are in actual use to do the work properly, because there is a certain number in the shops, and some in reserve, and some rebuilding. In 1877 the maximum number in steam was 947 and in stock 1447. In 1878 the maximum number in steam was 873, and in stock 1451. In 1879, 835 were in steam, and 1451 in stock.

THE heaters used on the New York Elevated Railroads consist simply of pipes extending the entire length of the cars. They are coupled from one car to the other by means of rubber hose. The average pressure of steam supplied by the locomotive is 25 lb. This is regulated by a small "pop valve" arranged in the hose under the rear platform of the last car. When the steam reaches any pressure over the desired amount the valve is raised and allows it to escape, thus protecting the hose from bursting when the pressure becomes too great.

COWS must be built with stronger ribs in America than in this country, for an American contemporary says:—"A few nights ago the freight train on the Savannah, Florida, and Western Railway was coming into Albany at the rate of about twenty miles an hour, and a cow was standing on the track. The cowcatcher ran smoothly between her forelegs, lifted her up gently, and took her along for some distance, the cow seemingly contented with her free ride. After a while the engineer halted his train, got down and had to force his bovine 'dead-head' passenger off the engine."

SEVERAL monster freight locomotives are in process of construction for the New York, Pennsylvania, and Ohio Railroad. They rest on six drivers and a four-wheeled truck, and will weigh 38 tons empty. Trainmen, says the *National Car Builder*, are considerably troubled by their trains breaking in two when hauled by these powerful consolidated engines, and the only remedy seems to be heavier draw-bars, links and pins. These engines are approaching some of ours in weight, and the Americans will apparently have to follow us in weight of rolling stock fittings, as they are already in short wagons.

THE work of cutting niches in the Hoosac Tunnel preparatory to laying a double track has begun. These niches are small recesses cut out of the side of the tunnel to enable workmen to have a place of safety for themselves and their tools while working in the tunnel after the double track is laid. The recesses will be 200ft. apart, 3½ft. in depth, 8ft. high, and 6ft. wide. At an interval of every 300ft. a larger niche will be built, the dimensions of which will be 10ft. in depth, 12ft. high, and 8ft. wide. These are designed for construction hand-cars and the larger apparatus used in constructing or repairing the tracks and the interior of the tunnel.

THE Midland Railway Company's return of working stock shows that the company now owns 32,344 engine trucks and carriages, of which ninety-five have been added during the past six months. These ninety-five include twenty-four locomotives with tenders, forty-four new coal wagons, and twenty-seven brake vans. Several trucks and six passenger carriages were withdrawn from service. As indicating the larger amount of business now transacted by the company, it is interesting to note that the stud, which now stands at 2829 horses, has been increased by ninety-four during the half-year, and thirty six new drays and carts, bringing up the total to 2085, have been added to this department.

CIRCULARS have been issued inviting attendance at a meeting of West Riding Traders and season ticket holders at the Victoria Hotel, Bradford, on the 21st inst., at 5 p.m., to consider various proposed reforms in railway matters. Amongst these are:—"(1) Joint use of stations and rolling stock. (2) A uniform 5-mile weekly season ticket for the three classes, taken out at any railway station, at 1s., 1s. 6d., and 2s. for the first five miles or fraction thereof, and at 6d., 9d., and 1s., for each five miles beyond the first five miles for the three classes. The average for all classes of season tickets being under £4 each. (3) The granting of a weekly season ticket, covering the three kingdoms or Europe, at £1, or £3, third class. Supposing 200,000 were issued weekly at £2 each, this would mean 20,000,000 a year, or 1 in every 70 who travel in a week; and in the busy season 500,000 would represent fifty millions of money, dispensing with cheap trips entirely."

THE proposed new railway from Rotherham to Bawtry has met with opposition, remarks our Sheffield correspondent, in an unexpected quarter. It is said that Mr. Wortley, M.P., at the instigation of his colleague, the Right Hon. A. J. Mundella, M.P., has consented to lead opposition to the measure on the ground of the proposed railway passing through Maltby Common. A plan of the proposed railway has been shown to me. The line really touches a corner of the Low or Far Commons, which are swampy places; no one would be likely to go there for health. A railway to Bawtry would be a great convenience to the people of Sheffield and Rotherham, as it would afford them a ready means of access to the common which in some parts is very attractive. There are thirty-six persons who claim to have common rights over the commons in the parish of Maltby, viz., Wood Lee, Stone Low, and Far Common, of these twenty-five have assented to the construction of the railway, one remained neutral, and ten have not yet given any answer. The n[illegible]y li[illegible], it is expected, will also develope the quarries at Wick[illegible]sley, which supply the greater portion of the grindstones used in the Sheffield trade. Other items relate to charges for the use of trucks, charges for horses and cattle, and to an annuity for servants.

CONSIDERABLE annoyance has, it seems, been caused in India by a sudden advance of the rates for carrying wheat and seeds to Bombay by the Great Indian Peninsula Railway, and the question of tariffs is likely to become prominent. The traffic in these commodities to Bombay showed a marked increase last year, the exports of wheat from that port amounting to 94,716 tons against 6007 tons in 1879, while the shipments of linseed were 85,100 tons against 24,000 tons the year before. This increase was of course to some extent due to a recovery from the effects of the famine period. It is argued that the advance of the rates will throw the business which Bombay has begun to develope back to Calcutta. The East India Railway Company are said to have always appreciated the advantage of low rates, and on this account, in spite of the longer voyage to Europe, the longer railway journey, and other disadvantages, that port has been able to compete with Bombay. It is added that the change will be disastrous to merchants, as, ever since the monsoon, contracts have been made for wheat and seeds for delivery in February, March, and April, the prices being based on the railway rates then advertised. The advance amounts to from 11 annas to 2½ rupees per candy, and will be sufficient to turn bare profits, such as are now made, into heavy losses.

NOTES AND MEMORANDA.

THE annual consumption of telegram forms throughout the United Kingdom amounts to 137 millions.

PHOSPHOR bronze is again being recommended for use as telegraph wires, on account of its great conductivity and strength.

A CHEAP and efficient method of constructing and laying underground telegraph and telephone wires or cables in such a way as to secure facility of inspection is much wanted.

TO remove old paint, slake 3 lb. of stone quicklime in water, and add 1 lb. of pearlash, making the whole into the consistence of paint. Lay this over the old work with a brush, and let it remain from twelve to fourteen hours, when the paint is easily scraped off.

A PAPER was recently read before the Academie des Sciences, on a process of total destruction of organic matters, for investigation of poisonous mineral substances, by M. Pouchet. The principle is that it is possible to heat between 300 deg. and 400 deg., in presence of carbon or organic compounds, mineral elements contained in a mixture of sulphuric acid and acid sulphate of potash. The sulphate of potash retains substances the most volatile and decomposable—*e.g.*, salts of mercury—while the organic matters are quickly destroyed.

THE *Bulletin of the Iron and Steel Association* says that "American steel has been exclusively used in the manufacture of the Brooklyn bridgework. The rejections in foreign steel were so great as to render it unprofitable to use it, although the first cost of the wire rods was less." We suppose that "rods" is a misprint for "ropes," that is to say, cables, and the meaning of the passage is not quite clear, but it is probably intended to convey that only the cost of the cable wire was less than that of the rest of the steel used in the bridge. It is a remarkable fact that English steel should have turned out so badly. We should like to hear something about this from the English firms concerned, whom we forbear to name. Is it possible that their representatives in the States were too economical?

IN his recent lecture on "Gas and Electricity as Heating Agents," Dr. Siemens observed that "Although by means of the combustion of either solid or gaseous fuel heats are produced which suffice for all ordinary purposes, there is a limit imposed upon the degree of temperature attainable by any furnace depending upon combustion. It has been shown by Bunsen and by St. Claire-Deville, that at certain temperatures the chemical affinity between oxygen on the one hand and carbon and hydrogen on the other absolutely ceases, and that if the products of combustion CO_2 and H_2O be exposed to such a degree of temperature they would fall to pieces into their constituent elements. This point of dissociation, as it is called, is influenced by pressure, but has been found for CO_2 under atmospheric pressure to be 2600 deg. C.—or 4700 deg. Fah. But long before this extreme point has been arrived at, combustion is greatly retarded, and the limit is reached when the losses of heat by radiation from the furnace balance its production by combustion.

AN alkaline spring has been discovered in Bunhill-row that possesses most of the constituents of Carlsbad water, but in a smaller degree. A tube well 217ft. deep has been recently completed on the premises of Messrs. Le Grand and Sutcliff, Bunhill-row, and an analysis of the spring found in the chalk proves it to be a soft water possessing the character of the spa waters referred to above. The well, although artesian, is only so to a partial extent, and a pump of novel construction raises the water from 123ft., and delivers it at the surface. Since this fact was made public, Mr. J. Lawrence-Hamilton has written to say that alkaline spas are plentiful in all parts of London. Wherever a well is sunk to a sufficient depth in London, alkaline water is sure to be reached either a few hundred feet from the surface or much deeper down in the greensand. As a notable instance of a strongly alkaline water, he refers to the water yielded by the artesian well in Trafalgar-square and with which St. James's Palace is supplied. At Streatham there is a Spa, the waters of which contain a very large quantity of sulphate of magnesia, and also sulphuretted hydrogen.

A CORRESPONDENT, "A. P. S.," sends an interesting note upon the action of frost on different liquids in glass bottles, to *Nature*. He says that "During the late severe frost we had a number of bottles broken in our laboratory by the freezing of their contents, and it is curious to observe what salts tend to prevent such an occurrence. Out of thirty sets of reagents the following were destroyed:—27 ammonium oscalate, 7 calcium sulphate, 8 potassium ferrocyanide, 1 lead acetate. It is remarkable that not one bottle of lime-water was frozen. That calcium sulphate, which only contains $\frac{1}{500}$ of solid, should freeze, is not astonishing; but the ammonium oscalate bore away the palm with ease, although the amount dissolved was considerable. A single bottle of saturated solution of alum was broken, also one of mercuric chloride. A curious thing happened to one bottle, which shows, he thinks, that ice does not expand suddenly when it freezes. He unstoppered a bottle of Am_2O that was still liquid, when the contents immediately solidified in his hand, without bursting the bottle. The next day he found the ice had protruded 3½in. from the neck of the bottle, carrying the stopper at its extremity."

IT has sometimes been noticed that shrubs on hills are less injured in some winters than those in valleys. It would appear that this is due to the fact that the hill plants are less subject to sudden and frequent variations of temperature. Some observations made at Giessen last winter by Herr Hoffmann throw light on the way in which plants are injured in time of hard frost. The great advantage of a hilly position was then apparent; the plants so situated took little or no harm, while quite near, in the valley, there was extensive injury. The injury, too, decreased in proportion to elevation above the valley. Some tender fruit trees placed in specially favourable circumstances on the low ground withstood the lowest temperature—23 deg. R. Still more instructive was the fact that one and the same bush—*e.g.*, *buxus*, or *thuja*—was killed in its foliage on the south side, while on the north side it remained green. Herr Hoffmann also considers that when plants are thoroughly frozen the killing takes place as surely whether the temperature of the plant be raised 20 deg.—*i.e.*, from minus 17 deg. to plus 3 deg.—or from minus 10 deg. to plus 10 deg. With each degree of less variation the injury is proportionally less, and for each species the fatal amplitude of variation is special and determinate.

THE apparatus employed by Dr. Siemens to effect the electro-fusion of such materials as iron or platinum, and a modification of which he considers will eventually be generally used for producing very high temperatures and for melting irridium, consists of an ordinary crucible of plumbago or other highly refractory material, placed in a metallic jacket or outer casing, the intervening space being filled up with pounded charcoal or other bad conductor of heat. A hole is pierced through the bottom of the crucible for the admission of a rod of iron, platinum, or dense carbon, such as is used in electric illumination. The cover of the crucible is also pierced for the reception of the negative electrode, by preference a cylinder of compressed carbon of comparatively large dimensions. At one end of a beam, supported at its centre, is suspended the negative electrode by means of a strip of copper, or other good conductor of electricity, the other end of the beam being attached to a hollow cylinder of soft iron free to move vertically within a solenoid coil of wire, presenting a total resistance of about fifty units or ohms. By means of a sliding weight the preponderance of the beam in the direction of the solenoid can be varied so as to balance the magnetic force with which the hollow iron cylinder is drawn into the coil. One end of the solenoid coil is connected with the positive and the other with the negative pole of the electric arc, and, being a coil of high resistance, its attractive force on the iron cylinder is proportional to the electro-motive force between the two electrodes, or, in other words, to the electrical resistance of the arc itself.

MISCELLANEA.

THE revenue of the Colony of New South Wales during the past year shows an increase of no less than £600,000 over that of 1879.

IT is stated that Mr. Silbiger has contracted for the construction of an electric railway between Shipping Point and the camp at Aden.

MR. EDMUND YATES will preside at the festival of the Newsvendors' Benevolent and Provident Institution, to be held at Willis's-rooms on Friday, 4th March next.

AT the meeting of the Leeds Civil and Mechanical Engineers' Society held on the 28th ult., a paper on "Traction Dynamometers and some Results of their Application" was read by Mr. G. F. Charnock.

DURING the year 1880 the Bridgewater Navigation Company carried 2,645,296 tons of merchandise, or 333,000 tons more than in the previous year. The total revenue amounted to £337,488, about £35,000 more than last year.

Mr. W. A. SUMMERS, whose death we recorded last week, had retired from the firm of Day, Summers, and Co. about twenty-one years, and since then had not engaged in engineering operations. Mr. Thos. Summers is still a member of the firm.

A SHEET works in the Dudley district that has been idle for a few years, known as the Staffordshire Ironworks, Greets' Green, is now under repair, and is about to be restarted by Mr. Grice, formerly with Messrs. Morewood and Co., Smethwick.

THE death, at the age of sixty-nine, of Mr. Wm. Mander Sparrow, of Albrighton Hall, has occurred. The deceased was a senior partner in the Osier Bed Iron Company, Wolverhampton; but for the past few years the business has been practically carried on by Mr. Sparrow's nephews, who are the other partners—Mr. W. A. Brown and Mr. T. W. H. Fowke.

A NEW edition is about to be published of the "Dictionnaire des Arts and Manufactures et de l'Agriculture, by M. Ch. Laboulaye. This is the fifth edition of this dictionary, and will be published in parts or in four volumes. It is a useful dictionary, but we may express the hope that either some new illustrations will be cut for the new edition, or that they will be much better printed than they are in the prospectus.

MESSRS. ROBERT THOMPSON AND SONS have successfully launched from their shipbuilding yard, Southwick, Sunderland, an iron screw steamer, the Regent, of the following dimensions: 290ft. long by 37ft. broad, and 28ft. depth of hold, having been constructed on the spar deck rule, under Lloyd's special survey to class 100 A1, and the Board of Trade for passenger certificate. Her engines are inverted compound surface condensing engines of 200-horse power, built by the North Eastern Marine Engineering Company, Limited, Sunderland.

A PAPER advocating the superiority of hydraulic over screw jacks was read by Mr. Corby at the meeting of the Manchester Scientific and Mechanical Society on Friday. The reader condemned the screw jack as a relic of barbarism, and expressed his astonishment that there were so very few mechanics who understood the hydraulic jack, simple as it was. He urged that in every works where there was any lifting to be done there should be at least one hydraulic jack, and he thought the day was not far distant when the screw jack would be a thing of the past.

THE Northern District meeting of the Association of Municipal and Sanitary Engineers and Surveyors will be held at Blaydon-on-Tyne, Friday, 25th February, 1881. The members will assemble at 12.0 in the large room, Station Hotel, Blaydon. The following papers will be read and discussed:—"Roadways, &c.," by James Hall, borough surveyor, Stockton; "Wood Pavements," by R. S. Rounthwaite, borough surveyor, Sunderland. During the day the works of Messrs. Smith, Patterson, and Co., sanitary ironfounders, Messrs. Douglas Brothers' Ironworks, Messrs, Harriman and Co.'s pipe works, and Blaydon Bottle Works will be visited.

AT the meeting of the Metropolitan Board of Works, last Friday, Mr. White introduced a deputation from the Westminster District Board of Works, who presented a memorial on the subject of widening and otherwise improving Vauxhall Bridge. The memorial stated that a bill had been introduced by the board into Parliament, empowering the board to alter Vauxhall Bridge by removing the two central piers and converting the three central arches into one span or opening. The memorialists, while acknowledging the great importance of this proposal, strongly urged the necessity for widening the bridge, and improving the carriageway and footways. The memorial was referred to the Bridges Committee.

A CORRESPONDENT sends the following report, taken from the *Sheffield Daily Telegraph*, of an action taken under the Employers' Liability Act:—"At the Lincoln county-court yesterday, Judge Stephens had before him the case of Charles William Paulger *v.* the North Lincolnshire Iron Company, which had been remitted from a superior court, and was brought to recover damages from the defendants for injuries sustained through their negligence. The damages were laid at £500. Plaintiff, a boy in employ of defendants, had an arm broken through the fall of a wagon from a drop on to the office in which he was working. The jury considered the office ought not to have been under the drop, and found a verdict for plaintiff—damages £275."

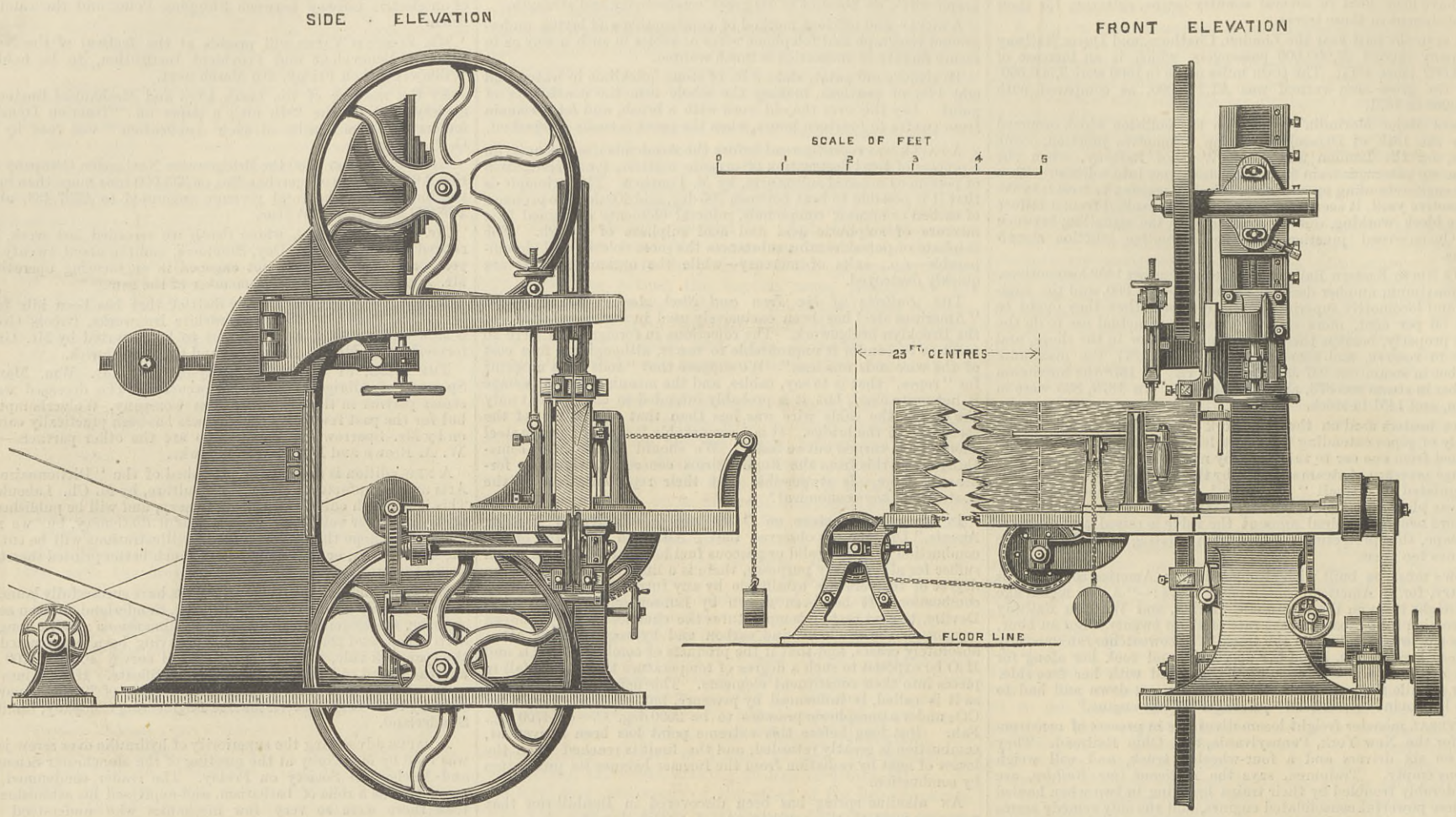
THE Swan's Electric Light Company has been registered, and, according to the terms of the agreement, Mr. Swan is to be one of the few fortunate inventors and patentees who are rewarded for their ability and energy. The capital of the company is to be £100,000, of which Mr. Swan is to be paid £25,000 in cash and 2500 fully paid-up shares. He is, moreover, to be appointed managing director of the technical department for fourteen years at a salary of £1000 per year. Thus, if it all comes about, Mr. Swan will receive for his inventions, past work, and future fourteen years' managing directorship, the sum total of £64,000; but this is, after all, not much for about a quarter of a century's thought, and, at least, twenty years' work—not as much as numerous merchants and stockbrokers make in the time. Mr. Swan has recently taken out new patents.

MR. JOHNSON, the electrician to Messrs. Tasker, Sons, and Co., Sheffield, has patented a microphonic transmitter, which is, our Sheffield correspondent says, reported to be, in combination with Professor Bell's receiver, the most powerful and distinct method of transmitting messages hitherto known. This transmitter has just been fixed to a wire connecting the Atlas Works of Messrs. John Brown and Co., in Sheffield, with their collieries at Carr-house and Aldwarke Main, some eight or nine miles away. Messrs. Steel, Tozer, and Hampton have similarly connected their Bessemer works at the Ickles with their offices in George-street and the Central Telephone Exchange. These are the largest telephonic circuits in the neighbourhood of Sheffield, but conversation is kept up with an ease which seems even to surpass the facilities obtained from other instruments attached to shorter circuits.

THE regulations for the London International Medical and Sanitary Exhibition, to be held by the Parkes Museum of Hygiene, at South Kensington, July 16th to August 13th, have been finally decided upon. The charge for floor space is to be £1 per foot frontage, with an average depth of 6ft.; wall space, from 5s. to 10s. per square yard. It may be here remarked that the mercantile spirit of South Kensington is here very evident in the charge of no less than £1 10s. per square yard to exhibitors, who are to show articles for the "advancement of science," and of from 5s. to 10s. to anyone who wishes to instruct the public in sanitary matters by hanging up a drawing. Applications for space must include a description of the articles proposed to be exhibited. For machinery in motion exhibitors will have to provide gas engines. New inventions will be protected under the Protection of Inventions Act, 1870. The work of organisation will be carried on at the Parkes Museum, and for this purpose the Library of the Museum will be open daily from 10 to 4, Saturdays, 10 to 2.

BAND SAWING MACHINE WITH SELF-ACTING FEED.

MESSRS. CHARLES POWIS AND CO., ENGINEERS, MILLWALL.



This machine has been specially designed and constructed by Messrs. Charles Powis and Co., Cyclops Works, Millwall Pier, London, to saw logs, flitches, and deals into boards of any thickness, by the continuous action of a band saw. The wheels, 48in. in diameter, are covered with two thicknesses of leather; the lower one runs on a fixed spindle, the upper one has a convenient arrangement for adjustment, and is fitted with a patent tension apparatus to prevent the breakage of saws.

The wood is supported by a table, and brought up to the saw by a pitch chain, and dogs attached to the chain. The feed is continuous, and can be varied in speed to suit any class of timber, whether hard or soft. The fence is provided with a screw and nut to enable the nicest adjustment to be made, and with a pressure roller and levers to keep the wood up to the fence.

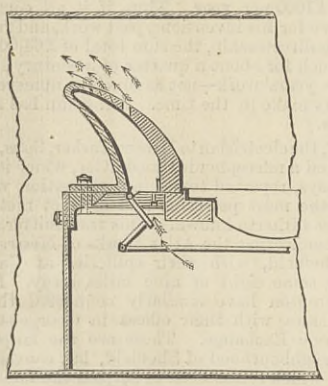
To facilitate the removal of the fence when the machine is not required for deal cutting, a portable jib crane has been attached to the main frame, and by means of wheel and screw one man can easily remove the fence.

The table can be set at any angle for bevel cutting. The jib may also be used in lifting and removing timber from or on to the table as may be required.

The countershaft for working the feed is fitted with fast and loose pulleys, bringing the feed entirely under the control of the workman. It is separate from the machine, and may be fixed either above or below the floor line as may be most convenient. The framing is a massive cored casting with a large base permitting the machine to be driven at a high velocity without vibration. It is constructed in a thoroughly sound and substantial manner, and may be regarded as a satisfactory machine.

HAMPTON'S SMOKE CONSUMING FURNACE BRIDGES.

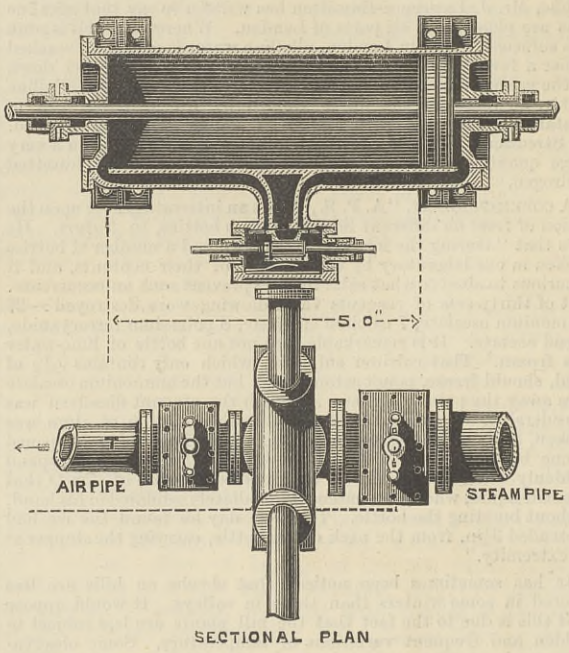
The smoke consuming bridge shown by the annexed engraving has now been fitted to boilers in a large number of works, and much satisfaction is expressed with the results obtained. The invention consists in the employment of a hollow perforated bridge through which air from the ashpit is admitted, the quantity of air being controlled by the valve seen at the bottom of the bridge, and which is operated by the connecting rod, which is

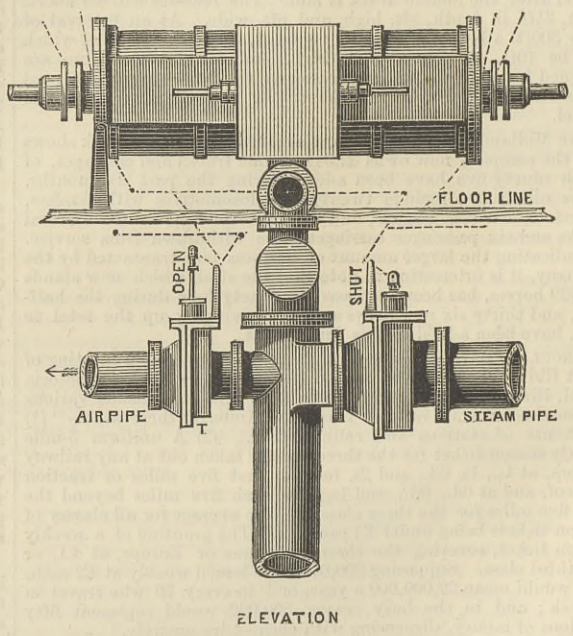


carried to the front of the boiler. By this means the quantity of admitted air may be increased when coal is freshly added and reduced as the fire burns clear. The parts are made so as to be readily fitted to any furnace and for renewal, and the whole is sufficiently simple to prevent disarrangement. Different opinions are held by engineers as to the propriety and economy of admitting air into this part of the furnace, but the testimonials submitted to us by Mr. Hampton are in favour of his invention. The bridges are made by Mr. J. Hampton, Loughborough.

PATERSON'S AIR BRAKE.

At one of the pits at Blantyre Colliery the engine draws coals with one cage only, so that in the descent the cage had to be regulated either by means of a brake or checking it with steam. This was found to be very objectionable, and about two years ago Mr. James Paterson, engineer of the colliery, invented an arrangement in which the piston of the engine acts the part of an air brake. The accompanying engraving explains the action. The engines have a pair of 30in. cylinders with the drum placed

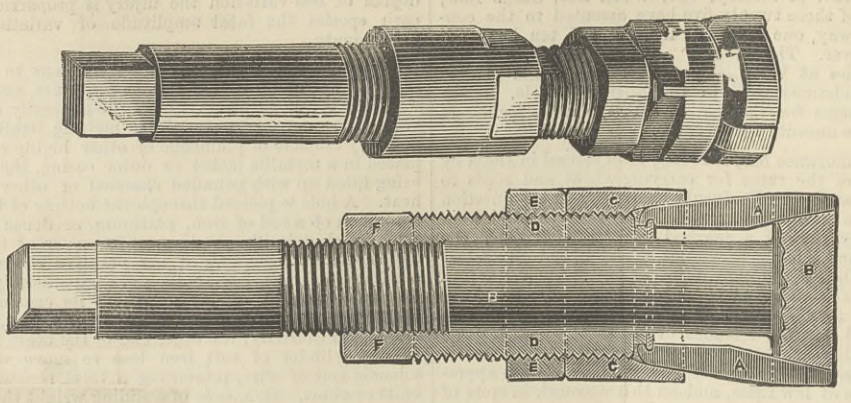




between, and work with the ordinary link motion. Between the cylinders and the throttle valve is placed a branch pipe with a throttle valve T opening to the atmosphere. The engineman works these valves by means of levers placed close to his hand, the line of which is shown by the dotted lines. When the cage and its load is ready for the ascent the link is put in forward gear. and the speed regulated by the steam throttle valve. When it reaches the surface and is about to make the descent, the link is kept in the same forward motion, the steam throttle valve is shut and the air valve is opened. The weight of the cage causes its descent, but the speed of it is regulated by the opening of the air valve, the piston becoming for the time an air compressor, drawing air from the exhaust and expelling it by this valve. This arrangement has worked very well, and continues to give great satisfaction.

TIMMS' EXPANDING BORING TOOL.

We illustrate in the accompanying engraving a new tool being introduced here by Messrs. Selig, Sonnenthal, and Co., Queen Victoria-street. The tool comprises a central spindle B, with a boss or disc at one end; in the boss are three longitudinal grooves cut for the insertion of an equal number of small steel cutters A, which fit accurately in the grooves, and project radially from the boss to the required extent of hole to be cut; the grooves are tapered and the cutters are tapered correspondingly, and retained in their position by notches at the end which fit on to a hollow sleeve C; this sleeve moves longitudinally on the spindle, and thereby expands the cutters to the desired size by sliding them out or in on the inclined surfaces of their grooves.



A strong steel nut C with an internal bevelled surface corresponding to the bevelled surface of the cutters is then screwed upon the cutters, and keeps them firmly in position; this bevelled nut is also locked by a jam nut E, making it impossible for the cutters to move out of position.

PLANT FOR THE SOFTENING, PURIFICATION, AND FILTRATION OF WATER.

MR. J. H. PORTER C. E., LONDON, ENGINEER.

(*For description see page* 122.)

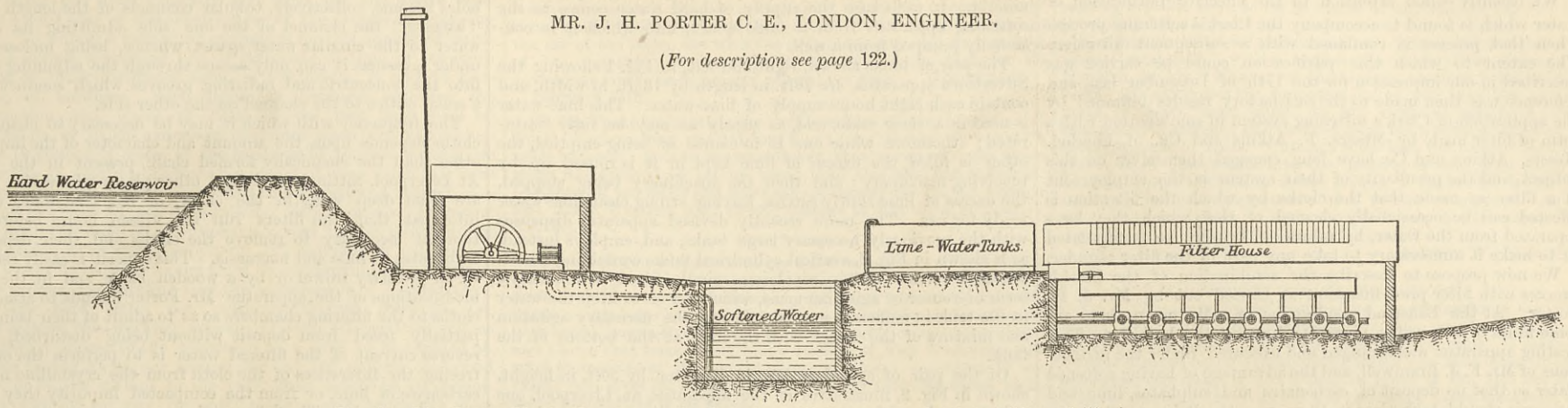
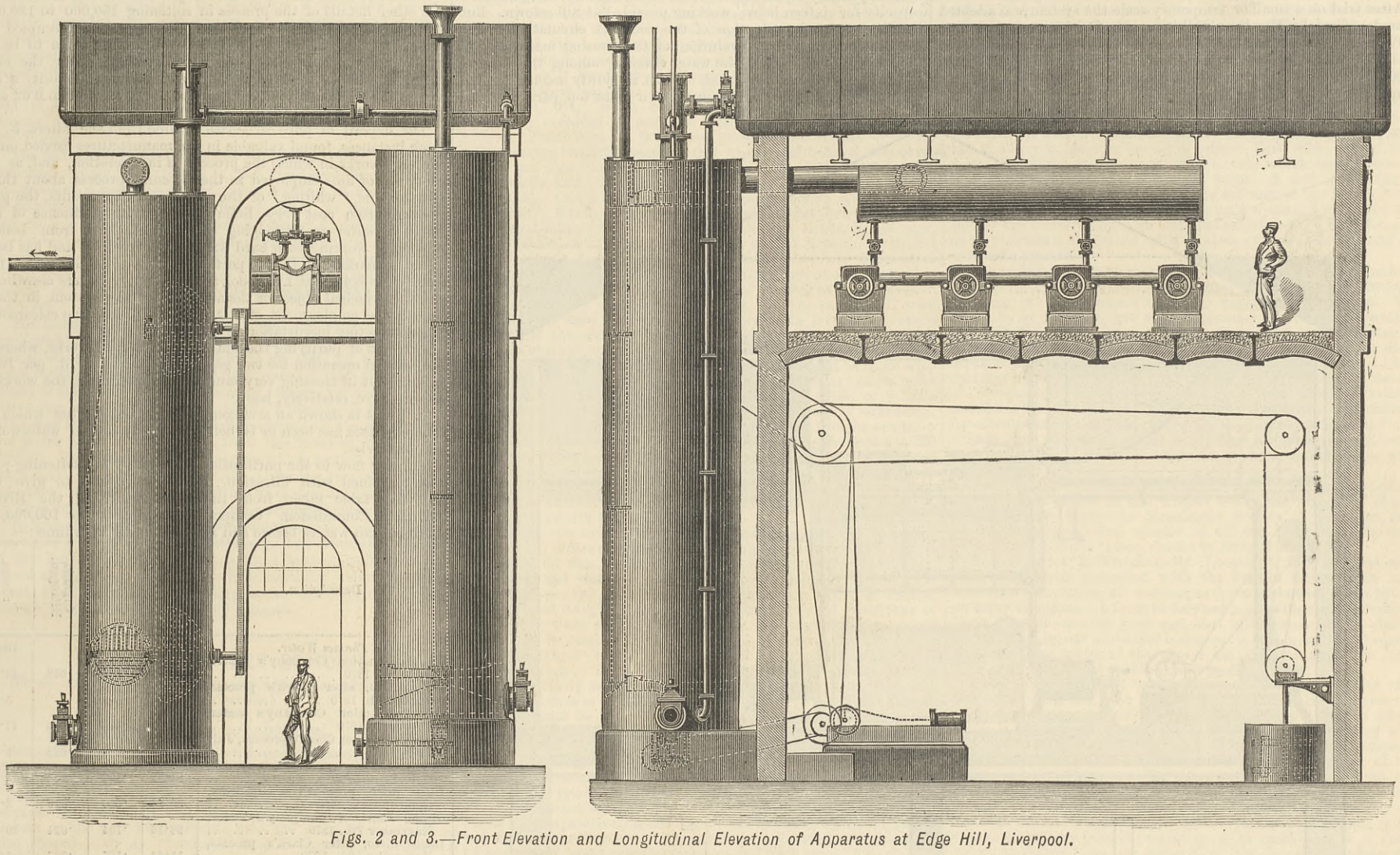


Fig. 5.—The Porter-Clark Process at the Swindon Waterworks.—Sectional View of Works.



Figs. 2 and 3.—Front Elevation and Longitudinal Elevation of Apparatus at Edge Hill, Liverpool.

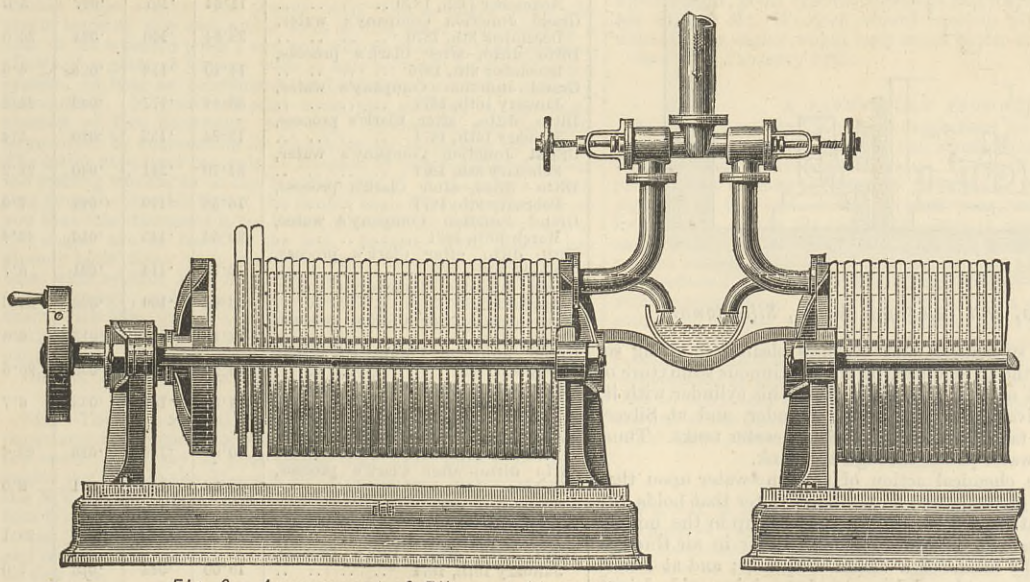


Fig. 6.—Arrangement of Filters at Liverpool.

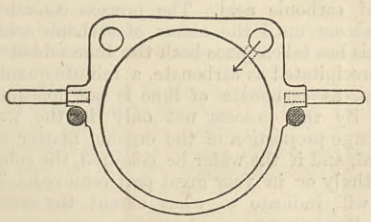


Fig. 7.—Water-space Frame.

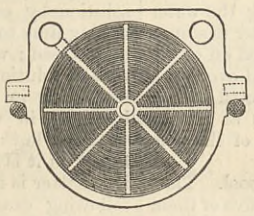


Fig. 8.—Filtering Plate or Chamber.

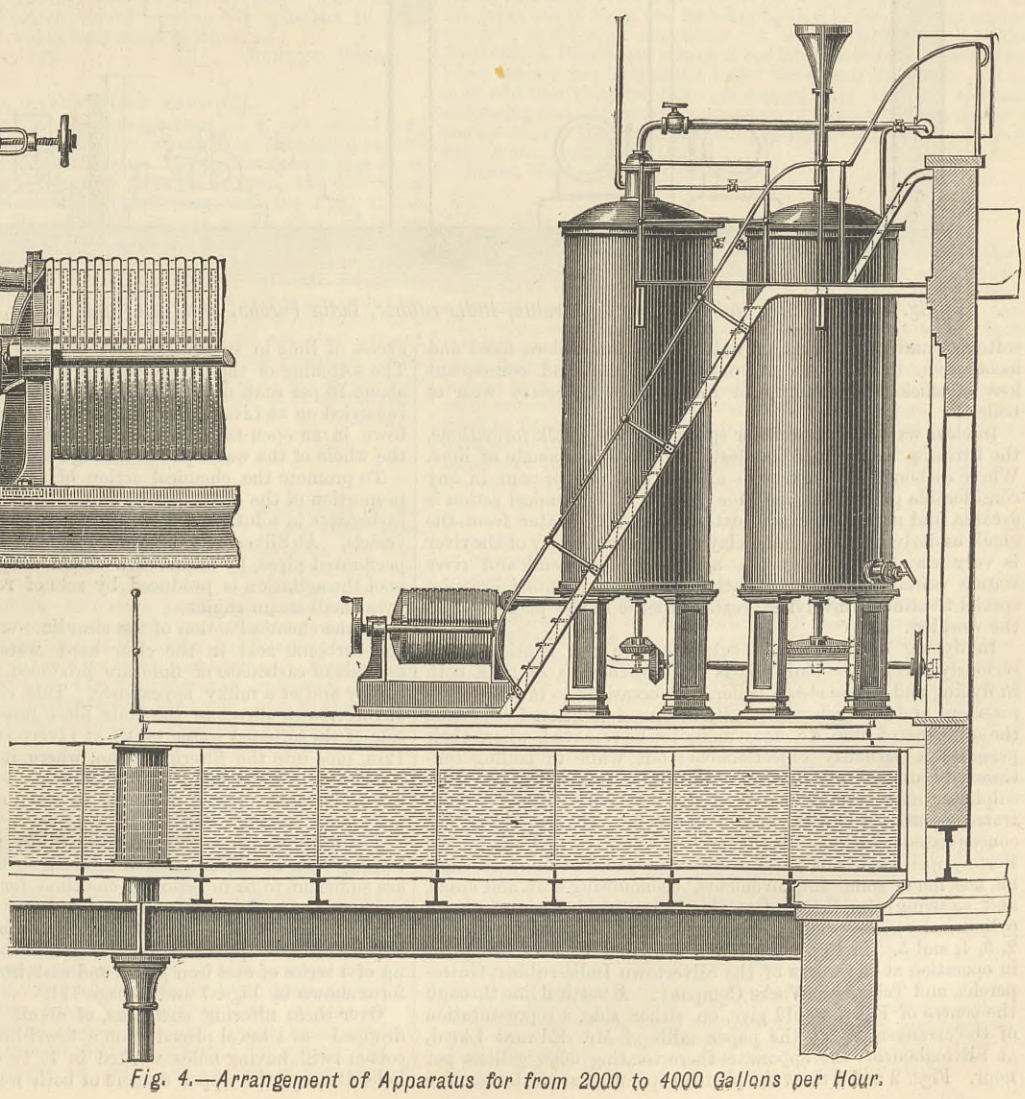


Fig. 4.—Arrangement of Apparatus for from 2000 to 4000 Gallons per Hour.

THE PURIFICATION AND SOFTENING OF WATER.

We recently called attention to the effective purification of water which is found to accompany the Clark's softening process when that process is combined with a subsequent filtration. The extent to which this purification could be carried was described in our impression for the 17th of December last, and reference was then made to the satisfactory results obtained by the application of Clark's softening system in combination with a form of filter made by Messrs. F. Atkins and Co., of London. Messrs. Atkins and Co. have long engaged themselves on this subject, and the peculiarity of their system is the employment of a filter so made that the cloths by which the filtration is effected can be occasionally cleaned of that which they have separated from the water, by means of brushes so manipulated as to make it unnecessary to take any part of the filter asunder.

We now propose to describe the combination of the Clark's process with filter press filtration as carried out by Mr. J. H. Porter. At the Banstead Asylum, as is well known, there are some miles of hot water pipes for heating the building. This heating apparatus was arranged and executed under the instructions of Mr. F. J. Bramwell, and the advantage of having softened water so that no deposit of carbonates and sulphates, lime and magnesia should take place in them, was the inducement to try the system of softening and filtration devised by Mr. Porter. After trial on a small or temporary scale the system was adopted as described by Mr. Bramwell before the British Association at Plymouth, in August, 1877. Since that time the arrangement of apparatus necessary for the combined processes has been largely adopted in manufactories, in private and public buildings, and for town water supply, and even more largely for the

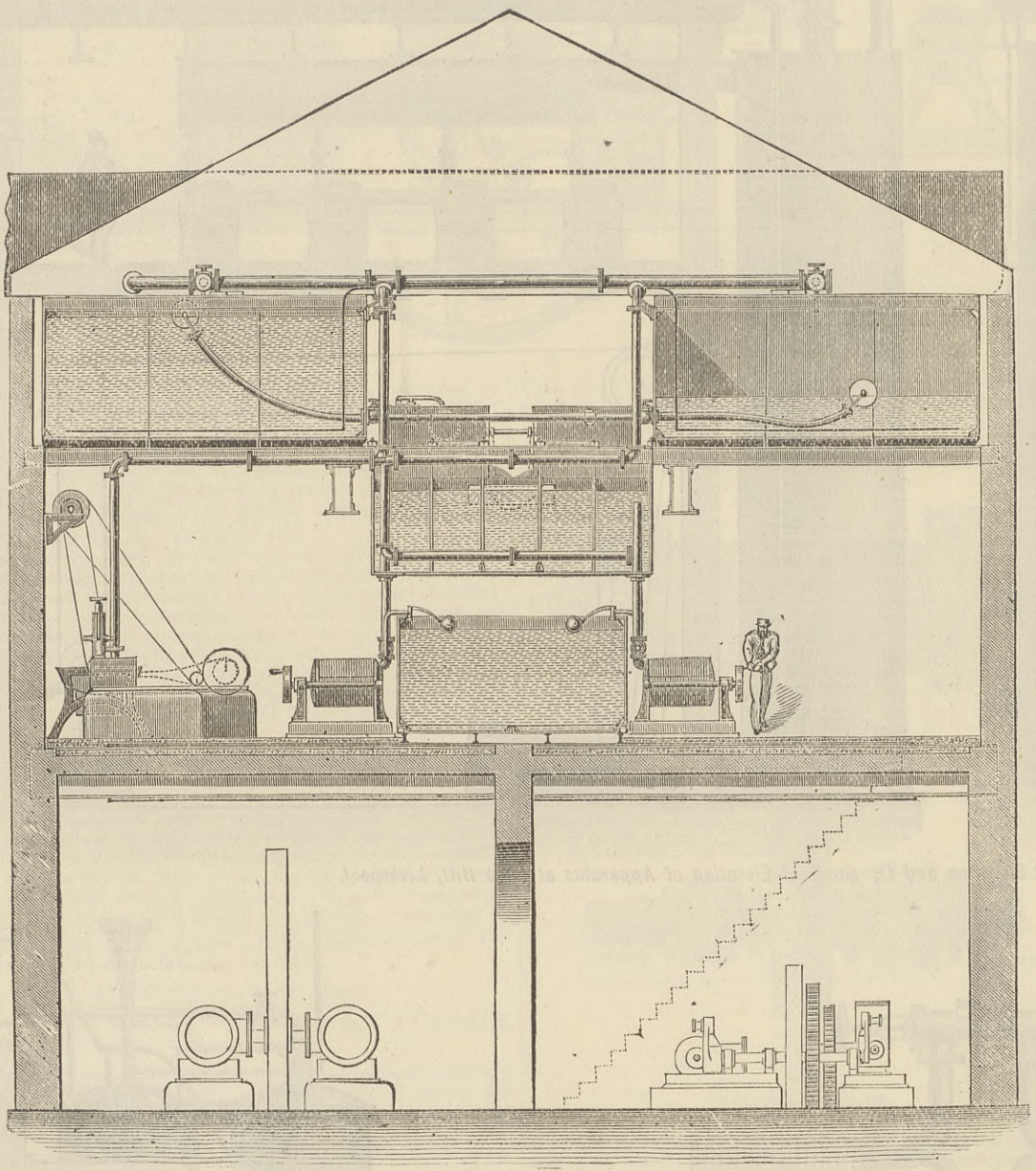


Fig. 1.—Softening and Filtering Apparatus, India-rubber, Gutta Percha, and Telegraph Works, Silvertown.

softening and purification of water for steam boilers, fixed and locomotive, in order to prevent incrustation and consequent loss of efficiency, economy in fuel, and unnecessary wear of boilers.

In clear waters from wells or springs of the chalk formations, the hardness is produced almost entirely by carbonate of lime. Where carbonates of magnesia and of iron are present in any considerable proportion, the time necessary for chemical action is greater, and necessitates more extensive plant. Water from the chalk underlying the London clay and in the vicinity of the river is very variable in character, and may—like pond and river waters containing organic matter and some alumina—require special treatment, involving greater expense in the plant and in the working.

In dyeing operations the sulphates are not considered to seriously affect the colours; it is the bicarbonate of lime, both in dyeing and in the steam boiler, that occasions so much embarrassment and so much waste. By means of additional re-agents, the sulphates of lime, &c., may moreover be removed, where their presence is seriously objectionable; but, while in boiling continuously under considerable pressure, a proportion of these sulphates may crystallise out as the solution becomes concentrated, occasional blowing out of the boiler will get rid of the concentrated solution. In the earlier works carried out by Mr. Porter, open vessels or tanks were employed, but more recently he has made some improvements, economising cost and space, and securing simplicity of working, by making use of closed cylindrical vessels. The two systems are illustrated by Figs. 1, 2, 3, 4, and 5. In Fig. 1 is given a sectional view of the plant in operation at the works of the Silvertown India-rubber, Gutta-percha, and Telegraph Works Company. A vertical line through the centre of Fig. 1 would give, on either side, a representation of the arrangement at the paper mills of Mr. Edward Lloyd, at Sittingbourne, the apparatus there treating 6000 gallons per hour. Figs. 2 and 3 show the plant in operation at the locomotive sheds of the London and North-Western Railway Company in Liverpool. At Silvertown 12,000, and at Liverpool 15,000 gallons of water are treated per hour continuously, or over a ton per minute. In each case the supply of hard water comes to the softening apparatus from a tank above, into which it is continually pumped from a well.

The pair of tanks shown, right and left, in Fig. 1 showing the Silvertown apparatus, are 29ft. in length by 13½ft. in width, and contain each eight hours supply of lime-water. This lime-water is used in a clear state, and, as nearly as may be, fully "saturated;" therefore while one is in course of being emptied, the other is filled, the excess of lime kept in it is roused up by revolving machinery; and then, the machinery being stopped, the excess of lime slowly settles, leaving strong clear lime-water ready for use. The more recently devised apparatus dispenses with the previously necessary large tanks, and employs instead, as is shown in Fig. 2, vertical cylindrical tanks containing a horizontal or vertical slowly revolving spindle fitted with a simple form of rouser or agitating arms, which serve to keep the water in the tank in sufficient motion to cause the necessary agitation and mixture of the water with the lime at the bottom of the tank.

Of the pair of cylinders, 7ft. in diameter by 30ft. in height, shown in Fig. 2, illustrative of the apparatus at Liverpool, one only is employed for the preparation of the lime-water, and contains a quantity equal to four hours' working only, as against the capacity for sixteen hours' working provided at Silvertown. But in this case, by the adoption of the constant circulation, and a constant but very slow revolution of the rousing machinery at the bottom of the vessel, the water entering among the lime at the bottom becomes saturated, and, as it slowly ascends by the current induced by the outlet pipe shown at the top, parts with the excess of lime in suspension, and becomes cleared in doing so. The softening of the hard water, by the continuous admixture of about 10 per cent. of this lime-water from this cylinder with it, is carried on at Liverpool in the second cylinder, and at Silvertown in an open tank between the two lime-water tanks. Thus, the whole of the water passes through this tank.

To promote the chemical action of the lime-water upon that proportion of the carbonic acid of the hard water that holds the carbonates in solution, a brisk agitation is kept up in the mixing vessels. At Silvertown this is done by forcing in air through perforated pipes, by means of a steam air pump; and at Liverpool the agitation is produced by sets of revolving grids driven by a small steam engine.

As the chemical action of the clear lime-water takes effect upon the carbonic acid in the clear hard water, infinitely minute crystals of carbonate of lime are produced, rendering the water chalky and of a milky appearance. This chalky water descends at Silvertown direct to the four filter presses ranged on either side of the softened water tank; at Liverpool it is led over by a 12in. pipe into the filtering room, where it is connected with a horizontal cylinder 2ft. 9in. in diameter; whence, as at Silvertown, the chalky water descends to the four pairs of filtering machines—see Figs. 3 and 6.

Fig. 6 illustrates a pair of these filters at Liverpool. They contain each 100 square feet of filtering surface, and five of them are sufficient to be in action at one time for the 15,000 gallons per hour. At Silvertown, where the water is less pure, and the head of pressure also less, a larger proportionate filtering area is required for the quantity of water treated. Each filter is made up of a series of cast iron plates and cast iron open frames of the form shown by Figs. 7 and 8, page 121.

Over these filtering chambers, of about 1in. in thickness, is dropped—as a towel placed upon a towel-horse—a cloth of fine cotton twill, having holes worked in it to correspond with the holes through the upper corners of both water space frames and filtering chambers. When these alternate water spaces and filtering chambers with cloths are pressed closely and tightly together by a powerful end-screw, it will be seen that the holes become, collectively, tubular channels of the length of the "battery," the channel of the one side admitting its chalky water to the circular water spaces, whence, being inclosed, and under pressure, it can only escape through the adjoining cloths into the concentric and radiating grooves which conduct it by a small outlet to the channel on the other side.

The frequency with which it may be necessary to change the cloths depends upon the amount and character of the impurity, other than the chemically formed chalk, present in the water. At Liverpool, Sittingbourne, and other places where the waters are from deep wells in the chalk, or red sandstone, we are informed that the filters run for fifteen hours before it is thought necessary to remove the cloths and their deposit of carbonates of lime and magnesia. This deposit is easily removed by an ordinary trowel or by a wooden blade, and in the other modifications of the apparatus Mr. Porter intends to attach the cloths to the filtering chambers so as to admit of their being thus partially freed from deposit without being disturbed, and a reverse current of the filtered water is to perform the office of freeing the interstices of the cloth from the crystalline mass of carbonate of lime, or from the compacted impurity they would otherwise retain. The labour of one man, however, is found sufficient at Edge Hill to cleanse cloths and filters and attend to the other details of the process in softening 150,000 to 180,000 gallons for the day's work, so that the time occupied in removing and cleaning filter cloths does not seem to be of great importance in all cases. At Silvertown, where the character of the water gives a slimy and viscous deposit, a lad assists the workman, and their united wages amount to 0·62 of a penny per thousand gallons.

The deposit of pure carbonate of lime from the filters is, in some instances, found valuable in the manufactures carried on at the very works in which the process is in operation, and, as for every ton of lime employed in the softening process about three tons of this "whiting," of the purest quality, results, the process will often cost very little indeed. The influence of the softened water in dislodging old incrustations from boilers previously working with hard water is very curious, and has been often remarked. It is particularly noticeable with the locomotive boilers at Liverpool, as in stationary boilers elsewhere, and the principal object of the adoption of the system in these cases is the employment of water that will leave no calcareous, non-conducting incrustation in the boilers.

The cost of purifying the water at Mr. Lloyd's works, where it has been in operation for two years, is found to be 1d. per 1000 gallons, but in treating very much larger quantities, the working expenses are, relatively, less.

In Fig. 4 is shown an arrangement of the apparatus which in different sizes has been or is being fitted in several waterworks and breweries.

Turning now to the purification effected by the softening process combined with filtration, it may be useful to give the following table taken from the sixth report of the Rivers Pollution Commission. Composition, in parts per 100,000, of metropolitan waters before and after softening with lime :—

Description.	Total solid matters.	Organic Carbon.	Organic Nitrogen.	rdness.
				Deg.
Thames Water.				
Grand Junction Company's water, June 1st, 1870	23·98	·144	·018	18·8
Ditto ditto, after Clark's process, June, 19th, 1870	9·26	—	—	3·8
Grand Junction Company's water, July 13th, 1870	23·02	·123	·023	17·6
Ditto ditto, after Clark's process, July 11th, 1870	10·00	·080	·022	3·6
Grand Junction Company's water, October 10th, 1870	24·72	·102	·014	21·8
Ditto ditto, after Clark's process, October 12th, 1870	9·26	·066	·019	3·4
Grand Junction Company's water, November 7th, 1870	28·10	·134	·024	20·3
Ditto ditto, after Clark's process, November 14th, 1870	11·64	·127	·027	5·0
Grand Junction Company's water, December 8th, 1870	28·84	·166	·024	20·6
Ditto ditto, after Clark's process, December 8th, 1870	14·10	·118	·021	4·9
Grand Junction Company's water, January 16th, 1871	30·24	·177	·042	21·8
Ditto ditto, after Clark's process, January 16th, 1871	13·84	·153	·019	5·4
Grand Junction Company's water, February 8th, 1871	31·70	·241	·040	21·2
Ditto ditto, after Clark's process, February 9th, 1871	16·58	·179	·021	7·0
Grand Junction Company's water, March 10th, 1871	29·56	·145	·016	22·4
Ditto ditto, after Clark's process, March 10th, 1871	13·70	·114	·021	5·7
Grand Junction Company's water, April 15th, 1871	26·22	·109	·022	20·6
Ditto ditto, after Clark's process, April 15th, 1871	12·18	·080	·013	4·6
Grand Junction Company's water, May 9th, 1871	28·26	·248	·033	20·6
Ditto ditto, after Clark's process, May 9th, 1871	14·34	·181	·033	6·7
Lee Water.				
New River Company's water, February 14th, 1871	30·60	·135	·018	22·4
Ditto ditto, after Clark's process, February 14th, 1871	13·76	·100	·011	6·0
Water from deep Wells in the Chalk.				
Kent Company's water, January 16th, 1871	40·42	·045	·014	29·1
Ditto ditto, after Clark's process, January 16th, 1871	19·00	·044	·016	7·0

Professor Wanklyn wrote of the process by precipitation without any filtration :—"Waters to which this method of purification is adapted are such as contain carbonate of lime retained in solution by excess of carbonic acid. The process consists in adding lime to such waters until the excess of carbonic acid is neutralised; when this has taken place both the lime added and that in solution are precipitated as carbonate, a minute quantity remaining in solution, as carbonate of lime is not absolutely insoluble in water. By this process not only is the water softened, but a very large proportion of the organic matter contained in it is removed, and if the water be coloured, the colouring matter is also entirely or in very great part removed. The following examples will indicate to what extent the organic matter is removed by this process :—

Parts per 1,000,000.

		Free. NH_3.	Albuminoid. NH_3.
I.	Before Clark's process	0·01	0·05
	After ,, ,,	0·01	0·02
II.	Before Clark's process	0·025	0·22
	After ,, ,,	0·030	0·08
III.	Before Clark's process	0·015	0·22
	After ,, ,,	0·020	0·07
IV.	Before Clark's process	0·195	0·12
	After ,, ,,	0·15	0·06

"It is to be observed, that the organic matter removed can be proved to be present in the chalk precipitated."

Of the hardening salts present in potable water, carbonate of lime is the one most generally met with, and the above table gives a good idea of the effectiveness of the process in removing this. To obtain a numerical expression for this quality of hardness, a sample containing 1 lb. of carbonate of lime, or its equivalent in other hardening salts, in 100,000 lb., is said to have 1 deg. of hardness. Each degree of hardness indicates the destruction and waste of 12 lb. of the best hard soap by 100,000 lb., or 10,000 gallons of the water when used in washing. Thus 10 gallons of water of the hardness of Thames water cause the waste of nearly a quarter of a pound of soap when it is used for washing, and yet the water may be softened and filtered at a cost of less than 1d. per 1000 gallons. It is, however, estimated that upon the scale of operations involved in the treatment of the London river water supply of 125 millions of gallons, the cost would be reduced to one-third or one-fourth of a penny per 1000 gallons. Considering that the householder of London pays, for very hard water not perfectly filtered, fully 2s. per 1000 gallons, the working expense of even 1d. per 1000 gallons will hardly appear to the consumer as a sum to be cavilled at. To one paying £4 4s. per annum for say 100 gallons consumed daily, or 36,500 gallons in the year, 36½d. would be an insignificant addition to pay for soft, purified and brilliantly clear water.

In 1877 the directors of the Swindon Waterworks Company had to consider the best system for purifying and partially softening the water supply of Old and New Swindon; and, after studying the various systems in operation—visiting among others the older works at Canterbury, and the examples of the process in operation at the works of Mr. Duncan, in London, and at the New Middlesex County Asylum, at Banstead, in Surrey, they gave the preference to the system adopted by Mr. Porter.

The water supply of the towns of Old and New Swindon is collected chiefly from springs in the greensand thrown out by the gault at Wroughton. The spring water is of about 34 deg. of hardness, in parts, per 100,000, or about 24 deg., in grains, per gallon; but the reservoir being formed by an embankment at the foot of a long and wooded ravine, the degree of hardness is more or less modified by a varying quantity of surface water, which contributes also varying quantities of organic matter, chiefly of vegetable origin, together with earthy matter or alumina.

The illustration, Fig. 5, shows a sectional view of the plant employed at Wroughton for the water supply of Swindon. A pair of wrought iron tanks, each 30ft. by 15ft. by 8ft. in depth, serve for the preparation of the lime water, a due proportion of which is led into one compartment of the smaller cistern, placed above one end of the long tank—50ft. in length—in the room at the lower level. Into another compartment of the same cistern, the water flows, by gravitation, from the reservoir on the higher ground. Valves actuated by levers, to which motion is given by a large float in the long tank beneath, allow the two waters to fall into this "mixing tank," in which a violent agitation is kept up by air continually forced in through perforated pipes.

To give the more time for the chemical action to perfect itself, the water is compelled, by partitions, to flow down the two sides of the long tank, and to return by a central compartment—closed at the upper end—from which, as under a similar arrangement at Silvertown, the chalky water descends to the eight double filters placed immediately beneath.

LETTERS TO THE EDITOR.

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

HIGH SPEED LOCOMOTIVES.

SIR,—Permit me to correct what appears to be a misconception of the meaning of a phrase in my letter to you which was published in your issue for January 14th. In mentioning the "double bogie" as the engine of the future, I used the American term for the "Fairlie," and was much pleased to find that Mr. Gobert, in the very next column, held the same views, which he also shared with an "eminent French engineer." American double bogie engines are always built with a single boiler and steam bogie at one end, and a tank at the other supported by a four or six-wheeled truck; and you will at once see that this plan allows of a grate at least as wide as can be made on the Wootten system, as long as convenient, and as deep as in the ordinary locomotive. In your editorial upon this subject, in the same number of THE ENGINEER, you say, "A fire-box may be made large either by augmenting its length or by increasing its width. The latter expedient can only be adopted by putting the grate over the trailing wheels, as in the Wootten box." A moment's reflection upon the possibilities of the double bogie fire-box will convince you that this statement is too broad, since all the driving wheels of this engine are in front of the box. Indeed, Wm. Mason has already built them with fire-boxes 62in. deep inside and grates 44in. wide by 52in. long for a 3ft. gauge, and 48in. wide for the regular gauge; and they run so smoothly that the smallest of them, with 42in. wheels and 10in. by 16in. cylinders, frequently run with ease at the rate of forty-five miles an hour on a 3ft. gauge.

WM. E. SPARKE.

Boston, Mass., February 3rd.

SIR,—There are several very interesting bits in your last week's paper anent high speed locomotives, about which I wish to say a few words. You say in your leader that "the only high speed engine yet built in the States is Mr. Wootten's." Now to my mind the N.Y.C.R.R. express engines with 18in. by 24in. cylinders, and four 6ft. 6in. coupled wheels (nearly the same proportions as the L. and N.W. Railway standard type, but a size larger), is another and perhaps the most likely engine for the purpose as yet reported on this side.

Is it not very questionable to say that "a speed of fifty miles per hour is daily reached with twenty coaches on the L. and N.W. Railway"—unless, of course, on a falling grade? We know that at the brake trials the highest speed attained or attainable was forty-nine and a-half miles per hour, and that on a good selected piece of line, with fifteen coaches only. True the Midland and North-Eastern trains ran faster, but, if I remember right, they were some tons lighter.

Reverting now to Mr. Wootten's engine, I think it is only fair to him to say that as the P. and R.R.R. runs though an anthracite region, and as the railway company own some of the most important mines, it is most likely a *sine qua non* to use that kind of coal in the company's locomotives. This is not all. The problem for Mr. Wootten to solve was to design an engine to burn waste anthracite slack, not coal. Now the use of such slack involves, as we all know, a large grate, a thin fire, and comparatively slow combustion; and to combine these with the other requirements of a fast-running engine presents, I venture to think, many difficulties which I hope Mr. Wootten's daring and ingenious design will successfully solve. I wonder, however, what sort of permanent way they have on the Bound Brook Route to endure a load of from fourteen to twenty tons per axle?

With regard to the letter of "X." on "the locomotive of the future," I should like to ask what outside cylinder types have been used on the Northern Railway of France since they discarded the Cramptons, twenty or more years ago. I omit, of course, the Engerth's and the four-cylinder monstrosities of MM. Flachat and Petiet. I have only seen insides used for passenger purposes. The fastest and heaviest trains in France are worked by outsides, and I believe the same is the case in Germany, where the speeds nearly if not quite equal those of our own lines. "X." seems to object to the use of the bogie, but with the ever-increasing size and weight of the engines now being built, the use of the bogie or its equivalent must surely become general ere long.

LOOKER-ON.

February 14th.

[In the Trent brake trials the total weight of the London and North-Western train was 241 tons 8 cwt., and the speed was 49·5 miles an hour. It is to be remembered that a run of only three miles was allowed to get up speed, and this was not sufficient. Distances of ten miles and more are constantly run on the London and North-Western with twenty coaches at fifty miles an hour.—ED. E.]

SIR,—Will you permit me to say a few words on a subject which possesses a great deal of interest; in fact, I do not know any matter which could be discussed in your pages which is so interesting to a very large number of your readers as the construction of high-speed locomotives, either in this country or anywhere else; and I hope that some of my fellow-readers of THE ENGINEER will avail themselves of the opportunities it always, according to my experience, gives for free discussion, and say their say about high-speed locomotives in its pages.

Before saying anything about Mr. Wootten's engines, let me suggest that the time is not very far away when we shall want to set our own house in order in the matter of locomotive construction. On all the main lines we are building heavier and heavier locomotives, and this increase of weight has but one object, namely, to keep the engines out of the repair shops—very laudable, no doubt, but we shall want ere long more than this; we shall want engines which can run trains of twenty coaches at an average speed of fifty miles an hour—a velocity which is now regularly exceeded by only one train in the world, namely, the Flying Dutchman, on the broad gauge of the Great Western. The average running speed of this train is, I believe, fifty-three miles an hour, and it is worked by the Great Britain, the Hirondelle, and other engines which are as much as twenty-five years old. Can it be that the narrow gauge cannot run a train at this rate? Exeter is not a very lively place, and Bristol is by no means a leading port. Can it be possible that Leeds, Manchester, Birmingham, or Liverpool do not want as fast a train as Bristol and Exeter? I can scarcely think this. Let our locomotive superintendents use a little of that weight which they introduce so freely, to make their engines capable of running at a higher speed with a fair load than is now possible, and the public will soon respond. A train from London to Liverpool in four hours would fill well if the ordinary fare and a-half were charged all round, and an average speed of a trifle over fifty miles an hour would suffice. The distance is 202 miles. The run should be made with one stop of ten minutes at, let us say, Rugby, eighty-three miles from Euston. The remaining run would be 120 miles, or a little more than the Great Northern run of 105½ miles to Grantham. This would present no difficulty, because water troughs render a big tender unnecessary. We have, then, 202 miles to be run in 230 minutes, which means a speed of 50·5 miles an hour. The fastest train now on the road takes five hours and five minutes, *by the time table*, which really means, as a rule, five hours and twenty minutes. There are wonderful things yet possible for locomotive superintendents if they will try to attain them.

Turning now to Mr. Wootten's engine, it ought not to escape notice that it was constructed to burn anthracite dust, and that it failed to do this. Are we to conclude, therefore, that if Mr. Wootten had the engine to design over again, he would have adopted a smaller grate? The engine has only 1100ft. of heating surface, and its cylinder capacity is, when compared with that of an 18in. by 24in. engine, as 97 is to 77. An English engine would have a 6ft. 6in. wheel, while Mr. Wootten's engine has a 5ft. 8in. wheel only. This augments the disparity to 113 to 77 approximately. Thus, the Wootten engine has a cylinder capacity per mile nearly double that of an English engine, with the same heating surface or a little more. The pulling power of the English engine would be over 99 lb. per pound average pressure in the cylinder, and this, with an average absolute pressure of 60 lb., would mean 125 lb. in the boiler, and would give a pull of, in round numbers, 6000 lb., which at 30 lb. a ton would be 200 tons gross. Deducting 55 tons for engine and tender, we have 145 tons left, or say fourteen coaches, a very nice train for fifty miles an hour. I cannot see how Mr. Wootten can steam his big cylinders with his comparatively small boiler; and this is no doubt the reason of the small efficiency of the engine as compared with its enormous weight, great cylinder capacity, and huge grate. The chances are that if Mr. Wootten would line up his cylinders to 19in. diameter his engine would keep much better time.

Swindon, February 14th. RUNNING BOARD.

A PATENT LAW PROPOSAL.

SIR,—As I see that you court suggestions for a new patent law, I venture as a patentee to offer one which is the offshoot of experience, and may therefore be of value. I would make the fees as at present, but prolong the term to twenty-one years, the £50 being payable at the end of the seventh year, and the £100 at the fourteenth. Up to the end of the seven I would allow additions and disclaimers at small fees, and insist upon the deposit of a perfect model at the end of the seventh year; this would represent the perfected machine or process—if carried out—and would be worth preservation. It takes seven years as a rule to get a machine commercially and mechanically perfect, and it would then be a valuable property. In other respects I would not alter present procedure. Each addition as well as original specifications would be published as now, and would be the property of the patentee, so that no other man could graft his improvements on it without the consent of the former.

W. H. BAXTER.

The Lawn, Brixton-hill, S.W.

ICE MAKING MACHINERY.

SIR,—It is necessary I should correct the statements of Mr. Gorman in the discussion on Mr. Lightfoot's paper, read before the Institution of Mechanical Engineers, regarding the Kirk machines at Hongkong. Some eight years ago Messrs. Kyle and Bain took out to Hongkong the second of my moist-air machines made—a 5-ton machine—and some years later added one of my earlier dry-air machines for occasional use. They drove out of the field an ether machine, and as the Tudor Ice Company could not compete, they bought their ice stores and business. Messrs. Kyle and Bain were both men who were thorough engineers, and well acquainted with the machines and the trade; and in their hands the manufacture of ice at Hongkong has been a thorough commercial success.

A. C. KIRK.

Lancefield House, Glasgow, Feb. 15th.

THE BLACKHEATH SUBSIDENCES.

SIR,—I was much interested with the article in your issue for the 4th of February respecting the subsidence of land at Blackheath, and it reminded me of a similar occurrence which came under my observation about twelve years ago. The farm at Whittingham upon which the sewage of Norwich is pumped has for subsoil the sands forming the strata known as the Norwich crag, which lies immediately upon the chalk, having a depth, I think, of 30ft. or 40ft. When the sewage was first allowed to flow over the land, we were astonished, day by day, to find the fields to be soon covered with circular holes, usually about 3ft., 4ft., or 5ft. in diameter and of various depths, the sides always being vertical; on one occasion the ground suddenly subsided for a space 21ft. in diameter and to a depth of 12ft. The sections of the chalk in pits in the neighbourhood show that the surface has numerous holes, which are known as "sand galls," or "sand pipes," and it appeared probable that the subsidences had taken place in these holes on account of the large quantity of water flowing over and soaking into the land, so far in excess of any rainfall the soil had previously been exposed to.

The late Sir Charles Lyell gives a very interesting description of these "sand galls," with a section of a chalk pit at Eaton, near Norwich, in his "Manual of Elementary Geology," 4th edition, p. 82. He attributes the formation, or at any rate the enlargement, of these "sand pipes" to the chemical action of water charged with carbonic acid derived from the vegetable soil and the decaying roots of trees. Cuttings show that the beds of sand and gravel bend downwards into the mouths of the pipes so as to become in part vertical, as would happen if horizontal layers had sunk gradually in consequence of a failure of support. As the Blackheath sands also lie upon the chalk, may not the subsidences described have arisen from a similar cause?

Leeds, February 12th. ALFRED W. MORANT.

KITCHEN BOILER EXPLOSIONS.

SIR,—The recent severe frost caused many fatalities, but those which were especially aggravating to the minds of engineers resulted from causes that were clearly preventable. I mean the terrible kitchen boiler explosions to which you have often directed attention, especially in the article in yours of the 21st January. I have carefully investigated the causes of these accidents, and have examined many boilers and copper cylinders which have exploded and caused fatal accidents. I have also burst several new boilers by hydraulic pressure. These small boilers were destroyed at various pressures, ranging from 250 lb. to 700 lb. on the square inch. When a kitchen boiler is at work it is subjected to a pressure of about 12 lb. or 14 lb. on the square inch—this being the value of the column of water which descends from the supply cistern. All these boiler explosions and all copper cylinder explosions are due to the excessive internal pressure. It seems absurd to put black on white to state such a truism. It matters not whether the boilers be of cast iron or wrought iron, or of copper; but this may be said in favour of copper, that when one of this metal does burst, it will cause a rent or tear which will, however, blow the bricks and oven about the room. A cast iron boiler is more terrible in its destruction, for in the case of the Eccles New-road accident, which killed a poor servant woman, I measured the side of the boiler which blew out, and calculated the total force to be 25 tons when compared with a piece of new boiler I burst by hydraulic pressure.

The accidents in the summer time do not cause much notice; but there are many fatalities when there is no frost at all, through stoppage of pipes caused by many unforeseen conditions. My advice is, in all cases, get a good plumber to fix a dead weight safety valve. Thin plates, fusible discs, and such expedients, I have no faith in. I have tried thin lead discs and also discs made of other metal, and by means of a small steam boiler I have destroyed them by bursting, viewing the pressure gauge by means of a telescope, but I never could make two alike. I believe architects are not without blame in their instructions to plumbers, for often plumbers only do as they are told by the architects.*

Bath and circulating boiler explosions all occur through over-pressure. The only safe course is to fix a safety valve, at a cost of a few shillings.

I was the foreman of the jury in the Eccles New-road accident, and have read papers on this subject before the Society of Municipal Engineers, before the Manchester Society of Engineers, and others, and the universal opinion of all who understand the subject is, that all these boilers should by fitted with valves.

Mr. Lavington E. Fletcher, Mr. Longridge, Mr. Baldwin, and other gentlemen connected with the various steam boiler and insurance companies, all endorse, or have endorsed, this opinion on many occasions. I brought forward a resolution in the Salford Town Council some six years ago, that all kitchen boilers should be examined by our municipal inspectors before houses are declared habitable; but we found that power did not exist under our local Acts of Parliament to enable this to be done.

To be a prophet of evil is not an enviable condition; but that was mine before the frost and during it; for I always know the exact time every winter when these disasters are about to occur. They do not take place until about the third or fourth day of a hard frost, when the walls have got cold, and when the temperature has become so low as to freeze the so-called air pipe of the boiler, and sometimes even the water in that reservoir of heat, the copper cylinder. Then comes the time of danger, and very often danger is averted only because of the difficulty in boiling the water in the boiler and in the cylinder—that is to say, mere radiation robs the heat from the water quite as quickly as it is generated, and thus saves the boiler. A long interval between the fire going out at night and its being lighted in the morning enables the cold to triumph sometimes. A woman who lived in West High-street, Pendleton, stayed in bed late one Sunday morning and when the fire was lighted the boiler burst and killed her. I can only add that these fatalities are created very often by the most disgusting and disgraceful carelessness of those who have charge of the erection of the houses and the pipes in them. I scarcely know upon whose shoulder to lay it.

W. H. BAILEY.

Albion Works, Salford, February 7th.

THE TRANSIT AND ITS OPTICAL DIFFICULTIES.

SIR,—The French astronomers have already had a preliminary meeting on the subject of the coming transit of 1883, and doubtless many more will be held to determine the details for the better observation of it than was made of the last. Will you again allow me a few words on the special difficulty in it which baffles the labours of all who, as things are, engage in it? I mean the black-drop difficulty. M. Leverrier, it may be interesting to note, a short time before his death declared that all attempts to get at a more accurate estimate of the sun's distance through the transit must be futile, till a more accurate note of the touching edges or outlines of the sun and the planet can be got at. That this is an important item in scientific astronomy none will dispute, and I feel sure that any, however small, light that can be thrown on it will be useful if thoroughly looked into and analysed, and is a subject worth the attention of the Council of the Royal Society, who have the disposal of the fund which the Government have placed at its disposal for the encouragement of scientific research.

In my former communication to you I tried to show that the old and first invented words to express and explain this phenomenon were now, if my explanation of it holds, obsolete; that the words diffraction of Grimaldi, and the inflexion and deflexion of Newton are inapplicable, and have no real relation to the phenomenon observed. It waits, therefore, for another explanation, and there can be, as I think, no doubt what that must necessarily be, and it points to the all but obvious remedy for the difficulty in the coming transit in 1883. I venture to trouble you therefore with this, to hint at the possibility of a mode of getting over or avoiding this difficulty. I would also now ask whether this is not a fair and legitimate opportunity for helping such inquiry and research out of the fund now at the disposal of the Royal Society, *i.e.*, the "Endowment of Research Fund." This inquiry, as a matter of scientific research, has too a twofold interest, viz., that of finding with accuracy the distance of the sun from the earth, and the solution of some difficult problems in optical science. Will you allow me, therefore, to suggest that a portion, though it be but a small one, of the Research Fund should be devoted to this special subject and inquiry?

C. BRUCE ALLEN.

February 8th.

* This requires qualifying, for I believe most architects only give instructions about the water and gas pipes, and the sewer pipes and water-closets, and sewage ventilation, in connection with houses over £500 a year rental; so we must fall back upon our pet enemy the Jerry Builder.—W. H. B.

PARIS WATER SUPPLY.—STANDARD METERS.

M. SAMAIN, BLOIS, AND MM. MATHELEN AND GARNIER, PARIS, ENGINEERS.

(*For description see page* 127.

FIG. 1.

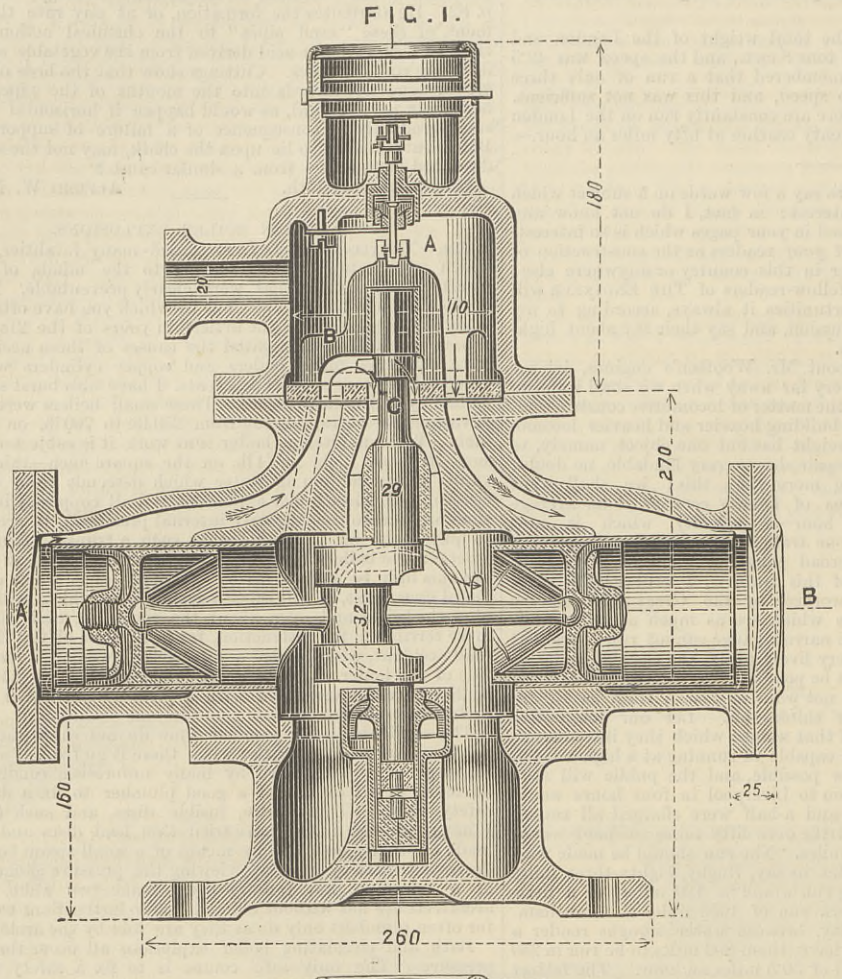


FIG. 2.

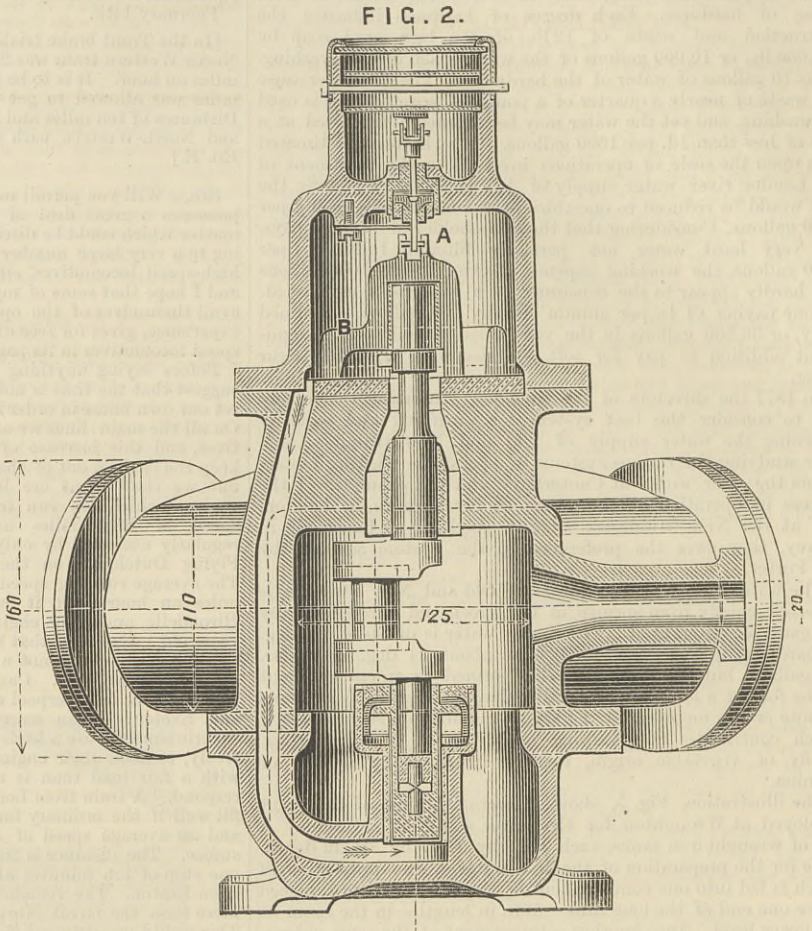


FIG. 3.

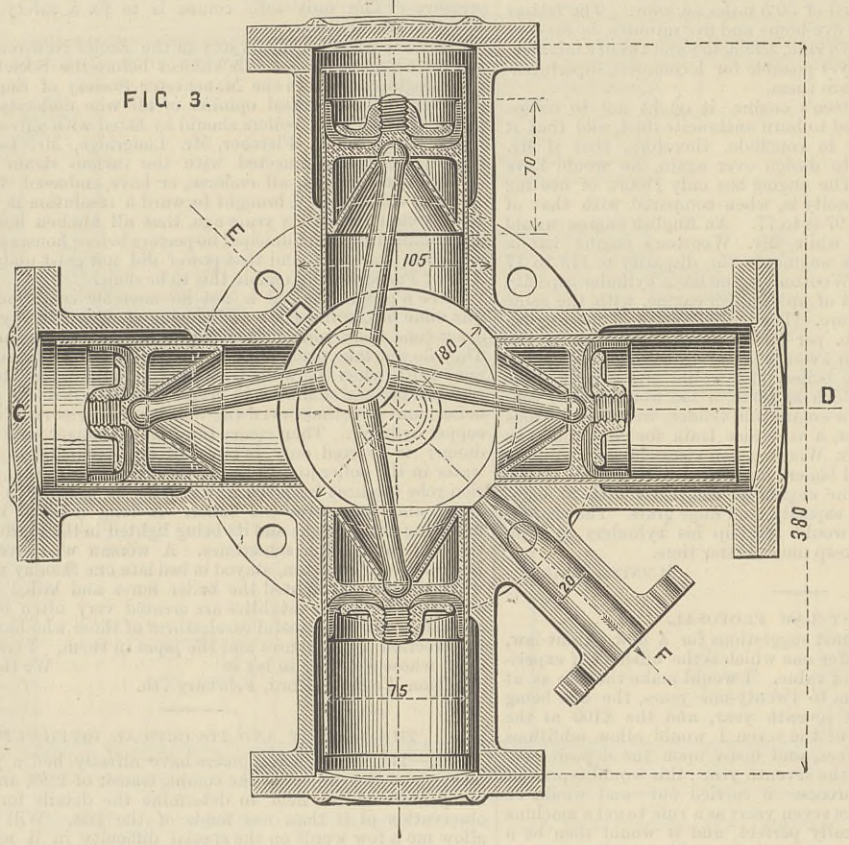


FIG. 4.

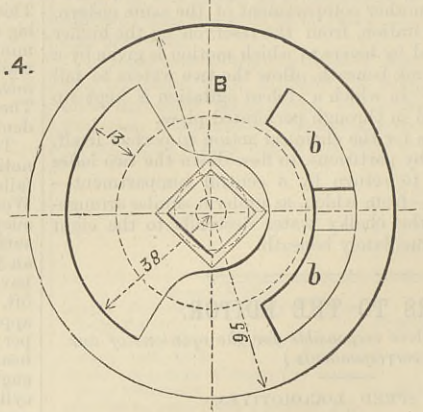


FIG. 5.

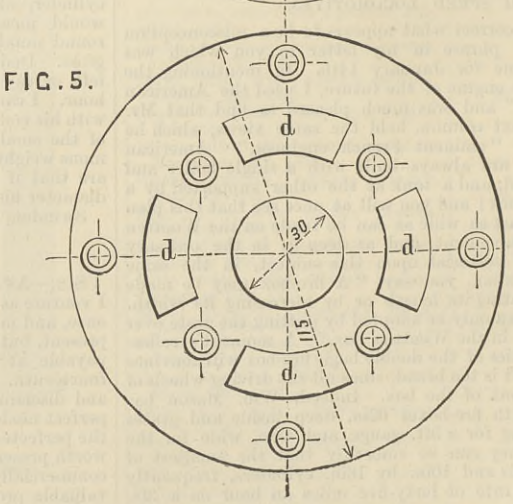


FIG. 6.

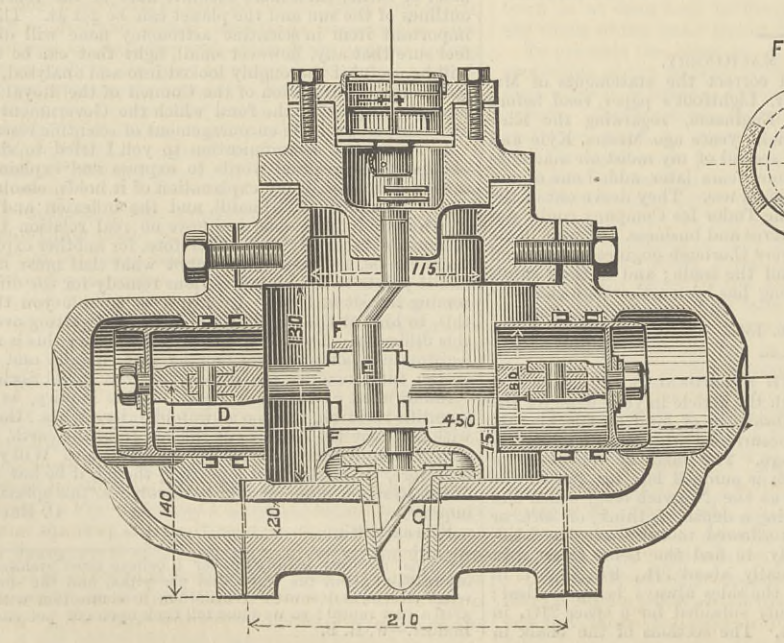


FIG. 8.

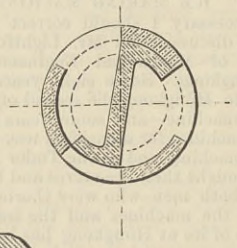
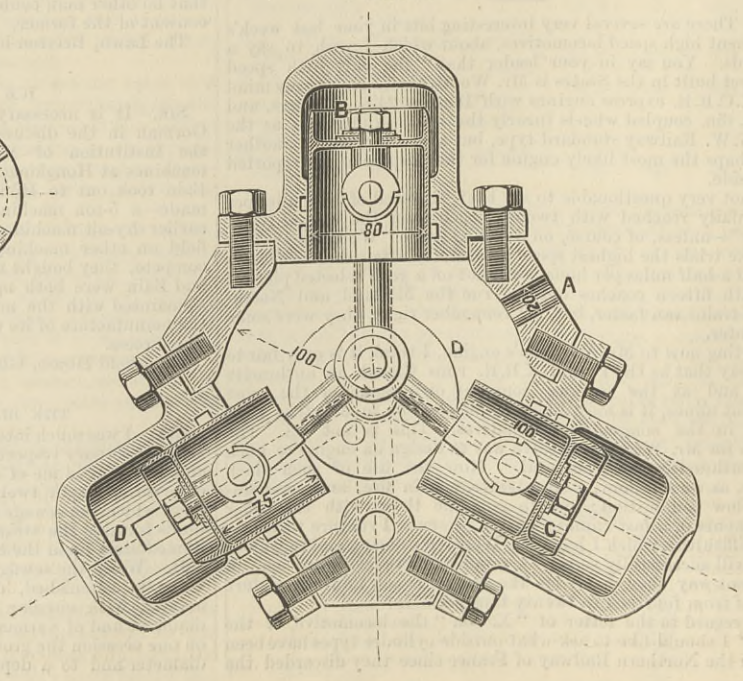


FIG. 7.



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VIENNA.—Messrs. GEROLD and Co., *Booksellers.*
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NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-Street.*

TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a 2d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

W. K.—*Apply to Mr. R. E. Crompton, C.E., Mansion House-buildings, Queen Victoria-street, London, E.C.*

J. W.—*We never express opinions upon the construction of specifications. It is a matter for your lawyer or patent agent.*

J. G. N. (Barcelona).—*Apply to the Secretary of the Iron and Steel Institute, Westminster-chambers, Victoria-street Westminster.*

J. W. (Craig Bank).—*If whaling ships go far north and stay there during the winter, they will infallibly be frozen up in salt water.*

C. J. L.—*Selected Low Moor plate is the best iron plate that can be used in a boiler, but Bowling and Farnley plates are very little, if anything, behind. No Staffordshire plates are made of equal quality.*

NOVICE.—*You could not successfully balance a frame as you propose; the water would be churned into foam with the air. A long elastic spring might be used for the purpose, but the spring would be short-lived.*

NIL DESPERANDUM (Northampton).—*Read the "Rudiments of Civil Engineering" by Law and Burrell, revised by D. K. Clark, and published by Messrs. Crosby Lockwood and Co. If you find you can master this book, then write to us again.*

P. R. O.—(1) *There is no treatise on the steam engine published which supplies useful information concerning its repairs.* (2) *Mr. Clark's book would not answer your purpose. If you want an easily understood work on the theory of the steam engine, Goodeve's will be found all that can be desired.*

F. F. AND S. (Boston).—*The horse-power which a wrought iron shaft 3½in. in diameter will transmit comfortably without whipping, may be found by multiplying the number of revolutions pev minute by ·18. If the shaft makes 48 revolutions per minute, then the power which it can transmit will be* $48 \times \cdot 18 = 8 \cdot 64$ *I.H.-P.*

R. G.—*You have left out the stack or rain water pipes in your calculation. These cannot be closed, and would admit a great deal of air; then the frictional resistance of air passing through long lengths of sewer would be very great. The plan, you may rest assured, is inapplicable save on a small scale and under special conditions.*

YOUNG DRAUGHTSMAN.—*You give no data on which to found a calculation. A crane post may have no stransverse strain on it whatever, or it may have to carry the entire load, according as the weight is or is not counterpoised. Read the treatise on cranes in Weale's Series, published by Messrs. Crosby Lockwood and Co., price* 1s. 6d.

K. E. M. (Dublin)—*There are no official examinations to be passed to enable anyone to style himself C.E. Any engineer may do this, but it is seldom of any value whatever to one who has little or no claim to civil engineering education. If your qualifications permit, you may be eligible as a member of the Institution of Civil Engineers of London or of Dublin. Communicate with the Secretary,* 25, *Great George-street. Westminster; or for the Institution of Ireland, to the Secretary, St. Stephen's-green West, Dublin.*

B. E. (Birmingham).—*You are perfectly right in your conclusions, but the crane shown in your present sketch is not that shown in your first sketch. The crane will tend to pick up as you assume, and you must treat the case as that of an ordinary lever with the end of the arm next the load acting as a fulcrum. In your case it appears that the respective lengths of the arms of the levers are* 8ft. *and* 4ft. *If you make your calculations as though the whole strain had to be borne by one arm and bolt, you will be quite safe.*

F. S., A CONSTANT SUBSCRIBER.—*Gun and pistol barrels are browned, blued, and blacked by several processes. The brown colour is obtained by rubbing butyr of antimony on with a piece of cloth as a rubber. Gloves should be worn to protect the hands. The barrel must be carefully cleaned and freed from grease. The thin coat of rust obtained in this way is to be rubbed smooth, and if necessary the antimony may be applied a second time. Subsequently the barrel must be well oiled and rubbed quite smooth. The browning will last a long time, and can easily be put on again if injured. Blueing either of a light shade or nearly black is effected by heating the parts in a muffle, or by plunging into a bank of nearly incandescent charcoal in small pieces. This needs practice to secure the desired colour without damaging the article to be blued.*

INKIE'S DIVING SUITS.

(*To the Editor of The Engineer.*)

SIR,—Would any reader kindly inform us the name and address of the maker of Inkie's diving suits? F. AND C.

Birmingham, February 14th.

CUTTING VULCANISED INDIA-RUBBER.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers tell me where I can procure a small hand-machine for cutting sheets of vulcanised india-rubber into square pieces, say 1in. to 2in. square. C. R. C.

Birkenhead, February 12th.

HIGH-SPEED ENGINES.

(*To the Editor of The Engineer.*)

SIR,—With reference to high-speed engines, I notice in your issue of the 11th inst. a letter respecting an engine made by Mr. Brotherhood, of London, to run at 600 revolutions per minute, or even more. Allow me to state that there are engines running every day at a speed of over 1000 revolutions per minute, made by Thos. Broadbent, of Huddersfield, for his patent direct-acting steam hydro-extractor. H. B.

Huddersfield, February 14th.

A GEOMETRICAL PROBLEM.

(*To the Editor of The Engineer.*)

SIR,—Will any kind reader of THE ENGINEER please assist me by giving a solution, algebraical or otherwise, to the subjoined question? If a wrought iron plate is 18in. long and 12in. wide at one end, and slanting down equally on both sides to 8in. at the other end, how far from the narrow end will the plate have to be cut in two so that the new plates will be the same weight each, and retaining the same form?

Middlesbrough, February 14th. AN OLD MILLWRIGHT.

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THE ENGINEER *can be had, by order, from any newsagent in town or country at the various railway stations; or it can, if preferred be supplied direct from the office, on the following terms (paid in advance):—*

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

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Feb. 22nd, at 8 p.m.: "On the Weight and the Limiting Dimensions of Girder Bridges," by Mr. Max am Ende, Assoc. M. Inst. C.E.

SOCIETY OF TELEGRAPH ENGINEERS AND ELECTRICIANS. — Thursday, Feb. 24th: Council meeting at 7 p.m., ordinary general meeting at 8 p.m. Adiourned discussion on Mr. Alex. J. S. Adams's paper, "Earth Currents —Electric Tides;" and, time permitting, the following papers will be read:—"On the Application of Dynamo-Electric Machines to Railway Rolling Stock," by Lieut. P. Cardew, R.E., Associate. "On the Interference with the Processes of Manufacture of Wool and Hair, arising from the Development of Electricity during Spinning: with a description of Apparatus Applied to Obviate it," by Edward B. Bright, Member.

DEATHS.

On the 15th ult., accidentally drowned in crossing a creek at Evergreen, Santa Clara county, California, ALEXANDER NORTON SHILLINGFORD, C.E., only son of the late Comr. A. Shillingford, R.N., of Folkestone.

On the 2nd inst., at 12, Victoria-terrace, Weymouth, OSWALD YOUNGHUSBAND, C.E., eldest son of the late Mr. Thomas Younghusband, in his 48th year.

On the 8th inst., at Kidwell Park, Maidenhead, JOHN FLEMING, C.E., aged 57.

On the 8th inst., at his residence, Leicester-place, Beverley-road, Hull, after an illness of three years, WILLIAM ALLTOFT SUMMERS, in his 73rd year, formerly of the Northam Ironworks, Southampton.

THE ENGINEER.

FEBRUARY 18, 1881.

ANTHRACITE AS A HOUSE COAL.

WE have already explained, we hope clearly, that the adoption either of a smokeless coal or of a system of burning coal in such a way that no smoke would be produced, would not free London from fogs, nor would it render these fogs less pestiferous than they are now. The advantage gained would be entirely a matter of cleanliness. We should have fewer "blacks;" the fogs would be clearer and more readily seen through, but they would not be purer in the sense that they would contain less sulphurous acid gas, or carbonic oxide or carbonic acid. Something, however, would be gained. The anthracite coalowners of Wales have not missed their opportunity, and they have been for some time past endeavouring to induce the population of London to burn anthracite instead of bituminous coal. They organised an exhibition of anthracite coal burning grates and stoves, which was held last week at the Alexandra Palace. All this is just as it should be. The Welsh coalmasters have done well to let the Londoners know that there is a coal in existence which burns without smoke, but we fear that facts will be too strong for them, and that the peculiarities of anthracite will effectually prevent its use as a house coal. It is desirable that full information should exist upon this subject, and it will interest many of our readers to know what are the properties of anthracite which preclude, or seem to preclude, its use for domestic purposes.

Broadly speaking, there are two kinds of anthracite only, although if we please to draw minute distinctions, it would be very difficult to say where anthracite ends and bituminous coal begins. The first is hard and the second soft anthracite. Once more we use the words in a wide sense. The first is found in enormous quantities in the United States, and nearer home it is mined in Ireland, at Slieveardah, in the north, and at Jarrow in the Queen's County; there are one or two places of less importance where it is found. In its distribution in Ireland it resembles to some extent that of hematite ore, being found in pockets and basins, and usually at small depths. It is hard and lustrous, breaks with a conchoidal fracture, which reflects the light freely. It is also stratified when in large pieces, thin veins of pyrites running through it, and rendering the coal from some pits so sulphurous that it is almost useless. The coal is very difficult to ignite, and must be burned in comparatively large and deep grates, or it will not burn at all. It makes an intensely hot fire, and quickly warps and destroys all cast iron with which it comes in contact. It is useless as a fuel for small rooms, such as are found in the larger number of London houses. The American anthracites closely resemble those of Ireland, and are equally unsuitable for domestic consumption. In Ireland the Queen's County anthracite is freely employed as a kitchen, and in some houses as a general house coal. For the former purpose it answers very well, provided the fire is never let out night or day. It is a peculiarity of anthracite that if a fire is once made up properly, it will last for at least eight hours without replenishing. It produces a large quantity of light ash, and unless the draught in the chimney is absolutely perfect, the sulphurous acid given off from the coal will play havoc with furniture. We have seen a kitchen clock only two or three years old, the brass wheels of which could be broken up between the finger and thumb from the effects of the acid gas. Delivered by cart at a distance of twelve or fifteen miles from the pit, this coal costs about 30s. per ton.

Welsh anthracite and steam coal is a very different mineral in many respects. By many persons it is held not to be an anthracite at all, though some of it closely resembles the Irish coal. The best varieties, such as that from Powells Duffryn, Bwlfa, and Llangenech, are dull in colour, but having a peculiar silvery lustre in some lights. They do not break smoothly; they are, as a rule, brittle, and burn almost without smoke, but with some flame. The flame of Irish anthracite is that of carbonic oxide, but that of Welsh coal is due to a hydrocarbon. Some of the Welsh anthracites will give off a good deal of light smoke if they are improperly burned, but the best, such as Bwlfa, used on the Metropolitan Railway, may be regarded as quite smokeless. The coal is extremely clean, and produces but a minute quantity of ash. It will burn in smaller grates, and is more easily managed than American or Irish anthracite; but we fear we must say that for domestic use it is quite unsuitable. It cannot readily be lighted by an untrained servant, and it is quite impossible to get up a good fire with it quickly. A fire of ordinary house coal lighted half an hour before the family meet in the breakfast-room will be bright and cheerful; an anthracite fire takes about two hours to reach perfection. To burn anthracite satisfactorily, the fire should be kept alight all night; and this can hardly be regarded as a point in favour of the coal. Again, as we have said, there is no medium about an anthracite fire; it is either very good and hot, or it is not a fire at all. Once made up, it must be left alone; it will not bear poking or stirring, and the radiant heat which it gives out when at its best is very strong and overpowering, especially in small rooms. One firm of coal merchants advertise the sale of Welsh anthracite in London at 25s. per ton, and they advise the fitting of the grates in which it is to be burned with a blower—a circumstance which speaks volumes for the difficulty encountered in lighting up. A very grave defect in the coal is its brittleness. It breaks in the cellar, in the scuttle, in the fire. The slack of bituminous coal can be readily burned, but with the slack of anthracite nothing can be done. It will positively pass through a house fire uncomsumed, although in steam boiler and other furnaces it can be burned freely enough. Thus the slack which would accumulate in the cellar would very soon prove an intolerable nuisance, while it would represent a very considerable addition to the cost of the coal. In Ireland this slack, and the culm, or semi-coal, which lies at the top and bottom of the vein of true coal, are burned by the poor, who knead them up with clay, and make them into balls about as large as oranges, which are dried in the sun. These balls make a very good fire, but it is quite certain that anthracite slack and dust could never be so used in London.

It is, we think, much to be regretted that a fuel possessing so many admirable qualities as Welsh coal may not be used for warming our rooms. A properly made-up fire of anthracite is so perfectly clean and brilliant that it is impossible to regard it without satisfaction. Of ashes there are little or none. As the fire does not need stirring dust is not raised. It is quite free from sulphur and bad smells. A fire made up over night will be good in the morning. Such advantages, if they were generally understood to be possessed by any fuel, would go far to recommend it to the householder of London. But, as we have said, we fear it may not be that anthracite will become the fuel of the metropolis. It must always be expensive because of the waste due to brittleness. It will tolerate no half measures. Wallsend or Silkstone we can allow to smoulder away for hours, and a touch with the poker when needed will send a cheery flame leaping up the chimney. With anthracite there can be nothing of this kind. It must be always burning at full speed, or it will go out. The highest speed at which it can be burned in a house grate is just about the slowest rate at which it will burn at all; and the slowness with which a fire of anthracite can alone be kindled precludes its use, as we have said, for a morning fire. We confess we do not see how these difficulties and objections can be got over by any species of grate. It has been suggested that, by burning a mixture of Welsh and north-country coal, much advantage would be gained. We cannot perceive this. Few householders would care to have two kinds of coal delivered into their cellars, to be subsequently mixed judiciously; and we know that the result of a practical test of the mixed coals proves that the anthracite will burn the north-country coal at full speed, or else it will remain in the fire apparently as incombustible as so many stones. We wish the anthracite coal-owners of Wales every success. They have our warmest sympathies; but if anything is to be done with anthracite it must be by working it into some "patent" fuel, which will eliminate the objection of brittleness and consequent waste, to begin with, and which will light up more readily than the coal. But all briquette fuel contains pitch, or resin, or some other inflammable substance which burns, at first at least, with a dense smoke. The anthracite briquette to suit the London market must be something quite unlike any patent fuel yet made, and we much fear that it is impossible of production.

VALVE GEAR FOR HIGH SPEED LOCOMOTIVES.

IT is almost impossible to take up just now an American journal which deals with railway matters without finding something bearing on the running of passenger trains at high speeds. For the moment this would seem to be the all-absorbing question with the railway men of the United States; and not a few mechanical engineers, whose life has no special connection with railways or their working, manifest just as much interest in the subject as any one else. The perusal of much that is written under such circumstances carries the memory back many years, to the time when the building of an engine which would run passenger trains at thirty miles an hour presented a difficult problem. History is repeating itself in the United States, and questions long since dead and buried are dug up, galvanised into the semblance of life, and eagerly discussed at the other side of the Atlantic. The stereotyped sixty miles an hour seems to be the one thing needed to make American railroads perfect in American eyes; and the attainment of this speed is regarded on the one hand as a triumph of genius on the part of the builder of the engine, and an everlasting record of the skill of some individual engine driver; and on the other as presenting difficulties so great that it is hardly possible that they will ever be overcome. The most recent turn of popular engineering opinion is toward the condemnation of the standard type of American locomotive. We begin to hear that it is perhaps after all not quite what is wanted; that it is very good indeed for forty miles an hour or less, but that sixty miles an hour is quite a different matter, and that some changes must be made. Putting such murmurs and what we know of

American railroad men together, we are led to think it probable that a large crop of more or less abnormal designs will be grown in the present year, and that some very curious locomotives indeed will be built at the other side of the Atlantic in 1881. Hitherto American locomotive superintendents—or "master mechanics" to give them their transatlantic title—have been esteemed in this country as men who know quite well what they are about; and it comes upon us as a surprise to find that they appear to be able to make little or no progress in solving the problem put before them in a straightforward way. It is possible that something of the doubt and perplexity which seem to environ them is due to an aversion from appearing to copy English ideas. They want to be original, but do not quite see their way to obtaining their wish. They raise old difficulties, many of them imaginary, others long since disposed of in this country, and are for the moment torn by conflicting opinions. If a deputation from the principal railways in the States would pay this country a visit, they could learn such a lesson in a couple of weeks as would save their companies a large expenditure, and enable them to give the public almost at once that high speed which is needed. It may be urged here that English high-speed engines would not suit American lines, and that American engineers know best what is good for them. We venture, however, to point out that no engineers in the world have had anything like the experience of our own locomotive superintendents in the working of fast, heavy traffic; and the modern English or Scotch express locomotive can traverse any line at high speed on which it is at all justifiable to run fast. Under the circumstances our brethren at the other side of the Atlantic cannot do better than avail themselves of the experience acquired here.

Among other defects now being discovered in the American engine is the link motion. Mr. Frank C. Smith, a correspondent of the *National Car Builder*, an ably conducted American railway journal, asserts that "before high railroad speed, so much talked about at present, is a success with the present load carried, a substitute for the link motion must be found. The link as a special expansion gear is a failure, and while for high speeds with the present loads more boiler and grate surface is an imperative necessity, it is almost an equal necessity that an expansion gear be used which will make a far better disposition of the steam." We know that the opinion thus set forth is held by a good many engineers in the States, though we are happy to say not by all; and even in this country the link motion is held by some persons to be an objectionable, defective, and even a barbarous device. It is worth while, therefore, to point out that such assertions, when true, are so only in a very limited sense, and that they are not true in any sense as regards locomotives. Quoting once more from the correspondent of our contemporary, we have the defects of the link motion thus set forth: "When cutting off close at high speeds, the link wire-draws the steam badly, it exhausts too early, and closes the exhaust and cushions too early." Our authority then goes on to say that the proper valve gear for a high-speed locomotive is the old-fashioned gab motion, or as it is called in the United States, the "V hook," with a separate cut-off valve to give expansion; and he goes on to say that, "As no automatic cut-off stationary engine builder would think for a moment of building an economical engine with a single valve for the distribution and exhaustion of the steam, it does seem out of place for locomotive builders to attempt it, inasmuch as the stationary engine builders have carried the economical use of steam much nearer perfection than locomotive builders ever dreamed of, and high speed depends either upon a greater supply of steam, or a more economical use of the present supply."

It would not be easy to find any contribution to a technical journal which shows a more complete misapprehension of facts, and of the influence exerted by conditions on the efficiency of certain mechanical devices, than we have here. Engineers on this side of the Atlantic have tried all that is here suggested, and more. The gab and separate expansion are as old as the days of Stephenson. They could never be made to answer, and they never will. To use them effectively, there must be either three excentrics to each cylinder, or a complex mass of levers and pins and slots, the existence of which on a high-speed locomotive would be simply intolerable. Mr. Baldwin, the founder of the Baldwin Locomotive Works, for years fought against the link motion. We have had occasion already to refer to the catalogue of the Baldwin Locomotive Works. We make no apology to our readers for quoting here the following passage from the introduction of that catalogue:—"But while Mr. Baldwin, in common with many other builders, was thus resolutely opposing the link motion, it was nevertheless rapidly gaining in favour with railroad managers. Engineers and master mechanics were everywhere learning to admire its simplicity, and were manifesting an enthusiastic preference for engines so constructed." It was not until 1857 that Mr. Baldwin finally abandoned separate cut-off valves. Indeed, they have been fully and fairly tried in no place more than the United States. To assume that the link motion will not do in the face of the fact that it has done for some thirty years in this country, and that it is now fitted to hundreds—we had almost said thousands—of English engines, any one of which can run with ease at sixty miles an hour, appears just a little absurd to Englishmen. In truth, the link motion is the most perfect thing that can be applied to a high-speed locomotive, just because of the peculiarities which Mr. F. C. Smith holds to be its grave defects. Before going on to explain this statement, it may be well to point out for the benefit of American readers that the English locomotive is beyond question the most economical non-condensing engine in existence, the average consumption of fuel in an inside cylinder engine, not exceeding 3 lb. of coal per indicated horse-power per hour, while in some cases it is much less. Thus, in the Great Britain broad gauge engine, 18in. cylinders 24in. stroke, single driving wheels 8ft. diameter, Sir Daniel—then Mr.—Gooch found when the reversing lever was in the fifth notch, the steam being expanded three times, that the consumption of feed-water was at the rate of 21·24 lb. per indicated horse-power per hour. Assuming that each pound of coal evaporated 10 lb. of water, this gives a consumption of 2·12 lb. of coal per horse per hour. If Mr. Smith can cite any better performance of a non-condensing engine with any valve gear he can name, we shall be pleased to publish the particulars.

Like a great many other engineers Mr. Smith thinks no doubt that a perfect diagram must have a straight vertical admission line, a hyperbolic expansion curve, and square corners; and he furthermore perhaps believes that the strain put by the steam on the piston accurately represents that on the crank pin, and in all this he is wrong. The momentum of the piston, with its rod and connecting rod and crosshead, is great enough at high speeds to alter totally the strains to which the crank pin is subjected; and in any locomotive when running at sixty miles an hour the crank would have to drag the piston away from the cylinder cover at each end of the stroke, unless compression and early admission had previously sent the pressure up to 100 lb. or so on the square inch. In the same way, when the steam pressure falls after the steam is cut off, the momentum of the moving parts keeps up an impelling force on the crank-pin long after that of the steam has practically ceased. Again, it is well known that if, when a locomotive with a heavy load is running at a high speed—say fifty or fifty-five miles an hour—being at the time well linked up, the reversing link be moved forward another notch, so as to give more steam, the effect is at once to reduce the speed of the engine instead of accelerating it. This effect is produced by rendering the exhaust more tardy, and so augmenting the back pressure. It is the special advantage of the link-motion that it exhausts very early in the stroke; and for outside cylinder engines—which have always more back pressure than inside cylinders, because of the greater dampness of the steam in them—this early exhaust is particularly required. At slow speeds, however, the link-motion, when notched up, loses nearly all the advantages of which we speak. Then the exhaust takes place too early, and the compression is excessive and useless, seeing that the moving parts have no momentum to speak of. It is here that Mr. Smith has blundered. He has confounded slow and quick speeds, and assumed that, because the link-motion is, beyond doubt, a defective expansion gear for engines running at 60 to 100 revolutions per minute, it must also be defective at 250 to 300 revolutions per minute. There is, in point of fact, no analogy between the two. As a valve gear for high-speed engines the link-motion, especially Allan's type, is as near perfection as may be as a distributor of steam; but for slow-speed engines it is unsuitable, save that its great simplicity renders it an admirable reversing gear.

So far we have dealt with valve gear only from the distribution point of view; but there are other things to be considered, and it is a defect in the inside cylinder locomotive that it is very difficult to make a direct connection between the valves and the links, and at the same time to get in cylinders more than 17in. in diameter. It is here that Joy's gear, as now being used by Mr. Webb, steps in and supplies a want; but after all this has very little to do with Mr. Smith's proposition, which is practically this:—To get high velocities we must use our steam as economically as possible, and consequently we must have a separate cut-off valve. We have tried to show that Mr. Smith is wrong, and we can assure our American readers that if they suffer themselves to be led away by such reasoning, and abandon the link motion in favour of separate cut-off valve devices, they will find themselves further than ever from obtaining a high-speed engine which will keep out of the repair shops for a few weeks at a time.

SUBSOIL AND SURFACE DRAINAGE.

A prominent point in the discussions upon the two bills now before Parliament for the prevention of floods is the relative velocity with which rainfall finds its way into rivers, from drained and undrained land. It is most generally held that the modern increase of underground drainage, especially of heavy lands, has materially reduced the sponge-like holding power of the land, and that a given fall of rain can now, by running off the surface and through the drains, reach the rivers in much less time than it can off undrained lands. This is, however, stoutly contested, especially by the holders of the high lands. They argue that drained land is not only drier but also more porous than undrained land, and that it will hold as well as absorb a certain quantity of water before allowing it to penetrate to the drains. That is to say, underdrained land is more or less dried from the drains to the surface, and its mechanical condition is more like a sponge than is that of undrained land. Consequently, when rain falls on it, it will hold a considerable quantity of water, instead of shooting it off at once, as it would have done if it had been already full, as heavy land usually is in its undrained state. Something may be said for this argument, though from undrained heavy land a very large quantity of the water which falls upon it can only be removed by evaporation. Water drains away very slowly from undrained heavy water-logged land, and that which remains in every surface hollow, and which from circumstances of level and contour cannot be removed by surface drainage, must lie until by slow percolation and by evaporation it is carried off. This it would seem must generally be a much slower progress in very wet seasons than that which takes place on land well drained, for as soon as the earth above the drains becomes supersaturated, the subsoil drainage commences to do its work, and continues to do so until all excess of water is removed from the land. Commenting upon the suggestion that a good deal of the surplus water on undrained land has to be removed by evaporation, our contemporary, the *Mark Lane Express*, remarks, "just so; but extensive evaporation increases the volume of moisture in the atmosphere and so increases the rainfall." Even were it not the fact that evaporation takes place most rapidly in windy weather, so that the moisture of local evaporation is transported, the argument is against the objections to subsoil drainage instead of with them, as our contemporary suggests. Quitting arguments upon the theories of others, however, and giving his own experience, the writer is more happy and says:—"A few years ago, when droughts were causes of as great anxiety as floods are now, this argument was used to enforce the prediction that the climate of this country had become permanently drier, partly through the drainage of the land, and partly through the cutting down of trees. On the whole, we are disposed to conclude that land draining, by itself, has not contributed to floods so much as it has diminished them on an average, though we think it obvious that in some instances the converse is true, as, for instance, where gravelly uplands have been drained and their water has been brought through intervening clay soil to rivers. But subsoil draining has led to better surface draining. Ditches and streamlets are kept more clear than they were, for the sake of giving outfalls to the drains, and this undoubtedly leads to a more rapid conveyance of water from the uplands to the rivers." With the question of whether upland owners should be charged with a portion of the expense of river conservancy deemed necessary to relieve the flooded lowland, we are not here concerned. The arguments of the upland owners against such a course are certainly strong, for not only is their land generally inferior to that of the dales, but they would be glad to keep some of the water which naturally and too soon finds its way down towards the streams. That there are differences of opinion, however, as to the effects of extensive subsoil drainage is a matter of interest, and as much depends upon a settlement of the question a good deal may be expected to be said upon it.

PORTABLE ENGINES AT THE MELBOURNE EXHIBITION.

Two stories concerning portable engines at the Melbourne exhibition have reached this country, and bid fair in a very short time to be known all over the world. The first reflects severely on the reputation of the jurors who awarded the prizes at Melbourne for agricultural machinery, and the second affects a firm of no less reputation and standing than Messrs. Clayton and Shuttleworth, of Lincoln. In the *Times* of November 2nd, 1880, appeared a list of awards of prizes made at the Melbourne Exhibition, and among others we have "engines, agricultural, Ransomes, Sims, and Head, Ipswich, gold medal." Now it so happens that a very large quantity of goods for the Melbourne Exhibition were lost on board the Sorata, when that ship was wrecked, and among the rest, according to the *Melbourne Leader* of October, 23rd, 1880, the whole of the steam engines and thrashing machines sent for exhibition by Messrs. Ransomes, Sims, and Head. For what then was the gold medal awarded? for engines which were not in the exhibition, although they ought to have been? and if so, why so? It is very difficult to believe that this is possible, but we know that jurors sometimes do strange things. The only escape from the dilemma is to conclude that Messrs. Ransomes, Sims, and Head's agent at Melbourne, entered some other engines which he had in stock. If this is the case, the fact redounds highly to the credit of the firm which thus obtained a gold medal for an ordinary commercial engine, put in competition with engines specially got up for exhibition by other firms. It is well that this point should be cleared up. The next story to which we have alluded is told by Messrs. Clayton and Shuttleworth themselves, in a circular which has been issued pretty freely by the firm, which states: "The information will doubtless have reached you that our agents in Melbourne—W. Shuttleworth and Co.—have been fined £1000 by the Minister of Customs for systematic undervaluations of invoices, and as our name has been connected with the transaction in the most unwarrantable manner in some of the colonial newspapers, we think it right that we should state in justice to ourselves, although such assurance on our part may be unnecessary in your case, that we were totally ignorant of these frauds until the arrival of the last mail which brought us the information in question. We have at once severed our connection with the firm referred to, and shall in future be represented in Melbourne by our former agents, Messrs. Henry P. Welch and Co." To make this circular quite intelligible we must explain that there is an *ad valorem* duty on portable engines imported into Melbourne of 27 per cent., and it has long been known that for this reason it is practically impossible to do any trade in portable engines with Australia. Messrs. W. Shuttleworth and Co. got over this difficulty by representing that the portable engines which they imported were worth less than they really were, and thus saved duty. Messrs. Clayton and Shuttleworth knew how difficult it was to sell portable engines in Australia, but nevertheless they sold them, while others in the trade could not sell them, and their agents must have used no small skill to explain away the difficulties which must on this score have suggested themselves to their principals. Messrs. Clayton and Shuttleworth have our sympathies. The transaction can do their reputation no harm. But they will do well to make all the facts public, and place the conduct of their agents in its true light; until this is done, the Lincoln firm will be asked how it is that they did not sooner discover that a fraud was being carried on, the abnormal number of engines which they sold in Australia being sufficient to excite suspicion.

THE CRISIS IN THE COAL TRADE.

At this moment there are fears of the most gigantic strike in the coal trade which has ever taken place in England. The Lancashire miners are already "out." Some 10,000 Yorkshire colliers are "idle," to use the local euphemism, though the dispute has been partly settled in Staffordshire, where the men were threatening to bring their tools out of the pits. Of the Lancashire strike, which is an accomplished fact, there is no need to say much; Staffordshire is certain to turn out less serious than it looks; but that in South Yorkshire is in a condition which calls for comment. The miners demand an immediate advance of 10 per cent. To this the employers reply that the present state of the coal trade will not admit of this request being conceded, and they offer the miners the opportunity of ascertaining for themselves, by means of experienced accountants, to whom they would submit their books, that what they say is true. Mr. Frith, the secretary for the Barnsley Miners' Association, has obtained figures in support of the men's demand, and to these he stubbornly adheres. The masters, with a view to settling this difference of opinion, made the miners, through their delegates, a distinct proposition, as follows:—"The miners shall take any one period of six months from July 1st, 1879, to December 31st, 1880—say July 1st, to December 31st, 1879, January 1st to June 30th, 1880, or July 1st to December 31st, 1880—during which the average net selling price of coal shall be ascertained at, say, six Barnsley pits and three Silkstone pits. The average price shall also be taken at the same pits for the last four months—say, October, November, and December, 1880, and January, 1881. If the last period of four months shows any advance over the other six months periods to be selected, the men's wages shall be advanced 2½ per cent. for every complete 4d. of advance in the selling price of coal that may be shown, up to 1s. 4d. per ton—the fifth advance of 4d. per ton entitling the men to a further advance in wages of 5 per cent. instead of 2½; this settlement to apply from 1st March next." With this they also offered the sliding scale for the regulation of wages in the future. The delegates pressed the employers to give them an advance at once along with the sliding scale, but the coalowners declined to alter their offer, and the delegates returned to place the proposition before the general body of the miners. A further conference is to be held, when the result of the reference to the miners

will be reported. At present the great majority of the miners decline even to entertain the question of the sliding scale unless the 10 per cent. advance is first conceded.

THE AMERICAN PATENT OFFICE REPORT.

IT appears from the recently issued annual report of the United States Commissioner of Patents that there were 20,059 applications—including design patents—during the year 1879, and of that number 12,725 were actually granted. There were 634 applications for re-issue, 488 being successful. Out of 1293 applications to register trade marks, only 872 were complied with, whilst 355 labels were registered out of 576 tendered for registration. As compared with previous years the patents issued show a falling off, the number of grants never having been so small since 1866, when they reached 9450 only, out of 15,269 applications. A comparison of the returns for a series of years shows that the proportion between applications and issues fluctuates in a most remarkable manner. For instance, in 1867, out of 21,276 applications only 13,051 were allowed, whilst in 1875, out of 21,425 applications no less than 17,026 patents were issued. It is difficult to believe that the merit of the schemes submitted to the examiners varies very much from year to year, so that the discrepancy can only be due to the changing moods of the examining staff. The receipts during the year amounted to 703,931 dols., the expenditure being 529,638 dols., thus leaving a surplus of 74,292 dols. The total accumulated "balance in the Treasury of the United States on account of the Patent Fund," on the 1st January, 1880, was 1,420,806 dols. The largest item of expenditure was that of salaries, which absorbed 398,761 dols. The *Official Gazette* cost 29,761 dols.—less 7412 dols. received for subscriptions—whilst 37,041 dols. were expended under the head of photo-lithography. From a table showing the geographical distribution of the patents granted, we learn that the State of New York stands first with 2556 patents, followed by Pennsylvania, 1369; Massachusetts, 1134; Illinois, 949; Ohio, 902; New Jersey, 587; Connecticut, 569; down to New Mexico territory with only 2, Arizona territory being unrepresented. The most inventive State is Massachusetts, where one patent was issued to every 403 inhabitants. This is followed by Connecticut with 1 to every 945 of the population, and Rhode Island with 1 to 1138. Only 364 patents were issued to subjects of Great Britain, including Canada; 91 to French subjects; 128 to Germans and 65 other foreigners. These figures are not a little remarkable, as tending to show that the American law does not exercise much attraction upon foreign inventors. The Commissioner enlarges upon the defects of the office with considerable freedom, in a way which should convince enthusiasts on this side of the water that America has much to do before arriving at perfection. The printing of the back specifications is much in arrear; the illustrations to the report for 1870 are not yet printed, notwithstanding the very large annual surplus fund, and the commissioner makes no apology for pointing out "a few of the inconsistencies and absurdities involved in the law, as it now stands," which, he says, "evidently needs careful amendment."

THE MIDLAND RAILWAY.

THERE are none of the reports of our great railways more interesting than that of the Midland. That which has been just issued shadows forth the fact that the company will maintain that bold policy which has brought it to the front rank of railways. It has now increasing traffic, and as some of the works of magnitude it has been for a considerable time engaged on are approaching a termination, it proposes in the present session of Parliament to seek power to enter on others. The capital of the company, paid up, has now been raised to the vast sum of £68,458,100, but the bills that affect it in the present session would increase that amount by several millions. In the past half year the Midland Railway spent on capital account £632,119; it estimates that in the current half year it will expend £980,000; and that after that, to complete the works now in hand and to be entered on, a further sum of £1,610, 596 will be needful. It is evident, therefore, that that path of progress that has been entered on is not believed to be nearly completed yet. It is worth while noticing that the passenger traffic of this great company gives a very large part of the increase in its revenue in the past half year—an increase due to the lowest class. For whilst of first-class passengers there were carried on the Midland in the past six months about 1,021,000, there were conveyed not less than 13,435,681 third-class passengers. It is evident that as the 49 miles of railway now in course of construction are completed, there ought to be a large addition to the passenger traffic of the Midland. Of the amount to be spent on these lines, the largest portion will be spent in the current half year, so that it may be looked upon as certain that during the present year there will be an opening of a considerable length of road on the Midland system, so that the line will be freed from the burden of a large amount of unprofitable capital. Freed from this dead weight, and with the great bulk of the joint lines completed in the current half year, it may be hoped that the Midland will have, in the course of a month or two, a larger increase of traffic receipts than it has recently chronicled. It is a line that has been made, not bought; its greatness has been achieved rather than thrust upon it; and all who have watched its career will hope that it may have that reward it has so well deserved.

LITERATURE.

A Complete Course of Problems in Practical Plane Geometry, with an Introduction to Elementary Solid Geometry. New, revised, and enlarged edition. By. J. W. PALLISER. Simpkin, Marshall, and Co. 1880.

THE first edition of this little work, issued some years ago, met with considerable favour at the hands of teachers and students, so that the edition was soon exhausted. For some years the book remained out of print; but we are sure the new and enlarged edition will receive as hearty a welcome as did the original. We speak from a considerable amount of experience in the use of the old edition when we say that, of the many works upon the subject, we found none better, none more useful to the student, or with problems so well graduated and selected as that of Mr. Palliser. The study of geometry, whether theoretical or practical, is of a very fascinating nature, after the student has advanced to a certain point; but frequently the rudimentary difficulties are so great that this advance is never made. Many eminent teachers, in order to lessen the early difficulties, have strongly advocated the system of combining a theoretical and a practical course at the same period of school life; and this has been found to be of great advantage. Mr. Palliser is a teacher, and knowing a teacher's difficulties, he has been able in a great measure to encounter and overcome them. His selection of problems enables the student to solve, without much exertion, the various practical questions that may be presented to him. The additions made to this edition of some simple problems in solid geometry cause us to suggest the question whether it would not be better to supplement the work on Practical Plane Geometry by one on Solid Geometry, keeping the two branches distinct. What is given, in fact, makes us ask for more.

The pages now given up to the introduction to solid geometry could be filled with original problems to test the student's capability of adopting the knowledge gained by the use of the work. It must be remembered that the invention of descriptive geometry, or what is called in this work solid geometry, is of quite recent date, the second edition of Monge's Géométrie Descriptive being published only in 1820. Whilst, then, we admit the great value of a knowledge of practical plane geometry in all branches of engineering, we must at the same time advise the student not to rest content with having mastered one branch of his subject, but to contiue to master that other branch generalised and simplified by M. Monge. To return to what Mr. Palliser has done, we must direct attention to the rules he gives to be observed by students, as they are important. To condense his observations we may say he indicates the attainment of accuracy, neatness, and celerity. The author not only preaches, he practises; and in the 239 problems worked he shows how careful he has been to ask from the student nothing that a little patience and perseverance will not overcome.

Laxton's Builders' Price Book for 1881. London: Kelly and Co. Sixty-fourth edition.

IT would be somewhat difficult to prepare a price book which would be of very great use to engineers in general practice, for every year brings forth so many changes, and every engineer has so many points of practice peculiar to himself that no general price book of extensive use could be compiled. That such a book may be compiled for the use of builders, however, is attested by the fact of the appearance of the sixty-fourth edition of Laxton. That such a book should reach so many editions is, perhaps, indicative of the attention paid by the publishers to its revision and improvement every year. It is now stated to contain over 72,000 prices, and besides these are given notes and memoranda; the whole of the Metropolitan Building Acts; the unrepealed sections of previous Acts; a list of district surveyors; notes of cases and decisions in the superior courts, headings for building contracts, &c. A new section on sanitary work, occupying eleven pages, has been added to the last edition, and some useful hints are therein contained; but the value of this section would be much increased if some small centre-line diagrams were employed to illustrate the directions given by the author. The latter does not seem to think it absolutely necessary to employ separate cisterns for closet and house purposes; as he says that with properly executed plumbing, and the employment of a regulator closet valve, contamination of the water in the cistern cannot take place. We will not quarrel with this opinion, except to observe that it is not always easy to insure good plumbing work, and that in order to allow for bad work it is sometimes best to use the separate cistern. For additions to this sanitary section and others where necessary the publishers have plenty of room without increasing the thickness of the book. Sixteen pages are taken up with a list of patents for 1879-80. This is practically useless. It is too old to be news, too brief to be descriptive, while those interested will have, long before the book is published, obtained full information on any of these selected patents. The index to a book of this kind is, of course, of great importance, but it has hitherto been hampered with the interleaved advertisements. Builders and others will be glad to see that the index is henceforth to be free of these insinuated and obstructive notifications.

Zeitschrift für Instrumentenkunde. Organ für Mittheilungen aus dem gesammten Gebiete der wissenschaftlichen Technik. 1er Jahrgang. 1es Heft, Januar, 1881. Berlin: Julius Springer.

THIS is the first number of a monthly periodical devoted to subjects connected with the construction of philosophical instruments. It contains an article on the standard barometer and pressure gauge made for the Imperial Standards Commission at Berlin. This is followed by a paper by Dr. Foerster, the well-known astronomer, on the illumination of micrometer arrangements in telescopes and microscopes. C. Reichel deals with the question of micrometer screws, and the means of avoiding imperfections in such screws. There are also articles on spectrum apparatus, and on an electrical apparatus for indicating the variations in the height of the mercurial column of a numometer at a distance. The number also contains minor notices relating to contrivances useful in the physical laboratory and workshop. The journal is likely to prove of service to those interested in the refinements of mechanical construction as applied in the manufacture of the complicated apparatus now employed in the investigation of physical science.

PARIS WATER-METERS.

IN consequence of the new regulations for the supply of Paris with water which came into force on the 1st of January, the authorities have adopted four types of water-meters. These are, first, Kennedy's; second, Frager's, manufactured by M. Michel, of Paris; third, that of M. Samain, an engineer of Blois; and fourth, the meter of MM. Mathelen and Deplechin, manufactured by MM. Mathelen and Garnier in Paris.

All the meters are of the piston type. We illustrate the two last-named on page 124. Samain's meter has four cylinders; the water under pressure arrives through a pipe at the upper part, enters the distributing chamber A, and from thence passes alternately to each end of each cylinder through ports governed by the rotating valve B turning with the shaft C, itself put in motion by the cranks. Figs. 1, 2, and 4, show very clearly the shape of the valve, while Fig. 5 illustrates the shape of the port face surface. When one of the openings *b* of the valve comes over one of the ports in the seat, the water acts on the piston, and causing the rotation of the shaft and of the valve, which now closes the admission port *d*, the piston then making a back stroke, pushed by the piston diametrically opposite, expels one cylinder full of water, as indicated by the arrows in Fig. 1. The water enters the central chamber of the meter, and escapes by the delivery pipe as shown in Figs. 1 and 2. The action of all four cylinders is the same. The valve acts directly on the counter. The cylinders and pistons are of gun-metal; the packings of leather. The average speed of the meter is sixty revolutions per minute.

Deplechin and Mathelin's meter is shown by Figs. 6, 7, and 8. It consists of three pistons and a rotating distributing valve. The water under pressure is admitted by the orifice A, and presses equally on the faces of the three pistons B, C, D, and motion is obtained by reducing the pressure on the back of each in turn. The piston B being at the end of its stroke, the two pistons D and C are put in motion by the pressure on their upper faces, and they drive the crank F, to which they are coupled by the rods F F. This crank in its turn puts the piston B in motion, and the water which filled the space behind the pistons escapes by the orifice G of the rotating valve, and at the same time a fresh quantity of water is admitted behind B. The crank drives the cock valve as shown in Figs. 6, 7, and 8. It is divided into two compartments, one for admission and the other for exhaust. It works in a gun-metal casing having three openings or ports, the use of which requires no explanation. The axis puts the counter in motion. In order to facilitate the inspection of the meters they are provided with a stuffing-box on one of the cylinders, in which works a pin, by which the meter can be locked at will. If water can then be drawn from the service pipe it is evident that the meter is leaking.

The merit of various water meters is just now an especially interesting question for the people of London, as the adoption of constant supply measured by meter and paid for accordingly is stoutly advocated by many persons, and has much to recommend it. It is by no means impossible that much will be said on the subject when Parliament finds time to legislate on the water supply of the metropolis. We are indebted to our esteemed contemporary *Annales Industrielles* for the drawings of which our engravings are copies. It is to be regretted that no information is supplied concerning the efficiency of any of the meters named.

TENDERS.

PORTSLADE.—BREWERY AND PLANT.

FOR the plant, machinery, and various brewery utensils for the new Brewery, Portslade, near Brighton, for Messrs. J. Dudney and Sons. Messrs. Scamell and Colyer, Civil Engineers, 18, Great George-street, Westminster, S.W.

	£	s.	d.
CONTRACT No. 3.—BOILERS.			
Appleby Bros.			
Cater Walker, Sons, and Co.	1685	0	0
Horton and Son	888	0	0
Thornewill and Warham—accepted	886	0	0
CONTRACT No. 4.—MILLWRIGHTS WORK.			
Hunter and English	3874	0	0
Pontifex and Sons	2985	0	0
Bennett	2924	10	0
Thornewill and Warham	2728	0	0
Oxley and Co.	2560	10	0
Pontifex and Wood	2510	0	0
H. Woods and Co.	2500	0	0
Wilson and Co	2473	9	10
CONTRACT No. 5.—COPPERS, UNDERBACKS, COILS, &c.			
Shears	1139	0	0
Blundell Bros.	1031	4	0
Pontifex and Sons	1016	0	0
Bennett	985	0	0
J. Dale and Co.	960	1	6
Pontifex and Wood	825	0	0
Bindley and Briggs—accepted	817	0	0
CONTRACT No. 6.—SLATE TUNS, YEAST BACKS, &c.			
Sharp and Sons	1166	0	0
Brindley	1035	0	0
Braby and Co.	985	0	0
Stirling	908	0	0
Ashton and Green—accepted	658	0	0
CONTRACT No. 7.—COPPER AND IRON PIPE CONNECTIONS, ATTEMPERATORS, &c.			
Shears	2440	0	0
S. Dale and Co.	2314	0	0
Siebe and Gorman	1959	0	0
Oxley and Co.	1826	9	0
Blundell Bros.	1700	6	0
Wilson and Co.	1606	18	7
Pontifex and Sons	1580	0	0
Bennett	1520	0	0
Thornewill and Warham	1450	0	0
Bindley and Briggs—accepted	1435	0	0
CONTRACT No. 9.—REFRIGERATORS.			
Lawrence and Co.	285	0	0

WICK HARBOUR.—Mr. Kinipple, harbour engineer, of Westminster and Greenock, has patented his monolithic system of forming sea breakwaters and harbour walls. This invention enables harbour works to be constructed in jointless masses of concrete *in situ* without the aid of divers, stagings, or overhead travellers, in fact without the use of the ordinary costly plant. This system has been experimentally tried with, we understand, great success at New York, Quebec, and Greenock, and last year it was also experimentally used by him at Wick, in the reconstruction of the south pier head, upon its old or rubble foundations. The Government Loan Commissioners granted a sum of from £10,000 to £12,000 for these repairs, and for the extension of the head this year for 40ft., so as to render last year's repairs safe against any seas which may enter the Bay of Wick. The extension will be of the same monolithic construction, and founded deep into the hard clay of which the bottom of the Bay is composed. At Wick any breakwater which is not of monolithic construction from foundation to parapet cannot be relied upon as safe against all contingencies of sudden and severe storms. It is claimed for the system that one of its chief merits is its simplicity and reliability, for any breakwater in the most exposed localities can now be constructed at about one-half the usual cost, and certainly within one-third of the time formerly occupied in executing these works, for there is nothing whatever to prevent a breakwater being commenced at its head, centre, or root, or being carried on simultaneously from end to end. Mr. Kinipple states that no skilled workmen beyond ordinary labourers or fishermen are required, and indeed a present of a batch of Portland cement to some of the poorer fishermen is all that is necessary to enable them to repair or construct small breakwaters along the coast. The system is well adapted for founding on rocky or irregular bottoms, but in many cases trenches would have to be dredged by dipper or other dredges for the reception of the concrete. The concrete is mixed either in bulk or in blocks, and allowed to set or harden out of water, so that when thrown overboard into the foundations or works it is hard enough to prevent the cement from separaring from the sand and shingle while passing through the water, and soft enough when in the work to fall together and to become one compact mass, equal in strength after a short time to the natural rocks. Where the walls are required to be vertical or battered, a few iron rods are used with sliding planks, to retain the concrete in form for a few days until it is set. At Wick masses of concrete cast in this manner resisted a heavy storm within twenty-four hours after they were put in, while stones of several tons weight were hurled in every direction by the same gale.

NARROW GAUGE RAILWAYS, IRELAND.*

By Mr. William Lewis, Member.

Having promised a paper on this subject, I have much pleasure in fulfilling my promise, but in doing so, I find that within the limits of a single paper it would be quite impossible to do more than deal generally with the voluminous and varied matters necessarily embraced in a question of such importance as that of a narrow gauge railway system, suited to the requirements of the country. I must, therefore, ask this Institute to kindly accept from me this skeleton paper, which is a mere abstract of my own experience of the construction and working of a system in the North of Ireland for the past six or seven years, hoping that inquiry may be induced thereby, and that the subjects sketched therein may be considered worthy the attention of the members of the Institution, and by eliciting valuable and practical suggestions, add to, and render more complete the details of a system which is assuming considerable importance in Ireland.

I am happy to say that a good deal of the prejudice and objections existing heretofore to narrow gauge railways is rapidly disappearing, and that many strenuous but honourable opponents of the system are now leaning to the opinion that, as feeders to main lines, and in supplying remote districts with rail accommodation, narrow gauge railways and tramways are useful and necessary, and may be safely introduced without injuriously affecting in any way or disparaging the property or principle of the wide gauge lines. Neither is the system considered unworthy the attention of our friends at the other side of the Channel, having an interest in Irish projects; who in forming syndicates for the development of our Irish railways, introduce capital into the country, open up new industries, improve their properties and prospects, and give employment to the many. At this stage I must take the liberty of digressing for a moment from the exact text of this paper, and call the minds of some of the older members back to a period of some twelve or fourteen years ago, when engineering was at a very low ebb indeed. Public works being almost stagnant, enterprise and capital seemed to have left our shores, no remunerative employment could be obtained by members of the engineering profession, many of whom—luckily perhaps for themselves—went abroad, and in foreign climes obtained there the employment, and attained the eminence their industry and ability entitled them to at home. This exceptional state of affairs occupied the attention of many well-wishers of Ireland, and amongst others the late Sir John MacNeil, with whom I was at that time associated in business. We frequently discussed the subject together, with the view of arriving, if possible, at some remedy or panacea which would restore confidence, and imbue railway property and projectors with new life and fresh energy. Railways were admittedly required in the country, but money could not be obtained to construct wide gauge lines. It became therefore, necessary to cheapen their construction by some other and effective means, which, in giving the accommodation suitable to the requirements of the country in its then depressed state, would at the same time develop her industries. This was proposed to be effected by extending a cheap network of narrow gauge railways over Ireland, which it was expected would meet the exigencies of the times, and give the facilities to trade and employment then so much required. Various plans were proposed. Sir John MacNeil recommended a 3ft. 6in. gauge, which we estimated could at the time be constructed and equipped for £3000 per mile. Fast speed was not considered necessary to the system, which was intended for branch lines and mineral districts, and goods being the principal traffic—fifteen to eighteen miles per hour was considered sufficient speed. Stations would only be erected at terminal points. Public roads crossed on the level—save where a bridge would be cheaper—the carriages constructed on something of the omnibus plan, guards would pass through, take money and give out tickets, thereby avoiding to a great extent the heavy expenses attending the construction of intermediate stations, platforms, signalling, and employment of station masters, porters, and other costly paraphernalia indispensable to the working of a wide gauge system, but less required on the narrow. It was proposed that a company should be formed in London, which would advance two-thirds of the capital if the remaining one-third could be raised by baronial guarantee, or otherwise obtained locally. The scheme fell through, owing to panic and financial difficulties, and our narrow gauge railway was doomed to temporary oblivion, and remained so until the year 1870, when Mr. William Valentine, of Belfast, a gentleman of great commercial experience and ability, anxious to develop the mineral districts of the County Antrim, employed me to lay off a narrow gauge railway from Ballymena to Cushendall, a distance of twenty-one miles, and for which project we obtained an Act of Parliament. This line—the first narrow gauge railway constructed in Ireland—was completed and opened for goods traffic in the year 1875. This railway was followed by another, promoted by Mr. Chaine, M.P., and others, from the Port of Larne to Ballymena, with branches, a distance of some thirty miles. This useful project was opposed both in the Lords and Commons, but was carried, and the line completed and opened for passenger traffic and goods in the year 1878. In continuation of the same system a Bill was applied for in 1879 for a line from Ballymena to Portglenone, a distance of some eleven miles, which was also opposed in Lords and Commons, but was carried, and for the construction of which the contract drawings have been prepared, and the line pegged out. (A further extension to Derry is now before Parliament, as shown on a cartoon map, which, if carried, will increase by fifty miles the existing length of narrow gauge railways in the North of Ireland.) These projects, simple and useful in themselves, were obtained at great Parliamentary expense to the respective companies. And here I would take the liberty of calling the attention of the members of this Institution to the conduct of Irish railway bills through Parliament, and the heavy expenses, delays, and inconveniences attending their progress through committees. I know of many good measures that were abandoned in consequence of this dreaded expense, and which I, in common with other engineers, found to act as a great bar to the development of useful measures for Ireland, and discouragement to local promoters and others actuated by good wishes, and desirous to further her industries. When we consider the heavy cost of obtaining an Act for a simple project, such as a plain local railway or other useful scheme, requiring but ordinary engineering skill to project, and little legal acumen to employ in the preparation of the bill, surely a local commission, composed, say, of five Irish members of Parliament, having no direct interest in the schemes proposed, could, from their residence in, and knowledge of the requirement of the country, and the merits of the proposed measures, arrive at a more direct and satisfactory conclusion at one quarter the expense and time than by the present tedious and expensive process "of lodging plans in London, where they lie for probably three months, hurrying over witnesses to committees—many of whom are not examined at all—employing a host of counsel, parliamentary agents, and so-called experts, who often from their ignorance of the country and its necessities, muddle a clear plain case, and allow clauses to be inserted in the Act, which in practice are afterwards found to be injurious and destructive to the success of an otherwise good and remunerative project." I only hope that the attention of the Institution will be called to this—a real grievance—and that through its influence and representation some energetic member of Parliament may be induced to bring this matter before the House. In the Isle of Man local bills are locally disposed of. Why cannot the same thing be done here? The standing orders could be easily adjusted to meet the requirements of this country, such as the clauses affecting the gauge, the time and place for lodgment of documents, and constitution of the commission of inquiry, which could be held at the nearest assize town, where the cases could be practically decided, and if approved, the plans for construction at once proceeded with, the Royal assent being obtained in the usual course, thus effecting a saving in time of at least a half, as compared with the present system, which takes from nine to twelve months from time of lodgment of documents to that of obtaining the Act. I hope the members will not consider these remarks foreign to the subject matter of this paper, or that they are influenced by any feeling on my part, other than that of a sincere desire in the interests of the engineering profession to have the abuse remedied, our bills facilitated, and useful measures carried, at a reasonable expense and in a practicable shape. The County Antrim is the only part of Ireland at present where narrow gauge railways have been introduced, about seventy miles of which have been constructed and are at work. On the Ballymena and Cushendall Railway, only used at present for mineral traffic, the working expenses average about 38 per cent. of the receipts. On the Ballymena and Larne Railway, a passenger and goods line, the receipts at present are not more than £9 per mile per week; the working expenses are necessarily high, some 60 per cent., but as the traffic is rapidly increasing, this high rate will reduce in proportion to the receipts, as the appliances for working the line can accommodate at least double the traffic at present brought over the railway. On the Cushendall Mineral Railway, 4 per cent. has been paid in dividends, and on the latter 2 per cent. The average cost per mile proper exclusive of land and rolling stock of the Cushendall Railway was £3600. The average of the Ballymena and Larne £3400. In the case of the Cushendall Railway, had a wide gauge line been made, it would have been both costly and unremunerative from the physical difficulties of construction. And in the case of the Ballymena and Larne, the line would have been—if practicable at all—very costly, and unsuited to the requirements of the district. But for the introduction of the narrow gauge railway system, the County Antrim would be deprived of the benefits obtained from the development of its mines, mills, and other resources, and a large tract of country left unopened and unconnected with the markets and seaports. The rate of speed on narrow gauge railways in the north of Ireland, averages eighteen miles per hour for goods or mixed trains, and twenty-three miles per hour for passenger trains, this rate of speed can be increased if found necessary, but as there is no necessity for fast speed, it is found that all the requirements of present traffic are fully provided for by this rate. Narrow gauge railways can be constructed cheaply through hilly districts, where the wide gauge, from its great expense, would be rendered impracticable. Wide gauge lines with proportionate curves, and necessarily heavy earthwork and masonry, incident to a rough country would be doubled and quadrupled in cost. Some of the railways for instance already constructed in the North of Ireland, namely, the Larne and Ballymena and Cushendall Railways, would have proved a sad example in the history of railway failures if formed on the wide gauge principle, as I am sure from my long experience of wide gauge railway construction, that they could not have paid one shilling dividend, and it is doubtful if they could have even paid "working expenses." Narrow gauge railways constructed through rough countries contrast most favourably with wide in point of cost. But even through level countries, apart from the saving in land, permanent way, &c., the advantages are very great in avoidance of heavy bridges, road approaches, and expensive lands and houses, by the introduction of curves and gradients, not applicable to a wide gauge line. Narrow gauge railways have been constructed to the extent of hundreds of miles through India, Norway, Queensland, Canada, and in the United States, where the standard gauge is 3ft., and great savings effected in working expenses. On narrow gauge railways in Ireland the wagons are constructed to hold 6 tons of goods, with a tare of 2½ tons. On some of the wide gauge, as at present worked, the proportion is about 1 to 1—that is, 6 tons of paying load to 6 tons of dead weight, and on the narrow, 6 tons of paying load to 2½ tons of dead weight. It is found in actual work that the disparity between paying and non-paying load is much increased—except in mineral traffic—from large or wide gauge wagons being unable always to carry their maximum load arising from bulky freights, which, though filling the wagon, only weigh perhaps some two or three tons. The carriages are constructed on the bogie system, to hold an average of forty passengers each. The accommodation is found sufficient, and the motion to be at least as smooth as on first-class constructed railways. The engines for passengers are bogie tank engines, weighing about 18 tons full; and the goods engines about 24 tons. Narrow gauge stock we find in practice to be proportionately stronger than the wide; the wagons are easier loaded and shunted, and from their strength not easily injured by fly shunting. A narrow gauge railway fully equipped with suitable stock for, say, a length of thirty miles, may be constructed over an ordinary country for £5000, and as low as £4000 per mile, where a broad gauge railway could not be constructed for less than from £7000 to £9000. The working expenses of the Ballymena and Larne Railway are 1s. 8d. per train mile, broad gauge railway 2s. 6d. to 3s. per train mile. Steam tramways for light traffic may be profitably introduced to suburban districts, along country roads, where suitable, and for country districts where the cost of a railway from the very limited character of the traffic could not possibly pay, and which could be afterwards converted into a railway, if the traffic increased and justified the change, by widening the roads and fencing in the railway, as we propose to do, with some tramways in this country. In other provinces much good could be accomplished by the promotion and extension of cheap railways and tramways. Hundreds of miles of country are at present unprovided with railway accommodation to market and the seaboard, and the people in consequence thereof thrown almost a century back in commercial pursuits and industries, which this system would inevitably develope and remedy. It is not my intention to trouble you at present with detailed estimates and quantities of the various items embraced in the construction of a narrow gauge railway, which, however, I shall be most happy to furnish any member with, requiring such information; but to confine this paper to an abstract of comparative cost and savings, effected on each main item, "Broad and narrow gauge, single and double lines," and in doing so, I hope the members will acquit me of any attempt to institute invidious comparisons of the two systems which are both ably represented here, the cost and working expenses of either depending upon local conditions, some lines from their traffic showing large receipts and cheap working expenses, whilst others from small receipts, show necessarily large working expenses. I estimate the cost of one mile of narrow gauge railway through ordinary country, taking as data the cuttings at an average depth of 5ft., with two public road bridges per mile, independent of rolling stock, Parliamentary expenses, law and engineering, at £4100 per mile, and of a wide gauge railway upon similar data, at £5700 per mile, making a saving of £1653 per mile in favour of narrow gauge. I estimate the cost of a double narrow gauge railway at £5800 per mile, as compared with £8214 of wide gauge, making a saving of £2411 per mile in favour of the narrow gauge upon the data heretofore stated. The savings therefore, upon construction of a single line of narrow gauge—say thirty miles long—would be £49,590, and upon a double line, £72,330, apart from maintenance of works, which is nearly in the direct proportion to gauge—*i.e.*, 3ft., 5ft. 25in. (See Board of Trade Returns.) And from savings in cost of rolling stock, which would be very considerable, the cost dependent of course—as already stated—on the character of the traffic. The savings on a mile of single narrow gauge railway construction and on a mile of double line ditto, as compared with the wide gauge lines I arrive at the figures in the annexed table. These amounts are calculated upon the most favourable condition of prices—viz., the earthworks at 1s. per cubic yard; fencing, at 1s. 6d. per yard; ballast, 2s. 6d. per cubic yard; rubble masonry, at 15s.; arching, 30s.; rails, at £8 per ton; land, £100 per acre, and all other prices in proportion—the proportion of cost—wide and narrow, being regulated by the current prices of labour and materials and the physical character of the country. On the Ballymena and Larne Railway the ruling gradient is 1 in 41, and 1 in 46 for a length of 1 mile thirty-seven chains, out of Larne, round some curves of seven chains radius, from which No. 3 engine brings up a net load of 80 tons at a speed of about twelve miles per hour—a good deal of course depending upon the condition of the rails—when the rails are dry and no slipping occurs, this average load and rate are exceeded. With No. 1. engine and one saloon carriage we have run the twenty-four miles in fifty-two minutes. Fast speed, however, is not now required or considered important on this line of railway. The working expenses have been returned to me at 19·16d. per train mile, made up of the following items:—

Single Line.

	£	s.	d.
Earthwork, per mile	150	10	0
Road approaches	194	4	0
Fencing of road approaches	16	10	0
Road metal	12	12	0
Ballast and boxing	133	12	0
Public road bridges	211	0	0
Permanent way—rails and fastenings	423	0	0
Sleepers	133	6	8
Carriage of materials and laying	5	16	0
Culverts	7	10	0
Accommodation works	20	0	0
Land	75	0	0
Proportion of signals	20	0	0
Stations and platforms	100	0	0
	£1503	0	8
Contingencies, 10 per cent.	150	0	0
Saving on one mile	£1653	0	0

or (say £1653 × 30 = £49,590 on thirty miles).

Double Line of Narrow Gauge.

Savings on a mile of narrow gauge construction:—

	£	s.	d.
Earthwork, per mile	200	13	0
Road approaches	194	4	0
Fencing of road approaches	16	10	0
Road metal	12	12	0
Ballast and boxing	177	0	0
Road bridges	224	0	0
Permanent way, rails, and fastening	841	10	0
Sleepers	266	13	4
Carriage of materials and laying	11	12	0
Culverts	7	10	0
Accommodation works	20	0	0
Land	100	0	0
Proportion of Signals	20	0	0
Proportion of stations and platforms	100	0	0
	£2192	4	4
10 per cent contingencies	219	8	5
	£2411	12	9

Say £2411 × 30 = £72,330 on 30 miles.

Miles run.	Rate per week. £	s.	d.		d.	d.
1202				Engine coal (20·82 lb.)	1·38	
				Engine oil (20 naggins)	0·24	
	27	4	10	Stores, waste, &c.	0·08	
				Wagon oil	0·11	
				Locomotive department and repairs of rolling stock	3·63	
						5·44
	26	10	10	Station masters, porters, &c.		5·30
	29	2	11	Permanent way		5·82
	13	0	6	Manager and secretary's office		2·60
	95	19		1 = 1202 miles = per train mile		19·16

No. 1 engine is a bogie engine, with drivers and trailing wheels coupled; her weight, loaded, about 19 tons; outside cylinders, 11in. diameter and 18in. stroke; the diameter of the driving wheels, 3ft. 9in., and the bogie wheels, 2ft.; her speed is about 31 miles per hour. No. 2 is a side-tank engine; her weight, loaded, about 21 tons; wheels coupled, 3ft. 3in. diameter; her speed averages about 16 miles per hour. No. 3 is a more powerful engine, saddle-tank, with six wheels coupled, 3ft. 3in. diameter; cylinders, 14in. diameter and 18in. stroke; with bogie wheels, 2ft. diameter; her weight, loaded, being 25½ tons; her speed averages about 19 miles per hour. These engines have been built by Messrs. Peacock, and are very suitable for the purposes intended—viz., light and heavy traffic, separate and combined. The passenger carriages used are composite and carried on double bogie wheels, and on wheels with Cleminson's radiating axles, 2ft. 4in. diameter; on the former they are some 49ft. long, and on the latter 36ft. long, and carry on an average forty passengers each comfortably; the floors of the carriages are 2ft. 10in. over rail, and 6ft. 6in. wide in clear, and 10ft. high in centre over rail. 1st and 3rd class passengers' compartments only are used. The wagons consist of coal, lime, cattle, and iron ore trucks, &c. The tare of the coal wagon—which is a large factor of the traffic—averages 2¾ tons, and carries a profitable load of 6 tons. The cattle wagons accommodate fifteen head, and the iron ore is carried in hopper wagons, holding five tons each. The ore is discharged at the quay of Larne by cranes, which lift the truck off the frame into the vessel, which is found to answer the purposes of high shooting stage originally intended. The average work with one large steam crane, is about 100 tons per hour. At Larne harbour extensive quays and wharves have been erected by the proprietor, Mr. Chaine, M.P., upon which both the broad and narrow gauge lines are laid, and over which travelling steam cranes work night and day, to accommodate the increasing traffic of the port. An extension some 600ft. long is now being made to the quay, the works being under the superintendence of Mr. Macdonald, C.E., a member of this Institution, from whom a paper on the works and machinery applied would, I have no doubt, prove useful and interesting. In concluding this paper I would call attention to the fact that—due to the difference of gauge—Ireland is saddled with a more costly and cumbrous working system than either England or Scotland, although her general traffic cannot favourably compare with either country, and that, no matter how the rolling stock may be altered or lightened, the standard Irish gauge inflicts a loss upon the profitable working of our railway system, but which, in many future lines, may be remedied by an "alteration of the gauge."

* Read before the Institution of Civil Engineers, Ireland.

Sanitary Houses.—The Society of Arts propose to award medals for plans showing the best sanitary arrangements in houses built in the metropolis, such plans to be exhibited in the Society's rooms, Adelphi, in June, 1881, and to be sent in on or before 12th May, 1881. One silver medal will be awarded for the best sanitary arrangements carried out and in satisfactory working in a house let out in tenements to artisans for which a weekly rental is paid. One silver medal for the best sanitary arrangements in actual satisfactory working in a house of the yearly rental of from £40 or less to about £100 in value. One silver medal for the best sanitary arrangements in actual satisfactory working in a house of the yearly rental value of £200 and upwards to any amount. The houses must be open to the inspection of the judges, who, in considering their award, will be guided by the suggestions of plans for main sewerage, drainage, and water supply, made under the Public Health Act, 1875. The houses must have been in actual occupation within the last three months, and a certificate must be given by the occupiers, on a printed form, stating the satisfactory working of all the sanitary arrangements, such form to be obtained at the Society of Arts. The houses may be old, fitted with modern sanitary arrangements, or may be new. They must be within the metropolitan area of the Board of Works. The sanitary arrangements must include the conditions for good water supply, drainage, warming and ventilation of the house, and precautions taken against frost. The medals may be awarded to the occupiers of the houses or the lessees, or the owners. The plans must consist of a ground plan and sections, to the scale of not less than 1in. to 5ft.; details not less than 1in. to the foot. The plans may be accompanied by specifications.

THE INSTITUTION OF CIVIL ENGINEERS.

AT the meeting on Tuesday, the 8th February, Mr. Abernethy, F.R.S.E., president, in the chair, a paper on the "Temporary Works and Plant at the Portsmouth Dockyard Extension," by Mr. C. H. Meyer, Assoc. M. Inst. C.E., was read.

After briefly describing some of the means used in carrying out these great works, which were begun in 1867, and were practically finished in 1876, the author alluded to the peculiarities of the site, and to the method adopted to reclaim 75 acres of the tidal portion of the harbour by cofferdams. These comprised 3100 lineal feet of shallow dams, 300 lineal feet of outer or main dams, and 200 lineal feet of special dams, across channels, which were closed by panels, the details in all cases being given. Mention was then made of the reasons that had led to the extensive use of steam power and mechanical appliances in the carrying out of the works, on which was brought together perhaps a larger amount of such plant than probably had previously been used on any similar work. Some of these appliances, including an attempt at dredging from staging, which, however, was not altogether a success, and the use of various travellers for performing heavy work, and of different forms of steam piling engines, were described in detail. As ordinary roads and railways laid upon the ground were in most cases inapplicable, timber viaducts for double lines of way had generally to be adopted within the area to be occupied by the intended works. A viaduct of about 3000ft. in length for a double line had also to be constructed to connect the works with the site chosen for the deposit of the surplus excavated material. This latter work necessitated the crossing of a navigable channel, named Fountain Lake, in Portsmouth Harbour. In order not to impede the water traffic, a swing bridge became necessary. A bridge for this purpose was specially designed by the late Mr. E. P. Smith and Mr. Ernest Latham, its requirements being two openings of 50ft. each in the clear for the waterway, and handiness and rapidity in action when in use. This was obtained in a most satisfactory manner; the bridge, however, was only for a single line of way. It was supplied with automatic locking gear, so that the moment it was swung into position it was ready without further delay for the passage of trains. With regard to the timber viaducts, the author pointed out what experience had shown to be their capability as to endurance, and under what conditions they failed He then described the gantries, or roadways, for the heavy steam travellers, which were so much used on the works, and under what conditions they had been found sufficient for their purpose, and the contrary. The arrangements for keeping the works free from water, and the freedom of the site from water, were next touched upon. Under ordinary circumstances, one Murray's chain pump, lifting the water about 50ft., was generally sufficient to keep the area within the shallow dam—the drainage area of which was about 100 acres—clear. Mention was also made of an experimental boring, sunk to investigate the condition of the beds lying below those actually excavated in the ordinary course of the work, both with a view to obtain an insight as to the necessary foundations, and the determination of the exact geological position of the beds exposed. The author then described the means specially adopted in excavating for, and in constructing, wells in that part of the work outside the limit of the area first reclaimed, where, on account of the depth of the mud through which the foundation had to be reached, the work was treated in an entirely different manner from the rest. It was found unadvisable, if not impossible, to do without whole timber sheet-piling through the entire depth of the mud, and to work within the trenches so formed. The outer cofferdam, close to which this part of the work was situated, was exposed to considerable risk, being alongside Fountain Lake. Diagrams illustrating this part of the work were shown, as well as others, exhibiting features both in the structure of the permanent works and in the means taken to carry them ont.

The paper concluded with a notice of an entrance of 94ft. clear opening, which had to be constructed to afford direct communication with the harbour. Deep mud and the vicinity of the cofferdam rendered this a work of difficulty. It was not thought prudent to excavate the entire width at once; the outer half was, therefore, first completed, and a curved brick wall, or dam, built in segments to render its removal easy, was carried across the opening, thus supporting the cofferdam, and clearing the ground for the construction of the second half.

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

(*From our own Correspondent.*)

UPON 'Change in Birmingham this afternoon, and in Wolverhampton yesterday, finished ironmasters reported continued reluctance by consumers to purchase beyond immediate necessities. As a result, the works are only partly occupied, and not a little difficulty is found in procuring orders sufficient to render even this amount of employment possible. Except in the case of the sheet-makers, any attempt to secure higher prices than ruled before the advance in coal at once stopped negotiations. Hence manufacturers, while all protesting their inability to afford to sell at previous rates, had mostly to be content with them.

The boiler-plate makers announced that Lancashire consumers and our Government are just now about the most conspicuous home buyers. But the demand is by no means large. On account of certain of the foreign markets some makers are active, though there is a belief among their competitors that they would be more in pocket if they were to refuse the orders. Prices are about £8 to £8 5s. for minimum quality plates, £9 for good plates, and £9 10s. to £10 for superior makes.

The marked bar firms are going along only quietly; still the demand has of late been slightly better, as well for Colonial and United States as for home consumption. The full rates of £7 10s. were demanded for the bars of such firms as Messrs. Wm. Barrows and Sons, the New British Iron Company, and Messrs. Phillip Williams and Sons; and of £8 2s. 6d., subject to merchants' commission, for the Earl of Dudley's common bars rolled at the Round Oak Works.

The demand for common and medium bars was to-day better than that for best sorts, so far as the home trade is concerned, but for foreign consumption they had to yield the palm to the products of high class makers who have established a name abroad, £6 to £6 10s. for common, and £7 for medium qualities was quoted.

Hoop makers announced a renewal of United States inquiries for baling hoops. As before, however, the Americans are buying keenly, and sellers are unable to get prices which mean much profit. Very few will consent to give as high a figure as £7 at works, or £7 10s. delivered in Liverpool for hoops that will bear even a capital strain. Ordinary hoops are priced at £6 to £6 10s. at works.

Specifications are not forthcoming from the galvanisers with sufficient rapidity to keep all the sheet mills actively on. In part this is attributable to the receipt of telegrams by galvanisers this week ordering the postponement of shipments to the Cape, because of the despatch of troops to South Africa. The top price for galvanising singles was to-day £8, and the same firms would have accepted £9 for doubles and £10 10s. for trebles. In their corrugated state galvanised heets of ordinary quality were, for 24 w.g. in bundles, delivered in Liverpool, £13 10s. to £14. Makers reported a capital demand on home and foreign account alike.

Ironmasters on Change to-day and yesterday were not a little concerned at the movement in Belgium—fearing, if it should only partially succeed, a great increase in Belgian competition in such finished iron as this district supplies, as well as in the girders of a section which has not yet been generally adopted by Staffordshire finished iron firms as one of their leading products.

In the pig iron trade no improvement can be reported Only slight success attended producers' efforts to get better prices, claimed because of the higher cost of fuel. Cinder pigs were plentiful at £2, and might here and there have been had for less money. Staffordshire part-mine pigs were £2 10s. to £2 15s., and all-mine sorts £3 5s. for hot blast, and £4 5s. for cold blast, with "some consideration" to old customers. Pigs made in other districts were in better request than native brands; yet neither as to these can the demand be said to be good. Derbyshire and Northampton sorts were mostly £2 7s. 6d. to £2 10s. per ton. Sellers of Cleveland pigs asked 51s. 6d. for No. 4 forge, delivered in this district, and 52s. 6d. for No. 3 foundry—makers' prices. But they failed to effect sales. Nor were hematite agents any more successful. Notwithstanding that the United States demand was reported to be large for these pigs, consumers hereabouts cannot be induced to give anything like agents' quotations, namely, 72s. 6d. for Tredegar make, 75s. for Blaina, and 75s. for Barrow.

The iron-rivetting firms who look to the civil engineers, gas companies, and the like for work, have mostly a good prospect before them. More gasometer orders are in hand at the leading yards than for a long time past.

Hardware merchants are credited with having a considerable number of orders to place for Australia, received by the last two or three mails; but manufacturers that are not engaged in the galvanised industry are beginning to fear as the result of their own experience that the statement contains more rumour than fact. Nevertheless, the export work in hand is large in respect of the Antipodean centres. Next in order come India and South America. Brazil is most conspicuously in the better direction. Excepting for requirements incidental to across-country traffic, the Cape trade is depressed. The West Indies keep good. Canada is quiet and the States demand still delays its expression.

An adjourned conference of ironworkers representing Staffordshire, Worcestershire, and Shropshire, was held on Monday at Wednesbury, to consider the mutual insurance scheme proposed by the Conciliation Board. The principle of the scheme was approved by a large majority, and resolutions were passed to the effect that the employers' contributions should be equal to the aggregate contributions of the workmen; that the contributions of the latter should, for an experiment of one year's duration, be 4d. per month, and the benefits 8s. per week in case of disablement, and £60 in case of death; and that the scheme should be registered. The workmen engaged in the collieries of the Pelsall Coal and Iron Company, have requested that an early meeting may be convened of the representative coalmasters and men, to consider the Employers' Liability Bill, with a view to contracting out of the Act, and to the formation of a general fund to meet all classes of colliery accidents. On Monday all the colliers engaged at the Sandwell Park Colliery, West Bromwich, left their work in consequence of a dispute with regard to the operation of the Employers' Liability Bill. An explanation by the manager showed that there was a misunderstanding, and the men returned to work the following day.

The hardware industry of South Staffordshire has lost one of its chief supporters by the decease of Mr. Hy. Rogers, of the firm of Hy. Rogers, Sons, and Co., hardware merchants, Wolverhampton.

The seventeenth annual report of the Patent Nut and Bolt Company, Limited, Birmingham, shows that, on the year's working, there has been a net profit of £36,556. This sum, plus last year's balance, gives a disposable surplus of £43,183. It is proposed to pay a dividend of 10 per cent. for the year with £28,000, to place £10,000 to the reserve fund—thus raising it to £100,000—and to carry the balance, £5183, to next year's account.

In North Staffordshire there are somewhat better signs in the finished iron trade. The mills have been running fairly, though there is no chance allowed for an accumulation of work upon the books, since the specifications have to be frequently sought after. For plates the demand is tolerably satisfactory. A fair share of the work just now doing is on foreign account. Almost all the production of the forges is used up in the district. The call from outside districts for puddled bars has declined of late. Sales of raw iron and ironstone are limited.

There is now no probability of the strike that was threatened by the colliers of North Staffordshire coming about. The North Staffordshire Iron and Coalmasters' Association have met and decided that because there have occurred symptoms of an improvement in the coal and iron trade since the 4th inst., that the members of the association will not be considered bound by resolutions come to on that day, but that each firm is at liberty to arrange with their own workmen. At the same time the association hints that if employers can they should allow an advance of 10 per cent. The men in a delegate meeting held at Stoke have accepted the offer of 10 per cent., and several of the collieries are on at that rise.

At the Whitfield Colliery of the Chatterley Company, North Staffordshire, where the disastrous explosion and fire have occurred, the various pits have been flooded, and the shafts of the Institute Pit, in which the explosion took place, are both filled up. Attempts have been made to explore the Hardmine seam worked from another shaft; but the water was too high. The pouring of water into the Cockshead seam was suspended, but has had to be resumed. The mixed gas issuing from the small opening left in the fatal shaft has been tested under the direction of Dr. Angus Smith, of Manchester, and found to contain carbonic acid and hydrogen—a most destructive, though non-explosive mixture. The temperature at the bottom of the shaft is 76 deg. This pit is likely to remain covered up for some weeks. For the 300 miners thrown out of employ, work is being provided as fast as possible. The Engine pit is now open, and some of the hands are being set on there. Meetings for the raising of funds are being held in the neigbbourhood. About £1000 has been subscribed. Only one of the victims was a member of the Miners' Relief Society, so that seventeen widows and fifty orphans are left quite unprovided for. A meeting of miners' delegates, held at Stoke, has passed resolutions in favour of an investigation into the cause and circumstances of the occurrence, and also of an inquiry as to whether the case came within the Employers' Liability Act.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron trade of this district continues in a very depressed condition, and a combination of adverse circumstances stand in the way of the development of an improved business. The effects of the recent bad weather upon the trade have not yet disappeared, whilst the continuance of the colliers' strike, which has resulted in the stoppage of many of the finished ironworks in the district, is still further tending to lessen the local consumption of iron. In addition to this, the unsatisfactory reports from other iron markets are influencing buyers, who in most cases are still well covered with iron bought last year, in holding back orders, and the result is that for pig iron there is extremely little inquiry. Makers, however, still entertain a feeling of confidence with regard to the future, and are very cautious about entering into engagements extending over any very long periods; but merchants are showing more disposition for forward speculation, and there is no difficulty in buying iron for long forward delivery.

Lancashire pig iron meets with a very slow sale, but makers are well covered for the present by existing contracts, and there is still a large quantity of iron going away from the works, the deliveries which are at present being made by the most important company in the district being, I understand, considerably in excess of those at this time last year. Local makers are not pressing sales, and their quotations for delivery into the Manchester district remain at 46s. 6d. for No. 4 forge, and 47s. 6d. for No. 3 foundry, less 2½ per cent., but there is not quite so much firmness at the full rates.

So far as outside brands offering in this market are concerned, the tendency of prices all round has been downwards. Middlesbrough iron delivered equal to Manchester has been offered at about 46s. 6d. to 46s. 10d. per ton net cash for g.m.b.'s, but these figures do not lead to any important business here. Lincolnshire and Derbyshire irons are now being offered for forward delivery into this district at 46s. 6d. for No. 4 forge, and 47s. 6d. to 48s. for No. 3 foundry, less 2½ per cent. Some makers are still quoting higher figures, but then prices are little more than nominal.

Finished iron makers are rather stiffer in their prices, but this is due, not so much to any actually increased demand as to the present increased cost of coal, and it can scarcely be said that any real advance is being obtained, the average selling price of bars delivered into the Manchester district remaining at about £6 per ton. I hear, however, that there is a gradually increasing consumption going on amongst the small users of iron in various branches of trade, and this is regarded as a healthy sign of an actually improving general trade which affords good grounds for hopefulness in the future.

Local machinists continue moderately employed, but general engineers are reported to be not so busy as they were, and amongst founders there are general complaints of slackness, the demand for builders' castings especially being extremely dull.

There is if anything less indication of an early termination of the strike in the Lancashire coal trade this week than last. In the Manchester, Bolton and West Lancashire districts although a few of the collieries have a moderate number of men at work, the bulk of the miners are still out, and at the meetings which are continually being held the strongest determination is expressed not to return to work until an advance of wages is conceded. The colliery proprietors, on the other hand, are equally determined not to give way to the demands of the men, and should the strike be prolonged there is a probability of some of the pits being closed entirely for the present. In the Ashton, Oldham, Atherton, Tyldesley, and Skelmersdale districts the strike is practically at an end, and it is hoped that in other districts the men will be getting to work next week. So far as supplies are concerned, the quantity of local coal coming into the market is still only limited, but outside districts continue to send in large quantities. Round coals are tolerably plentiful, the only actual scarcity being in engine classes of fuel, for which prices have been stiffer during the past week, burgy and slack being comparatively very little under round coal, but there is still no really fixed quotations in the market. The present high prices of manufacturing classes of fuel, which in many cases are nearly double the rates ruling prior to the strike, are, as I have already intimated, seriously affecting consumers, and, in addition to the ironworks already stopped, there is a probability of a considerable number of cotton mills being temporarily closed.

The seventh annual meeting of the shareholders of Messrs. Andrew Knowles and Sons, Limited, was held on Tuesday in Manchester, and the directors' report, of which I gave a short abstract last week, came in for a considerable amount of criticism. It was strongly urged that "new blood" should be infused into the directorate, and ultimately two Manchester shareholders were added to the board, which will now consist of five of the vendors of the collieries when the company was formed, and six independent members.

An adjourned private conference of delegates, representing various Lancashire colliery districts, was held in Manchester on Tuesday, and a resolution was passed that the lodges in the county be organised as a federation of districts, such districts to contribute to a central fund for certain objects to be decided upon, and a committee was formed to draw up the necessary rules.

Barrow.—There is a very steady request for hematite pig iron in this district, and Bessemer steel, especially in railway material, is in large consumption. Orders are still being given out with considerable freedom both by home and foreign makers, but the competition is so keen that prices are not advancing as might under other circumstances be expected. Last week's prices are still quoted, the value of iron now ranging from 65s. for inferior qualities to 69s. for all round Bessemer samples. The order sheets in the hands of makers are very numerous, and they consist in a great measure of consignments for foreign consumers. The tone of the steel trade is especially promising, because not only have makers large consignments of metal to deliver, but the orders which are being booked show that the requirements of users of this metal are very large, and likely to be larger. Shipbuilders are especially well employed, and the same may be said of engineers' ironfounders, boilermakers, and finished ironworkers, while railway rolling stock makers have a full programme of work in hand. Iron ore is in very good demand, and the mines are actively employed. The coal trade is steady, and there is a full demand, but supplies are not regular, owing to the continuance of the strike, and prices in consequence are high. There is a considerable amount of employment furnished for working men of all classes in Barrow, but more workmen are coming to the town than it is possible to find work for, and house accommodation is again inadequate, although such a large amount of property was built a few years ago. Several blocks of house property are, however, being built. There is every reason to believe the population of Barrow at the present time is not less than 50,000.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

A FEATURE of the Board of Trade returns for January is worth special notice. There is a diminution in the exports of all kinds of iron, but an increased export of wire and steel. Last year iron and steel rose in value to £2,094,724, went back last month to £1,645,280. There was a falling off in rails of over 11,000 tons, chiefly because of a lull in the demand for America and India; but there is an increase from these markets of over 1000 tons of wire, and nearly 1000 tons of steel, the diminution noted already being on raw material. France seems to be gradually decreasing its demand for steel, the "call" for January being only 120 tons. The United States has increased from 468 tons in 1878 to 3775 tons in 1881, and "other countries" show an increase of more than double. For the opening months of the three years the increases come out thus:—1879, 1710 tons; 1880, 4458 tons; 1881, 6366 tons.

A still more satisfactory feature is the steady expansion in the exports of hardware and cutlery, the value last month being £278,120, as against £254,616 in January, 1880. The increased demand comes from Australia, Canada, the United States, South Africa, the West Indies, the Argentine Republic, France and Spain. The Indian market has fallen away somewhat, and Russia, Germany, Holland, and Brazil, have also had less hardware and cutlery than a year ago.

In machinery there is also a gratifying increase, the increase on steam engines and in general machinery being close on £60,000 in each case. For steam engines the improving markets were the United States, India, Germany, Holland, and Italy; and for general machinery the United States, India, Australia, France, Holland, and other less important countries.

In plate and plated wire, as well as in telegraph wire, there has also been a decided improvement. Generally, all the goods in which Sheffield is directly interested have been in greater demand than the products of other industries. In February there is every reason to anticipate a still further improvement in the engineering departments, as well as in cutlery and hardware generally.

The general condition of the staple trades remains unaltered from my last report. Engineering houses who do business with the collieries will be adversely affected by the strike which is now in progress and threatening to extend. Wire manufacturers who supply the special wire for winding purposes, as well as for underground communications, report a brisk trade up to the beginning of this month, but they are anticipating that the coal trade disputes will unfavourably affect their business this quarter.

The silver-platers must have been doing very well, if Messrs. John Round and Son, Limited, give any indication of the real condition of trade. During the year ending 31st December last they have made a profit which enables them to pay a dividend of 12½ per cent., and carry £500 to the reserve fund. The company recently acquired the adjoining premises—the Pavilion Music-hall

—for £4549, which will enable them to carry on their business with more convenience.

The annual meeting of Messrs. Rodgers and Sons, Limited, was held on Wednesday—Mr. Robert Newbold, chairman of the directors, presiding. The report and account were adopted, and "the usual dividend" was declared. As "the usual dividend" is 17½ per cent., and the company's £100 shares are quoted at £255, the shareholders have no reason to be dissatisfied with their investment. The chairman announced to the shareholders that a telegram had been received from Melbourne, intimating that the firm had received a first-class award at the Melbourne Exhibition.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

Though no actual change in the price of pig iron could be said to have taken place at Middlesbrough on Tuesday, still the market was undoubtedly firmer than the week before. At all events the downward course of things seems to be stayed for the present, and has even given place to a feeling of cheerfulness and to something akin to firmness. The scare produced by the enormous increase of stocks in January is passing away, and the hopefulness which prevailed when the new year set in is again showing itself. People are arguing that the depressing causes were only temporary, and will soon become lost in the healthy activity of the spring trade. Certain it is that the recent terrible weather must have been a preponderating cause. Shipbuilders say that out of the six weeks which have elapsed since New Year's Day, they have not been at work more than two. What is true of them is true of bridge-builders, general contractors, and others whose operations are conducted in the open air. Diminished consumption has been the result. All are now hoping that the winter is nearly over, and that working, if not genial, weather is about to ensue without interruption for some time to come. If so, it is thought distribution and consumption will soon overtake any excess of accumulations over and above a reasonable stock. No. 3 pig iron may be said to be worth 38s. 6d. per ton for prompt delivery; No. 4 forge, 1s. less; warrants, 1s. 6d. more. The stock in Connal's Middlesbrough stores has increased by 2840 tons during the week, and now stands at 140,455 tons. Purchasers of warrants are still to be found anxious to increase their stake, notwithstanding the heavy premium they have to pay. Their idea of the future course of the market is of course truthfully indicated by their actions, and it is to be hoped, for their sake, they may not prove to be mistaken. Finished iron has suffered somewhat from the recently prevailing flatness. Prices have not actually fallen, but the minimum current price has been freely taken. Specifications have been scarce, and at one time there was a danger that several works would be temporarily laid off. Now things look better. More specifications have come to hand, and yet more are in view so soon as the weather has permitted the shipbuilders to work down their accumulated stocks of material. So busy are local builders, that it is said English shipowning firms are actually ordering ships from foreign builders who have yards at the North Europe ports, and obtain their material from England.

Ship-plates are still £6 15s.; angles, £5 15s.; and common bars £5 12s. 6d. per ton f.o.t. Middlesbrough. The shipments of the week were, of pig iron, 13,961, and of manufactured iron, 7892 tons. Other materials seem gradually to be creeping up in value. Old rails, for instance, are certainly worth more than a week ago. It is said the Americans are buying them up, as well as heavy scrap of all kinds. Double heads cannot now be obtained under about £4 2s. 6d., and flange rails, £4 c.i.f. Tees. Light scrap commands 55s. per ton, and wrought iron turnings about the same. The demand for puddled bars continues, £4 at makers' works being obtainable. Purple ore has increased in value up to about 18s. 6d. per ton delivered at consumers' works. Castings fluctuate slightly up and down with the pig iron market, but beyond this there seems to be no improvement in the price. Judging by the keen competition there always is for the smallest orders, this section of the trade at present must be in a very unsatisfactory condition. The coal market is steady, with a tendency, if anything, to weakness. Whenever the Lancashire difficulty is ended, it is not unlikely prices will recede.

Labour difficulties are rather on the increase, and concessions seem to be expected and frequently given with scarcely a show of resistance. A strike of a day or two has just occurred at all the Stockton plate mills, resulting in the men getting pretty nearly all their own way. This is in direct violation of the principles of the Board of Arbitration and of the sliding scale. The tactics of the men were, as usual, to take the employers in succession. They first obtained what they wanted at Bishop-Auckland, where there are two works, next at Darlington where there is one, and lastly at Stockton where there are four. They now threaten Middlesbrough where there are two, and these will doubtless have to give way. The strikers are in this case shearmen's forkers, who are almost always Irishmen. Their earnings hitherto have been 5s. per day. They now have struck for, and obtained, a tonnage rate which in many mills will yield them 8s. to 10s. per day. It has been a most difficult matter to keep them steadily and soberly at work on the lower rate, and at the higher it is certain they will be very much more troublesome.

The ironworkers of Staffordshire, Worcestershire, and Shropshire have resolved to contract themselves out of the Employers' Liability Act, and to accept a mutual insurance scheme proposed by their employers. It is to be hoped that the Northern men will follow so good an example, and thus benefit their position substantially, without having recourse to continual and harassing litigation. The moulders, fitters, blacksmiths, boiler smiths, pattern makers, &c., employed by Messrs Bolckow, Vaughan and Co., at Middlesbrough, amounting to from 700 to 800 hands, put in their notices on Saturday to leave in fourteen days, unless an advance of 5 per cent. on their wages be granted. The firm up to this moment steadily refuse, and say they can manage without these men—for the present, at all events. On the Wear the smiths have demanded, and in many cases obtained, an advance of 3s. per day.

The differences between the Cleveland ironmasters and the North-Eastern Railway Board, on the matter of dues on minerals, seem in a fair way to be amicably adjusted. A sliding-scale, dependent on the realised price of pig iron, has been arranged, which both parties are said to have agreed to. It has not been announced, however, when the new system will come into operation.

Touching the question of labour, there is a fashion among certain politicians to preach that the remedy for all the ills which affect the Irish at the present time is to be found in emigration. If so, why do they not emigrate at once into the iron and coal districts of the North of England? There, all strong, able-bodied young men are now eagerly welcomed. Good wages and constant work are assured for all who can and will work steadily. No objection to race or creed is offered. Moreover, there are some splendid positions, attainable by the few whose qualities are above the average, positions beyond what they could expect by emigration anywhere else—positions worth £500 per annum, and even more! Why then urge our best labourers to leave the country or to stay fomenting sedition at home? Why not preach an emigration to the North, where they are wanted and can do good for themselves and others?

NOTES FROM SCOTLAND.

(From our own Correspondent.)

Except that there has been some animation in the warrant market this week, the general features of the iron trade are unchanged. In the malleable and other works at home there is a steady and comparatively large consumption of crude iron, but the foreign demand has not yet come up to expectations. Advices from the United States, regarding the Scotch pig iron trade there, are not at all cheering, and orders come in but slowly from the Continent. Nevertheless, there can be little doubt that, if the weather should become more favourable, there would soon be a substantial increase in the volume of our exports. Those of last week, while 545 tons under the departures in the same week of last year, yet show an increase of 2846 tons on the preceding week, the aggregate shipments being 10,072 tons. Since Christmas the exports are 53,824 tons, as compared with 78,889 in the same period of last year, and 47,262 tons in 1879. The arrivals of pigs from Middlesbrough are small, but this was to be expected, seeing that in the last two months of the past year merchants have imported far more than was required to meet current demands in order that they might be prepared for the closing of the navigation by frost. This may be expected to militate against the increase of the deliveries to Scotland from the Cleveland district for some time. One of the Eglinton furnaces having been put out of blast owing to an accident at the Lugar Ironworks, there are now 122 furnaces blowing, as compared with 111 at the same date last year. Eight of the number are making hematite, a manufacture which is destined largely to increase in Scotland. Stocks continue to increase rapidly, the past week's addition to those in the hands of Messrs. Connal and Co. being 3385 tons, and the aggregate in these stores being now 522,587 tons.

Business was done in the warrant market on Friday morning at from 50s. 3d. to 50s. 5d. cash, and 50s. 6d. fourteen days and one month, the afternoon quotations being 50s. 4d. to 50s. 5d. and 50s. 2d. cash, and 50s. 6d. to 50s. 3d. one month. The market opened more strongly on Monday, when transactions were effected up to 50s. 5d. cash, and 50s. 8d. one month, at which figures the market closed. On Tuesday there was a decided inclination on the part of outsiders to purchase warrants, the prices of which accordingly slightly advanced. Business was done at 50s. 4½d. cash to 50s. 9d. cash, and 50s. 11½d. one month. The market was much stronger on Wednesday and Thursday, the result to some extent of the failure of an iron broking firm to meet their engagements. On Wednesday warrants were at 51s. 1½d. cash and 51s. 3d. one month, and today 51s. 6d. one month was quoted.

The prices of makers' iron have not been quite so weak, although the tendency is still downwards. Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 60s.; No. 3, 52s.; Coltness, 61s. and 52s.; Langloan, 61s. and 52s.; Summerlee, 60s. and 51s. 6d.; Calder, 60s. and 52s. 6d.; Carnbroe, 58s. and 52s.; Clyde, 51s. 6d. and 49s. 6d.; Monkland, 51s. 6d. and 49s. 6d.; Quarter, 51s. 6d. and 49s. 6d.; Govan, at Broomielaw, 51s. 6d. and 49s. 6d.; Shotts, at Leith, 61s. and 53s. 6d.; Carron, at Grangemouth, No. 1, 52s. 6d.; ditto, specially selected, 56s.; No. 3, 51s. 6d.; Kinneil, at Bo'ness, 52s. and 51s.; Glengarnock, at Ardrossan, 58s. and 52s. 6d.; Eglinton, 52s. and 49s.; Dalmellington, 52s. and 49s.

There is a continuance of activity in the malleable iron trade, but fresh orders have not been coming in so regularly of late.

The coal trade has been more active in almost all the mining districts, but particularly in Lanarkshire and Ayrshire. It is noticeable that the Irish trade—a great part of which went to England during the miners' strike here last summer—is now coming back, and in Ayrshire particularly, where an advance of wages was given to the colliers by the sale masters last week, there is marked animation in the trade. The export trade in Glasgow has likewise materially increased in bulk, and prices have been firm at the advance which took place during the frost of January. On the east coast the inland trade in coal has also been good, but the shipping department there, as a rule, is dull.

A miners' conference took place in Glasgow on Monday, and was but poorly attended. The delegates conducted their business in private, but it is believed no resolution was adopted as to the proposed movement for an advance of wages. The advance given in North Staffordshire may possibly have some influence in determining the course to be pursued here, although the backward condition of the iron trade may well deter the men from pressing their claims at present.

For several months the Omoa and Cleland Coal Company, Limited, have been conducting sinking operations, and at a depth of seventy-five fathoms they have now found an excellent splint coal 4ft. thick, with 4in. of gas coal at the bottom of the splint, besides a really good clayband ironstone mine 9in. above the coal.

At a meeting of the Glasgow Chamber of Commerce this week, Sir James Bain called attention to the proposed increase in the duty on metal pipes imported into Canada, which is said to be mainly contemplated as a measure of protection to the Montreal Rolling Mill Company. Sir James explained that at present, between duty and freight, 35s. had to be added to the prices of £4 to £4 10s. quoted for pipes on this side, but it was proposed to add 5 per cent., which would greatly limit the trade to Canada, if it did not put a stop to it altogether.

The Mining Institute of Scotland held a meeting a few days ago at Hamilton, Mr. Ralph Moore, inspector of mines, in the chair, when Mr. Thomas Borland, Craigneuk, read an interesting paper on "A Comparison of the Different Systems of Working Thick Seams of Coal." His principal contention was that the ventilation of every colliery ought to be conducted in such a way that should an explosion take place in any part of the mine, it would be confined to that particular division.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

The condition of the tin-plate trade is really getting quite serious. In the neighbourhood of Swansea the falling off is very perceptible, and even at low and ruinous prices no trade of any consequence can be done. The Glanyrafon Iron and Tin-plate Company are gone into liquidation; Forester, Sullivan, and Davis appointed liquidators. The iron trade may be regarded as quiet, although the Messrs. Crawshay continue to turn out a large quantity of iron rails, but they are about the only firm doing so, the great demand being for steel. Steel rails are firm, and in request, and inquiry for old rails and scrap at firm rates continues.

About 6000 tons of iron and steel left the Welsh ports last week.

An important case, of great interest to Welsh ironmasters, has just been heard in Queen's Bench, Westminster, the Blaenavon Company *v.* the Canadian Midland Railway. This was for breach of contract to purchase 1000 tons of steel rails; but the plaintiff's case was dismissed with costs, on the ground that the court had no jurisdiction in a contract with a foreign company. Some surprise has been exhibited at the decision, seeing that the railway was reported to have an office in London, and three directors residing in England. Ironmasters will take the lesson to heart.

Vigorous work continues to be done at the Swansea docks, and confident hope is now expressed of completion by the time specified. The Prince of Wales is understood to have promised his presence at the ceremony. The Harbour Trust returns for January again exhibit a gratifying increase, though the weather has been seriously against the business of all the Welsh ports. Cardiff in particular has suffered.

Many of the largest coalowners are pledged to the full amount of their output, and it is by no means uncommon for an application for quotations to be answered by "are not open to sale."

Cyfarthfa has started its new range of coke ovens, and good work is being done. Over seventy ovens are being erected at Dowlais by the Coppée Company, London. The aim of both the Dowlais and Cyfarthfa companies is evidently to utilise steam coal for coke. They have none of the best bituminous coals on either estate, such as the Ebbw Company possess, and so the aim is by best scientific appliance to obtain an equal coke from steam coal. Two blocks of the White Rose Colliery coke ovens were relighted this week. Prices, however, are not so much advanced as one could wish, good coke being offered at 12s. per ton.

The house coal trade at Caerphilly, Bargoed, Deri, Pengarn, and at New Tredegar continues good, and prospects are fair for a continuance. At the latter place Moss, Smith, and Tillett are busy at the new colliery above the Uchdir, which promises to afford ample employment for a large number of hands.

A singular discovery has been made of a faulty clause in the Mines Regulation Act. This actually sanctions smoking in certain parts of a colliery, and thus, inferentially, colliers are allowed to have pipes and materials for smoking and lighting on their person. Yet other clauses forbid this and render them liable to penalties if caught. The matter is to be submitted to the Home Department.

An iron screw steamer was launched at Wills' yard, West Bute Dock, this week.

Just as my parcel was about to be despatched, I heard of a slight upward movement having occurred in tin-plate. Some makers have been able to get 3d. a box advance. It is to be hoped that this is the beginning of a change. Coal advances are firm, and prices generally for hematite bar and rail show a little stiffening.

The International Electrical Exhibition.—A circular has been issued by the *Commissariat Générale*, signed by M. G. Bergertt, chief of the commissariat, stating that the French railway companies have arranged to transport all articles relating to and to be exhibited in the International Exhibition of electrical apparatus and machinery at a reduction of 50 per cent. from the usual tariffs for both high speed and low speed. The Exhibition grounds and buildings will be considered as bonded stores for the time, and articles sent for exhibition will be exempt from duty. Articles returned from France will be sent away by rail at the above reduced tariffs. Imported articles retained in France will not be exempted from duty. Official notification has been given from America, Germany, and other countries, that in those countries collective action has been taken, and that they will be represented at the Exhibition. In England the organisation affairs have by some means fallen within the clutch of the South Kensington Octopus, and therefore no official notification of any kind for the guidance of individual exhibitors has been made.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

8th February, 1881.

529. Pressing Bricks, &c., B. C. D. Greenhill, Puriton.
530. Mountings for Boots, &c., L. Bennel, Iserlohn.
531. Pressing, &c., Machine, W. S. Clark and R. Davenport, Manchester.
532. Gas Motor Engines, J. Fielding, Gloucester.
533. Bicycles, &c., W. Mickelwright, Shepherd's-bush, and A. G. Gladwyn, Hammersmith.
534. Dressing Fabrics, W. E. Gaine, Hammersmith.
535. Gas Condensers, F. Morris, Brentford, and S. Cutler, Millwall.
536. Coverings, R. H. Gudgeon, Winchester.
537. Weaving Fabrics, W. Dewhirst, Bradford.
538. Cutting, &c., Tea, D. Whyte, Glasgow.
539. Lamps, E. G. Brewer.—(*T. A. Edison, New Jersey.*)
540. Draught Apparatus, E. H. A. Herbert, Erith.
541. Withdrawing Corks, &c., F. W. Russell, London.
542. Telephonic Apparatus, J. Sax, London.
543. Pianofortes, H. Lake.—(*A. Hebard, Cambridge.*)

9th February, 1881.

544. Consolidating Metals, D. Adamson, Dukinfield.
545. Corking Bottles, W. H. Beck.—(*E. Guichard, Reims, France.*)
546. Dinitro-benzole, J. A. Kendall, Dalston.
547. Registering Apparatus, H. J. B. Kendall.—(*C. E. Wilson-Bunster, Valparaiso.*)
548. Connecting, &c., Link, J. Walker, Derby.
549. Lifting Apparatus, M. Scott, London.
550. Ornaments, S. H. Sharp, Leeds.
551. Fire-arms, &c., L. Joalland, Havrè.
552. Digging, &c., Machinery, J. Parker, Springfield.
553. Artificial Ice, J. H. Willcox, Liverpool.
554. Polychromatic Prints, L. A. Groth. — (*G. Schwerswald, New York, U.S.*)
555. Obliterating Scars, &c., E. Marriott, Hornsey.
556. Measuring Lines, F. P. d'Opdorp, Brussels.
557. Draw-off Taps, J. Davison, Auchmill.
558. Pen-holders, E. Fischer, Halle-upon-Saale.
559. Decorating Buttons, &c., J. H. Johnson.—(*C. G. Dobbs, New York, U.S.*)
560. Sugar, J. H. Johnson.—(*Brissonneau Brothers and Co., Paris.*)
561. Roofing Tile, C. D. Phillips, Newport.
562. Carbon Burners, P. Jensen.—(*T. A. Edison, New Jersey, U.S.*)
563. Filter-presses, H. E. Newton.—(*A. L. G. Dehne, Halle-on-the-Saale.*)
564. Injectors, W. L. Wise.—(*H. Cuav, Paris.*)
565. Gas Engines, A. T. Allcock, Newark-on-Trent.
566. Feeding Apparatus, F. Craven, Brighouse.

10th February, 1881.

567. Welding Tubes, A. and J. Stewart and J. Wotherspoon, Coatbridge.
568. Fire-bars, A. Murfet, Nottingham.
569. Silicious Pig Iron, A. Crawford, Glasgow.
570. Wearing Apparel, J. G. Dowd, Ireland.
571. Ventilating Apparatus, H. Mestern, Berlin.
572. Aerated Beverages, H. S. Wellcome, London.
573. Transcribing Apparatus, A. P. Hodgson, Paris.
574. Ageing Cigars, T. Browning, London.
575. Sanitary, &c., Material, R. H. Smithett, Kent.
576. Spinning Apparatus, G. Bodden, Oldham.
577. Steam Engines, A. C. Kirk, Glasgow.
578. Braces, &c., G. Walker, Birmingham.
579. Electro-photo Receivers, H. Chameroy, France.
580. Safety Hooks, W. Hewitt, Mostell.
581. Smoke-consuming Grates, F. Edwards, London.
582. Glass-holders, I. Sherwood, Birmingham.
583. Sugar, J. H. Johnson.—(*E. Etienne, Paris.*)
584. Purifying Smoke, O. Bulmer, Marsden, and W. Stones, Leeds.
585. Setting Saws, W. Marks & T. Pritchard, London.
586. Steering Apparatus, G. D. Davis, London.
587. Hydraulic Cranes, F. W. Walker, Leeds.
588. Soup, S. Pitt.—(*J. F. Tyrrell, New York, U.S.*)
589. Mangling, &c., Machines, N. Tupholme, Sheffield
590. Plaiters, W. Mather, Manchester.
591. Table, W. R. Lake.—(*A. F. Mauchain, Geneva.*)
592. Combs, &c., T. R. Harding, Leeds
593. Oil, Fat, and Butter, W. White, London.

11th February, 1881.

594. Bicycles, &c., H. G. H. Berkeley, London.
595. Folding Easy Chairs, A. Lloyd, London.
596. Engines, P. Giffard, Paris.
597. Fastenings, S. Wood & G. R. Jolliffe, Birmingham
598. Slide Valves, E. Pilkington, Pendleton.
599. Mixing Machinery, S. Forrest, Hyde.
600. Lines or Cords, J. D. Sprague, Norwood.
601. Bracelets, &c., W. West, Birmingham.
602. Water Pipes, &c., L. Appleton, London.
603. Spinning, &c., Yarns, H. Illingworth, Bradford
604. Bicycles, &c., J. H. Gosling, Southsea.
605. Washing, &c., Fabrics, D. Stewart, Glasgow.
606. Corsets, R. Langridge, Bristol.
607. Telegraphic, &c., Apparatus, P. M. Justice.—(*J. F. M. Bartelous, Brussels.*)

12th February, 1881.

608. Glue, A. J. Boult.—(*R. Hagen and F. Seltsam, Forchheim, Bavaria.*)
609. Spring Beds, E. P. Alexander.—(*A. Herbet, Paris.*)
610. Paving, &c., P. Stuart, Edinburgh.
611. Brewing Apparatus, W. Davenport, Birmingham.
612. Harrows, H. G. Grant.—(*C. Moulin, France.*)
613. Moulds, J. Duncan & B. E. R. Newlands, London.
614. Beverages, A. J. M. Bolanachi, West Dulwich.

14th February, 1881.

615. Tentering Fabrics, J. Ashworth, Rochdale.
616. Piston Rings, A. Henshaw, Sheffield.
617. Drilling Machines, T. and R. Lees, Hollinwood.
618. Motive-power, W. H. J. Grout, South Hornsey.
619. Irons, R. Macaulay and J. Ballintine, Glasgow.
620. Packing Sugar, &c., A. and J. D. Scott, Greenock.
621. Violins, H. Haddan.—(*E. Mollenhauer, New York.*)
622. Coast Defences, T. R. Timby, Nyack, U.S.
623. Minerals, A. Browne.—(*H. Strickland, Antwerp.*)
624. Cooked Food, E. A. Brydges.—(*E. Finne, Norway.*)
625. Ammonia, &c., J. C. Mewburn.—(*T. Scholz and F. Stroehmer, Dresden.*)
626. Scissors, A. J. Boult.—(*T. Fischer, Prussia.*)
627. Steam Engines, W. F. Goodwin, Stelton, U.S.
628. Cartridges, W. Lorenz, Baden.
629. Feed Apparatus, A. Clark.—(*A. Dudouy, France.*)
630. Drawing-off Beer from Casks, T. Slade, London.
631. Brake, W. L. Wise.—(*J. F. Carpenter, Berlin.*)
632. Looms, W. Tetley, Bradford.
633. Looms, E. Smith, Houley.

Inventions Protected for Six Months on deposit of Complete Specifications.

489. Nailing Barrel Hoops, W. Morgan-Brown, Southampton-buildings, London.—A communication from E. Cole, Brooklyn, U.S.—*5th February*, 1881.
490. Nailing Machines, W. Morgan-Brown, Southampton-buildings, London.—A communication from J. H. Foster, Chicago, U.S.—*5th February*, 1881.
495. Hatters' Irons, H. A. Bonneville, Cannon-street, London.—A communication from F. C. Taylor, New York, U.S.—*5th February*, 1881.

545. CORKING BOTTLES, W. H. Beck, Cannon-street, London. — A communication from E. Guichard, Reims, France.—*9th February*, 1881.
563. FILTER-PRESSES, H. E. Newton, Chancery-lane, London.—A communication from A. L. G. Dehne, Halle-on-the-Saale, Germany.—*9th February*, 1881.

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

549. FURNACES, &c., J. Sawyer, Alma-street, New North-road, London.—*9th February*, 1878.
526. BICYCLES, &c., D. Rudge, Wolverhampton.—*8th February*, 1878.
539. FURNACES, T. W. Williams, Swansea. — *9th February*, 1878.
541. GRANULATING, &c., WHEAT and BRAN, A. B. Childs, Fenchurch-street, London.—*9th February*, 1878.
542. GAS-METER INDICES, G. Joslin, Colchester.—*9th February*, 1878.
550. SHUTTLE WHEELS for LOOMS, W. Mitchell, Ripley. —*9th February*, 1878.
553. FLOATING DOCKS, &c., J. L. Clark and J. Standfield, Victoria-street, London.—*9th February*, 1878.
561. CASKS, &c., F. Ransome, Lower Norwood, and B. L. Thomson, Ingram-court, Fenchurch-street, London.—*11th February*, 1878.
592. SHELLING COFFEE, &c., J. A. Mosquera, Lindengardens, Bayswater.—*12th February*, 1878.
613. VALVES, H. J. Pearson, Beeston.—*14th February*, 1878.
654. MITRE and BEVEL WHEEL TEETH, W. T. Hamilton, Rathmines.—*16th February*, 1878.
872. STEAMSHIPS, &c., A. F. Yarrow, Isle of Dogs, Poplar.—*4th March*, 1878.
569. VENTILATING APPARATUS, J. G. Stidder, Southwark Bridge-road, London.—*11th February*, 1878.
570. GYROMETERS, W. Morgan-Brown, Southampton-buildings, London.—*11th February*, 1878.
688. LAMPS, J. T. C. Thomas, Minories, London.—*19th February*, 1878.
1245. INKSTANDS, &c., J. E. Ransome, Ipswich.—*20th March*, 1878.
563. GRANULATING, &c., GRAIN and SEEDS, A. Mechwart, Buda Pesth.—*11th February*, 1878.
575. EXPANSION VALVE GEAR, B. Hunt, Serle-street, Lincoln's-inn, London.—*12th February*, 1878.
622. OVERHEAD SEWING MACHINE, W. Lee, Dundee.—*14th February*, 1878.
629. ROCK DRILLS, E. de Pass, Fleet-chambers, Fleet-street, London.—*14th February*, 1878.
580. REFRIGERATORS, &c., W. and G. Lawrence, Notting-hill, London.—*12th February*, 1878.
594. STEELYARD, C. and W. Hodgson and J. Needham, Salford.—*12th February*, 1878.
596. ELECTRICITY, E. B. Bright, Delahay-street, Westminster.—*13th February*, 1878.
600. ORNAMENTING GLASS, &c., P. R. de F. d'Humy, Lichfield-street, Soho, London.—*13th February*, 1878.
630. DYEING and PRINTING, A. M. Clark, Chancery-lane, London.—*14th February*, 1878.

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

508. TREATING GRAINS or MALT, W. Garton, Southampton.—*9th February*, 1874.
620. BOOTS and SHOES, J, and A. Keats, Newcastle, and A. Greenwood, Leeds.—*18th February*, 1874.
517. WHITE PIGMENT, J. B. Orr, Glasgow. — *10th February*, 1874.
563. SETTING DIAMONDS in DRILLS, &c., C. A. Terrey, St. George's-road, London.—*14th February*, 1874.
585. HAY-TEDDING MACHINES, W. R. Lake, Southampton-buildings, London.—*17th February*, 1874.
587. ROTARY WEB PRINTING MACHINES, G. A. Wilson, Liverpool.—*17th February*, 1874.
640. ELECTRIC TELEGRAPHS, W. H. Davies and F. H. W. Higgins, Cornhill, London.—*19th February*, 1874.
572. DRESSING FLOUR, W. Palmer, Knockcloughrim, and C. Hopkinson, Retford.—*14th February*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 4th March, 1881.

4040. HOLDING the FLIGHT FEATHERS of BIRDS, M. Arnold, Acton.—A communication from P. Voitellier. —*5th October*, 1880.
4052. SEATS, &c., J. S. Henry, Golden-lane, London.—Com. from V. Bareau & A. Croisé.—*5th October*, 1880.
4054. DRAIN PIPES, T. H. Baker, Red Lion-square, Holborn, London.—*6th October*, 1880.
4060. WAGONS, P. B. Elwell, Wolverhampton. —*6th October*, 1880.
4067. CLOSETS and ASH-PITS, J. R. Pickard, Leeds.—*6th October*, 1880.
4071. LOCKS and LATCHES, F. H. Steeds, Harborne.—*7th October*, 1880.
4073. FASTENINGS for CARRIAGE DOORS, &c., W. H. St. Aubin, Willenhall.—*7th October*, 1880.
4077. PUNCHING, &c., MACHINES, J. Boothroyd, Leeds. —*7th October*, 1880.
4078. LOOMS, G. P. Hartley, jun., Blackburn.—*7th October*, 1880.
4080. SYRINGES, J. Davol, Providence, U.S. — *7th October*, 1880.
4085. ANCHORS, J. Evans, Stafford.—*8th October*, 1880.
4086. STEAM BOILERS, H. J. Haddan, Strand, Westminster.—Com. from P. Privat.—*8th October*, 1880.
4088. TRICYCLES, R. H. Charsley, Oxford.—*8th October*, 1880.
4090. STREET CABS, T. Greenhill, Alfred-place, Bedford-square, London.—*8th October*, 1880.
4094. EXTRACTING COPPER, &c., from ORES, W. Elmore, Blackfriars-road, London.—*8th October*, 1880.
4099. RAILWAY POINTS, H. Whitehead, Bucknall, and R. Hodgson and T. Dodd, Winsford.—*9th October*, 1880.
4101. SECURING CORKS in BOTTLES, H. T. Lufkin, Chelmsford.—*9th October*, 1880.
4104. LABELS, &c., W. R. Harris and J. G. Cooper, Manchester.—*9th October*, 1880.
4121. DOOR and other KNOBS or HANDLES, W. Macvitie, Birmingham.—*11th October*, 1880.
4122. PRESERVING FOOD, S. H. Linn, Southampton-buildings, London.—*11th October*, 1880.
4128. RAILWAY BRAKES, W. R. Lake, Southampton-buildings, London.—A communication from E. Schrabetz.—*11th October*, 1880.
4135. BREECH-LOADING ORDNANCE, W. Morgan-Brown, Southampton-buildings, London. — A communication from S. M. Richardson.—*12th October*, 1880.
4142. PICKERS for LOOMS, H. Almond, Blackburn, and J. Holding, Manchester.—*12th October*, 1880.
4179. WASHING ROOTS, W. Griffiths, Shrewsbury.—*14th October*, 1880.
4184. COMPRESSING AIR, D. Greig and M. Eyth, Leeds. —*14th October*, 1880.
4270. GAS-MOTOR ENGINES, C. G. Beechey, Hilgay, Norfolk.—*20th October*, 1880.
4437. BUFFER-BOXES, W. Eyre, Ellesmere-road, Sheffield.—*30th October*, 1880.
4463. PRESERVING SHIPS' BOTTOMS, &c., W. Renney, Cawley-road, London.—*1st November*, 1880.
4509. DISINFECTING WATER-CLOSETS, &c., E. Warner, Stowmarket.—*4th November*, 1880.
4607. PORTABLE ENGINES, &c., R. Brown, Morton.—*9th November*, 1880.
4632. PUDDLING FURNACES, W. S. Williamson, Congleton.—*11th November*, 1880.
4751. TREATING MAIZE, E. R. Southby, Holborn Viaduct, London.—*18th November*, 1880.
5005. SECURING TOGETHER SHEETS of PAPER, L. de Horwath, Paris.—*1st December*, 1880.
5278. DREDGING APPARATUS, J. Standfield and J. L. Clark, Westminster-chambers, Westminster.—*16th December*, 1880.
5363. GUNS, &c., H. E. Newton, Chancery-lane, London.—Com. from J. Ericsson.—*21st December*, 1880.
5380. WOOD PULP, &c., E. C. T. Blake, Brixton.—*22nd December*, 1880.
41. KNITTING MACHINERY, J. and H. Kiddier, Nottingham.—*4th January*, 1881.
100. MILL GEARING, N. Macbeth, Bolton. — *8th January*, 1881.
207. STEAM ENGINES, &c., T. Robertson, jun., Glasgow. —*15th January*, 1881.
241. RAILWAYS, &c., T. G. Hardie, Leeds, and T. Kendall, Shipley.—*20th January*, 1881.
300. WORKING RAILWAY POINTS, G. Edwards, Cheltenham.—*22nd January*, 1881.

Last day for filing opposition, 7th March, 1881.

4103. COTTON DRYING FELTS, J. Crossley, Bury.—*9th October*, 1880.
4105. TREATING SOLID MATTERS, J. Bannehr, Bush-lane, London.—*9th October*, 1880.
4112. NECK YOKES, J. L. Babb, Greenland, U.S.—*9th October*, 1880.
4114. CRABBING, &c., WOVEN FABRICS, G. W. Hawksley, Sheffield, and W. Lumb, Wakefield.—*9th October*, 1880.
4123. TANNING, W. Nicholson, Sheffield.—*11th October*, 1880.
4125. COAL PLATES, &c., J. Mathewson and G. Tidey, Denmark-road, Kilburn.—*11th October*, 1880.
4134. SIGNALLING APPARATUS, E. Guende, Cavaillon (Vaucluse), France.—*12th October*, 1880.
4137. SEWING MACHINES, G. Illston, Birmingham.—*12th October*, 1880.
4143. PURIFYING GAS, H. and F. C. Cockey, Frome Selwood.—*12th October*, 1880.
4148. HOLDING SPECTACLES, J. Betjemann, Pentonville-road, London.—*12th October*, 1880.
4149. LAMPS, G. W. von Nawrocki, Berlin.—Com. from E. Köhler.—*12th October*, 1880.
4151. STAYS, &c., E. A. Allibert, Brompton-square, London.—*13th October*, 1880.
4153. REGULATING APPARATUS, R. W. Gossage, Creek-road, Deptford.—*13th October*, 1880.
4167. EXTRACTING TAR, &c., P. J. Wates, Bedford-hill, Balham.—*13th October*, 1880.
4169. CONVERTING GRAINS, F. Wirth, Germany.—A communication from H. Seck.—*13th October*, 1880.
4191. ELECTRIC LAMPS, G. P. Harding, Jermyn-street, Piccadilly, London.—*15th October*, 1880.
4192. LAMPS, G. P. Harding, Jermyn-street, Piccadilly, London.—*15th October*, 1880.
4203. LINING for FURNACES, H. C. Bull, Liverpool.—*15th October*, 1880.
4209. CUTTING TOBACCO, S. P. Wilding, Rood-lane, London.—A communication from G. A. Reiniger and C. Petri.—*15th October*, 1880.
4241. UMBRELLA STICKS, C. D. Abel, Southampton-buildings, London. — Com. from Messrs. Baumgarten and Mensendick.—*18th October*, 1880.
4244. CRUSHING, &c., MACHINERY, R. Cook, Sheffield. —*18th October*, 1880.
4254. ARTIFICIAL LIGHT, W. A. S. Benson, Kensington, London.—*19th October*, 1880.
4278. COKE, &c., H. C. Bull, Water-street, Liverpool.—*20th October*, 1880.
4303. NITROGENOUS ORGANIC SUBSTANCES, T. Morgan, Cockspur-street, Charing Cross, London.—A communication from J. Mayand.—*21st October*, 1880.
4363. SUSPENDERS, H. J. Haddan, Strand, London.—Com. from T. O. Potter.—*26th October*, 1880.
4387. CRAVAT FASTENINGS, J. Hinks, T. Hooper, and F. R. Baker, Birmingham.—*27th October*, 1880.
4436. LOOMS, I. Bradshaw, Preston.—*30th October*, 1880.
4443. MILLING CUTTERS, &c., A. Muir, Manchester.—*30th October*, 1880.
4553. TURNING, &c., MACHINES, W. W. Hulse, Manchester.—*6th November*, 1880.
4637. PULVERISING MATERIALS, T. R. Jordan, Grace-church-street, London.—*11th November*, 1880.
4686. SIGNALLING APPARATUS, W. W. Biddulph, East Sheen.—*13th November*, 1880.
4999. GROOVED PULLEYS, J. V. Hope, Wednesbury.—*1st December*, 1880.
5120. HOLDING WINDOW BLIND CORDS, C. E. Gibson, Birmigham.—*8th December*, 1880.
5145. SKATES, R. H. Bishop, Holloway-road, London, and H. F. Hailes, Hornsey.—*9th December*, 1880.
5151. NAILS, J. A. Coleman, Grand Hotel, Trafalgar-square, London.—*9th December*, 1880.
69. CASTING METAL PIPES, C. B. Palmer, R. Crompton, and J. Chambers, Nottingham.—*6th January*, 1881.
78. DYNAMO-ELECTRIC MACHINES, J. E. H. Gordon, Dorking.—*6th January*, 1881.
118. BRUSHES, G. W. von Nawrocki, Berlin.—A communication from C. Flemming.—*10th January*, 1881.
154. IRON and STEEL, J. A. Hugett, Finborough-road, Kensington, London.—*12th January*, 1881.
177. MOTIVE POWER, J. Imray, Southampton-buildings, London.—*14th January*, 1881.
245. LIGHTING GAS, C. L. Clarke and J. Leigh, Manchester.—*20th January*, 1881.
256. ROLLER BEARINGS, W. R. Lake, Southampton-buildings, London.—A communication from J. E. Maynadier.—*20th January*, 1881.
278. MATCH-FILLING MACHINES, C. R. E. Bell, Knightrider-street, London.—*22nd January*, 1881.
299. ROTARY ENGINES, J. Matthews, Chancery-lane, London.—*22nd January*, 1881.
303. MACHINE GUNS, W. Tranter, Birmingham.—*22nd January*, 1881.
329. CARBONIC ACID, &c., J. Williamston, Westoe.—*25th January*, 1881.
393. DRIVING CHAINS, F. Ley, Derby.—A communication from J. M. Dodge.—*28th January*, 1881.
431. MOULDING APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from W. B. Carpenter.—*1st February*, 1881.

Patents Sealed

List of Letters Patent which passed the Great Seal on the 11th February, 1881.)

2617. STREET, &c., LAMPS, J. G. Wilson, Market-street, Manchester.—*26th June*, 1880.
2965. STRAINER-BOXES, R. Norton, Tynemouth-road, Heaton.—*19th July*, 1880.
3124. BRICKS, &c., A. McKerlie and R. Bradshaw, Liverpool.—*29th July*, 1880.
3309. BREWING, &c., A. Collingridge, Paris.—*14th August*, 1880.
3313. ROTARY MOTION, E. W. Anderson, Washington, U.S.—*14th August*, 1880.
3318. SEWAGE TRAPS, C. Perks, Burton-upon-Trent.—*16th August*, 1880.
3323. MONEY TILLS, H. E. Sambrook, Bricklayers' Arms, Old Kent-road, London.—*16th August*, 1880.
3331. WINDING YARN, W. Knowles, Bolton-le-Moors. —*17th August*, 1880.
3376. ASBESTOS SHEETS, &c., S. Pitt, Sutton.—*19th August*, 1880.
3382. BALL, &c., VALVES, J. Willoughby, Plymouth.—*20th August*, 1880.
3387. WASHING FIBRES, J., C., L., and M. Jefferson, Bradford.—*20th August*, 1880.
3402. SCREW PROPELLERS, J. Taylor, Birkenhead.—*21st August*, 1880.
3424. ELECTRIC CONDUCTORS, G. Barker, Colemore-row, Birmingham.—*24th August*, 1880.
3486. SCREW PROPELLERS, W. J. Griffiths, Bayswater. London.—*28th August*, 1880.
3512. GAS ENGINES, &c., H. Aylesbury, Bristol.—*30th August*, 1880.
3566. COVERING ROOFS, J. H. Johnson, Lincoln's-inn-fields, London.—*2nd September*, 1880.
3596. BRUSHES, S. Abraham, Manchester.—*4th September*, 1880.
3721. HURDLES, &c., W. Bailey, Wolverhampton.—*13th September*, 1880.
3767. PACKING BRAN, A. M. Clark, Chancery-lane, London.—*16th September*, 1880.
3849. SAFETY VALVES, W. R. Lake, Southampton-buildings, London.—*22nd September*, 1880.
4213. CLIPS, &c., R. B. Jones and J. Hughes, Liverpool.—*16th October*, 1880.
4453. TAR-INHALING CIGAR, A. Rousseaux, Brussels.—*1st November*, 1880.
4666. CANDLES, W. H. Beck, Cannon-street, London.—*12th November*, 1880.
5044. CORKING, &c., BOTTLES, H. W. Beckton, Dudley. —*3rd December*, 1880.
5046. VELOCIPEDES, J. K. Starley, Coventry. — *3rd December*, 1880.
5088. HARVESTING MACHINES, W. G. Manwaring, Banbury.—*7th December*, 1880.

(*List of Letters Patent which passed the Great Seal on the 15th February*, 1881.)

3048. FOIL of TIN, &c., F. H. F. Engel, Hamburg.—*24th July*, 1880.
3277. INTERPOSING or SPREADING APPARATUS, G. C. Bacon, Fleet-street, London.—*11th August*, 1880.
3329. ORNAMENTING LENO, &c., A. Morton, Darvel.—*17th August*, 1880.
3333. ANCHORS, T. E. Norton, Southampton. — *17th August*, 1880.
3338. RAILWAY CARRIAGES, J. Wetter, Strand, Westminster.—*17th August*, 1880.
3343. JET APPARATUS, G. D. Robertson, Palace-chambers, Westminster.—*17th August*, 1880.
3345. DISTRIBUTING TYPES, F. Wicks, Glasgow.—*18th August*, 1880.
3346. MATRICES, F. Wicks, Glasgow.—*18th August*, 1880.
3347. CARRYING APPARATUS, W. R. Bull, Angell-road, Surrey.—*18th August*, 1880.
3348. DRAWING CORKS, A. Muir, Harborne.—*18th August*, 1880.
3356. BIB, &c., VALVES, E. Smith, Carlisle-street, Soho. —*18th August*, 1880.
3364. LIGHTING GAS, &c., P. Aube, Paris. — *19th August*, 1880.
3372. ORGAN HARMONIUMS, P. Jensen, Chancery-lane, London.—*19th August*, 1880.
3392. CUTTING TICKETS, L. von Hoven, Castle-street, Holborn, London.—*20th August*, 1880.
3395. POLISHING BOOTS, T. G. S. M'Carthy, Knightsbridge, and A. Shakespear, Nassau-street, London. —*20th August*, 1880.
3396. CARRYING EGGS, J. Halley, and A. Barr, Glasgow. —*21st August*, 1880.
3399. ROTARY MOTIVE POWER ENGINE, J. Roberton, jun., Lawhope.—*21st August*, 1880.
3410. MIXING MACHINES, J. Liddell, Glasgow.—*23rd August*, 1880.
3468. WEIGHING MACHINES, J. Hines, Glasgow.—*26th August*, 1880.
3469. DRYING CORN-FLOUR, J. Currie, Paisley.—*26th August*, 1880.
3530. STEAM HEATING APPARATUS, F. Hart, Queen Victoria-street, London.—*31st August*, 1880.
3597. TRAM-RAILS, J. Smith, jun., E. Lones, and J. Hill, Barrow-in-Furness.—*4th September*, 1880.
3602. JEWEL CASES, W. Hardy, Thistleton. — *4th September*, 1880.
3629. ARMOUR-PLATES, J. D. Ellis, Sheffield.—*7th September*, 1880.
3647. HORSESHOES, W. W. Box, Crayford, and F. J. Beadle, Erith.—*8th September*, 1880.
3667. RAISING, &c., APPARATUS, C. D. Abel, Southampton-buildings, London.—*9th September*, 1880.
4027. CHECKING WASTE of WATER, B. J. B. Mills, Southampton-buildings, London.—*4th October*, 1880.
4110. DRAWING OFF FLUIDS, T. J. Easey, High-street, Stepney.—*9th October*, 1880.
4354. BRAKES, &c., S. Fairman, Baltimore, U.S.—*25th October*, 1880.
4393. ELECTRIC LIGHTING APPARATUS, W. R. Lake, Southampton-buildings, London.—*27th October*, 1880.
5132. TREATING HOP PLANTS, T. J. Wall, Laura-place, Southampton.—*8th December*, 1880.
5243. PRINTING MACHINES, T. B. Dooley, Chelsea, Massachusetts, U.S.—*14th December*, 1880.
5352. DYNAMO-ELECTRIC TELEGRAPHY, S. Pitt, Sutton. —*21st December*, 1880.

List of Specifications published during the week ending February 12th, 1881.

2088, 6d.; 2117, 8d.; 2142, 6d.; 2193, 6d.; 2274, 6d.; 2316, 6d.; 2360, 6d.; 2374, 4d.; 2522, 8d.; 2591, 6d.; 2639, 1s. 4d.; 2648, 6d.; 2673, 6d.; 2674, 6d.; 2689, 6d.; 2729, 6d.; 2730, 1s.; 2764, 8d.; 2767, 6d.; 2771, 6d.; 2793, 6d.; 2816, 6d.; 2817, 4d.; 2840, 6d.; 2841, 2d.; 2843, 4d.; 2844 2d.; 2846, 6d.; 2852, 6d.; 2854 6d.; 2858, 4d.; 2863, 4d.; 2864, 8d.; 2865, 2d.; 2867, 2d.; 2871, 2d.; 2872, 4d.; 2877, 6d.; 2878, 4d.; 2880, 4d.; 2881, 2d.; 2882, 2d.; 2883, 4d.; 2884, 4d.; 2885, 2d.; 2886, 2d.; 2887, 2d.; 2889, 2d.; 2891, 2d.; 2892, 2d.; 2894, 2d.; 2895, 6d.; 2902, 4d.; 2906, 4d.; 2907, 4d.; 2908, 2d.; 2911, 6d.; 2917, 2d.; 2918, 2d.; 2925, 2d.; 2929, 2d.; 2938, 2d.; 2939, 2d.; 2940, 2d.; 2942, 2d.; 2943, 4d.; 3011, 6d.; 3116, 4d.; 3196, 6d.; 4091, 4d.

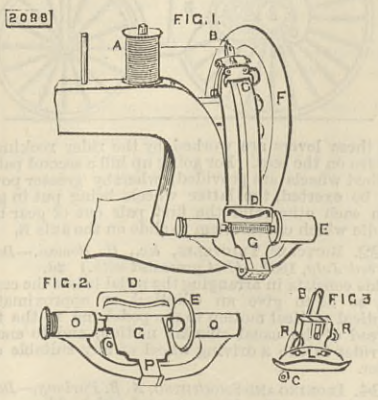
*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane,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

ABSTRACTS OF SPECIFICATIONS.

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

2088. THREAD-WINDERS for SEWING MACHINES, &c., *T. McGrah and W. Bown.—Dated 22nd May*, 1880. 6*d*.

The cotton is passed from the spool A, Fig. 1—which represents part of a Singer sewing machine—into the slot in the guide and tension B; thence along the extending arm or guide C; then underneath the bar D formed at the end of the smoothing plate, and the end is afterwards placed in between the buffer end of winder E and that of the buffer of the shuttle-reel, so as to secure the end of the cotton or thread; then by rotating the wheel F of the sewing machine, the friction of the same bearing against the buffer of the winder causes the same to revolve, which at the same time rotates the shuttle-reel. The tension on the thread pulls up the smoothing plate G of the winder, so as to bear against the cotton which is being wound upon the shuttle-reel, flattening or smoothing the



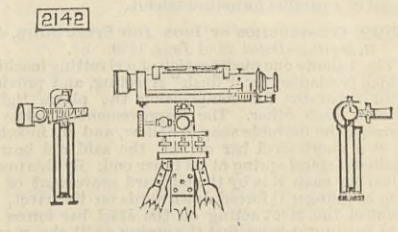
same, each successive coil of thread formed upon the reel acting as a guide, and thereby causing the thread to traverse upon the bar gradually from end to end of the reel until the same is sufficiently filled with cotton. Fig. 2 shows a winder detached from the machine. G is the smoothing plate hinged to the frame of the winder at P; D the thread guide forming part of the smoothing plate; O O the sockets of winder bearing, and E the buffer and centre for carrying the reel. Fig. 3 shows the combination of thread conductor and tension B, bar L, hinge R, and clamp, as arranged to fit upon the bend guard of a Singer machine or corresponding part of other machines, so as to act in conjunction with the bar or roller attached to the smoothing plate.

2117. STOPPING BOTTLES, &c., *D. Rylands.—Dated 24th May*, 1880. 8*d*.

Two or more holes are formed in the stopper and corresponding holes in the outside of the neck of the bottle, one end of suitable metallic clips being forced into the holes in the stopper, which is then pressed over the mouth of the bottle, and the other ends of the clips enter the holes in the neck. The stopper is removed by forcing out the clip with a sardine knife or other pointed instrument. A Second part of the invention relates to the manufacture of bottles of uniform length.

2142. MEASURING DISTANCES, *W. F. Stanley.—Dated 26th May*, 1880. 6*d*.

This relates to the measurement of distances by triangulation from near and distant base, and consists of a cylindrical steel measuring line divided in parts to constitute a base; a telescope or sight director moving upon a double axis with divided arc to read off degrees and parts or calculate distances; a second telescope or sight on movable axis, and two rods having sights to direct them to an angle with one of the telescopes when two are used. The line is made of steel wire,



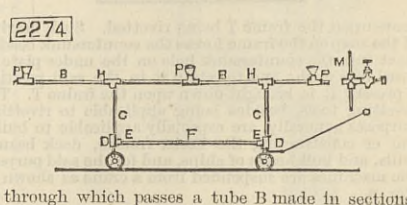
tempered to spring temper, so as to roll upon a coil and open out straight when unrolled. For taking a distant base one jointed telescope only is used, the line being distended between the two rods, and for a near base one rod is dispensed with, the line being distended between the two jointed telescopes. Fig. 1 shows the single telescope for triangulating a distant base, and Figs. 2 and 3 the two telescopes used for triangulating a near base.

2193. ANTISEPTIC and ABSORBENT PADS, *W. and A. Southall and T. Barclay.—Dated 29th May*, 1880. 6*d*.

This pad is intended to absorb discharges in childbed, as well as natural discharges of women, and for absorbing discharges generally. It consists of a pad of absorbent wool enclosed in a casing of absorbent gauze, to the back of which a light band is secured, one end passing up to the waist in front and the other to the waist behind where they are fitted with loops to receive a belt passing round the waist of the wearer.

2274. WATERING GARDENS, &c., *J. Deverill, jun.—Dated 4th June*, 1880. 6*d*.

The apparatus can be used for watering gardens, distributing liquid manure, and also as a fire extinguisher, and it consists of two pairs of wheels to run on the ground, on the axles of which bridge-pieces are secured and receive T-pieces D having lateral sockets E to take the end of a tube F. In the T-pieces are secured tubes G, on the top of which are other T-pieces



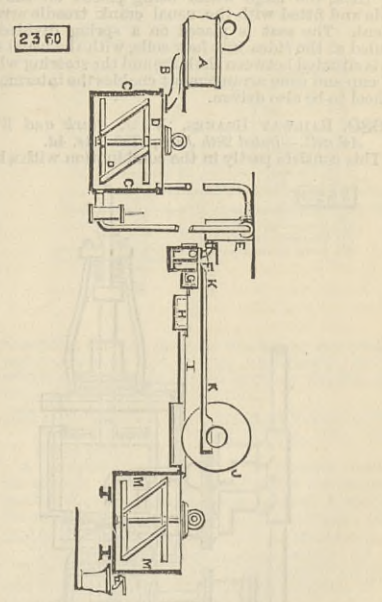
H, through which passes a tube B made in sections joined by T-pieces P, to which roses are secured. At one end of B is a cross-bar or lever M, and a stop-cock, connected by a flexible tube to the water or other liquid under pressure. The tube B can be turned by the cross-bar M so as to bring the roses to any desired position.

2316. DINNER PLATES, &c., *C. H. Wood.—Dated 8th June*, 1880. 6*d*.

The rim of the plate is moulded with recesses to receive the different condiments used at table, so as to keep each one separate and prevent it running down into the plate. A breakfast plate is formed with such recesses, and also a cup and U-shaped piece, to serve as an egg-cup and toast rack respectively.

2360. CLEANING MATERIALS USED IN THE MANUFACTURE OF PAPER, *J. Robertson.—Dated 11th June*, 1880. 6*d*.

The "half stuff" is discharged from the breaking engine A through the pipe B into the tank C, where it is thinned with water until the mixture is very fluid, and kept agitated by the rotating stirrer D. From the tank the "half stuff" is pumped up into the box or tank E, from whence it is discharged through the stop-cock F on the first or wider strainer G, in passing through the slits of which the material is separated from the coarser impurities. When it is possible to arrange the breaking engine A and the tank C at a higher level than the strainers, the pump and tank E may be dispensed with. The box bottom underneath the strainer G communicates with another and finer



strainer H, in passing through the narrower slits of which the finer impurities are separated from the fibre. From the last strainer the admixed "half stuff" and water flows over the shute I to the revolving sieve or drum J, where it is separated from a portion of the water, the latter passing through the meshes into the interior of the sieve, and thence outwards through an opening at the centre or hub on the conduit K, and thence into the chamber H, from which it may flow back into the tank C, or on to the first strainer G, thereby saving water by enabling the same quantity to be utilised over and over again. From the sieve J the cleansed "half stuff" passes into another tank M, also provided with a revolving agitator, and it may thence be discharged into the bleaching or notching engine, or run into a simple got-up paper-making machine, and made into paper direct, to be afterwards bleached.

2374. Rails, *H. A. Fletcher.—Dated 11th June*, 1880. 4*d*.

This consists of an improvement in the form or shape of rails, the base or lower flange of the rail being extended or spread out where it rests upon the

2374

sleeper or other support, instead of being made as usual of a parallel form throughout.

2522. Construction of Iron and Steel Ships, &c., *H. Smith.—Dated 22nd June*, 1880. 8*d*.

Fig. 1 shows one modification of a rivetting machine, which is adapted for "flush" rivetting, and provided with apparatus for compressing the plates tightly against each other. The improvement consists in forming the movable snap E hollow, and in inserting in it a short steel bar or rod, the said rod bearing against a spiral spring at its inner end. By this means when the snap E is by the outward movement of the ram or plunger C forced downwards on the rivet, the point of the rivet acting on the steel bar forces the said bar upwards against the spring until the snap E

2522

FIG.1.

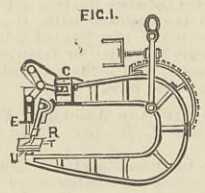
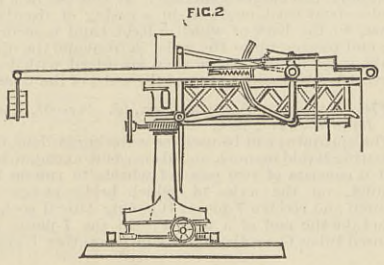


FIG.2



bears upon the frame T being rivetted. Such bearing of the snap on the frame forces the countersunk beaded rivet into the countersunk hole on the under plate U until it is flush; and to retain it in the said position a presser R is brought down upon the frame T. The rivetting tools, besides being applicable to rivetting purposes generally, are especially applicable to building or constructing the keels, frames, deck beams, hulls, and bulkheads of ships, and for the said purpose the machines are suspended from a crane as shown in Fig. 2.

2550. Traps for Catching Rats, &c., *J. Burridge—Dated 23rd June*, 1880.—(*Not proceeded with.*) 2*d*.

The trap is made in the form of a box, and is provided with a grated, close, or other doorway or outlet, through which the animal may be released for destruction. The trap has preferably inclined sides up which the animals can easily get or ascend, and the receptacle depends from its summit as a pit or well, and near to but—preferably—not quite at its top is provided with a balanced or false floor, on a part of or suspended above which the bait is placed in such a position as regards its distance from the sides as that it cannot be reached therefrom by the animal, necessitating that the animal should step down on to the apparently safe floor, when it is precipitated into the trap.

2566. Securing Letters in Envelopes, *W. R. Lake.—Dated 23rd June*, 1880.—(*A communication from A. de Colmont.*)—(*Not proceeded with.*) 2*d*.

This consists in the use of a disc of tin foil which is secured to the envelope by tongues passing through the envelope and document therein, and which are bent over on the opposite side and fastened with sealing wax.

2591. Velocipedes, &c., *H. J. Lawson.—Dated 25th June*, 1880. 6*d*.

The vehicle is supported on three wheels of different sizes. The small wheel is used for steering, and is placed in a line with the intermediate wheel on one side of the vehicle, and may be placed either at front or back, the large wheel being placed on the other side and fitted with the usual crank treadle arrangement. The seat is placed on a spring divided and coiled at the sides into four coils, with the usual slide. It is situated between the large and the steering wheels. A cup and cone arrangement enables the intermediate wheel to be also driven.

2639. Railway Brakes, *W. J. Clark and W. H. Ashwell.—Dated 28th June*, 1880. 1*s*. 4*d*.

This consists partly in the combination with a brake

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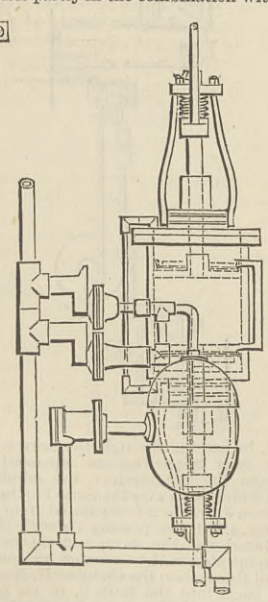

cylinder and a receiver or accumulator of an automatic reversible check valve between the train pipe and receiver or accumulator, and controlling valves that automatically regulate the communication between the receiver or accumulator and the cylinder, and between the cylinder and the external atmosphere; the whole so arranged as to form a compound brake capable of adapting itself automatically to work by either compressed air or vacuum.

2599. Hydrants and Stand Pipes, &c., *J. Chidley.—Dated 25th June*, 1880.—(*Void.*) 4*d*.

This consists in the construction, combination, or arrangement of parts of hydrants or stand pipes, whereby they are rendered non-refrigerating, thus producing a continuous supply of water during the most inclement weather.

2648. Railway Carriages, *W. W. Hilles.—Dated 29th June*, 1880 6*d*.

This consists in the substitution of a fixed transverse plate or bar A of wrought iron for the axletree as at present in use, extending from side to side between the supports within which the wheels

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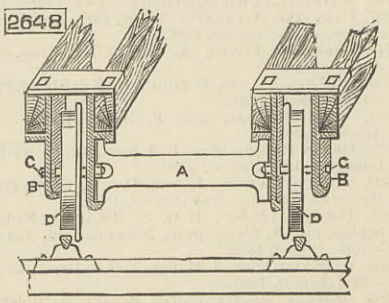


revolve. These supports consist of brackets B of wrought iron bolted on to the framework of the carriage, one for each wheel. Each bracket will contain an axle or short spindle C fixed in its place, on which the wheel D revolves. The framework of the carriage should be composed of two longitudinal beams of timber on each side to which the bracket is bolted.

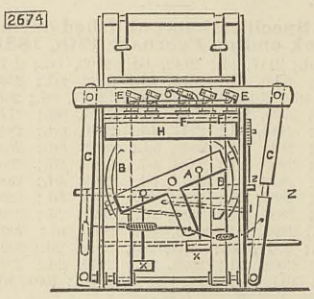
2673. Vessels for Conveying Sea-water to Inland Towns, *J. Hayes.—Dated 30th June*, 1880. 6*d*.

The vessel consists of a circular pontoon the ends of which are shaped to offer the minimum resistance when in motion. It is fitted with apparatus so as to create a partial vacuum within it whereby the vessel can charge itself with sea-water through suitable valves. Compressed air is used to empty the vessel of the water, which proceeds along pipes into suitable reservoirs.

2674. Looms for Weaving Smallwares, &c., *W. Glover.—Dated 30th June*, 1880. 6*d*.

A T-shaped lever A is connected to the reed frame and carries two rollers working in elbow slots B causing the reed to move backwards and forwards, such lever being actuated by the treadles X. To one arm of the lever are connected by cords the picking sticks C, which carry the cross bars on which are small swivel bars E. On each of these bars are two rods which fit into holes in shuttles F. The cross bars slide across the reed frame, on which is a stud serving to raise and depress either end of the bars E alternately as they pass over it. A connecting rod causes all the bars E to oscillate simultaneously when the pick-

2674



ing sticks are actuated by lever A. The arm Z prevents the reed beating up until the shuttle has reached either side of the warp by coming in contact with a roller on the picking stick H to the taking-up roller, and carries a wheel driven by a finger on the oscillating lever I. An improved taking-up roller and stop motion for the same are described. A second improvement consists in the use of two vertical shuttle pickers, and forming two sheds by drawing the warps from two beams, while a third improvement consists in the employment of three or any number of shuttles to each warp moving on swivel bars, in rotary looms, so that 24 or more picks are made during each revolution, while the loom revolves at a much slower rate than usual.

2689. Velocipedes, &c., *G. Liedman and C. Beeger.—Dated 1st July*, 1880. 6*d*.

The axle A of the driving wheels is connected to an axle B between it and the axle of the front wheel by a pair of toothed wheels. The axle B is cranked and connected to a system of levers C in the form of lazy-tongs, to the upper end of which the seat is connected,

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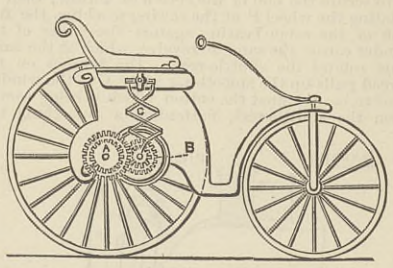


and these levers are worked by the rider rocking to and fro on the seat. For going up hill a second pair of toothed wheels are provided, whereby greater power can be exerted, the latter wheels being put in gear with each other and the first pair out of gear by a handle which causes them to slide on the axle B.

2722. Bicycles, Tricycles, &c., *H. Homan.—Dated 3rd July*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in arranging the pedal below the crank pin, so as to give an elliptical or approximately elliptical vertical motion to the pedal and to the feet instead of the usual circular motion, and to enable the rider to use a driving wheel of any suitable diameter.

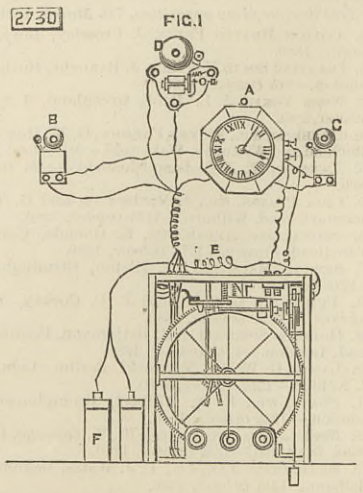
2724. Ironing and Smoothing, *A. B. Furlong.—Dated 3rd July*, 1880.—(*Not proceeded with.*) 2*d*.

The iron is fixed at the lower end of a vertical spindle and is depressed so as to pass over the article by any suitable contrivance. The motion of the iron when in use is rotary, being driven by suitable gearing.

2730. Improvements in Automatic Electric Time Signalling Apparatus, *J. Wetter.—Dated 3rd July*, 1880.—(*A communication from W. H. Shuey.*) 1*s*.

This invention consists in the combination with a timepiece provided with mechanism for breaking an electric circuit at any regular intervals of time of a motor actuated by spring, weight, water, or other power; a wheel furnished with stop pins corresponding in number to the number of minutes in twenty-four hours, this wheel being revolved by the motor; a circuit-closing device connected with the signalling devices and adapted to close the circuit at any moment of time indicated on the wheel, the stop pin corresponding to the time of sounding, the signal being withdrawn to allow of the automatic closing of the circuit; an armature connected at one end with the circuit closes, and electro-magnets located in the circuit embracing the time mechanism and adapted to regu-

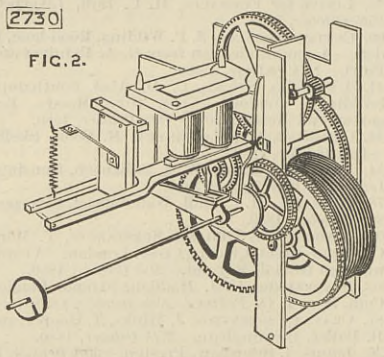
2730 FIG.1



late the movement of the stop-pin wheel and cause the motor connected therewith to impart an intermittent rotary movement thereto, and move it through a space equal to the distance between any two adjacent stop-pins, showing each moment of time as indicated

2730

FIG.2.



by the time mechanism. Fig. 1 represents the clock A with bell B, which rings three minutes before a train goes east, bell C, which rings three minutes before a train goes west, and bell D, which rings at the starting time of all trains; E is the signalling apparatus, and F the battery. Fig. 2 gives some details of the signalling apparatus.

2738. Tanning Hides, &c., *C. D. Abel.—Dated 5th July*, 1880.—(*A communication from J. and C. Ballatschano and H. Trenk.*) 2*d*.

This consists, First, in the use for tanning hides of a bath composed of the nitrates, or the sulphates, or the hydrochlorates of metals combined with lime and dissolved in pyroligneous acid. Secondly, in the use for tanning hides of a bath composed of glue or other analogous gelatinous substances combined with oxalic acid or other acid that will not coagulate the glue, and with glycerine and acetate of alumina.

2740. Tentering, Drying, and Packing Pile or Plush Fabrics, *W. Norton and J. H. Hellawell.—Dated 5th July*, 1880.—(*Not proceeded with.*) 2*d*.

The pile or plush fabrics are packed in the form of a scroll as though they were wound on a roller, but with the successive coils of the scroll at a short distance apart, and kept from bearing against one another by reason of the fabric being held distended by its selvages.

2741. Brake Gear for Carts, &c., *H. Stott.—Dated 5th July*, 1880.—(*Not proceeded with.*) 2*d*.

Underneath the cart are two short shafts, on which are fixed spur wheels gearing with other spur wheels fixed on the bosses of the cart wheels. Upon these two short shafts are also placed the brake, which consists of pulleys and iron straps, the inside of which is covered with leather or other suitable material.

2758. Steam or Power Winding Machinery, *H. S. Mackenzie.—Dated 6th July*, 1880.—(*Not proceeded with.*) 2*d*.

A bed plate is provided with one or more shafts or pivots, to each of which is fitted worm and chain wheels free to revolve on same. The chain wheels are provided with drums for fitting the brakes to and for winding rope or chain if required. When the chain wheel is required for lifting anchors, &c., it is connected to the worm wheel by a clutch, which connects it to an engine which actuates worm or screw shafts gearing into the worm wheels, setting in motion the worm wheel or wheels, causing the chain wheel or wheels or drums to rotate with it.

2762. Treating the Feed Water of Boilers, *G. W. von Nawrocki.—Dated 6th July*, 1880.—*A communication from A. Stock.*)—(*Not proceeded with.*) 2*d*.

The compounds of lime and baryta are converted into soluble compounds by the addition of chloride of magnesium or other chlorides.

2764. Improvements in and Connected with Electric Lamps, *G. G. André.—Dated 6th July*, 1880. 8*d*.

In this motor the winding and commutators are

2764 FIG.1

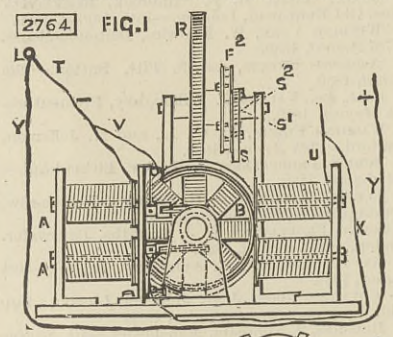
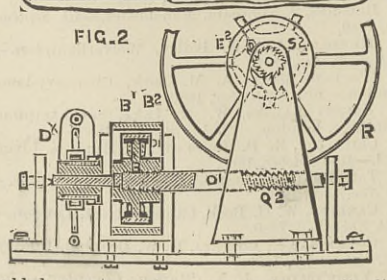
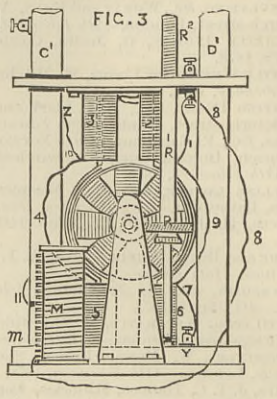


FIG.2



doubled, so as to get two currents in opposite directions, and cause the armature ring to revolve in the direction of the predominating current, and from this arrange for the adjustment of the carbons. Fig. 1 is a front elevation, Fig. 2 a side elevation of this motor. The electro-magnet cores A are when the motor is to be used with a lamp wound with thick wire. Outside these coils, but in the same direction, is a series of coils of thin wires to form a shunt resistance. The armature B consists of a central soft iron boss with a number of radial arms and a thin soft iron rim, the arms being wound with wire of suitable thickness, the outgoing end of the coils on one arm and the ingoing end of the coils on the next being brought down to the commutator C. The brushes D press on C at the points corresponding with the poles of the free magnets. If the motor is used for other purposes, modifications are made, such as

2764 FIG.3



widening the boss and winding with different wire. The apparatus for the adjustment of the carbons will be seen from Fig. 3, showing the motor affixed to the bottom part of the lamp. Resistances are so arranged as to form a Wheatstone bridge arrangement; thus, one branch is composed of the wires on the cores 2, 3, 5, and 6, another by a thin wire below the peg cap on M, the third by the arc, and the fourth by the thin wire from M to 2. An increase in arc resistance causes flow of current in one direction, a decrease causes a flow in the opposite; the motor thus keeps the resistance constant by varying the length of arc. The inventor claims this direct action of the motor, the combination forming motor, the method adopted for cutting a lamp out of circuit, &c.

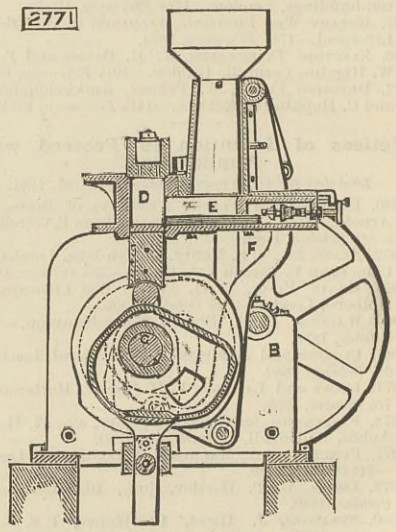
2767. Reduction or Eradication of Corns, *M. Wilson.—Dated 6th June*, 1880. 6*d*.

The instrument is formed with roughened side surfaces to reduce the corn by friction, and its end is made with a round blunt-pointed head also roughened, and which by turning the instrument is caused to act with a drilling or perforating action, so as to remove the central portion or core of the excrescence. These roughened surfaces may be formed of any suitable substance and in any suitable manner.

2771. Brick Machines, *W. L. Gregg.—Dated 6th July*, 1880. 6*d*.

To one end of shaft B is fitted a wheel gearing with a wheel on cam shaft C which actuates the plunger in the open top mould box D, one side of which has a feed opening E, to which the material to be formed into bricks is supplied from a hopper. The clay is

2771

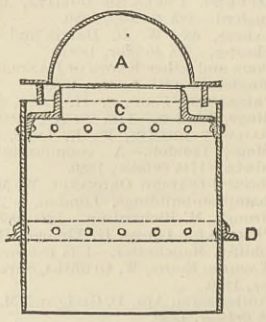


pressed forward into the mould box, D by a reciprocating feed slide F actuated by bell-crank levers worked by cams on shaft C. The pressure plate is held over the top of the mould box D at the moment when pressure is applied to the clay, by means of cams on shaft C.

2793. Annealing Pots for Tin Plates, *J. Jones.—Dated 7th July*, 1880. 6*d*.

The top or cover A is loose and projects over the edge of the pot. From the cover a rib or flange projects downwards and enters a trough C formed round

2793

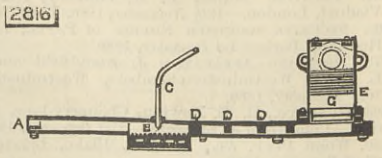


the pot, and filled with sand or other material to form a lute. D is an angle iron band rivetted to the pot to prevent it buckling.

2816. Carburetting Air, *E. Edmonds.—Dated 8th July*, 1880.—(*A communication from E. L. C. d'Ivernois.*) 6*d*.

The air to be carburetted enters through orifices A, and passes to a roughened or grooved hot plate B through channels formed by partitions. In passing over this plate the air interminglies with the hydrocarburet vapours, which are conducted to the plate

2816



through tube C. Checks D are placed in the way of the current so as to cause a more perfect mixture. Before entering the cylinder of an engine or into an

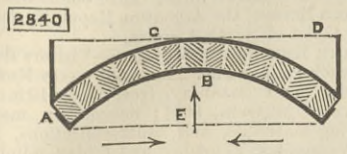
illuminating apparatus, it is caused to pass through tube E fitted with checks and then through wire gauzes G separated from one another by wires.

2817. TOBACCO PIPES AND CIGAR HOLDERS, *J. Thompson.—Dated 8th July*, 1880.—(*Not proceeded with.*) 4*d.*

The stem of the pipe is fitted with a bulb between the bowl and the mouthpiece, such bulb being filled with an absorbing material to arrest the nicotine, and made to open so as to charge and discharge it.

2840. HOLDING CURVED OR ANGULAR LINES OF TYPE, *A. M. Clark.—Dated 9th July*, 1880.—(*A communication from H. P. Hubbard.*) 6*d.*

A is a curved line of type supported on its inner side by a metal strip B provided with end flanges adapted to clamp the line. C is a metal strip bent to



the outer curve, and provided with end supports extending to the top of the curve. D and E are base lines consisting of straight leads to make the outside lines of the job straight so that it may be treated like a similar quantity of ordinary type.

2841. VESSELS FOR CONTAINING AND APPLYING LUBRICANTS, *H. M. Girdwood.—Dated 10th July*, 1880.—(*Not proceeded with.*) 2*d.*

A brush is enclosed in a tube which serves to catch any overflow from the vessel, and return it to the interior. To prevent the overflow escaping from the tube when the vessel is inverted a conical or diminishing pipe is inserted therein with its base or wide end near to the mouth of the tube.

2843. CASKS, &c., *R. Wyburn.—Dated 10th July*, 1880.—(*Not proceeded with.*) 4*d.*

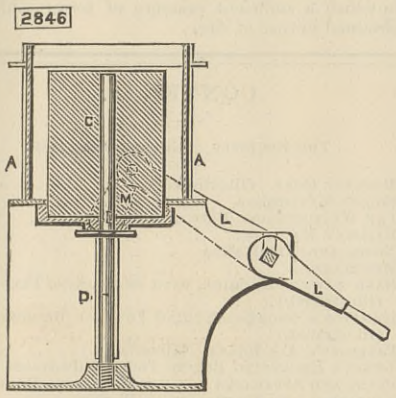
The cask is cylindrical, and consists of a thin sheet of wood with the longitudinal grain of the wood running diagonally from one of the longer edges to the opposite one, cemented to a similar sheet of wood with the grain running in the opposite direction. When quite dry they are bent round a mandril of the desired form and their ends cemented together.

2844. UTILISING THE LATENT HEAT OF STEAM, &c., *C. Pieper.—Dated 10th July*, 1880.—(*A communication from R. Handrick.—(Not proceeded with.*) 2*d.*

The steam generated in a boiler is caused to pass into a chamber inside the apparatus in the manner of a flue, whereby it is heated to a certain degree above that of the liquid by means of a hot medium conducted by a pipe through or into the steam. The steam being hotter than the liquid in the generator communicates its latent heat to the liquid, which is evaporated, while the steam is condensed.

2846. SAND MOULDS FOR CASTING CISTERNS, &c., *T. H. Chatton.—Dated 10th July*, 1880. 6*d.*

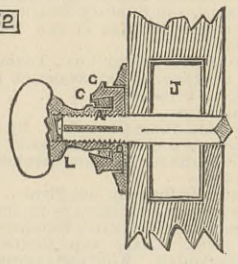
The box A is placed on a table, through a hole in which the pattern C forming the cistern slides on a



central spindle D, and is raised by the levers L and link M. This pattern is a solid block, and the space between it, when raised, and the inside of the box A is filled with sand, and the top flask put on when the pattern is lowered.

2852. FASTENINGS CONNECTED WITH SPINDLES AND HANDLES OF DOORS, &c., *P. D. Reynolds.—Dated 10th July*, 1880. 6*d.*

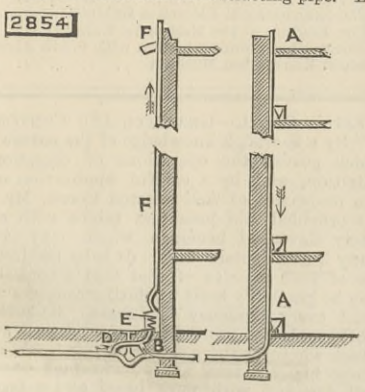
A square shoulder is formed on the inner end of the loose knob or handle, and engages with a corresponding aperture in a sliding collar C, which is slid over a square nut D either separate or in a piece with



the rose. The piece D has a shoulder with a thread to receive an outside collar G, to hold the sliding collar C in position. The knob screws on to the end of the spindle. If the collar D and rose are in one piece they do not turn with the spindle, but if made separate the collar D turns with the spindle and the rose is secured to the door. A modification is described for securing tops in position.

2854. EXTRACTING SEWAGE GAS FROM DRAINS, *B. Morton.—Dated 10th July*, 1880. 6*d.*

A is the soil pipe conveying the sewage to the drain, and B a branch pipe connecting the drain with an extracting pipe. C is a syphon trap and D a second pipe connecting the drain with the extracting pipe. E is a



chamber containing a coil heated by steam at the foot of the extracting pipe F. When steam is admitted to the coil the heat rarefies the air, and causes a strong up-current in pipe F, thus drawing the foul air and gas from the drain and down the soil pipe A. Fresh air is drawn in through an eye for cleaning the drain and also through the soil pipe. An opening is made to clean the trap C.

2858. THROSTLE FRAMES, *J. H. Johnson.—Dated 10th July*, 1880.—(*A communication from L. V. R. Ferouelle.*)—(*Not proceeded with.*) 4*d.*

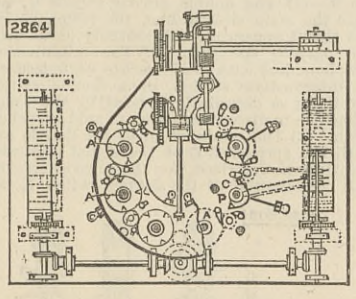
This consists in the use of a double spindle or twisting device in throstle frames which admits of the continuous winding of the thread or yarn, and at the same time imparts to it one, two, or more turns or twists for each revolution of the twisting or torsion apparatus.

2863. HORSE OR STEAM ROAD ROLLERS, *W. Holloway.—Dated 12th July*, 1880. 4*d.*

One or two water tanks are fitted to either horse or steam rollers, so as to combine a water cart and road roller in one.

2864. MANUFACTURE OF LACE, &c., *F. E. A. Busche.—Dated 12th July*, 1880. 8*d.*

The most important feature in this invention is the employment of special mechanism for stopping the action of any one of the bobbin carriers at any required moment, and for keeping the same out of action during any desired period of time. In one arrangement the toothed driving-wheels A, in lieu of being fixed as heretofore to the notched discs A^1, are maintained separate therefrom by an interposing collar



on the fixed spindle. The boss of the notched disc wheels A^1 turns loosely on the said spindle and rests at its lower end upon the said collar. Along the said boss slides vertically the clutch P, which, when rotated, imparts its movement to the said boss with its notched discs. On the under flange of the clutch there are provided as many projections as there are notches in the discs, and a corresponding projection is provided on the upper surface of the toothed wheel, with which projection one or other of those on the clutch at C engages.

2865. SYNCHRONISING OR SETTING CLOCKS, &c., *J. A. Lund.—Dated 12th July*, 1880.—(*Not proceeded with.*) 2*d.*

This consists of means whereby the minute spring is momentarily thrown out of action, thereby leaving the "motion" entirely free to be acted upon by a weighted lever or other analogous device released by the time signal, whether sent by an electric current or by a pneumatic or other time signal.

2867. HEATING APPARATUS, *M. Bauer.—Dated 12th July*, 1880.—(*A communication from S. Suchet.*)—(*Not proceeded with.*) 2*d.*

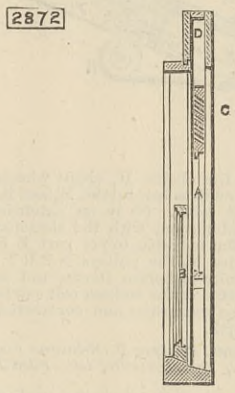
The apparatus is fitted with vertical and horizontal divisions, and is applicable to the insides of chimneys; cold air entering at one end and becoming heated passes out at the opposite end.

2871. CULTIVATORS AND DRAGGING MACHINES, *J. Robinson.—Dated 12th July*, 1880.—(*Not proceeded with.*) 2*d.*

A hand lever is used to throw the tines in or out of work, the motion of the lever being transmitted to the tines through connecting rods and levers. An intermediate double-ended lever is used to automatically lock the tines until moved by the hand lever.

2872. WINDOW FRAMES AND SASHES, *W. Wilson.—Dated 12th July*, 1880. 4*d.*

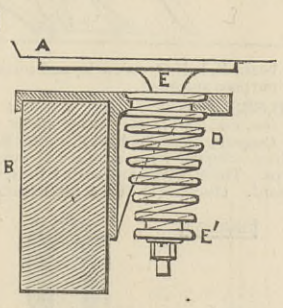
A is the top sash; B is the bottom sash; C louvres



(variable in number); D chamber in the reveal varying in depth to suit depth of ventilator.

2877. SUPPORTING THE BODIES OF RAILWAY VEHICLES, &c., *W. Stroudley and J. Cleminson.—Dated 12th July*, 1880. 6*d.*

The drawing shows one arrangement of springs according to this invention. A is part of the carriage body, and B one of the beams of the under framing. A bracket attached thereto is cast so that the upper



part of the taper helical spring D is screwed into it, the spring being thus suspended from the bracket. A strut E attached to the carriage body projects down through the middle of the spring, and has a collar E^1 bearing on its lowest convolution, which is secured to it by a nut.

2878. BITTER ALMOND OIL, BENZOIC ACID, &c., *F. A. Zimmermann.—Dated 12th July*, 1880.—(*A communication from Dr. E. Jacobsen.*) 4*d.*

One molecular weight of benzotrichloride is heated in a closed vessel on a water bath with a small proportion of chloride of zinc and with two molecular weights of glacial acetic acid. Hydrochloric acid is given off and acetyl chloride distils over, while benzoic acid remains behind with the unaltered chloride of zinc. Towards the end of the operation the heat is increased until the production of hydrochloric acid ceases and any undecomposed acetic acid has been driven off. The residue is powdered and extracted by a moderately warm solution of soda. This solution will yield white crystals of benzoic acid.

2880. WATERPROOF AND VERMIN-PROOF TEXTILE FABRICS, &c., *W. R. Lake.—Dated 12th July*, 1880.—(*A communication from D. M. Lamb.*)—(*Not proceeded with.*) 4*d.*

The fabric to be made waterproof or vermin-proof is treated with a compound consisting of a fatty or waxy matter dissolved in a hydrocarbon solvent, to which a hydrocarbon gum, such as india-rubber, is added. For each gallon of the solution is added ½lb. of salt and ½lb. sulphuric acid, whereby gases are set free which rise up through the compound and attack all sedimentary and mucilaginous portions which are precipitated. The mixture is then freed from gas by any suitable means, and is then ready for use.

2881. TAPS, *J. Wilde.—Dated 13th July*, 1880.—(*Not proceeded with.*) 2*d.*

The tap has two turn plugs placed a certain distance apart, and on their spindles are fixed toothed wheels gearing with an intermediate wheel, actuated by a handle so as to simultaneously open one plug and close the other, whereby a certain quantity of liquid will be drawn off each time the tap is opened.

2882. FLUFFING OR WHITING LEATHER SKINS, *S. Haley.—Dated 13th July*, 1880.—(*Not proceeded with.*) 2*d.*

The leather is placed on bars or bearers, and is caused to press on the underside of an emery roller, the leather being maintained quite tight by means of weights, to which both of its ends are secured.

2883. WATERPROOF AND VERMIN-PROOF FABRICS, *W. R. Lake.—Dated 13th July*, 1880.—(*A communication from D. M. Lamb.*)—(*Not proceeded with.*) 4*d.*

The fabric to be made waterproof or vermin-proof is treated with a compound consisting of a solution of paraffin and a hydrocarbon gum dissolved in some hydrocarbon solvent. For each gallon of the solution is added ¼lb. of salt and ½lb. sulphuric acid, whereby gases are set free, which rise up through the compound and attack all sedimentary and mucilaginous portions which are precipitated. The mixture is then freed from gas by any suitable means, and is then ready for use.

2884. TANNING, *A. M. Clark.—Dated 13th July*, 1880.—(*A communication from G. D. Zonca.*) 4*d.*

The hides, after undergoing the depilatory operation—say to the number of 175 pieces, weighing 400 kilogs.—are placed in casks with about 130 kilos. of ground fir bark, and the casks are then immersed in an infusion of the same bark, in which they are rotated for about twelve hours. The hides are then removed and secured together in pairs to form bags with the hair side outwards, which are then filled with a mixture of oak bark, valonia, and fir bark in powder, and immersed in an infusion of the same substance for ten or twelve days. The bags are then filled with the cold liquor, the mouths closed, and laid horizontally in the pit, where they remain half covered with liquor, the bags being emptied and filled every half-hour. After a certain time they are emptied and laid in the vat, a fresh set of bags being placed over them.

2885. EXTRACTING AMMONIA DURING DISTILLATION OF AZOTIC SUBSTANCES, *W. Brierley.—Dated 13th July*, 1880.—(*A communication from F. Richters.*) 2*d.*

When azotic substances, such as coal, peat, &c., are heated, a decomposition of the organic substances takes place. A part of the nitrogen escapes as ammonia, while another remains as azotic carbon, which latter, only when in a higher temperature, is transformed into nitrogen and carbon. Steam is discharged through this azotic carbon, whereby the water and the azotic carbon are decomposed, and ammonia and carbonic acid or carbonic oxide arise.

2886. HOLDERS FOR GAS GLASSES, *J. C. Heaton.—Dated 13th July*, 1880.—(*Not proceeded with.*) 2*d.*

The holder is made with one arm only, one end of which screws on to the gas pipe by the burner, the other being attached to the part which holds the glass. This part is preferably in the shape of an arc, and provided with clips, and on it moves an adjustable clip between which and the former clips the glass is held.

2887. ROTARY ENGINES OR PUMPS, *J. Stowe.—Dated 13th July*, 1880.—(*Not proceeded with.*) 2*d.*

This consists essentially of a cylinder and casing preferably revolving, an excentric piston revolving in the opposite direction, and through the hollow trunnions of which steam enters and escapes, and a slide valve and box for reversing and governing, and two or more sliding blocks arranged opposite each other.

2889. ENGINE GOVERNORS, *H. J. Haddan.—Dated 13th July*, 1880.—(*A communication from G. F. Pottle.*)—(*Not proceeded with.*) 2*d.*

A revolving shaft is screw-threaded and carries a nut with wings revolving in a fluid, so as to prevent the nut revolving as fast as the shaft. The tendency of the nut to move on the shaft is resisted by a weighted lever, but should the shaft revolve too rapidly, the nut rises, and through the lever operates a valve. The invention also consists in combining within a chamber an inlet pipe and an outlet pipe, the inner end of which projects into the chamber so far as to admit of a sleeve passing over and into it.

2891. DETECTING AND INDICATING STOPPAGES, &c., IN TELEGRAPHIC OR PNEUMATIC COMMUNICATIONS, *J. A. Lund.—Dated 13th July*, 1880.—(*Not proceeded with.*) 2*d.*

This consists of means for causing the ringing of an alarm bell by means of an electric current if the communication be broken.

2892. SYPHONS FOR DRAWING OFF CHAMPAGNE, &c., *W. E. Hipkins.—Dated 13th July*, 1880.—(*Not proceeded with.*) 2*d.*

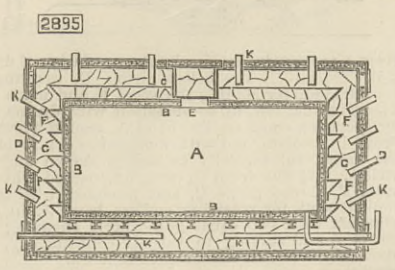
A cap which rests on the mouth of the bottle is surrounded by a tube in which a cylinder works, the bottom thereof forming a valve, which, when the cylinder is in its lowest position, seats itself in a diaphragm in the cap. The cylinder is pressed down by a spring, and is raised by a lever. Below the diaphragm named is a second diaphragm, to which a tube reaching to near the bottom of the bottle is connected by a screw, and near the top of it is a shoulder on which a cork rests, such cork consisting of two parts between which india-rubber washers are inserted.

2894. HOPPER BARGES, *W. Henman.—Dated 13th July*, 1880.—(*Not proceeded with.*) 2*d.*

The upper part consists of a flat, shallow, watertight, floating platform with openings through it. To each side of this platform is hinged the outer side of a float or deck boat, the decks of which come against the bottom of the upper float and close the openings therein. Slag or other material is fed into these openings and rests on the decks of the lower boats.

2895. PRESERVING FOOD, &c., *J. H. Johnson.—Dated 13th July*, 1880.—(*A communication from J. B. J. Mignon and S. H. Rouart.*) 6*d.*

This relates to the use of water having a salt, an acid, acohol, or equivalent substance dissolved therein or mixed therewith, so as to render the solution un-



congealable at the temperature at which ice is usually formed. The articles to be preserved are placed in a chamber A, after having been previously cooled to the lowest degree of temperature which it is possible to obtain in practice—say to about 20 deg. below zero Cent. The sides of this chamber are surrounded with a very thick covering B of non-conducting material, and the whole is contained within another or outer chamber C containing a preparation melting at a temperature below zero. This outer chamber is also enclosed in a covering D of non-conducting material. E is a door for introducing the articles; F are troughs for maintaining the ice as long as possible in contact with the covering B; K are tubes for introducing salt.

2902. REFINING SUGAR, &c., *B. H. Remmers and J. Williamson.—Dated 14th July*, 1880. 4*d.*

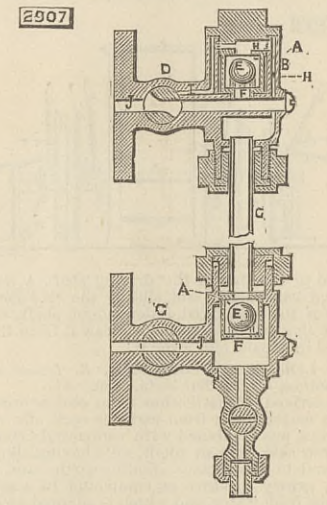
A small quantity of finely ground vegetable charcoal is mixed with impure sugar, and absorbs a very large proportion of the gum or mucilage, as well as a portion of the colouring matter it contains.

2906. COLOURING MATTER, *F. Wirth.—Dated 14th July*, 1880.—(*A communication from E. Oehler.*) 4*d.*

This relates to the production of colouring matters by the action of sulphuretted hydrogen, and of oxidising bodies on the amido-derivatives of secondary aromatic amines. The amido-deratives may be produced in either one of the following ways:—First, by combining any diazo-compound with a secondary monamine, and reducing the compound in any suitable manner; and, secondly, by treating the introso compounds of the secondary monamines with nitric acid, and reducing the compound in any suitable manner. A very weak solution of the nitrate of amidoethylaniline is saturated with sulphuretted hydrogen and treated with chloride of iron until the smell of the sulphuretted hydrogen disappears, when the colouring matter is precipitated by the addition of common salt, and a solution of chloride of zinc.

2907. WATER GAUGES FOR BOILERS, *J. Ellis.—Dated 14th July*, 1880. 4*d.*

This consists in forming a valve chamber A in the upper stuffing-box casting B, directly over the top end of the gauge glass C, instead of a separate chamber between the ordinary stop cock D and gauge glass stuffing-box. The chamber contains a spherical or other valve E, which during ordinary working rests upon ribs or pins F at the bottom of the chamber, and it is in equilibrium through the steam pressure from the stop cock D acting on the bottom of it, and the pressure from the lower cock G through the gauge glass acting on the top of it by means of a passage H leading from the gauge glass for that purpose. An



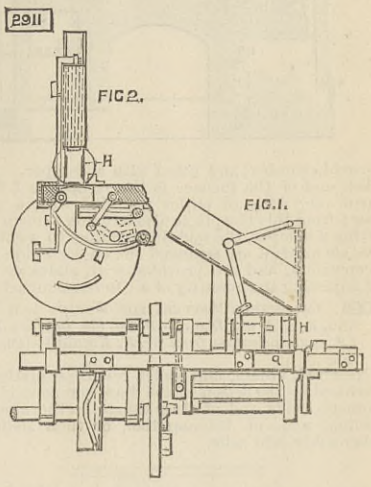
additional passage I is formed in the chamber of the upper cock leading from the ordinary passage J through the said cock to the upper portion of the valve chamber, and is controlled by the cock. This is for the purpose of equilibrating the valve in the chamber by opening the said passage when it is necessary to blow through.

2908. PERAMBULATORS, &c., *T. G. Wells.—Dated 14th July*, 1880.—(*Not proceeded with.*) 2*d.*

The seat can be revolved about a centre and set in any position, the footboard and body being stationary.

2911. MATCH-BOXES, *M. Wiberg, M.A.—Dated 14th July*, 1880. 6*d.*

This consists, First, in the use in the manufacture of match-boxes and their outer cases by machinery of "forms" H of a size corresponding to and such as will fit into a completed box or case, and causing the pieces of veneer to be wound around such forms;



Secondly, the use in such machinery for pasting the paper of a paste box Q, open underneath, and under which such paper is caused to pass; Thirdly, in apparatus for putting in the bottom.

2917. GOVERNING AND INDICATING SPEED OF ENGINES, *F. W. Durham.—Dated 15th July*, 1880.—(*Not proceeded with.*) 2*d.*

A propeller revolves in a suitable casing and its shaft is driven from the shaft of the engine to be governed, and its end bears against a spring in a thrust bearing connected to the throttle valve.

2918. METALLIC ALLOY, *J. Mc L. McMurtrie.—Dated 15th July*, 1880.—(*Not proceeded with.*) 2*d.*

This consists of certain proportions of copper, zinc, and nickel, with or without the addition of a small percentage of lead.

2925. PURIFYING MOHAIR, &c., *J. Walworth.—Dated 15th July*, 1880.—(*Not proceeded with.*) 2*d.*

The mohair is placed in boxes sliding on rods and fitted with racks to raise them to any desired height. Through the boxes pass endless bands furnished with teeth which carry the mohair over an air-tight chamber, in which a fan operates and draws a current of air through the loosened fibre, thereby removing infectious smells and insectiles, which pass to a furnace and are burnt.

2929. MEDICATED AND OTHER AERATED WATERS, *G. O. Willis.—Dated 16th July*, 1880. 2*d.*

This consists in the addition of glycerine or other like bodies resulting from the distillation of fatty matters to medicated and other aërated waters, thereby rendering them more palatable.

2938. Rolling Bars of Iron and Steel for Manufacture of Knees for Railway Wagons, &c., *J. Lones, C. Vernon, E. Holden, and R. Bennett.—Dated 16th July*, 1880.—(*Not proceeded with.*) 2*d.*

These bars are formed by a pair of rolls, the bottom one of which is cylindrical, and the top has in cross section nearly the figure of an involute curve.

2939. Loading and Unloading Brewers' Drays, &c., *G. W. von Nawrocki.—Dated 16th July*, 1880. —(*A communication from G. Koblinsky.*)—(*Not proceeded with.*) 2*d.*

A ladder terminates in a horizontal part or platform, and at the junction a lever is arranged on each side. The barrel, when lifted, depresses and passes over these levers, but is prevented by them from rolling down the ladder again. The barrel is raised by a rope from a winch arranged under the ladder.

2940. Indicating the Level of Liquid Fuel in Lamp Reservoirs, *D. Cohen.—Dated 16th July*, 1880.—(*Not proceeded with.*) 2*d.*

So as to prevent over-filling or running dry, a float rises and falls with the liquid between suitable guides. From it projects upwards a rod graduated so as to indicate the level of the liquid.

2942. Tramways, *H. Hughes.—Dated 16th July*, 1880. —(*Not proceeded with.*) 2*d.*

The rail is made in two longitudinal portions arranged side by side sufficient distance apart to admit the flange of the wheel between them. The part forming the guard rail is of ordinary angle iron, and the acting rail is of steel of similar section. The two parts are connected by rivets passing through distance pieces between them.

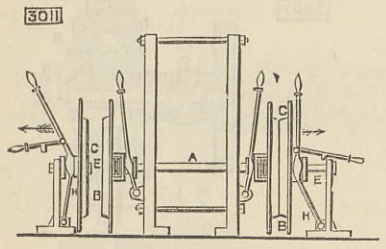
2943. Substitute for Whalebone, *R. Auerbach.—Dated 16th July*, 1880. 4*d.*

The fibres of pissava, palm leaves, alpha grass, kitool, or other like plants are steeped in naphtha containing resin in solution, or boiled in linseed oil with such resinous matters. These fibres are then saturated with a solution of silicate of soda to cause them to adhere together in flat or round strips, which are coated with brass or tin foil and covered with shellac or varnish.

3011. Coiling or Winding Wire into Coils or Bundles, *J. Patchett.—Dated 22nd July*, 1880. 6*d.*

This consists in mounting the loose half reel C of the machinery upon a fixed independent shaft E,

3011



situated in the line of the driving shaft A, carrying the fixed half reel B, and sliding the said loose half reel upon the said fixed independent shaft, so as to bring it in contact with or withdraw it from the fixed half reel by means of a lever H.

3116. Lubricating Compounds, *R. Irvine and R. Granton.—Dated 29th July*, 1880. 4*d.*

Oils derived by distillation from coal or other bituminous materials, or from earth or rock oils, or from earth wax, are combined with compounds consisting of a fatty acid with an alkali, salts having alkali reactions, and in some cases alkaline earths, and form a plastic, greasy mixture or compound in a solidified form free from water, and which is adapted to prevent friction of rubbing surfaces.

3196. Furnaces for Burning Pyrites, *J. Mason.—Dated 4th August*, 1880. 6*d.*

Within the calcining chamber A is arranged the inclined row of fluted cylinders B, keyed upon shafts which are carried in bearings outside the heating chamber. At one end of the chamber underneath the hopper E is the fire-grate F, which is provided with an uptake G and damper, and at the same end is also situate the down flue H leading into the main flue to

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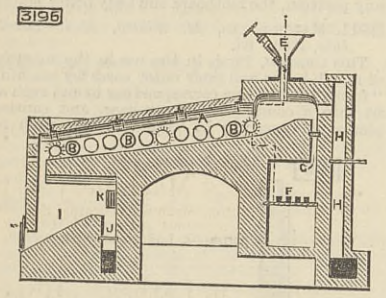


the acid chamber, and fitted with a damper. At the other end of the furnace is the receptacle I for the burnt ore, with an outlet provided with a sliding door; from this receptacle also extends a down flue J having a damper, the said flue leading to a chimney. Two air inlets K are arranged one on each side of the receptacle I, and are provided with slides or valves for adjusting the quantity of air to be admitted.

4091. Colouring Matters for Dyeing and Printing, &c., *J. A. Dixon.—Dated 8th October*, 1880.—(*A communication from Dr. K. Koenig.*)—(*Complete.*) 4*d.*

New red, brown, and violet colouring matters are produced by the action of the diazo compounds of the aromatic acids and of their ethers on the mono and disulpho-acids of betanaphthol, or their sodium or other equivalent salts.

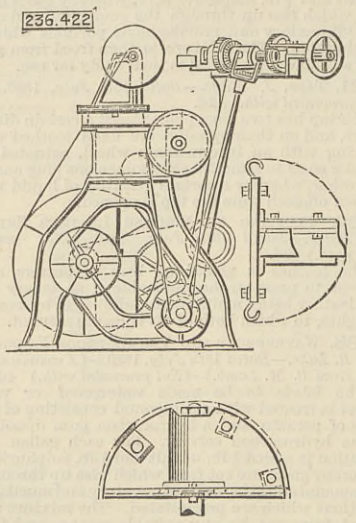
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

236,422. Lathe for Turning Irregular Forms, *Rudolph Eickemeyer, Yonkers, N.Y.—Filed June 25th*, 1880.

Brief.—Improvement on the Blanchard lathe. The chuck spindle is oblique to the cutter shaft. By varying the relative position of the follower and pattern block the work may be made to depart from the exact contour of the pattern in certain particulars and within certain limits, thus adapting the machine to produce varying sizes from same pattern. *Claim.*—(1) In a pattern lathe, the combination, with a suitable cutter head, a pattern block, and its operative mechanism, of a revolving chuck spindle, which is set obliquely to the axis of the cutter head, substantially as described. (2) The combination, substantially as hereinbefore described, of the cutter head, the follower, and the slide on which they are mounted, the pattern spindle, the chuck spindle, and the swinging frame on which they are mounted, and suitable operating mechanism. (3) The combination, with the cutter head, chuck spindle, pattern spindle, sliding bed, and swinging frame, of a follower and adjusting mechanism for locating said follower at any desired point laterally on said bed, substantially as described. (4) In a pattern lathe, the combination, substantially as hereinbefore described, of the follower, the obliquely arranged pattern block spindle, the sliding bed, and the adjusting screw for varying the height and diameter of blocks to be turned, notwithstanding the presence and operation of the pattern block, as set forth. (5) The combination, in a pattern lathe, substantially as hereinbefore described, of a chuck spindle and a pattern spindle mounted on a swinging frame, and adjusting mechanism, substantially such as described, for advancing and retiring the pattern spindle relatively to the chuck spindle, whereby the height of a block to be turned may be varied notwithstanding the presence and operation of a pattern block

236.422



as set forth. (6) In a pattern lathe, the combination of the semi-spheriodical follower having a rounded front edge and a dome-shaped rear, the cutter head and its cutters, with their cutting edges occupying a cutting line corresponding with the sectional outline of the follower, and suitable co-operating mechanism, substantially as described.

236,661. Bed-plate for Engines, *John H. Allen, Brooklyn, N.Y.—Filed October 9th*, 1880.

Claim.—An engine bed-plate of rectangular section throughout its whole length, having a straight top surface above the crosshead guide, extending at the same horizontal plane around the crank or crank

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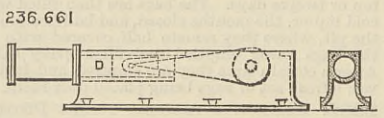

wheel, in combination with an internal crosshead guide D, consisting of a regular cylinder, all constructed and arranged substantially in the manner and for the purpose described.

236,680. Harvester, *Rudolph M. Hunter, Philadelphia, Pa.—Filed November 20th*, 1879.

Claim.—(1) In a harvesting machine, a platform A, upon which the grain falls as it is cut, provided with an aperture in combination with a plate E, inclined upward from front to back, and a grain box H or its equivalent, substantially as and for the purpose specified. (2) In a harvesting machine, a platform upon which the grain falls as it is cut, in combination with a trough secured to its discharging end, the loose shelled grain being collected and swept from the surface of the platform into the trough by the straw, &c., as it is discharged from said platform, substantially as and for the purpose specified. (3) In a harvesting machine, a platform A, upon which the grain falls as it is cut, provided with an aperture in combination with slotted plate C, carrying a plate E and grain box H, substantially as and for the purpose specified. (4) In a harvesting machine, the combination of platform A, having an aperture in plate E,

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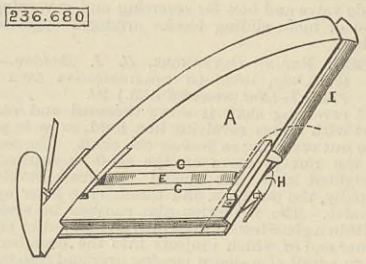

grain box H, and trough I, substantially as and for the purpose specified. (5) In a harvesting machine, a platform upon which the grain falls as it is cut, in combination with an inclined plate so arranged thereon and over an opening in same that the heads of grain shall fall upon said plate, substantially as and for the purpose specified. (6) In a harvesting machine platform upon which the grain falls as it is cut, the combination of a plate C with a plate E, substantially as and for the purpose specified. (7) In a harvesting machine, a platform upon which the grain falls as it is cut and from which it is swept by rakes or their equivalents, provided with a single rectangular aperture in the solid platform parallel to the cutter bar, and at such a distance from the same that the heads of the grain shall fall over the aperture when cut and the straw shall lie upon the solid platform before being swept off, substantially as and for the purpose described.

236,699. Machine for Making Asbestos Packing, *Heinrich Bollinger, Mailand, Italy.—Filed August 13th*, 1880.

Brief.—The drum D, which is slotted to allow the admission and removal of an endless band of asbestos, is geared into two equal gear wheels to provide for its complete revolution. The drum D is adapted to carry a spool of wire or asbestos thread excentrically situated at one end. As drum D revolves the winding material is wound off from the spool upon the band, which is

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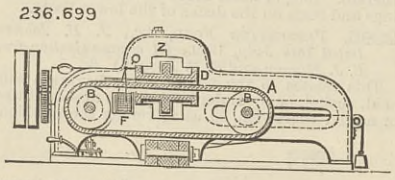

given a progressive motion by the revolution of drums B B. *Claim.*—(1) The hollow drum D, carrying an excentric pin for holding the spool F, and made with a longitudinal slot, in combination with drums B B, for operation on an endless band A, around which the drum D revolves, and with mechanism for revolving the same, substantially as herein shown and described. (2) The drum D, carrying toothed wheel Z, spool F, thread guide Q, and provided with longitudinal slots for receiving endless band A, in combination with two equal gear-wheels engaging said wheel Z and serving to turn it continuously, substantially as herein shown and described.

236,723. Sleeve-nut and the Method of Making Sleeve-nuts, *George H. Sellers, Wilmington, Del., assignor to William Sellers and John Sellers, jun., Philadelphia, Pa.—Filed September 9th*, 1878.

Claim.—(1) The process, substantially as hereinbefore described, of making a wrought iron sleeve-nut by forging a tube in polygonal dies and upon a mandril of the desired shape, and then forging the ends in cylindrical dies upon a smaller mandril. (2) A wrought iron sleeve-nut made by forging a tube in

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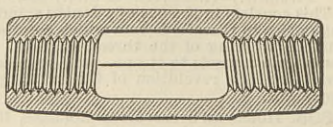

polygonal dies and upon a mandril of the desired shape, and then forging the ends in cylindrical dies upon a smaller mandril, substantially as and for the purposes described.

236,800. Apparatus for Telephone Lines, *Ezra T. Gilliland, Cincinnati, Ohio, assignor to American Bell Telephone Company, Boston, Mass.—Filed December 12th*, 1878.

Brief.—When the telephone is on its hook the line is closed through the bell and the telephone is cut out; but the telephone may be connected with the line on either side by removing it from the hook and moving the hook lever to one side or the other, as desired. *Claim.*—(1) The double gravity switch K, combined with the main electric line, the telephone line, and the signal apparatus, substantially as described, for the purpose specified. (2) The combination in a telephone line with the branches on opposite sides of an intermediate station, of a double switch, substantially as described, operated by the weight of a telephone to disconnect either of said branches, as set forth. (3) The combination of the double switch K with the springs E E of the signal apparatus, substantially as described, for the purpose specified. (4) The combination of the double switch K with the

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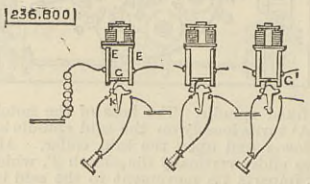

springs E E and connecting bar G of the signal apparatus, substantially as described, for the purpose specified. (5) The double switch K, combined with the signal apparatus, the main electric line, and the telephone line, and adapted to be automatically disconnected from either circuit by weight of a telephone, substantially as described, for the purpose described. (6) An automatic switch comprising, in combination with line-contact pieces and a conductor for establishing a ground connection, as required, a shifting telephone support, as explained, for connecting as desired the line on either side of said contact pieces with the ground conductor, and being movable under the weight of the telephone to restore the line circuit, substantially as set forth. (7) The combination of the switch having the arms, the springs E E connecting with a local circuit, the plates G^1, both normally connected with the main circuit, and the spring or a bar connected with a telephone circuit, substantially as described, for the purpose specified.

236,815. Extension Straw Stacker, *William Holmes, Ashland, Ohio.—Filed April 7th*, 1880.

Claim.—(1) An extension straw stacker constructed substantially as herein shown and described, consisting of the stationary lower part A B, the detachable side boards C, the movable upper part E F, the standards G,

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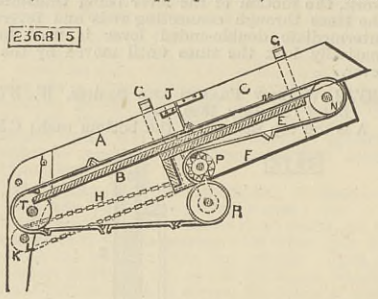

the hangers J, the chains H, chain wheels K, and shaft L, and the endless belt carrier M, and its pulleys N P R T, as set forth. (2) In an extension straw stacker, the combination, with the stationary lower part A B and the movable upper part E F, of the endless belt carrier M, the pulleys N P R T, and the shafts, substantially as herein shown and described, whereby the tension of the endless belt carrier will be unaffected by the extension and contraction of the stacker, as set forth.

236,828. Plough, *Egesippe D. Melançon and Jno. H. Ayrand, sen., Paincourtville, La.—Filed July 14th*, 1880.

Claim.—The standard D, having the projecting cap-plate E and end-threaded arm I, in combination with

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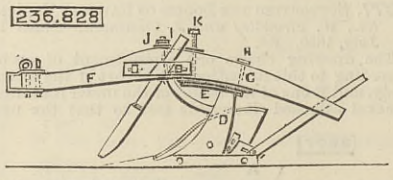

the beam F, bolt G, screw K, and nuts H J, as and for the purpose specified.

236,833. Electric Lamp, *Joseph V. Nichols, Brooklyn, assignor to the United States Electric Lighting Company, New York, N.Y.—Filed October 18th*, 1880.

Brief.—Copper wires are used to support the carbon strips. These wires are sealed in a metallo-vitreous cement. *Claim.*—(1) The combination, in an electric

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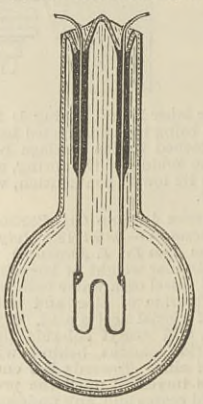

lamp, of a glass globe inclosing an incandescent conductor in a vacuum with conducting wires connected with said conductor, and metallo-vitreous cement interposed between the glass of the globe and the conducting wires and united to both by fusion, substantially as described. (2) In an electric lamp, a glass globe inclosing the incandescent or light-giving part in a vacuum, in combination with conducting wires of copper or other metal of high conductivity and metallo-vitreous cement interposed between the glass of the globe and the conducting wires and united to both by fusion, substantially as described.

Telegraphic Communication with South America.—The Western and Brazilian Telegraph Company, Limited, notify the repair of their Rio Grande do Sul Montevideo section, and the re-establishment of direct cable communication between Europe, the Argentine Republic, and the West Coast of South America.

South Kensington Museum.—Visitors during the week ending Feb. 12th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 8934; mercantile marine, building materials, and other collections, 2797. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1247; mercantile marine, building materials, and other collections, 151. Total, 13,129. Average of corresponding week in former years, 13,147. Total from the opening of the Museum, 19,693,730.

Fire Engines at the Melbourne Exhibition.—A very original use has been made at the Melbourne Exhibition of the steam fire engine shown by Messrs. Shand and Mason. It seems that there is not sufficient pressure in the mains to work fountains and for other purposes and the fire engine is used daily to make up for the deficiency by pumping into the mains in the building. On the first occasion when the fire was lighted at a quarter-past six o'clock in the evening, the pressure in the mains supplied from the Yan Yean was 30 lb. to the square inch. A connection was formed from the engine, which stood near the lake in the western portion of the grounds, and when work was commenced the pressure was increased to 90 lb. per square inch. A hose was then affixed to a pipe which rises to the terrace of the dome, and the branch was carried to the summit of an iron ladder which leads into the dome, or a height of about 200ft. Within ten minutes the water in all the pipes was increased to nearly 100 lb. per square inch, and at the end of that time, after the augmented pressure had been distributed over a mile and a-half of pipes, a stream was elevated to a further height of 50ft. or 60ft., or equal to the altitude of the lantern. The experiment not only demonstrated the power of the engine, but also gave assurance of the strength of the pipes and of the speedy manner in which a sufficient pressure of water could be obtained in case of fire.

CONTENTS.

The Engineer, February 18th, 1881.

Epps's Cocoa.—Grateful and Comforting.—"By a thorough knowledge of the natural laws which govern the operations of digestion and nutrition, and by a careful application of the fine properties of well-selected Cocoa, Mr. Epps has provided our breakfast tables with a delicately flavoured beverage which may save us many heavy doctors' bills. It is by the judicious use of such articles of diet that a constitution may be gradually built up until strong enough to resist every tendency to disease. Hundreds of subtle maladies are floating around us ready to attack wherever there is a weak point. We may escape many a fatal shaft by keeping ourselves well fortified with pure blood and a properly nourished frame."—*Civil Service Gazette.*—Sold only in packets labelled—"James Epps and Co., Homœopathic Chemists, London."—Also makers of Epps's Chocolate Essence for afternoon use.