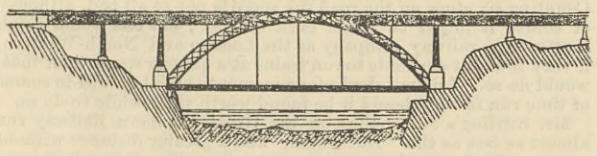
PROPOSED NEW BRIDGE OVER THE DOURO.

No. I.

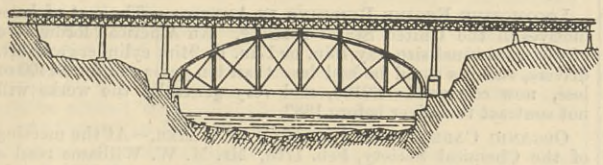
As most of our readers are aware, a full account of the great bridge over the Douro at Oporto, designed and constructed by Messrs. Eiffel and Co., of Paris, together with a complete investigation of the nature and value of the strains on and weights of the parts of that bridge, were given in vols. xlvi. and xlvii. of THE ENGINEER for 1878 and 1879. Our account of the structure and the strains thereon was chiefly derived from that by M. T. Seyrig, M.I.C.E., and engineer of the works, by whom it was described to the Société des Ingenieurs Civils, Paris. The bridge was, and is still, the most remarkable metallic structure in the world, and is the widest single span yet attempted. This span of 525ft. is, however, as has been briefly stated in our columns already, to be excelled by a gigantic structure of a similar order and over the same river, to join the city of Oporto and Villanova de Gaïa. Like the former bridge, it must be in one span —and this one must be no less than 560ft. in the clear—but the new bridge is to carry two roadways, one at about 39ft. above water level to connect the river banks, and the other at a height of 197ft. to connect the higher parts of Oporto and Villanova. The lower roadway is to be 19ft. 6in. in width and the upper 26ft. in width. The design as well as the contract were thrown open to competition as announced in our advertising columns at the time, and subsequently ten designs were sent in to the Bridge Commissioners at Oporto, with tenders for their realisation. The designs were numbered as received, and the first was one by the Société de Construction des Batignolles. The Société, however, sent in two designs, and as shown by the annexed sketch, the principal feature of one of these



Societe de Construction des Batignolles.

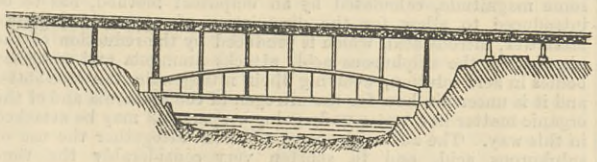
designs is an enormous arch springing from the level of the banks, the girders of the lower road forming the tension member of the whole considered as a bowstring girder, the upper road being supported by and merging into the top of the arch. The arch is 22·95ft. deep at the springings, and 26·25ft. at the centre of the upper part. The bracing between the flanges of the arch is of the single intersection type, one half being vertical. Lattice piers supported on masonry abutments carry the upper roadway, while the lower is suspended from the arch at six points by vertical slings. The estimated weight of this bridge is 3200 tons, and the cost £95,902; while that of the other design was £79,902.

The second design is that of the Société International de Construction de Braine-le-Comte—MM. Rolin and Co. —which consists of an upper straight lattice girder, supported on shore piers, and over water by an enormous bowstring girder 131ft. deep, divided by vertical and diagonal bracing into six main panels and two small spring panels. The weight of this structure would be 3342 tons, and the price £75,000.



Societe International de Braine-le-Comte.

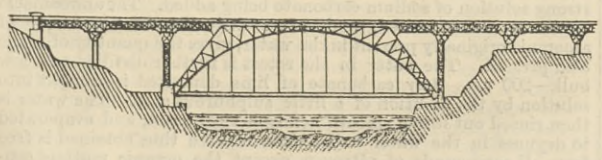
The third project is that of MM. Schneider and Co., Creusot, who propose a steel bridge, as is shown herewith.



Schneider and Co., Creusot.

It is of the same order in design, though of better appearance. The lower girders are 65·62ft. deep in the centre, and 39·33ft. at the ends. Five intermediate piers divide the upper girders into six parts between the shore piers, the lower girders being divided into twelve bays with single intersection bracing. The estimated weight of this bridge is 3417 tons, and the cost £67,000, from which it would appear that MM. Schneider proposed to use some very cheap steel, and had had some ideas of a very cheap mode of erection, though floating out seems to be necessary.

The fourth design was submitted by Messrs. Handyside and Co., of Derby. It was designed by Mr. M. Am Ende, M.I.C.E., Westminster, and, as shown by the paper recently read by him at the Institution of Civil Engineers, partakes in principle of his designs carried out by Messrs. A. Handyside and Co. on the Costa Rica Railway, in which,



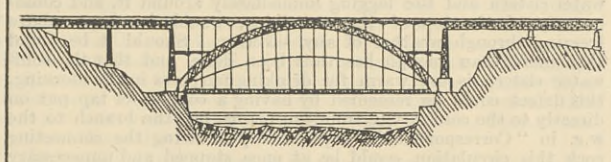
Messrs. Handyside and Co., Derby.

however, the intrados, or lower members of the arch, is polygonal instead of parabolic. The design is made with a view to erection, in the process of which the arch would be built in two parts and joined at the centre. The arch girders are spread towards their springing to gain lateral stability. The roadway is suspended by eleven bars, and the bracing consists of vertical and angular members. The estimated cost is £81,200.

The fifth design was by M. Lecocq and Co., Hals, Belgium, and the sixth by La Société de Fives-Lille. The former is a curious combination of all sorts of things in the way of bridges, and would have forever looked as though the scaffolding had never been removed; while the latter, consisted essentially of a huge parallel girder with vertical and cross bracing in four immense bays, 157ft deep and 131ft. wide. The design of Messrs. Lecocq represented a structure which would weigh 3150 tons and cost £74,000, while that of the Fives-Lille Company would weigh 2300 tons, and cost but £48,766; but this design is cheap and very ugly.

The next design was that of Mr. John Dixon, C.E., of London. This we illustrate on a large scale on page 182, and shall refer to at length hereafter, as it is a design which was made with the most careful attention to the question of erection, and is novel in several respects. We will only now say that the estimated weight of the bridge is 3400 tons, and the cost £94,540.

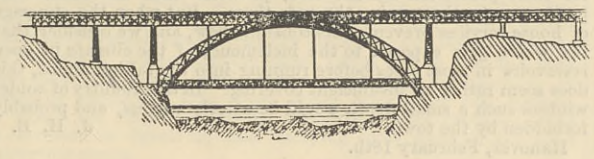
Designs 8, 9, and 10 are of the same order, and very much alike, the first of these being by MM. G. Eiffel and Co., Paris, the constructors of the existing bridge. Their design is worthy of their reputation, and is one of the most elegant of the ten. The arch is parallel, 18ft. in depth, as is seen in the annexed diagram, and springs from



MM. Eiffel and Co., Paris.

the foot of abutments carrying iron piers supporting the land girders and the shore end of the roadway girders over the arch, which are thence supported on columns about 50ft. apart, and connected at their upper part by light arches. The lower roadway girders are suspended. The vertical columns are all braced transversely, and at about half height is a system of horizontal bracing. The estimated weight is 2825 tons, and the cost £70,400.

The ninth design is by M. T. Seyrig, already mentioned, by whom it was made for the Société de Willebroeck, of Brussels. In this design M. Seyrig has departed from that of the existing Douro bridge, in that he has made



Societe de Willebroeck.

the arch deeper at the springing than at the centre. His object, as stated at the Institution of Civil Engineers in December last, when he read a paper on the modes of erection of large bridges, "was to overcome a difficulty that had been experienced in erecting that bridge from the arch resting on its abutment on a point; and one of the greatest difficulties, small as it may now seem, had been to support the first, second, and third panels securely during erection. There was but a small space available for the staging employed for the purpose, and the plan now proposed for the new bridge to be built alongside the first one, was to make the arch proper not with a pointed toe, but with its abutment ends deeper than its crown. It was thus evident that three, four, or more panels—the heaviest in the arch —could be got into place more securely, and probably at less cost than even with the very little staging and the ropes which in the former bridge were made to support them." The form of the new arch may also perhaps be considered more elegant, and to some extent it may also be regarded as an improvement. M. Seyrig described to the meeting the three designs, namely, the existing bridge and those shown by Figs. 3 and 4, as showing that the difficulties of erection in special cases ought to be as carefully considered as the question of the resistance and ultimate working strength of the bridge itself.

The depth of the arch at the springings is 39·33ft. and at the centre 26·25ft., and the girders spread at the springing for stability. The lower girder is suspended as in other designs, and the upper girders are supported in the same way as in the existing bridge which we have so fully illustrated. The estimated weight is 2900 tons, and the cost £82,000. The Société also sent in a second design, the weight of which would be 3305 tons and the cost £99,200. The first of these designs has been provisionally accepted. The tenth design, sent in by MM. Cail and Co., is an exact copy of the existing bridge, with a lower roadway, suspended from springing to springing as in those above. The estimated weight is 2309 tons and the cost £61,074.

The tenders from the ten firms who submitted designs thus ranged from about £21 to £24 per ton.

In another impression we shall return to Mr. Dixon's design, illustrated on page 182.

MACHINE GUN COMPETITION.

THE trials of the competitive machine guns, as far as they had to be carried out at Shoeburyness, have now been completed. We have already traced them through the parts of the programme relating to (1) Rapidity; (2) Accuracy with deliberation; and (3) Accuracy with rapidity, with the exception of the last part of the firing against targets fixed at 700, 500, and 300 yards range successively, to represent the position of a body of infantry advancing towards the piece. We gave the result of the Gardner (2 barrels) under this trial, but none of the others; and we are not aware that they have been published in any paper. The following are the results, including the Gardner (2 barrels) for the sake of comparison, in which a very slight correction will also be found:—

(1) Gardner (2 barrels) at 700 yards: Time of firing, 6 sec.; 4 hits. At 500 yards: Time of laying, 24 sec.; firing 6 sec., 6 hits. At 300 yards: Laying, 24 sec.; firing, 5 sec.; 8 hits. Total, 65 seconds time, 18 hits.

(2) Gatling (10-barrels) at 700 yards: Time of firing, 3·5 sec.; 16 hits. At 500 yards: Laying, 4·5 sec.; firing, 2 sec.; no hits. At 300 yards: Laying, 16·5 sec.; firing, 3·5 sec.; 8 hits. Total, 30 sec., 24 hits.

(3) Gardner (5-barrels) at 700 yards: Firing, 5 sec.; no hits. At 500 yards: Laying, 30 sec.; firing, 4 sec.; 18 hits. At 300 yards: Laying, 26 sec.; firing, 4 sec.; 29 hits. Total, 69 sec.; 47 hits.

(4) Nordenfelt (5-barrels) at 700 yards: Time of firing, 3 sec.; 7 hits. At 500 yards: Laying, 14 sec.; firing, 4 sec.; 15 hits. At 300 yards: Laying, 19 sec.; firing, 4 sec.; 31 hits. Total, 44 sec.; 53 hits.

(5) Gatling (10-barrel) at 700 yards: Firing, 4·5 sec.; 8 hits. At 500 yards: Laying, 8·5 sec.; firing, 5 sec.; 13 hits, 1 ricochet. At 300 yards: Laying, 12 sec.; firing, 3 sec.; 40 hits. Total, 33 sec., 61 hits.

(6) Pratt and Whitney (4-barrel) at 700 yards: Firing, 4 sec.; 36 hits. At 500 yards: Laying, 19 sec.; firing, 4 sec.; 39 hits. At 300 yards: Laying, 16 sec.; firing, 4 sec.; 35 hits. Total, 47 sec.; 110 hits.

The Nordenfelt (10-barrels) being fired after dusk, was directed to be fired again on the 4th February. At 700 yards: Time of firing, 2·5 sec.; 17 hits. At 500 yards: Laying, 18·5 sec.; firing, 2·5 sec.; 19 hits. At 300 yards: Laying, 16·5 sec.; firing, 2 sec.; 29 hits. Total, 42 sec., 65 hits.

The following results as to penetration were obtained against targets 20ft. square, consisting of twenty 1in. deals in thickness, with 1in. space between each, except the two front ones, which were touching each other. Range, 300 yards. The bullets of the 3-barrel Gardner penetrated 18 layers, the 10-barrel Gatling (long), 16 layers; the Gardner (5-barrels), 18 layers; Nordenfelt (5-barrels), 17 layers; the Gatling short (10-barrels), 16 layers; the Pratt and Whitney, 16 layers. Against a sandwich target consisting of two thin steel plates with elm layers between them, the bullets of all the guns were stopped by the steel.

The exposure test consisted in exposing the arms in the open to the action of very bad weather for a week. Half a minute was allowed for cleaning by ordinary means:—(1) The Gardner (2 barrels) after 30 sec. cleaning fired 209 rounds in half a minute. (2) The Gatling long (10 barrels) was fired after 25 sec., but jammed at the 29th round by cutting the rim of the cartridge with the extractor. (3) The Gardner (3 barrels) after 28 sec. cleaning fired 405 rounds in 30 sec. (4) The Nordenfelt (5 barrels) after only 12 sec. cleaning, fired 320 rounds in the half minute without a hitch. (5) The Gatling short (10-barrels) after 30 seconds cleaning, fired 313 rounds in half a minute. (6) Pratt and Witney (4 barrels) after 26 sec. cleaning, fired 357 shots, jamming, however at the 28th sec. (7) The Nordenfelt (10-barrels) after 20 sec. cleaning, fired, but jammed at 18 sec. from the top hopper not being put properly on. The Nordenfelt and both Gatlings were oiled, the others were not. Two men cleaned each gun, except the Gatlings, upon which three were employed. The following further tests were applied to try the effect of blocking the action. The 10-barrels Nordenfelt had a cartridge jammed in one of its chambers, and 20 cartridges were carried behind it by the carrier without explosion. On service the gun would have worked on with the loss only of the use of the plugged-up barrel. Bad and irregular feeding of the cartridges was also tried without detriment.

The two Gardner guns bore every attempt to injure their working by jamming or improper feeding with impunity. After exposure the arms were fired for rapidity. The following results were obtained:—Nordenfelt (5 barrels), 1000 rounds with two jams in 2 min. 52 secs.; the Gardner (5 barrels), in 1 min. 24 secs.; the Pratt and Whitney, in 2 min. 20 secs.

The arms were also subjected to the test of firing for half a minute under a shower of sand drained through a sieve. This stopped the whole.

Each arm was also dragged through a wet ditch and back again, after which the inventors with assistants were allowed to clean their pieces for action, using a bucket brush, screw-driver, cleaning rod, oil and waste. (1) The Gardner (2 barrels), after 3 min. 5 secs. opened fire, firing 3 feeds or 60 rounds. (3) The Gardner (5 barrels), after 4 min. fired 3 feeds of 50 rounds each (150 in all). (5) The Gatling short (10 barrels), after 14 min. 42 secs., fired 3 feeds or 90 rounds. (6) The Pratt and Whitney, after 9 min. 34 secs., fired its 120 rounds; and (8) the Nordenfelt (10 barrels), after 6 min. 20 secs., fired its 3 feeds or 300 rounds.

The guns were further tested for firing at the high elevation of 33 deg., this power being desirable to enable them to be directed on men posted in main tops of vessels, or in certain position in sieges, &c. All performed successfully except the Gatling, in which the cartridges, having no carrier to bring them into the proper position into the chambers, got across and became jammed. The respective weights of the guns are given as follows:—(1) Gardner (2 barrels), 3 qr. 17 lb.; (2) Gatling long (10 barrels), and also (5) Gatling short (10 barrels), 2 cwt. 1 qr. 2 lb.; (3) Gardner (5 barrels), 2 cwt. 2 qr. 22 lb.; (4) Nordenfelt (5 barrels), 1 cwt. 1 qr. 3 lb.; (6) Pratt and Whitney (4 barrels), 2 cwt. 1 qr. 9 lb.; (7) The Gatling (6 barrels), 1 cwt. 2 qr. 26 lb. These weights should be borne in mind, because weight probably tells against the speed, but assists the steadiness and accuracy of fire, and probably enables the piece to bear rough usage better.

The Gardner (2 barrels) was then fired for continuous working 3000 rounds without oiling; no jambs occurred. This piece may be further subjected to certain tests in the

Royal Arsenal. This may be due to the fact that it has been less tried in the service than the others. Nevertheless we are inclined to think it promises well for its final adoption in some form.

LETTERS TO THE EDITOR.

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

CHEAP PATENTS.

Sir,—Patent agents in good practice, who see more than anyone else the varied phases of the question, are, I believe, unanimous in the opinion that "cheap patents" will seriously benefit all classes, except the few very conservative manufacturers, with large and costly plant, who are afraid of new inventions superseding it. Let me give a few illustrations from my own practice, to show some of our reasons.

A mechanic, the father of a young family, invented a very useful machine. Too poor to patent it himself, he gave one half interest in the invention to a wealthy farmer, for means to provisionally protect it. He got a licencee, and began working the invention vigorously; but when the time for completing the patent arrived, unable to find his share of the money, he had to give another quarter share to the farmer for funds to complete the patent. He had to do this or lose the invention altogether. The farmer was of little further assistance pecuniarily, and a constant drag on the concern; on one occasion preventing the sale of the patent for nearly £20,000. Had the fees been moderate, the inventor might have dispensed with the farmer altogether. I have seen many parallel instances of large interests in meritorious inventions being parted with at start to very unsuitable persons, and with very disastrous results, merely to gain sufficient funds for patenting. Is this beneficial.

Some years ago an asthmatic, broken-down glass-worker came to patent the secret, which he had discovered, of making articles in glass so tough that they would bend in and out like horn without breaking. He went away disappointed, unable to pay the fees. Once or twice since he has returned to inquire if a cheap patent law were passed, or any new means existed of patenting his invention without first communicating it to capitalists, he having been robbed of two valuable inventions in past years from communicating them in confidence. At his last visit he seemed very old and feeble, and did not seem likely to last long. This man may have, and, I rather believe, really has, a very valuable secret; but if so, it possibly has died, or will die, with him, solely because the fees for patenting were too high. I know of many like instances, and almost daily have some inventor turn away disconsolate, too poor to pay, even for provisional protection.

Very few really first-class inventions pay before the fourth year, and it is generally about the end of the third year, when the £50 stamp comes due, that the really meritorious inventor is worst off for cash. Plimpton, the skate patentee, who made, it is believed, a quarter of a million sterling out of the last three years of his patent, paid with some difficulty both his £50 and £100 stamps before he had got back in profits even the original cost of patenting. Had he not paid the taxes, but allowed the patent to lapse, as nineteen out of twenty inventors would have done in despair, under the circumstances, is it likely, I ask, that there would have been a single skating rink in England to this day? What is true in the matter of roller-skates is true still more of larger and more difficult inventions. Indeed, I am inclined to believe that if the patents, suffocated in their birth by the cost of completion, and killed afterwards by the stamp duties, had been allowed free course, they might have greatly exceeded in value those that have continued for the fourteen years. It is a remarkable fact, known to patent agents, that nearly every valuable improvement that is brought out at the present time can be found shadowed forth in abandoned specifications of prior date, for the most part prematurely killed by the high fees.

Wm. P. Thompson,
February 15th. Patent Agent, Liverpool and London.

EXPLOSION OF HEATED WATER.

Sir,—With regard to your article on the explosion of heated water, in your number for January 21st, I cannot think that it is necessary to imagine that the sudden conversion of water into steam takes place with an impetus as it were, causing the pressure to exceed that before the explosion of a boiler, at least in most cases. It might be the case in the explosion of a perfectly free mass of water, and if so we must suppose the surplus of steam generated over and above that due to the initial temperature to draw its latent heat of generation from the rest of the water that did not explode, thereby reducing the temperature of this below 212 deg., to a greater or less amount according as your theory holds good. That it does to a certain extent we may gather from the analogy of liquefied carbonic acid gas which, when suddenly freed, becomes even partially frozen, owing to this part giving up its heat to that which becomes gaseous. The test of your theory would then seem to be the temperature of the water left unexploded. It would be rather hard to determine this experimentally, but it might possibly be done.

In your experiment of introducing superheated steam into a flask of saturated steam containing also free particles of water, there seems to be nothing to prove that the steam is formed with such an impetus as you imagine. It is true the process of generation of steam in this case was not arrested, but probably because there was not enough pressure to arrest it. The suspended particles of water would be converted into steam at a pressure a little lower than the superheated steam which was introduced, and the experiment simply shows that the flask would not stand nearly this pressure. Again, it is true that water can be heated above its boiling point by being kept very still in a smooth vessel, or in oil; but if an iron filing be thrown in, ebullition, and—if the water is hot enough to convert the whole into steam—explosion will immediately take place. Such quiet overheating is therefore not likely to take place in a metal boiler full of portions of rough surface and edges of plates, where the steam has plenty of opportunity of being generated. But suppose only a small aperture opened suddenly in a boiler. The particles of steam in its immediate neighbourhood escape first, taking the pressure off those behind, which then also begin to expand and move, and so on. Any suspended particles of water would do the same thing turned into steam gradually as the pressure was taken off. Since those near the opening must flash into steam first, if there was any such enormous increase of pressure as your theory supposes it would only keep those behind all the longer in a state of water, and the more gradual still would be the exit of steam.

Neither do I think that Mr. Chandler's sudden opening of a mud-hole cover could endanger the boiler directly, though, of course, since it is water which makes its exit from the boiler and then proceeds to become suddenly turned to steam outside, the foundation and brickwork supporting the boiler are apt to share in some degree the fate of your narrow-necked flask when the superheated steam is turned in; or, at any rate, they may get so damaged and shifted as to cause abnormal strains in the boiler itself, which may lead to its premature and violent end.

A simple calculation shows that a pressure of 5 atmospheres acting behind a bit of iron plate about 16 millimetres thick for $\frac{1}{100}$th of a second would produce a velocity of 130ft. per second. This would, I think, account for the destructive character of a boiler explosion without further trouble. J. H. B.

Hanover, February 18th.

KITCHEN BOILERS.

Sir,—Your "Correspondent"—February 4th—has given a plan for the arrangement of kitchen boilers and hot-water apparatus for houses which has lately come under my notice in London, and which, though apparently very sufficient in most cases, can be in some very dangerous. An exceedingly slight alteration will, I believe, make the plan perfectly safe, and, as he invites such suggestions, I venture to put this one forward. His figure is sufficient for my explanation. The dangerous case is this: In a house in Kensington which I have this winter had under my notice, and which I believe is in its arrangements a type of many others, the cistern was outside the roof, and all pipes leading to and from it were also for a certain length outside, and very insufficiently lagged for protection against such cold as we have this winter experienced. The standpipe for the blowing-off of steam and from the hot-water cistern also rose above the roof to a height of about 5ft. or 6ft. and entirely without lagging. All the pipes leading to and from the cold-water cistern became frozen tight. Now there still remained this standpipe as a safety valve, having a ½in. diameter. By a lucky chance this did not freeze, though if the water was not actually boiling and steam blowing off there would by no means be enough circulation of the water in this single pipe to prevent its exposed part, filled with water up to the level of that in the cold cistern, a length perhaps of 4ft., from becoming frozen up too. There would then be absolutely no exit for steam, and lighting up the kitchen fire in the morning would be an invitation to the boiler to burst.

The plan I would propose for obviating this catastrophe is, first, to carry the said standpipe up side by side with the others and underneath the same general lagging; and, secondly, to establish a connection by means of a cross pipe between this and the cold-water cistern, which could be turned off or on at pleasure by means of a cock. On any evening of threatening severity this cock could be opened, when a slight circulation would be established between the hot and cold-water cisterns upstairs. In order to set this circulation going it would only be necessary to shut this connecting cock, let off a little hot water into the bath so as to cool down thoroughly the descent pipe, and then open the connecting cock again. By this means the temperature of the cold-water cistern and the lagging immediately around it, and consequently of the top of the standpipe, would be kept above freezing through weather of any severity. Should it be found that more than enough has thus been done, and that the cold-water cistern is too warm for drinking purposes in the morning, this defect could be remedied by having a cold-water tap put on directly to the cold service from the mains, like the branch to the w.c. in "Correspondent's" figure. By shutting the connecting cock this circulation would be at once stopped and unnecessary expenditure of heat avoided. I might mention, though it is pretty obvious, that the proposed circulation between the hot and cold-water cisterns would be promoted by having this connection as near to the level of the water in the cold cistern as possible, though of course it must not be so high as to be above the surface in the case of water being drawn from the cold cistern, unless so much is then drawn off that the ball cock is letting water plenteously through from the mains, which should also be so much above freezing point as to obviate any danger of freezing while this is going on. The height of the connection depends then chiefly on the length of the arm carrying the ball of the ball cock.

Apropos of this last consideration, I may mention that there was during that severe frost at the end of January an alarm that the town mains were beginning to freeze, and on inquiry I was told, though on no very reliable authority, that the mains were only 2ft. below the road surface. Now, apart from the danger to them at this depth from heavy traffic on a road that is not very well constructed, this might in England's milder climate be sufficient for their protection against cold, provided that the water were pretty constantly running through them. But when the stoppage of house services prevents this constant flow, and we consider that the water gets exposed to the inclemency of the climate in open reservoirs in most cases before running into the falling mains, this does seem rather an insufficient covering. In this country of colder winters such a small depth would be utterly useless, and probably forbidden by the town. J. H. B.

Hanover, February 18th.

POISONING BY GAS BATH-HEATERS.

Sir,—A paragraph has recently appeared in the press respecting the death of Mr. C. F. Deacon, of Anerley, Surrey, who was poisoned by the noxious vapours arising from the gas apparatus by which his bath was heated. A Dr. Turner is reported to have stated at the inquest that gas burners were highly dangerous, and he advised that the use of them should be discontinued. To this sweeping condemnation wide publicity has been given. I have already received numerous letters from persons who have been alarmed by it, and I trust therefore you will permit me the right of a public reply. It is perfectly true that some of the methods now in use of heating water for baths by means of gas are not safe. None of the class known as instantaneous water-heaters for baths should be used in any room unless the products of combustion can be perfectly carried away at once by a flue, although small sizes may be safely used in sculleries and lavatories for heating small quantities of water quickly. They are especially dangerous in bath rooms, which are, as a rule, small and close; and the danger increases with the power of the heater. Although I am a patentee and manufacturer of these instantaneous heaters, I have never used them, or recommended their use, for baths. This, however, does not warrant a condemnation of all systems, and the one I have adopted for heating baths is such that no danger or unpleasantness can arise from its use. Even in the smallest and most confined bath room, without ventilation, the fumes given off by the burner used are so exceedingly small in quantity as to be incapable of causing the slightest harm. I cannot therefore permit Dr. Turner's remarks to pass without protest. It is evident that he has formed his opinion without possessing a full knowledge of his subject, and, intending only to condemn the system he knew, has at the same time condemned others which, his remarks prove, he can never have seen. Thomas Fletcher.

4 and 6, Museum-street, Warrington, Feb. 26th.

HIGH SPEED LOCOMOTIVES.

Sir,—Your correspondent "Running Board" seems to have a great opinion of the Great Western Railway in the matter of speed, and thinks the narrow gauge does not equal the broad; but I think he will find that the Great Northern Railway does the fastest running for long distances, and takes loads double and treble what the Great Western does. He says the Flying Dutchman—the 11.45 ex-Paddington—is the fastest train in the world, and averages 53 miles an hour. Now, this is the speed to Swindon—77 miles—only, it falls off very much beyond; and London to Exeter, 194 miles, including stops, averages 46 only; excluding stops, 49 miles. The 3 p.m. from London runs exactly the same speed as this, and there are two up trains corresponding, but there is no other train that does anything extraordinary on the Great Western. The above trains are made up of four or five bogie carriages only, equal to eight and ten narrow-gauge carriages.

Now, take the Great Northern 10 a.m. from King's Cross; it runs to York, 199 miles in 3 hours 55 minutes = 51 miles an hour, and to Edinburgh, 396, in 9 hours = 44, but it stops half an hour at York for dinner, and 17 minutes at three other stations; allowing for these stops it runs at 48 miles per hour. This train is twelve or fourteen carriages usually. The 10 a.m. ex-Leeds arrives at King's Cross at 2 p.m., 4 hours equal to 46½, including stops. Last summer there were two trains each way daily between Leeds and London, which ran in 3¾ hours = 50 miles an hour. These have been taken off for the winter, but, I believe, will be put on again this summer. These trains ran without stopping to Grantham, 105 miles, and *vice versâ* in 2 hours 3 minutes = 51¼ miles per hour. There are three or four trains which run between London and Peterborough in 1½ hours = 51 miles an hour; they are often very heavy, 15 to 18 carriages. I have seen 22 behind one of Mr. Stirling's splendid 8ft. engines, and 24 have been taken, and time kept I believe.

When the gradients of the Great Northern Railway are compared with the Great Western Railway, I think there can be no doubt that the narrow gauge is, at present, outdoing the broad. I may add that up-trains constantly make up time, lost by waiting for connecting trains from other lines, between Grantham and London, as much as 10 or 15 minutes; and it is not uncommon for them to travel short distances at 70 miles an hour; also that the Great Northern is very punctual. I am afraid this cannot be said of the Great Western. When it is considered that the Great Western takes first and second-class only, and at express fares, whereas the Great Northern takes first, second, and third at ordinary fares by all trains, except the 10 a.m. to Scotland, which does not take third, there can be no question by which line the public is best served.

The fastest train from Euston to Liverpool, 202 miles, takes 4 hours 50 minutes, not 5 hours 5 minutes as "Running Board" states. This is 42 miles an hour, only 4 miles slower than the run to Exeter, but the load is very heavy compared with the Great Western. Even the Great Eastern can show an average of 43 miles by three or four trains. F. S. H.

London, February 23rd.

Sir,—Will you permit me to make a few remarks about a letter signed "Running Board," which appeared in last Friday's issue of The Engineer. He says, very truly, that before long we shall want engines which will, with a load of 20 coaches, run at a speed of 50 miles an hour; and that the "Flying Dutchman" on the Great Western Railway is the only train in the world that exceeds that speed. Certainly it is the only train which has such a high time bill speed, but there are other trains in England besides the "Flying Dutchman" that, although they have not such a high average for their speed, do run quite as fast and with as many coaches too. The London and North-Western express trains constantly take 20 coaches and do not think much of travelling 50 miles an hour and more with such a load. The 4.10 p.m. express to Birmingham does the journey to Rugby in 1 hour 47 minutes, being slightly over 46 miles per hour; and counting one stop at Willesden Junction, the speed would be quite 47 miles an hour, if not more.

The fastest train to Liverpool takes 4 hours and 50 minutes, namely, the 4 o'clock express, which is due at Lime-street at 8.50. Counting six stops on the road the speed is not at all bad, although of course it might be made even quicker; but one would think that such a railway company as the London and North-Western, if they found it desirable to run trains at a quicker speed than that, would do so. I do not doubt for a moment that they will in course of time run faster, should it be found worth their while to do so.

Mr. Stirling's 8ft. engines on the Great Northern Railway run almost as fast as the "Dutchman," and a greater distance without a stop. Their speed is a little more than 48 miles an hour, and their average load from 16 to 22 carriages, and they have even gone so far as to take 28. Even though the London and North-Western engine in the Trent brake trials only attained 49 miles an hour with 241 tons, yet as only three miles were allowed to get up speed, it is, I think, hardly fair to judge them in that way; for it is evident that such a short distance was not sufficient, and that they might have attained a far higher speed had they been allowed a greater distance. B.

February 22nd.

Sir,—Now that a discussion on the above is opened in the columns of your valuable paper, I would like to ask whether any experiments have ever been made to prove the advantage or disadvantage of the steam dome for locomotives. The fastest trains in the kingdom—the 11.45 G.W.R. and 10.0 G.N.R. from King's Cross—are run with engines without steam domes. In fact, nearly the whole of the engines of the Great Northern Railway, the fastest narrow gauge line in the kingdom, have none. I have also observed that of late years many of the first engineers of the country are discarding their use. Fredk. H. Cridland.

Observer-chambers, Bournemouth, March 7th.

Locomotive Engine Building in America.—The cost of locomotives in the United States is rising. An American locomotive of the most usual size, say 16in. or 17in. by 24in. cylinders and 5ft. drivers, such as could be had less than ten years ago for £1400 or less, now commands £2100, and very generally the works will not contract to deliver before 1882.

Organic Carbon and Nitrogen in Water.—At the meeting of the Chemical Society, Feb. 17th, Mr. M. W. Williams read a paper "On the Estimation of Organic Carbon and Nitrogen in Water Analysis Simultaneously with the Estimation of Nitric Acid." Of all the processes in use for estimating the organic matter in water, the safest and most thoroughly scientific in principle is perhaps that of Frankland and Armstrong. To this process as at present worked there are, however, some objections. The time required to evaporate the water is over twenty-four hours. The water is kept for a long time in contact with sulphurous acid, a portion of which may at any time be oxidised to sulphuric acid. There is no test by which to make certain that the nitric acid has been completely destroyed. A correction of some magnitude, calculated by an empirical method, has to be introduced to allow for the dissociation of ammonic sulphite. Moreover, nitrous acid, which is produced by the reduction of the nitrates by the sulphurous acid, attacks ammonia and amidated bodies in acid solution, evolving their nitrogen in the free state, and it is uncertain how far the nitrogen of the ammonia and of the organic matter in a water undergoing evaporation may be attacked in this way. The author proposes to avoid altogether the use of sulphurous acid, and to shorten very considerably the time required for a water analysis. The process consists essentially in converting the nitrates into ammonia by the copper-zinc couple, as described by the author at the previous meeting, distilling off the ammonia with the addition of a little sodium carbonate, and evaporating the residue in the retort to dryness for the combustion. The process may be briefly described as follows:—The zinc foil is carefully cleansed from grease, &c., by boiling with dilute caustic alkali, and its surface freed from oxide by washing with acidulated water. It is then immersed in 3 per cent. copper sulphate solution as described in the previous paper. The copper-zinc couple is carefully washed, placed in a wide-mouthed stoppered bottle, and the water poured on, and allowed to digest at the proper temperature until the reduction of the nitric acid is complete. About 1200 to 1300 c.c. of water are used. Nitrous acid is present in the liquid as long as any nitric acid remains; 100 c.c. of the water are withdrawn. If a yellow colouration appears in half an hour after adding metaphenyten-diamine and sulphuric acid, a longer digestion is needed. If no colouration appears, the reduction is complete. The remainder of the water is poured off from the copper-zinc couple into a tall cylinder, and decanted from any particles of copper and zinc. A litre is distilled in a glass retort, until the distillate is free from ammonia, one or two drops of a strong solution of sodium carbonate being added. The ammoniacal distillate is nessterised, and, after deducting the quantity of amomnia originally present in the water, gives the quantity of nitric acid present. The water in the retort is further distilled to a low bulk—200 c.c. Any carbonate of lime deposited is brought into solution by the addition of a little sulphurous acid. The water is then rinsed out into a smooth hemispherical basin, and evaporated to dryness in the water bath. The residue thus obtained is free from all compounds of nitrogen, except the organic matters contained in the water. The combustion of the residue is carried out as prescribed by Frankland and Armstrong. The author has employed the process with many waters having nitrates, from 5 to 0·5 parts NO_3 in 100,000. The results agree with those obtained by the sulphurous acid method. The author claims for the process that it is free from the sources of error which accompany the use of sulphurous acid for destroying the nitrates, and that it is more rapid.

RAILWAY MATTERS.

CONTRACTS have been made for building the Canada and Atlantic Railway. The line, which will be 122 miles in length, must be completed by May 1st, 1883. Direct communication between Ottowa and Boston will then be established.

THE Queensland Government expedition for the survey of the projected Trans-continental railway started on January 14th. A previous survey, it will be remembered, was made by a party under Mr. Favene, despatched by the proprietors of the *Queenslander*, but no detailed account of his explorations were made public, and it is probable that the new expedition has been sent to endeavour to find a better line of route.

AT a recent meeting of the Oldbury Local Board, it was decided that the petition lodged against the Dudley and Oldbury Junction Railway Bill shall be withdrawn, provided that the Great Western Railway Company consent to the insertion of certain clauses which the Highway Committee consider necessary for the protection of the rights of the Board. In consequence, however, of the further action of the solicitors to the Bill, the petition has not as yet been withdrawn.

CONSIDERALE annoyance has been felt at the throwing out of the Swansea and Rhondda Railway Bill, especially in the Swansea district, though amongst the "initiated" not much surprise is felt, as it was admitted by railway experts that the point on which the Bill failed was its vulnerable one. Mr. Williams, the parliamentary agent for the Taff Vale, is said to have directed attention to this point at the very outset. Still it is not thought likely that the movement will be abandoned.

THE Corporation of the City of London and the Commissioners of Sewers for the City have withdrawn their petitions against the London, Chatham, and Dover (City and Suburban Traffic Station) Bill, which proposes to widen the Blackfriars Railway-bridge, so as to admit of three additional lines of rail, and to construct a new terminal station at the end of Queen Victoria-street, adjoining the present Blackfriars-bridge station of the Metropolitan District Railway, for the accommodation of the city and suburban traffic on the Chatham and Dover line. The frontage of the proposed new station will be to Upper Thames-street, but there will be a footbridge over that street from Queen Victoria-street, and also access by a staircase from the new station to the Underground Railway.

IN concluding his report to the Board of Trade on the collision which occurred on the 7th ult., at Crewe station, on the London and North-Western Railway, when a passenger train from Crewe to Whitchurch, came into collision with the tender of the engine of a goods train which had started at the same time from the loop line at the back of the up platform, Major Marindin observes that the "driver of the passenger train had very short warning of his danger, and I do not think he could have stopped his train by the application of the patent chain-brake with which the four leading vehicles were fitted; but it is worthy of remark that neither the driver nor the guard made any use of this brake, and I believe that it will be very commonly found that where a brake is not habitually used, as is the case with this chain-brake, it will be very liable to be forgotten when an emergency arises, instead of being at once instinctively applied."

ON Tuesday, a large and influential deputation, representing the Chamber of Commerce of Liverpool, shipowners' associations, and other bodies using the London and North-Western Railway for the transit of goods, had an interview with Mr. Moon, and other directors of railways having termini in Liverpool, at the offices of the London and North-Western Railway, at Euston-square, in reference to the inequalities in railway charges for the carriage of goods running to and from the port of Liverpool. The Mayor of Liverpool introduced the deputation, and said that all the mercantile houses were represented by it. Mr. Moon replied at some length, stating that the Midland, the Great Northern, the Manchester, Sheffield, and Lincolnshire Railway, the Bridgewater Canal, and the London and North-Western Railway were all represented there, and they had listened patiently to all that had been said. He believed it was their duty as well as their interest to do all they could for Liverpool; the London and North-Western Railway had spent as much money in Liverpool as the Mersey Dock Board had upon their docks. A committee of officers would be appointed; and if they would point out any inequalities which could be altered without injuring other towns, the matters would be gone through in detail and considered.

AT the half-yearly meeting of the Great Western Railway Company, held on the 4th inst., the chairman said that there was in the first-class passenger traffic a decrease of 109,430 passengers, and a decrease in the receipts of £6620. In the second-class 92,409 less passengers, and an increase of £21; in the third-class an increase of 448,236 in the passengers in number, and an increase in money of £19,939. Season tickets increased by £1404, making in the passenger receipts an increase of £14,744; and that the total increase from traffic of all kinds was £59,923. In the middle of February the increase was something like £100,000. But he then went on to say that to earn that money they had run an additional train mileage of 330,859 miles in passenger, and 233,056 miles in goods trains. It being one of the unsatisfactory features of railway accounts at the present time, that all are engaged in very close competition; and in meeting those requirements which, whether they pay or not, are pressed for by the public, and to this the companies must submit. The result is that the receipts per train mile are gradually diminishing every half-year with all railways. The receipts per train mile from "passenger trains was less by 2·21d., and on goods 0·84d. The North-Western is 0·66d. on the passengers and 4·72d. on the goods. The Midland decrease is 5·71d. on passengers and 1d. on goods. The Great Northern shows a decrease of 6·07d. on passengers and 2·34d. on goods, the tendency being as you see, and that tendency is clearly accounted for by the somewhat foolish competition and yielding to demands, which are very often unreasonable, for increased train accommodation." It seems a little unreasonable to cry out that an increase in earnings cannot be obtained without giving the public something for that increase.

RAILWAY overcharges on farm produce continue to form the subject of searching articles in the *Mark Lane Express*. From a table given in the last impression it appears that the Great Eastern Railway Company has been the least a sinner in the milk rates on short distances, while it has for the distance of fifty-one miles charged even less than the maximum allowable tonnage rate. The Great Northern Railway comes next, and is nearly as good as the Great Eastern. The South-Eastern is next. The Great Western comes next, but it is a great leap to its charges in the short distances up to thirty-one miles. Beyond seventy miles its charges are not in excess. The London and North-Western tariffs are again higher—the tariff, for instance, allowed by the Companies Act for six miles is 1·4 while 12 is charged, and even for thirty-one miles the charge is 15, while the maximum tonnage rate is 7. The London, Chatham, and Dover rates are much higher, its rates being the same as the London, Brighton, and South Coast. Our contemporary suggests a compromise scale considerably in excess of the maximum tonnage rates, but much lower than is charged by any but the two first-named companies. It proposes a charge based upon measure, and reckoning 180 gallons to the ton the rate proposed would give an average of 5·5d. per ton per mile, gradually diminishing to about 2·5d. per ton per mile for long distances. This would in some cases give even a higher rate than is charged by the Great Western on distances over 111 miles, or by the Midland. For distances not exceeding twelve miles a rate of ¼d. per mile is proposed; above twelve and not exceeding twenty-five miles, ½d. per gallon; not exceeding forty, ¾d.; not exceeding sixty, 1d.; increasing to 2d. per gallon for distances exceeding 150 miles. The fairness of the proposed rates will be gathered from the fact that the Great Western now carries 201 miles for 2d. per gallon and 176 miles for 1·75d., while the Great Northern carries 151 miles for 1·6d.

NOTES AND MEMORANDA.

THE United States census report thus classifies the population:—Males, 25,520,582; females, 24,632,284. Native born, 43,475,506; foreign born, 6,677,360. Whites, 43,404,877; coloured, 6,577,151. The remaining 170,838 are composed of Indians not in tribal relations and under Government care, Chinese, and other Asiatics. The Chinese are estimated at 105,363. Since the previous census the proportion of coloured people to whites and the excess of males over females have slightly increased; the proportion of foreign-born has slightly decreased.

M. PLANTAMOUR has been continuing his observations on periodic movements of the ground. In the year ending September 30th, 1880, he states that a great lowering took place on the east side, from October 4th to January 28th, viz., 95"·80—as against 28"·08 the previous year. The mean temperature of December was unusually low, but the author thinks some other cause must have operated also. The level placed in the meridian showed nearly the same oscillation as the previous year—4"·56. In winter the south side rises with rise of temperature; in summer it falls.

THE following describes an ingenious separating apparatus for cesspools, designed by J. Lesueur, Paris:—The liquid and solid matters are caused to pass from the pan to a perforated cylinder closed at bottom by a pivotted perforated plate. The liquid matters escape through the holes in the cylinder and bottom to a suitable pipe. The solid matters are retained on the bottom plate until they are sufficiently heavy to overcome a counterweight attached thereto, when the bottom plate turns on its axis and deposits the matters into a pipe leading to the cesspool.

IN making carbolic acid from coal tar, the tar is distilled until anthracene begins to pass over; the portion of distillate which passes over between the temperatures of 150 and 200 deg. Cent., is collected apart, and mixed with saturated potash-ley and powdered potassium hydrate. The carbolic acid combines with the potash, forming a crystalline substance, which is next dissolved in hot water, when the carbolic acid floats to the surface as an impure oil. The lower alkaline liquid is next saturated with hydrochloric acid, when there is a further yield of oil. This is washed with a little water, digested over chloride of calcium, and re-distilled several times. It is afterwards cooled down to —10 deg Cent., when pure carbolic acid crystallises out.

DR. FRANKLAND'S method or practice in analysis of the London water must have become more precise, or else even that immaculate water supply of the Kent Company is deteriorating in respect of inorganic impurities. According to the analyst, if the amount of organic matter in the water through the nine years ending 1876 is taken as unity, that supplied during the month of January contained 1·9, or nearly double the average quantity of nine years. Whence this so-called organic impurities in water from these chalk wells? The Kent Company had better look to its interests, for if the Kent water is to double in organic impurities in a year or two, there is no telling what may be the result of another year or two and another mode of analysis. Excessive hardness of water with organic impurities is a combination people will not like long.

THE great earthquake of Casamicciola, in the Island of Ischia, is no exception to those which have preceded it in affording curious and apparently anomalous phenomena. The higher part of the little town has suffered most. It is one heap of ruins. Between 300 and 400 houses have been destroyed, while about 200 inhabitants are, or were, buried in the ruins; but curiously, from amidst the ruins rises the tower of the church, with the clock standing at five minutes past one, the time of the shock. Prosessor Palmieri thinks that the disaster is due not so much to the violence of the earthquake shock alone, but to the fact that that shock expended itself upon the partly unsupported, or unequally supported, thin crust under which the hot springs, for which the place has become celebrated, have probably acted by corrosion in dissolving and carrying away some of the solid supporting strata.

A THERMO-MAGNETIC thermoscope is described in the *Proc. R. S. E.* by Sir W. Thomson. It is well known that the "permanent" magnetism of steel magnets is not constant, but changes slightly with changes of temperature, the magnet becoming weaker when warmed, and recovering its strength as it is cooled. The magnetic thermoscope is intended to indicate differences of temperature by showing differences between the magnetic moments of steel magnets. Two thin wires of hard steel, each one centimetre long, are arranged so as to form a nearly astatic couple, being magnetised to equal strength and set in opposite directions, but not quite parallel, so that they set at right angles to the magnetic meridian. Two other magnets, about twice the size of the former pair, are placed on one side of this astatic couple as "deflectors," being laid in one line nearly along the magnetic meridian, with their similar poles facing one another at about two centimetres apart. When properly adjusted the little astatic pair suspended between them will be found to be excessively sensitive to the least change in the strength of either of the deflectors, and if they are at different temperatures will turn through an angle, which, if small may be regarded as a measure of the temperature-difference.

OBSERVATIONS on the part of different railway men do not agree as to the relation between season and the breakage of rails. In a recent issue of the *Organ für die Fortschritte des Eisenbahnwesens*, Herr Theune states the results of his observations with respect to the fractures of steel rails in the district—Kattowitz—under his observation. He notes that 329 such fractures took place during the years in which his interesting observations were made. Among the rails which were laid in the open country there were 2·4 fractures per mile, while in forests, where rails are exposed to greater damp, the rate rose to 6·7 per mile. The changes of the various seasons have a striking influence on the number of breakages which take place. Thus, during the first quarter of the year—the coldest season generally—there were 216, in the second quarter 28, in the third quarter 14, and during the fourth quarter 71 fractures. The greatest number of fractures of rails took place from the eighth to the tenth years after their having been laid down; the average working time was found to be 7·5 years. With respect to the parts where fractures took place, Herr Theune remarks that there were 73 fractures in the face of the rail, 51 breakages in the web, and as many as 265 fractures through the fish-plate holes. The very great excess of fractures in the first quarter seems to indicate error in observation or in the accounts consulted.

IT seems that notwitstanding the great opacity of metals, it is quite possible by chemical means to procure metallic leaves sufficiently thin to examine beneath the microscope by transmitted light. An examination of such metallic sections, Mr. J. Vincent Elsden, in a communication to *Nature*, says, will show two principal types of structure, one being essentially granular, and the other fibrous. The granular metals, of which tin may be taken as an example, present the appearance of exceedingly minute grains, each one being perfectly isolated from its neighbours by still smaller interspaces. The fibrous metals, on the other hand, such as silver and gold, have a very marked structure. Silver, especially, has the appearance of a mass of fine, elongated fibres, which are matted and interlaced in a manner which very much resembles hair. In gold this fibrous structure, although present, is far less marked. The influence of extreme pressure upon gold and silver seems to be to develop a definite internal structure. Gold and silver in fact appear to behave in some respects like plastic bodies. When forced to spread out in the direction of least resistance their molecules do not move uniformly, but neighbouring molecules, having different velocities, glide over one another, causing a pronounced arrangement of particles in straight lines. This development of a fibrous structure, by means of pressure, in a homogeneous substance like silver, is an interesting lesson in experimental geology, which may serve to illustrate the probable origin of the fibrous structure of the comparatively homogeneous limestones of the Pyrenees, Scotland, and the Tyrol.

MISCELLANEA.

THE Central Telegraph-office at Amsterdam is lighted by the Von Hefner-Alteneck system of electric lighting. The result is said to be very satisfactory.

THE authorities at Chatham are endeavouring to obtain representation on the Medway Conservancy Board, the Rochester Corporation being the present conservators under the ancient charter.

WE have received a copy of a large, well-executed lithograph likeness of Sir John Lubbock, D.C.L., F.R.S., M.P. The artist is Mr. A. Arnst, and the lithographers Messrs. Benyon and Co., whose works are at Cheltenham.

OWING to the recent heavy rains, a portion of a large tunnel on the Carrickfergus and Larne Railway connected with the short sea passage from Larne to Stranraer fell in on Tuesday, blocking the line, and causing a suspension of traffic.

ON Tuesday a party of about thirty non-commissioned officers of the Royal Engineers trained in various scientific schools, and at the School of Military Engineering, left Chatham for India, for special employment under the Indian Public Works Commissions.

THE experiment made by the Birmingham guardians in manufacturing the gas used in the workhouse has proved a great success. The experiment commenced eleven months ago, and it is found that the gas costs only 1s. 6d. per 1000ft., and the saving effected is over £1000 annually.

WE understand that Mr. Howard A. Allport, of the Bestwood Coal and Iron Co., Nottingham, has bought the Wharncliffe Woodmoor Colliery, near Barnsley, which he intends to work on his own account. The coal is said to be of very good quality for house, gas, and cooking purposes.

A COMPANY is being formed to purchase and work the patents for filtering materials and filtering and water softening and purifying apparatus of Messrs. F. H. Atkins and W. G. Atkins, the name of the company to be the "Atkins Water Softening, Purifying, and Engineering Company, Limited."

A PAMPHLET entitled "A Review of Facts and Records in connection with Kitchen Boiler Explosions and Hot Water Boiler Explosions of 1881," with some useful remarks on their prevention, by Mr. S. B. Goslin, has been published by Messrs. Warner and Sons, Crescent Foundry, Cripplegate, and by Messrs. McCorquodale, London.

THE effect of building docks near to the sea is shown by the report of the Sharpness Dock and Gloucester and Birmingham Navigation Company, which states that owing to decreased receipts, caused, as is alleged, by the policy of the Avonmouth and Portishead Dock Company at the mouth of the Avon, no dividend can be paid this half year.

AN interesting paper on the long-wall system of working in South Wales, by Mr. A. C. Chapman, is contained in the March number of the Journal of the British Society of Mining Students. The results of some experiments with a Rammell fan, 26ft. in diameter, are also given by Mr. W. S. Gresley, and a paper is given by Mr. C. E. Gritton on the Kind Chaudron method of sinking and tubbing shafts.

A MESSAGE may now in ordinary business be received in England from Natal in eight hours actual time; but greater speed than this was made a few days ago when Mr. Pender, M.P., chairman of the Cape Cable Company, telegraphed in the morning to inquire whether there was any foundation for the rumour of the death of Sir Evelyn Wood, and at half-past four received a message declaring the report to be without foundation.

IN a paper read recently before the American Institute of Mining Engineers, the author gave some evidence to show that a little too much haste had been exhibited in condemning the use of the electric light in mines. He exhibited some lamps of Edison's make, which he said were well adapted for illuminating mines, as they can be enclosed in wire gauze, or, if necessary, immersed in water. He thought the dangers described by Mr. Preece were rather imaginary. That lamps such as those of Mr. Edison may be conveniently enclosed in glass vessels of water to ensure safety was shown more than a year ago in the Polytechnic Museum in Berlin; but it is not only in the lamp, but from broken or exposed wires, that Mr. Preece, whether reasonably or not, saw danger.

ACCORDING to official returns recently issued, the receipts of the telegraph service during the year ended March 31st, 1880, were £1,469,795, and the working expenses £1,115,765, of which sum £12,100 was a contribution to a depreciation fund to replace submerged cables, leaving a balance of profit of £354,030, equal to 3·36 per cent. on the capital of £10,529,577. Another return shows the gross amount received and the gross amount expended in respect of the telegraph service from the date of the transfer of the telegraphs to the State to the 31st March, 1880. The total received has been £11,592,160; the total expended, £9,920,597; leaving a total balance to meet interest on stock created on account of the telegraph service and the redemption of debt of £1,671,563.

THE Garth Castle, an iron steamer of 3700 tons gross register, her dimensions being 376ft. in length, 43ft. 6in. in beam, and 32ft. 8in. in depth, is fitted with engines, which on trial developed 3325 indicated horse-power, with a steam pressure of 75 lb., revolutions 66, the average speed being 14·32 knots. Several novelties have been introduced in the construction of the machinery not usually met with in merchant steamers. The boilers have Fox's corrugated steel flues, the funnel has a double casing to promote draught. The starting and reversing gear is of Brown Brothers' manufacture. The propeller shaft is of the so-called fluid compressed steel, and the propeller blades are of manganese bronze, adopted on account of its immunity from corrosion and pitting, while it is said that owing to its strength the blades are made materially thinner than if made of any other metal.

A paper, on "Explosives used in Coal Mining," was read before the Manchester Geological Society, by Mr. W. Smethurst, at a meeting held in Wigan on Friday, the 4th inst. Mr. Smethurst, who has recently been carrying out a series of experiments with safety lamps before the Royal Commissioners on Accidents in Mines, condemned strongly the present system of shot lighting in mines, and urged that a system of firing by electricity should be brought into use. He did not think mines could be worked profitably without the use of explosives, but the present dangers might be considerably reduced, and he recommended blasting with dynamite and water cartridges as preferable to the use of gunpowder. At the same meeting a discussion also took place on the "long wall" system of working coal, and this system was generally recommended as preferable to "pillar and stall," inasmuch as they could to a large extent dispense with shot firing, there was less labour for the collier, and the coal was got in better condition.

ON the 1st inst. Messrs. Raylton, Dixon, and Co. launched from the Cleveland Dockyard, Middlesbrough, one of the finest steamers they have yet turned out. She has been built to the order of Messrs. Thos. Skinner and Co., of London and Glasgow, and will form one of their well-known Castle Line to China, for which Messrs. Dixon are also laying down for them another rather larger vessel. The Bothwell Castle, the name of the new vessel, is a handsome model, with clipper bow, and full figure-head of Mary Queen of Scots. She will carry nearly 4000 tons of tea, and her dimensions are 345ft. extreme length, 38ft. 6in. beam, 27ft. 6in. depth, moulded, and about 2600 tons gross register. Her decks, rails, and fittings are entirely of East Indian teak, and her passengers will be accommodated in a deck-house aft with marble saloon, and comfortable sleeping rooms, specially arranged for good ventilation. She is fitted with Harfield's patent steam windlass, and Bow and McLachlan's steam steering gear. The engines of 280-horse power nominal are being constructed by Messrs. Thos. Richardson and Sons, of Hartlepool, where she will be taken to have them fitted on board.

THE NORDENFELT GUN.

FIG. 1

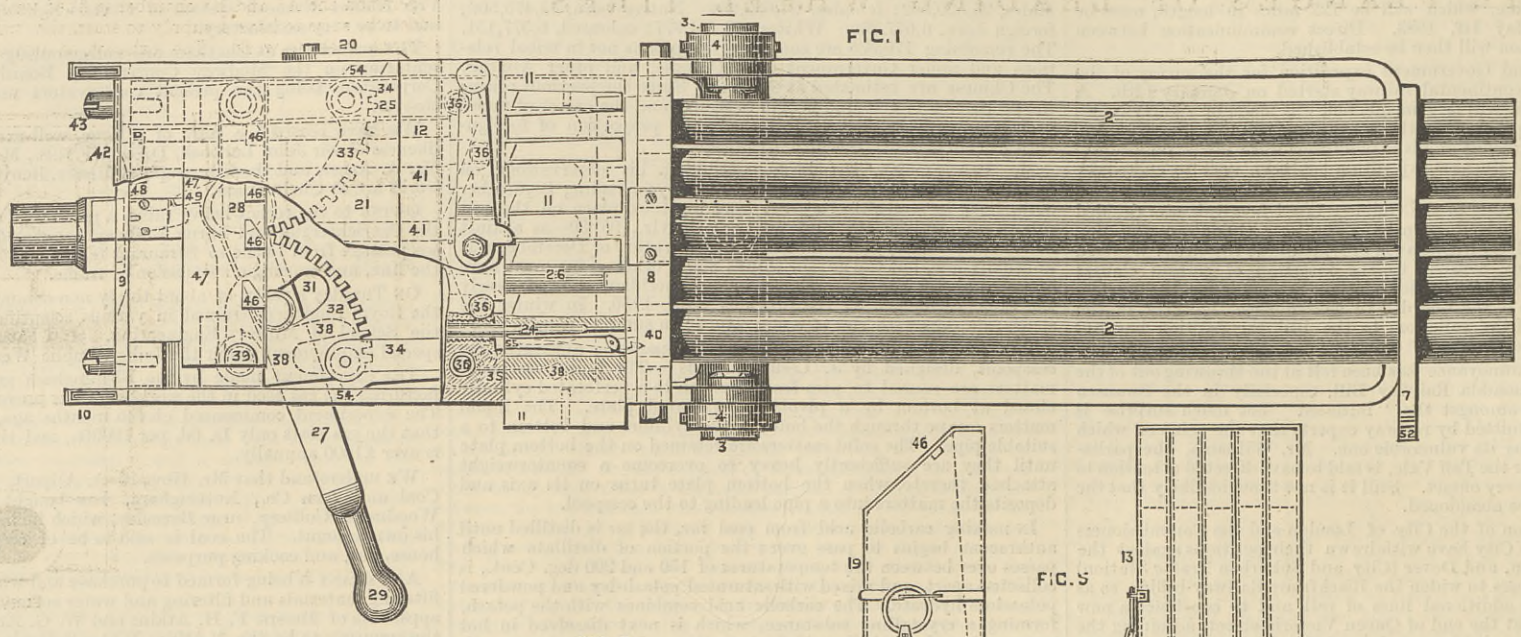


FIG. 5

FIG. 2

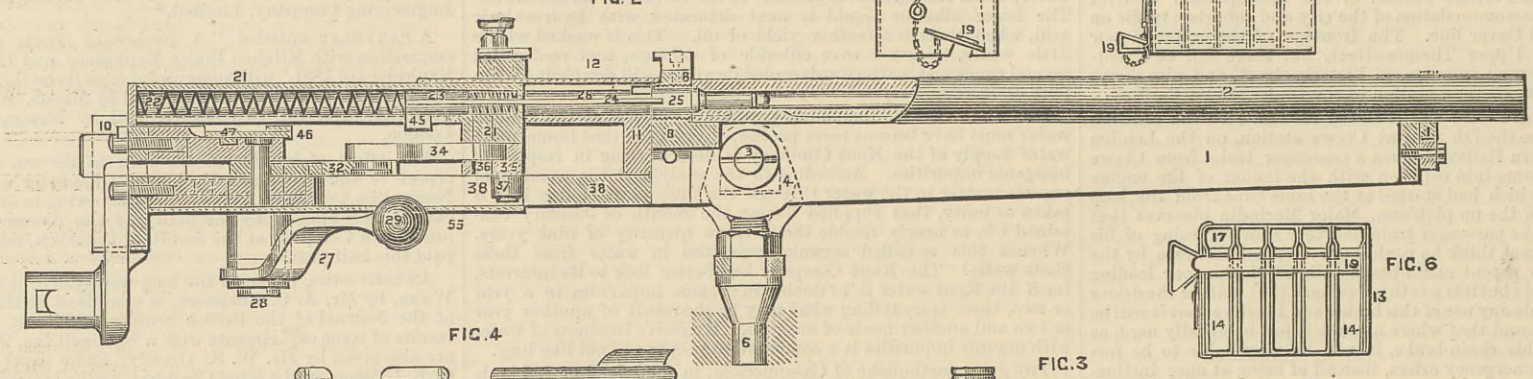


FIG. 6

FIG. 4

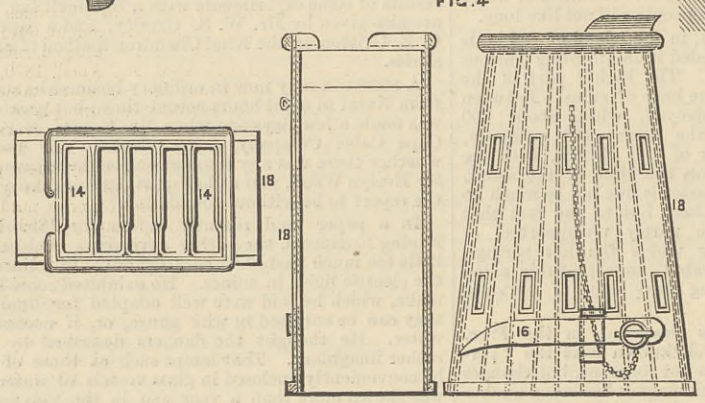
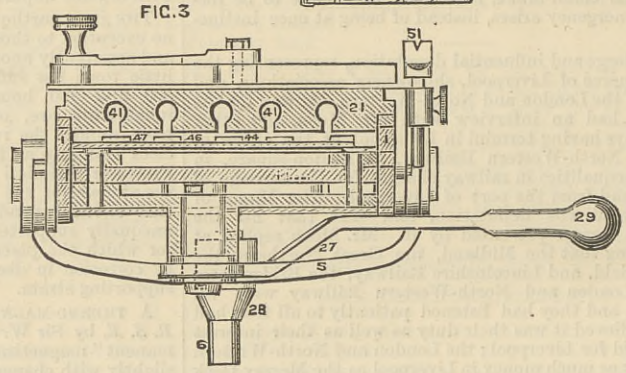


FIG. 3



Illustrations of the Nordenfelt machine gun have appeared in our columns, but none which show its construction in detail. We now make up this deficiency, availing ourselves of a paper read before the United Service Institution for our information.

Fig. 1 shows a plan, partly in section, of a battery gun; Fig. 2 a longitudinal section. The frame 1 holds the barrels 2 fixed in a horizontal plane, one by the side of the other, and it also carries the mechanism behind the chamber ends. The frame hangs upon two trunnions 3, round which it is turned, to give elevation and depression to the gun; the trunnions rest in bearings 4 on a crosshead 5 swivelling on a central vertical pivot 6, which for naval or for field purposes may be dropped into a gun-carriage or gun-bed to allow the lateral aim being given to the gun to the right or left. The frame has three cross-pieces, the foremost of which, 7, holds the muzzles of the barrels, whilst the breech ends of the barrels are screwed into the middle cross-piece 8. The rear cross-piece 9 is fitted on to the rear end of the frame, and held to it by screws or wedges 10. At the breech end of the barrels, and resting upon the frame at both sides, is what is called a carrier block 11, which has a to-and-fro transverse movement given to it. The carrier block has cut in it a number of grooves or openings equal to the number of barrels in the gun; into each opening a cartridge is dropped, and then, by a subsequent movement of the carrier block, is brought into a line with the barrels, in order that the cartridges may be pushed forward into them.

The cover 12 of the mechanism has open holes, through which the cartridges fall from the hopper into the carrier block 11, and there are guiders fixed on the lower side of the cover which hold the cartridges in position while they enter and are moved by the carrier block; the cover is held to the frame by two bars 20, the ends of which move round pins, so that the lid can be raised in order to lay open the mechanism, which is then free and can be lifted out of the frame.

In rear of the carrier block is an action block 21, which carries the spiral springs 22 by which the hammers 23 are propelled forward and cause the strikers 24 to explode the cartridges 25. This block has a to-and-fro movement in a direction lengthwise of the barrels. Projecting from the forward part of the action-block are breech pins 26, one for each barrel. When the block is moved forwards, these push forward the cartridges which are lying in the carrier block, and cause them to enter the breech ends of the barrels. Within each breech pin is the striker, which is driven forward by means of the hammer. These move in a line with the strikers, and are pressed forwards by the spiral springs. The action of the several parts results from a forward and backward movement being given to a lever or firing handle 27, which turns on an axis pin 28 fixed to the rear cross-piece 9. One end 29 of the firing handle 27 which reaches outside the frame is held by the gunner, the other end is fixed to the pin 28, which has a crank or action lever acting with a cam slot 31, which is cut into a segmental piece 32 moving round its centre, and with teeth or cogs cut along its circumference, which teeth act upon similar teeth cut into a similar segmental piece 33 placed in a reversed position at the opposite side of the frame. By the movement of the firing handle these two segments receive a forward and backward motion, which is transferred by means of two driving bars or links 34 to a driving block 35, thence to the spring box 21 by a double set of pins 36, two of which are fixed to the driving block and the other two to the action block.

The Loading.—As the action block is moved forwards and backwards, a friction roller 37 upon it, at the end of each backward and at the beginning of each forward motion, acts upon a bent bar 38, which at one end turns on a fixed centre 39, and at the other enters into a groove on lower side of the carrier block and gives to the carrier block its transverse to-and-fro movement; when the carrier block moves to the side, a layer of cartridges, one for each barrel, falls from the hopper through the cover into openings cut in the carrier block in such a way that when the carrier block returns, these cartridges are moved exactly in a line with the barrels, so that the breech pins which are screwed into the front of the action block which acts as a breech common to all the barrels, can push them into the chambers, where the breech pins support the whole of the cartridges until all of them have been fired; the carrier block remains in the same position until the extractors 40 fixed to the breech pins have again drawn out the empty cartridge cases, after which when the firing handle is near its rearmost position the carrier block again moves to the side to receive a fresh layer of cartidges. The loading can also be done by hand if required by simply dropping a layer of cartridges into the cover and carrier block after each volley has been fired.

Firing.—The breech pins are screwed into the part of the action block in the exact lines of the centre lines of the barrels, and each breech pin holds within it concentrically the striker or firing needle which is to fire the percussion cap, and which protrudes slightly in front of the breech pin. The rear ends of the strikers are acted upon by the striking hammers supported by and acted upon by the spiral springs. The hammers with their spiral springs run within round holes or channels 41 bored out lengthwise in the action block. The rear ends of the spiral springs are supported by a bar 42 at the rear end of the action block, which bar can be lifted by loosening one of the screws 43 holding it, when all the spiral springs, the hammers, and the strikers can be taken out. Each channel has on its lower side a slit 44 lengthwise, through which protrudes the head 45 of the hammer, the one side of which is bevelled to fit and to act upon studs 46 on a sliding bar which is called the trigger comb 47—the trigger comb in the larger guns is moved by a separate cocking piece. When the action block is drawn back by the firing handle, the heads of the hammers force the trigger comb to one side, just enough to allow the heads of the hammers to slip behind the studs. As soon as the heads have thus passed through, the trigger comb is forced back into its original position by a spring 48 acting by a tumbler upon the trigger comb, which prevents the hammers from passing forward until the trigger comb is again moved. When the action block is moved forwards the hammers are thus held back, and the spiral springs are compressed until after the cartridges are within their chambers and the breeches are closed; a short lever 49 on the inner end of the axis pin begins to act upon a vertical knee 50 attached to the trigger comb, and moves it to the side. The studs of the trigger comb then pass in front of the hammer heads, and as the studs are of varying width—each stud being slightly wider than the stud on its right—one hammer 23 is released at a time; the spiral spring 22 presses it forwards until it gives a blow to its striker 24, and the shots are thus fired one after the other, which causes less recoil than if they were fired all at the same moment. When the firing handle is again moved backwards, the trigger comb is pushed back by the before-mentioned spring into position for again catching the hammers for the next volley. Back sights 51 and fore sights 52 are provided on one or both sides of the barrels, so that the eyes can always be kept in the alignment of the aim, whether the gun is served by one or two gunners.

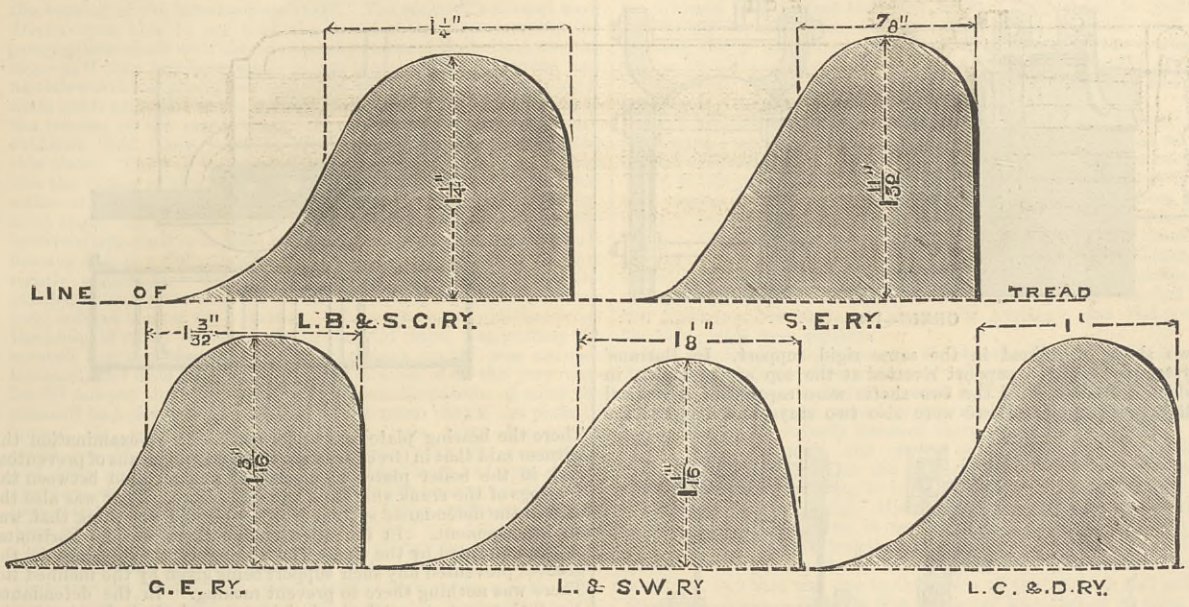
Half-cock.—On the rear cross-piece is fixed a catch with a handle to it, which can be moved into such a position that it acts upon a leg or stud fixed to the trigger comb in such a way that it counteracts the force of the above-mentioned angle and spring, and thus keeps the trigger comb steady in its position furthest to one side, when the studs of the trigger comb do not touch the heads of the hammers, which thus pass freely in and out through the trigger comb. Thus the springs are not compressed, and no cartridges can be fired, although they can at this half-cock position be passed through the mechanism and the chambers, and again extracted without their percussion caps being struck. By again releasing the hold of the half-cock catch upon the trigger comb, the mechanism again is and remains at full cock. Instead of half-cock a drill stop is often used which simply prevents the handle from being moved so far back that the hammer heads can be held back.

Extraction.—Each breech pin has one or two extractors, each consisting of the extractor proper 40 and the spring 53. The extractor is fixed into the breech pin by a pin, round which it moves guided by a slot, the hook protruding sufficiently to catch the rim of the cartridge case when the cartridge is within the chamber and the breech closed. The spring acts with its one end freely on the back of the hook, pressing it inwards, and the other end of the spring fits into a slot near the base of the breech pin, so that the extractor spring is screwed in at the same time as the breech pin and is held in position by the action block. After all the barrels have been fired, the breech pins draw the extractors backwards, and all the empty cartridge cases are extracted through the openings of the carrier block until the rims of the cartridge cases pass outside it, when the empty cases fall through. The extractors cannot release the cartridge cases which they have begun to withdraw until the proper time, the grooves in the carrier box in which the extractors lie being so formed as not to allow premature movement of the extractor.

Résumé of Action.—When a charged hopper is placed in position, nothing more is required than to move the firing handle forwards and backwards as far as it will go in each direction. If moved rapidly, the gun will give a rapid succession of volleys; if moved more slowly, a rapid succession of single shots will be discharged.

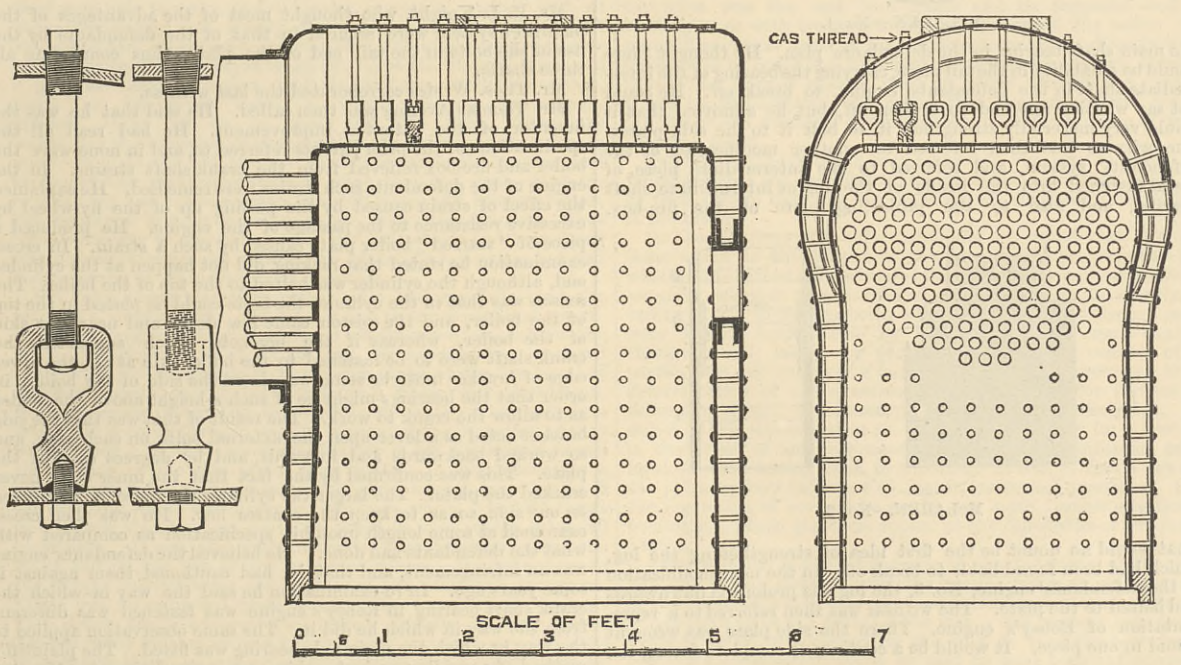
Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—H. Burstow, engineer, to the Royal Adelaide, additional for service in the Vivid; J. C. Largs, engineer, to the Defence, vice Jackson; P. Colquhoun, chief engineer, to the Swift; and J. W. Hole, assist.-engineer, to the Swift.

THE FLANGES OF LEADING WHEEL TIRES.



THE shape and dimensions of the flanges of the tires of the leading wheels of locomotives may be supposed to exert an important influence on the safety—as regards keeping on the rails—of trains, especially those which run at high speeds. It seems, however, that there is no unanimity of opinion among engineers as to what is really the best form of tire. We give above cross sections of the leading wheel tires used on five of our important railways—the London, Brighton, and South Coast, the South-Eastern, the Great Eastern, the London and North-Western, and the London, Chatham, and Dover Railways. It will be seen at a glance that no two of these flanges are alike. The South-Eastern flanges are far deeper than the rest; the contrast between them and those of the London and North-Western line being especially marked. All our sections are to full size. If our readers can throw any light on the relative wear and tear and safety of the various sections shown, they will do good service. The question is one concerning which little or no information exists—each locomotive superintendent adopting the form which seems best to himself, and seldom, if ever, comparing notes with others on the subject of the results obtained. It is by no means improbable that the form of a flange exerts some influence on the wear of rails, but on this point the world is quite in the dark. It is also probable that the form of the rail-head will affect the duration of the tire, and it is argued with some force that for every form of rail-head there is a section of flange better than any other. It will be seen that stout flanges, such as that of the London and Brighton line, seem to be specially designed for losing a great deal of metal before they become too thin; but the South-Eastern flange has a great deal of metal at the root, the place where the wear is most severe. These two tires may be taken as standing at opposite ends of the scale. Which of the two gives the better results? The question will be complicated by the character of the line—as it is straight or crooked, and by the quality of the tire—but it ought to admit of settlement. The durability of a tire is of secondary importance compared with its safety.

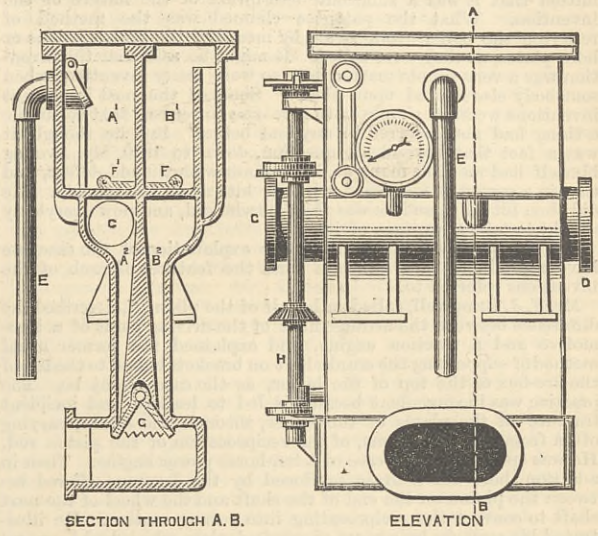
PERKINS' HANGING FIRE-BOX ROOF STAY BOLTS.



THE roof stays illustrated by the annexed woodcuts have been designed and patented by Mr. Stanhope Perkins, of the Manchester, Sheffield, and Lincolnshire Railway, for all locomotive, portable, and other boilers where the fire-boxes are suspended from the crown or outer fire-boxes. A description of the method of fixing the stays will best show their application. After the boiler and fire-box has been rivetted together complete, the copper box is put in, being fixed in its proper position, and is afterwards put under the radial drilling machine, and all the holes drilled from the outer shell for the copper stays, and also all the holes drilled in a direct line from the crown plate to the top plate of the copper box; and whilst in that position, the holes in the outer shell are tapped with a conical tap, tap of sufficient length for the plain end to pass through the hole which has been drilled in the copper box; which, of course, keeps the tap in proper line. When all the holes are completed the copper box is withdrawn out of the outer shell and the top plate of the copper box is tapped with the Whitworth's ordinary taps; the whole of the screws are then screwed in from the inside of the box perfectly tight; the socket is then screwed on. This socket is turned hollow, so as to give a sharp edge, and must be screwed down by a bar until the whole of the sharp edge has cut into the copper a perfect circle. It is then turned backwards by the bar and the hollow filled with putty cement, and afterwards screwed perfectly tight to the proper position as shown in the engraving. This will prevent leaky roof stays, as it is impossible for the water to come into contact with the metal, preventing any oxidation taking place. The long roof stays are then passed down and screwed into the outer shell, within ¼in. of home, with an hexagon or square nut screwed on the end of the stay and held inside of the stirrup, and in all cases must be screwed up tight in the stirrup; and the roof stay must then be screwed perfectly tight into the outer shell. This will tend to draw the top plate of the box nearer to the outer shell, and will thus assist the ordinary expansion of the copper box. It is claimed that this system will prevent broken tubes and oval tube holes, as this mode of staying will not allow the crushing down of tube or plates, besides giving a much greater water area. It enables the top of the box to be well cleaned and easily got at by the washers; and is a much neater arrangement altogether than the old system of beam roofing stays. The system is in use on the Manchester, Sheffield, and Lincolnshire Railway, and with complete success.

A NEW CONDENSER.

A CORRESPONDENT writing to the *American Machinist* describes the simple form of condenser which we reproduce herewith. He says of it that it draws its own injection water from a well, removes its air without an air pump, and possesses many novel features on a new principle, *unpatented*. He asks: "Why not pass the great body of steam—exhaust—into the air, or use it for other purposes, such as heating, &c., and then form the vacuum in the cylinder by the condensation of the remainder?" By such a plan very little water would be needed. The quantity used could be easily lifted by the vacuum formed, and the body of steam as it flowed into the atmosphere would remove its own air. Dispensing, as it would, with air pumps, &c., it would place it in the reach, as an economical adjunct, of small as well as large engines. Working upon these reflections I produced the drawings sent herewith. Although impracticable in detail as shown, the principles involved could be carried out, thus making a working condenser. The condenser consists of a cast iron body, which contains two chambers, A and B, connected with the exhaust pipes, C and D, with each end of the cylinder of the steam engine. The upper part of the chamber A^1 and B^1 contains the water for condensation, which is supplied through the pipe E. The water flows through the valves F into the lower chamber A^2 and B^2 in finely-divided streams, condensing the steam. Communication with the atmosphere is cut off by the valves G. In slow-moving engines it could be made to work automatically; but with high-speed engines it would be necessary to operate the valves by suitable mechanism, and connected with the engine, to insure the valves closing at the proper time. In operation the A^1 and B^1 chamber is filled with water nearly to the top, so as to have a supply to start the condenser when the engine is set to work. The exhaust, as it rushes through the



pipe from the cylinder, passes into the chamber A^2, opening the valve G, carrying out the water in A^2, and also the air in the cylinder. After the main body of the exhaust steam has passed one end of the cylinder, a similar action is taking place at the other end. Each end of the cylinder has its own condenser.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—COMMON PLEAS DIVISION.

(*Before* MR. JUSTICE STEPHEN *and a Special Jury.*)

Feb. 21st to 24th.

AVELING *v.* MCLAREN.

THIS was an action brought by Mr. Thomas Aveling, the well-known engineer, against Messrs. J. and H. McLaren, of the Midland Engine Works, Leeds, for the alleged infringement by them of the plaintiff's patent, dated 8th April, 1870, No. 1037, for the adaptation to the boiler and fire-box of portable or locomotive or traction engines of projecting side horn plates for the purpose of carrying the bearings of the shafts of several of the working parts, so as to relieve the boiler and fire-box from undue strain and torsion. The defendants by their pleadings disputed the validity of the patent, especially on the ground of want of novelty. They alleged as instances of prior publication, the earlier patents of Joseph Barrans, 13th January, 1859, No. 120; Hornsby, Bonnall, and Astbury, 10th July, 1863, No. 1726; D. K. Clark, 28th June, 1866, No. 1728; D. Greig, 16th March, 1868, No. 890; W. and W. T. G. Bray, 12th January, 1859, No. 91; and as instances of prior user they referred to user by J. Fowler and Co., Clayton and Shuttleworth, Hornsby and Co., and Robey and Co. The action was commenced in 1879, the statement of claim was delivered in January, 1880, the statement of defence in the following March, and the action came on for trial on the 21st February last.

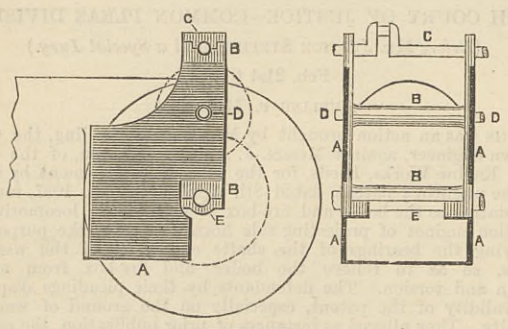
The Solicitor-General, Sir Farrer Herschel, Q.C., Mr. Aston, Q.C., and Mr. Carpmael were counsel for the plaintiff; Mr. Webster, Q.C., and Mr. Macrory for the defendants.

The SOLICITOR-GENERAL, in addressing the jury, said that happily there was no question as to what the defendants had actually done, and therefore the two main questions which they would have to decide would be whether the plaintiff's patent was for a new invention, and whether, in the next place, that which the defendants had done amounted to an infringement of that patent. He explained by reference to a model the difference in position of the working parts of a locomotive and of a portable or traction engine, and pointed out that in the latter the bearings of the crank shaft were exposed to a more or less considerable strain by the thrust of the piston and connecting rod. The old method of construction was to fasten the brackets which supported the crank shaft by pins or screws on each side of the boiler. Upon these brackets there would often be a strain of 5 tons for every reciprocation of the piston, often as many as 150 a minute, and of course this strain was transmitted to the crown of the boiler. This strain was a source of great trouble. It caused cracks and breakages and constant repairs. Mr. Aveling searched for a remedy. He continued the sides of the fire-box up above the crown of the boiler, and on the top of them he fitted his crank shaft. By this means the strain was removed from the crown of the boiler, and the defects of the previous system cured. Simple as the invention was, others had not discovered it, and Mr. Aveling himself had prior to 1870 made 800 engines, while fully appreciating the defects of their construction, but not seeing his way to cure them. Since then some of the most important engine builders had appreciated the value of the invention and had taken licences from the plaintiff to use it. Now, the defendants had said, granting the invention, that they had not infringed it, and further that the plaintiff had no valid patent. What they had done was not of course to use identically the plaintiff's system. No infringer ever did that. They fastened to the side of the boiler plates to carry the crank shaft. Therefore, they said they used only what the plaintiff admitted had been used before. If that were all, no doubt that would not be an infringement. But they did this further, they carried the plates which were fastened to the boiler in a backward direction, and then bolted them to the sides of the fire-box, which was also prolonged endways to meet them; so in effect the plates and fire-box were one, and the result was that the strain on the shaft was taken off the bolts on the boiler and distributed over the sides of the fire-box in the same way as in the invention of the plaintiff. By joining the plates to the prolonged fire-box it was thought, no doubt, that the infringement was not so palpable as if they had simply supported the shaft on the prolonged sides of the fire-box. Now, by merely making use of the bolts by which the prolonged ends were secured to the boiler they could not avoid liability. A man would not the less infringe because he made a colourable alteration in the arrangement. Then the defendants, to meet their case, had alleged that the plaintiff's invention was not new. Upon this point the learned counsel failed to see anything in the specifications of the various inventions mentioned in the particulars which bore upon the matter. He would only deal with Mr. Greig's. That gentleman was a partner in Messrs. J. Fowler and Co.'s works, who were alleged to have used the invention before the date of the plaintiff's patent. Mr. Greig's prolonged backwards the sides of the fire-box, and fitted the wheel-axle and the axle of the wheel communicating motion in those prolongations. The strain of the crank shaft, which was carried in the usual way, was in no sense borne by those prolongations. Accordingly, Mr. Greig's plan did not appear to be any anticipation. No doubt Messrs. Fowler had adopted Mr. Aveling's plan, but under a licence from him. Next it was said that the plaintiff's invention was not sufficiently

described in his specification. Two methods were described. In each the essence was that the fire-box sides were prolonged, but in one case the sides of the fire-box itself formed the bearings; in the other brackets were fastened on the sides. Of course, they were exactly similar, in that the strain was distributed over the sides of the fire-box. The Solicitor-General then read the specification, and submitted that it was a sufficient description of the nature of the invention. What the patentee claimed was the method of relieving the boiler from strain by means of the prolongations or horn plates, as they were called. It might be said that the invention was a very simple matter, but so were many inventions when somebody else lighted upon them. Some of the most important inventions were so simple as to give rise to remark that so simple a thing had not occurred to any one before. But he thought it was a fact that beyond all question, down to 1870, Mr. Aveling himself had made as many as 800 engines with the old defect, and that in a period of ten years, without hitting on the remedy. He did then hit on it, and he was the first who did, and now everybody sought to take advantage of it.

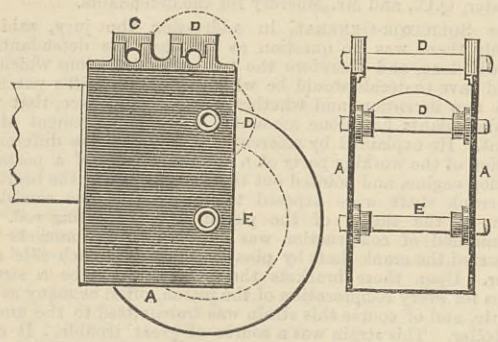
For the purpose of facilitating the explanation of the case, we have reproduced in a diagram form the features of each of the inventions referred to.

Mr. F. J. Bramwell, called on behalf of the plaintiff, described the difference between the arrangement of the driving parts of a locomotive and a traction engine, and explained the former usual method of supporting the crank shaft on brackets bolted to the top of the fire-box or the top of the boiler, as the case might be. The practice was inconvenient because it led to leakage and incipient fracture of the plates of the boiler, through the strain, varying often from 5 to 6 or 7 tons, of the reciprocation of the piston rod. He was speaking of the case of a ten-horse power engine. Then in addition there was a strain produced by the leverage offered between the pinion on the end of the shaft and the wheel of the next shaft to convert the reciprocating into rotary motion. He illustrated his remarks by a piece of cracked plate which had been cut out of a boiler to which the brackets had been bolted in the old way. He had read the plaintiff's specification, and he thought it described the invention in a manner that a competent workman could understand. He had also read the specifications referred to by the defendants' particulars. Prior to 1870 he did not know of any engine constructed in the way described in Aveling's specification. The plaintiff's specification showed two modifications. According to the first the side plates of the fire-box were prolonged backwards and upwards, and on the inside of each was bolted a casting carrying the bearings of the crank shaft, the intermediate shaft and the travelling wheel axle.



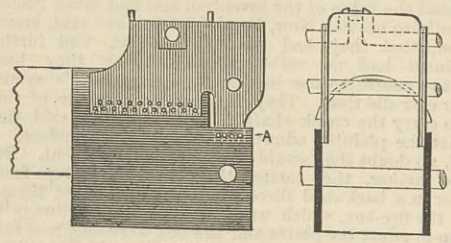
AVELING No. 1.

The effect of this arrangement would be to throw the strain upon the sides of the fire-box as a whole instead of localising the strain upon the top of the fire-box. In this plan a wrought iron plate A or horn plate was rivetted to the fire-box and carried a strong vertical frame of iron B in which were the bearings. C was the crank shaft and D the intermediate shaft, and E the wheel axle. The witness was then examined upon the specification and the drawings of this modification, and he stated that in his opinion the plate A was part of the fire-box itself and not a separate plate



AVELING.—No. 2.

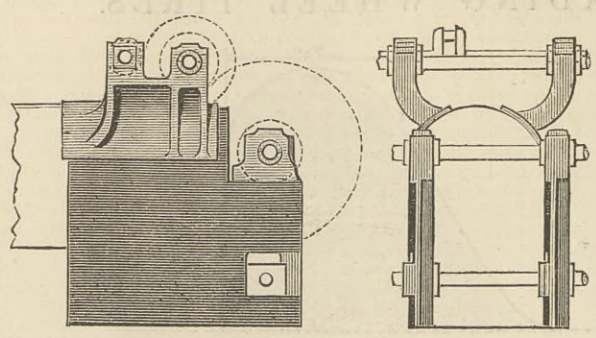
rivetted on, but it was immaterial which it was. In the second modification the plates were carried up not merely on the hinder part, as in the first method, but throughout their length, and in that way they became very convenient. As shown, there were two intermediate shafts, in lieu of one in the former plan. He was then shown a drawing of what it was admitted the defendants had done.



McLAREN.—No. 3.

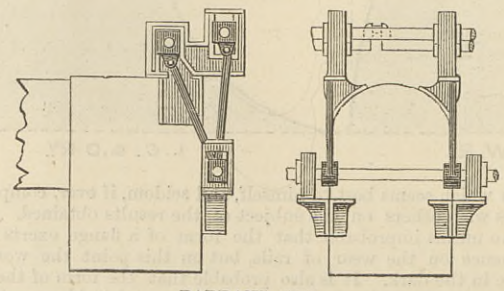
In that drawing the crank shaft and intermediate shaft were shown carried in plates, supported partly by being bolted to the boiler, but they were carried backwards and further supported by being bolted to the backward prolongation of the side plates of the fire-box. The effect of this arrangement was to relieve the bolts, which in that case did go through the boiler, from a considerable part of the strain, and distributed it over the side plates of the fire-box. He saw no other object for prolonging the upper plate downwards, and attaching it to the lower plates, than to relieve the boiler of undue strain. There need have been no means of connection between the extended under plate and the extended upper plate, if the object had been simply to carry the intermediate shaft.

Cross-examined: In the plaintiff's first plan the bearings were bolted to a plate, which was not, in his view, part of the boiler or fire-box, but to a projection. In the defendant's plan the support of the crank shaft, apart from the tail end of it, was rivetted to the boiler top in the old way. He could not conceive any object of the extension of the tail end but for the attachment he had described. He had not been told how the defendants developed their engines. He had only been shown the drawing of the alleged infringement. It was not an uncommon thing to make the bearings of the crank shaft and intermediate shaft in one piece before 1870. In Greig's system there was such a bearing rivetted to the boiler crown. It was well known to be desirable to have the



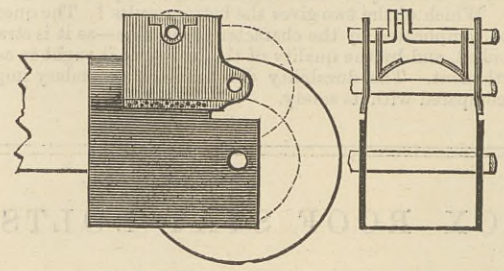
GREIG—1868.

two shafts contained in the same rigid support. In Barrans' system there was a support rivetted at the top of the boiler, in which the bearings of the two shafts were capable of a vertical sliding movement. There were also two stays, one diagonal the



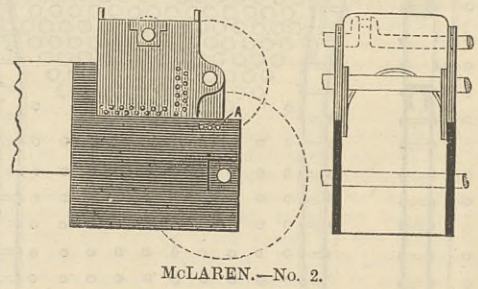
BARRANS—1859.

other vertical, connecting the main shaft or bearing with the crank shaft or intermediate shaft. The bolts between the tail end of the defendants' support effected the same purpose as the vertical stay of Barrans, so far as the intermediate bearing was concerned. The triangle in Barrans' plan effected the same result as the crank and intermediate shafts in one piece bolted to



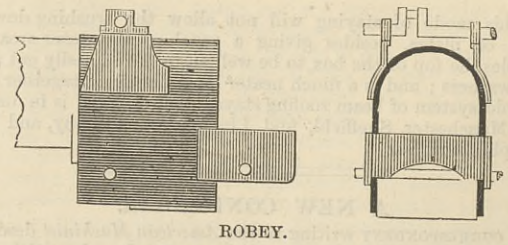
McLAREN.—No. 1.

the main shaft bearing in the defendants' plan. He thought there would be a liability in the tail piece, carrying the bearing of the intermediate shaft in the defendants' engine, to break off. He could not say whether any had so broken off, but he admitted that it would very materially strengthen it to bolt it to the side plates. The witness was then referred to another modification of the defendants' system, and referred to the intermediate piece of metal fastened into the inside of the lug or intermediate shaft bearing, and also to the projecting plate of the fire-box.



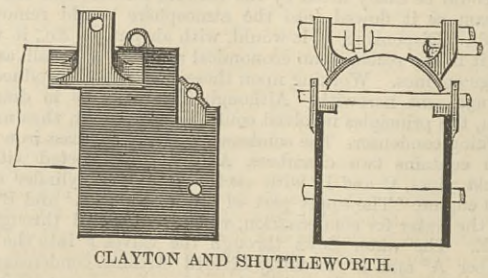
McLAREN.—No. 2.

That would no doubt be the first idea of strengthening the lug, which had been found liable to break off. In the next modification of the defendants' engine, No. 3, the lug was prolonged downwards and bolted to the plate. The witness was then referred to a representation of Robey's engine. There the side plate was wrought round in one piece. It would be a continuous complete frame, the



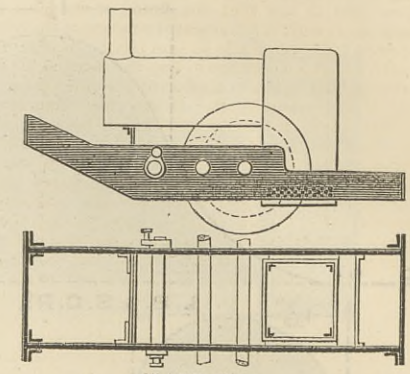
ROBEY.

top of the boiler and sides of the fire-box. The main bearing was taken by a plate rivetted into the side of the fire-box near the bottom of the side of the fire-box. In fact it was a projection or extension backwards of the sides of the fire-box. It would be immaterial whether it was a separate plate superimposed on the fire-box or simply a continuation of those sides. The crank shaft bearing was then rivetted to the same plate at the upper part of the boiler. His attention was then called to Clayton and Shuttle-



CLAYTON AND SHUTTLEWORTH.

worth's system. In that the intermediate and main bearings were both borne by the plates at the sides of the fire-box, and the crank shaft bearings were rivetted on the boiler top. He would not consider that Mr. Robey's was an infringement of the plaintiff's patent He could not recollect that it was a very common thing to put the bearings of all these shafts in the same plate in traction engines. He did remember one case, on reconsideration. He alluded to Clark's.



CLARK—1866.

There the bearing plate was underneath. In re-examination the witness said that in Greig's system there was no means of preventing rack in the boiler plates by means of a connection between the bearings of the crank shaft and the side plates. That was also the case in the defendants' system No. 1. He did not think that was an infringement. In Barrans's engine there was no horizontal support afforded by the ties. The sliding of the bearings in the grooves prevented any such support being given by the inclined tie. There was nothing there to prevent racking. In the defendants' No. 2 there was a method of tieing a crank shaft bearing to the side of the fire-box, and that he thought would be an infringement. Robey's plan did not effect the plaintiff's object. Clayton and Shuttleworth's was the same as Greig's in effect. It did not provide against racking. There was no indication that the bearing frame was rivetted to the fire-box. He never saw one of Clark's engines to his recollection.

Mr. J. C. Amos, after describing the disadvantages resulting from the old system, said that he did not know of a successful attempt to remedy them before the date of the plaintiff's invention. There had been attempts, but they were not successful because only partial. For example, two brackets were united to form a saddle over the boiler. In every case stays or rods were used. He believed that the object the defendants had in view when shaping the tail end of the upper plate was to cure racking. None of the prior specifications referred to were, in his opinion, anticipations. In cross-examination, he stated that in an old engine by Barrett, Exall, and Andrews an attempt was made to unite the cylinder crank shaft and guide bar brackets, but he was not aware that it ever became well known. It was given up. It was expensive and added weight. To some extent it remedied the defects spoken of. In re-examination he thought difficulties due to variable expansion of parts had something to do with the system being given up.

Mr. W. H. Maw confirmed generally the evidence of Mr. Bramwell. He dealt with the strain due to the gearing, and also expressed an opinion that in the prior systems the strains due to the reciprocation of the piston were not distributed as in the plantiff's invention, while in the defendants' system they were to some extent.

Mr. R. L. Knight, who thought most of the advantages of the plaintiff's system were secured in that of the defendants by the use of the bolts in the tail end of the plate, thus connecting all three shafts.

Mr. Thos. Wildes corroborated the last witness.

Mr. Thomas Aveling was then called. He said that he was the inventor of the patented improvement. He had read all the specifications of the prior patents referred to, and in none were the boiler and fire-box relieved from the crank shaft strains. In the engine of the defendants such strains were remedied. He explained the effect of strain caused by the pulling up of the fly-wheel by excessive resistance to the passage of the engine. He produced a piece of "starred" boiler plate caused by such a strain. In cross-examination he stated that racking did not happen at the cylinder end, although the cylinder was bolted to the top of the boiler. The reason was that in the cylinder the bolts could be placed in the top of the boiler, and the piston came low down and near the skin of the boiler, whereas if the brackets which supported the crank shaft were to be fastened to the boiler skin at all, the lower edge of bracket must be some way down the side of the boiler, in order that the bearings might be of such a height above the boiler as to allow the crank to work. The result of that was that the side bracket acted as a lever upon the external bolts on each side, and so worked backwards and forwards, and by degrees cracked the plate. This was confirmed by the fact that the inner bolts never cracked the plate. The larger the cylinder the more it was fitted on one side, so as to keep the centres low. He was then cross-examined at some length upon his specification as compared with what the defendants had done. He believed the defendants' engine was an infringement, and that he had cautioned them against it some years ago. In re-examination he said the way in which the crank shaft bearing in Robey's engine was fastened was different from the way in which he did it. The same observation applied to the way in which the main axle bearing was fitted. The plaintiff's method of providing against racking was quite different. He contended that while he removed all the strain the defendants removed it partially, but they did what they did in the same way.

Mr. David Greig expressed himself quite satisfied with the evidence of Mr. Bramwell. He was a licencee of the plaintiff and had used the plaintiff's invention. In cross-examination the witness was asked for the licence, but he was not able to say whether it was in Court. His firm and Messrs. Aveling and Porter had a mutual arrangement by which there were mutual rights to use one another's improvements. That arrangement was about a year old. They had a licence before that, namely in 1872. It was revoked some years ago. They had made engines with the side plates extended and also with plates rivetted on the side plates, additional plates. His firm held no licence between 1875 and 1880.

That closed the plaintiff's case.

A discussion then followed as to the points of law which it was intended to raise on the part of the defendants. One of the contentions was that if the plaintiff's patent was wide enough to include the defendants system No. 3 it was bad. Further if the plaintiff's patent was wide enough to include the joining together of the two known pieces, the bracket with the two bearings in it, and the plate extended backwards, carrying the main axle, it was not good subject matter for a patent. It was also submitted that the patent was invalid, because the provisional specification contained no reference to the second modification claimed by the final specification. Moreover, there was no infringement.

Mr. Webster, Q.C., then addressed the jury. He disclaimed on the part of his clients any attempt to evade the plaintiff's patent. It would be proved that what they had done was merely in the ordinary course of their own development. In the first place it would be essential for the jury to inform themselves as to what was known at the date of the plaintiff's patent, and then to consider, with the help of his lordship, what it was that the plaintiff's specification really described and covered. Now as to this, it was most important carefully to consider the list of inventions set out in the particulars of objection, with the view to see whether the plaintiff had spread his net sufficiently wide to take in any of them. If he had his patent would be bad. This was one of the chief reasons in cases of this kind for setting out a list of prior inventions. Now it was common knowledge as far back as 1870 that the backward extension of the plate forming the side of the fire-box might be used as a

support for the main axle. Clayton and Shuttleworth's engine was an instance of that. So far the defendants had only been proceeding in a well-known path. But then it was said that was not all; they had also put in that plate an extension upwards, in which was the bearing of the intermediate shaft. The plaintiff's counsel were driven upon this to say that the union of the piece carrying the intermediate shaft with the side plate by means of the bolts A was the same as if they had been made in one piece. But in Clayton and Shuttleworth's engine there again was the bearing of the intermediate shaft attached to the extension of the side plate. Next as to the bearing of the crank shaft. It was clear from Mr Bramwell's evidence that there must be rigid union between that and the side plate. The real merit put forward of the plaintiff's invention was the fitting of this bearing to a plate which did not form part either of the boiler or fire-box. What was the state of knowledge as to that? In Robey's engine there was the extended plate, the intermediate shaft in a plate rigidly connected, and the crank shaft bearing also in a plate rigidly fixed by rivets, the whole three being rigidly connected. The plaintiff could not contend that the making in one piece that which was previously made in two was good subject matter for a patent. There was no doubt that what the plaintiff really meant to claim, and did claim, was putting the several bearings in one frame. Barrans's engine was another instance, and here he desired again to impress upon the jury that he did not put these instances forward as anticipations of what the plaintiff had done, but to support a contention that if the plaintiff spread his net widely enough to include them his patent could not be supported; in other words, that the defendants had only done what the plaintiff's predecessors had done. Now Barrans, instead of putting his intermediate bearing on the same plate as the main bearing, put it on the same as the crank shaft. That was not new in 1870. The same thing was done by Greig; also by Clayton and Shuttleworth. In Greig's engine there were the crank shaft and intermediate shaft bearings in one piece. There was the fire-box side plate extended backwards, and if "horn plate" were the proper word, which it was not, there it was. In that extended plate there was the main axle bearing, and what had been done by the defendants was to connect those parts together. That was a most natural development where the strengthening of the system was required. The jury could see the same thing in Clayton and Shuttleworth's engine. Having regard then to the existing state of knowledge, it became material to consider what the plaintiff really claimed, because as the House of Lords said in *Harrison* v. *Anderston Foundry Company*, unless the defendants had adopted the plaintiff's particular combination they had not infringed. The plaintiff described the carrying back of the fire-box sides and putting in them the cast iron frame carrying the bearings. That was the sole invention described in the provisional specification, and the defendants had not taken it. That was the sole invention for which the plaintiff got his patent. The plaintiff said in his specification that he put his crank shaft in that frame instead of on brackets on the top of the boiler, which was what the defendants did. He, in fact, charged the defendants with infringing, by doing that which he himself pointed out was to be avoided. The plaintiff only claimed the method of supporting the bearings in the manner described by him, and bearing in mind the prior systems, it was clear he could only support his patent on the particular arrangement described by him. It must be borne in mind, in considering the development of the defendants' system, that tying together the three bearings was a most common and natural thing to do; in machinery wherever there was a strain, as in the case of gearing, tending to separate the bearings, it was most usual and mechanical to tie them together. Mr. McLaren would prove that the attachment had nothing to do with the boiler. Indeed, they were able to make, and did make, successful engines without the attachment, with simply the bracket on the boiler. Mr. Bramwell had expressed an opinion that the attachment was provided because the lug might break off. But Mr. Bramwell was not a practical machine maker, and Mr. McLaren would show that, made as he made them, it would be an exceedingly difficult thing to do to break off the lugs. The jury would find in the course of the case that the defendants had simply improved upon the old bracket by known mechanical means, and there was this great advantage in what they had done—that for repairs they had not to remove the side plates and bearing frame, but simply a self-contained portable thing, the bracket. That went some way to show that what the defendants had been doing was not an attempt to imitate the plaintiff's invention, but had been progress in an independent direction.

Mr. John Imray was then called. He had carefully read the plaintiff's specification. He did not find in the provisional specification any suggestion of the second modification claimed in the final. Modification No. 1, as he read the specification, consisted of two side plates separate from the side plates of the fire-box, but fastened thereto, having between them a strong cast iron frame, with stiffening tubes for the shafts and axle. That cast iron frame the witness thought was the essence of the invention of that modification. In the second modification it was not correct to call the sockets in the side plates horn plates. A horn plate was a plate in which the axle bearings could slide to and fro. In No. 2 the cast iron frame was dispensed with as a whole. In 1870 it was well known that bearings could be fitted in side plates extended backwards. It was also well known to have bearings behind the boiler and on the top of the extended plates. He did not see in the alleged infringement the essence of the plaintiff's invention. There was no extended plate to carry the crank shaft bearings. The crank shaft support was bolted directly to the boiler. Assuming the bracket to be a known thing, and the extended plate to be a new thing, he saw nothing in the plaintiff's specification by way of direction to join those two. On the contrary, he saw two new things. The object of the three bolts A in the defendants' No. 2 was simply to tie together the bearing of the intermediate shaft and the bearing of the main shaft. It was a common thing to tie shafts together. That which tied them together should act both as a strut and a tie. If the lug or bearing of the intermediate shaft in the defendants' No. 1 were too weak or liable to break, its attachment to the lower plate would be an obvious way of strengthening it. The defendants' system offered great advantages where repairs were needed to the crank shaft supports. The part only was removed instead of taking the whole engine to the shops. There would be no difficulty in connecting the bracket and the extension of the side plate in Greig's engine, and when done it would be the same as the defendants' engine. He saw no reason why mechanically Robey's should not be a very good engine. In Barrans's engine the shafts were all tied together; so they were in the plaintiff's, but the combinations were different, because in the former the shafts were movable together, while in the plaintiff's they were not. In Clark's engine there was the usual binding together of all the shafts in one plate, as in a locomotive. In cross-examination, Mr. Imray stated that in Greig's, Robey's, Barrans's, and Clayton and Shuttleworth's engines, the entire strain from the working of the piston-rod was borne by the attachments to the crown of the boiler. He thought that was a defect in a badly-constructed engine, but not if the work was well done. If they made their base wide enough, and put in a sufficient number of bolts or rivets, the defects due to racking would be avoided.

Mr. W. Deane, locomotive superintendent of the Great Western Railway, stated that in 1870 the practice of connecting shaft bearings was well known. It was also a well-known thing to do to extend the plates of the fire-box backwards, for the purpose of carrying the main axle. It was also a well-known thing to do to bolt on the top of the boiler a bracket for carrying one or more geared shafts. It would be an obvious expedient to tie together the bracket and the extension of the fire-box plates. The plaintiff's specification did not deal with saddle-brackets at all. On the contrary, it proposed to abolish them. In cross-examination he stated that the tying together of the tail-piece with the fire-box extension in the defendants' engine was an improvement. It was better than if there were no such connection. It strengthened the lug, and less expenditure of material was needed. In the use of brackets secured to the boiler there was, of course, a strain to be counteracted. Whenever fastenings were needed, there was a strain to be met, and it was only a question of fastening properly whether there was injury or not. He had not heard Mr. Bramwell give his evidence to the effect that that mode of support led to racking and injury of the boiler, but he would not agree with such an opinion, and he should set the practice of nearly all the portable engine builders of the country against it. Racking could always be provided against by a perfect system of fastening, and by lengthening the base of the brackets.

Mr. Chas. Morris had seen an engine at Messrs. A. and W. Eddington's which had been made by Robey and Co., and of which he prepared a drawing, from which the model in Court was made.

Mr. Eddington stated that in 1869 he had repaired a Robey traction engine. That was the engine of which the last witness had made a drawing. He had known the engine for the last twelve years. There had never been any difficulty through the brackets having been attached to the boiler. There had been no leakage. In cross-examination Mr. Eddington stated that in his practice he rivetted the bracket to the top of the boiler. He also carried his side plate over the top in one piece. In Aveling's and McLaren's the side plates were separate.

Mr. Daniel Fisher, manager to Messrs. Rogers and Co., of Epsom, proved the illustration of Clayton and Shuttleworth's engine. Such engine had been used by his firm in 1869. There never was any leakage caused by the brackets. If they were made long enough and properly fastened there would be no leakage.

Mr. John McLaren, one of the defendants, said that when brackets were fastened on the boiler, if the work was not well done there would probably be leakage. There was no difficulty in doing such work properly. His practice was to make the bracket as long as possible, curve it carefully to the boiler, and bolt it down throughout its length, and he had never found a defect follow. He had found the lug carrying the intermediate shaft break off, but that was due to the strain of the gearing and not to the piston strain. When it first happened he patched it, then for the future he put in the connecting plate. That plate had a double purpose; it strengthened the lug and tied the geared shafts together. He decidedly preferred to mount the crank shaft support on the top of the boiler. The witness was closely cross-examined as to the strains and their effect on the fastenings of various kinds, but he adhered to what he had stated that it was a question of good or bad work.

Dr. John Hopkinson, F.R.S., agreed with the evidence of Mr. Imray and the defendant. Taking Clayton and Shuttleworth's engine with its extended plates carrying bearings and the bracket at the top, he did not find any directions in the plaintiff's specification for the union of the two. The plaintiff had not added anything to the common stock of knowledge in that respect. If there were a disadvantage in bolting the bracket to the boiler he did not find that the defendants' system avoided it. He agreed with Mr. McLaren's reasons for his practice. He did not think that there was any substantial difference between Clayton and Shuttleworth's and the defendants' system. He did not think that the three bolts A in the tail piece in the latter had any appreciable effect in counteracting the strain from the piston rod.

Mr. Webster then summed up the defendants' case. He pressed upon the jury and the Court the argument that if the plaintiff's patent was wide enough to include what the defendants had done, it was bad. It would be their duty to read the specification with the intention of supporting it, and if so read he was satisfied that the defendants could not be held to have infringed the plaintiff's combination. That combination could not be held to cover the tying of the bearings in Clayton and Shuttleworth's engine. The plaintiff's invention was the cast iron frame and its supports, and had nothing to do with brackets fitted to the top of the boiler. The plaintiff said that none of his bearings were bolted directly to the boiler, and he could not be heard to contradict his own specification. The learned counsel went in detail through the evidence which he had adduced, and asked that the jury should not say his clients had infringed a combination of things not one of which they had taken.

The Solicitor-General then addressed the jury in reply. He submitted that the defendants had infringed, notwithstanding that by their system they had not taken off all the strain from the top of the boiler.

Mr. Justice Stephen, before summing up, stated that the questions which he should put to the jury would properly be—first, whether the defendants infringed the plaintiff's modification No. 1; secondly, whether they infringed modification No. 2; thirdly, the utility of the invention being admitted, whether different means were known before 1870 by which the same result could be obtained; and, lastly, he proposed to have the consent of the parties that any question of fact which might be necessary to the determination of the questions of law reserved for further consideration should, if necessary, be determined by the judge. The object of this was of course to obviate the necessity for a new trial in the event of any fact necessary for the determination of the legal question having been overlooked. It was in fact a power to the judge to draw inference of fact in incidental questions. Upon the suggestion of counsel he would put some further questions as to utility. These questions appear at the conclusion of the judge's charge.

After pointing out the difference of the functions of the judge and jury in this class of cases, the learned judge stated that much of the evidence which had been adduced, and properly adduced, would have to be put aside by the jury. For example, he did not think it would be necessary for the jury to consider how far the plaintiff's specification could be said to have been anticipated by any of the numerous patents which had been brought before them. The first and great question was whether the defendants had infringed the plaintiff's invention in either of its two forms. The question of the validity of the second modification was one for the Court, and with that they need not concern themselves. The jury must, in considering the question of infringement, assume the patent to be valid; whether it was so or not if need be would be for subsequent consideration. Counsel on both sides had told them that if a man took out a patent for an invention, and if another obtained the same result by the use of substantially the same means, that would be an infringement. Now the word "substantial" included all the important and essential parts of anything. It was suggested in this case that the defendants had adopted substantially the same means though it might be with different objects, in consequence that is of the natural development of their system. Upon this point reference had been made to the case of *Cannington* v. *Nuttall* (L R. 5 H. L. 205) to show that a patented invention must not be used for a purpose different from that for which it was intended. But in that case Lord Westbury had not, he thought, intended to do more than affirm the old principle laid down in *Crane* v. *Price* (I. W. P. C 408), that a patented process applied to a new purpose might be a good subject matter for a patent, though so much of the invention as was covered by the previous patent could not be used without licence. That was, he thought, the case of *Cannington* v. *Nuttall*, only there the defendant had not obtained such licence, and "therefore," said Lord Westbury, "if you mean to use it as a foundation for a new patent and do not pay for it, your addition in the new patent does not prevent what you do from being an infringement." If the jury thought that substantially the same result was obtained by substantially the same means, then the motive of the defendants was not material, however laudable it might be. Then as to the similarity. The plaintiff had said that he had noticed such and such defects; he had sought a remedy and had arrived at the result which formed the subject matter of his patent. The defendants said they had other objects in view, and were thereby led to the result charged as an infringement. In his view it was useful to consider what the respective objects were in attempting to arrive at a conclusion whether the results were the same. He then read the plaintiff's specification, commenting upon it as he read, and stated that the essence of No. 1 modification appeared to be the plates and cast iron frame with the shafts arranged in it vertically. Had the defendants taken that? They had a saddle on the boiler. The cast iron frame was absent. The defendants' bearings were not in a vertical line, though they were connected. Was there a difference in substance? Next as to modification No. 2. Here no doubt the resemblance was greater, but that of course would be for the jury to consider. His lordship then read the plaintiff's specification describing this modification, and proceeded to point out that the characteristic feature of the plaintiff's modification was making the horn plates take the thrust of the piston instead of the bolts. It seemed to him upon this part of the case that the whole question as to infringement resolved itself into this—did the connection of the plates in the defendants' engine by the three bolts A make the two things substantially the same? What did the jury say as to the evidence on both sides as to these bolts? Mr. Bramwell said that they distributed the piston strain over the side plates. If they were removed the engine would be reduced to its old state of defects. He did not say that the three bolts took all the strain, but he saw no use for them except to take such part of the strain as they could. The question was whether they took off so much as to make the two systems identical. Mr. Amos and other witnesses agreed to a certain extent with Mr. Bramwell. Then Mr. McLaren, who had given his evidence with perfect frankness, said he did not agree with what had been said about leaks in consequence of piston strains. It was a mere matter of construction. He had made many engines and had so found it. He did not intend the bolts to relieve strain. He found the lug break off and he set about to remedy the defect, and for that purpose he bolted on the tail piece. To that it was replied that it was immaterial why he did it, if that which he did violated the plaintiff's patent. To this Mr. McLaren rejoined that he did not violate the patent, because the bolts A did not give any support to the rivets which held the saddle or cradle, and which rivets were admitted to be no infringement. Before there could have been a strain on bolts A the rivets must have given. Mr. McLaren, moreover, did not stand alone, other witnesses had been called in confirmation of his views. Then, on the other point, admitting the fitness of the plaintiff's invention to cure the defects of which he spoke, were there other means of securing the same end in use in 1870? On that witnesses had stated positively that they had known engines which never leaked. No doubt leakage could be prevented by supporting the bearings in horn plates, but they had known it prevented in other ways in old engines of which they spoke. Then Mr. Webster wished the jury to say whether the defendants attached the bearing of the intermediate shaft to the extended side plate for the purpose of strengthening the lug bearing. That was a question of belief or disbelief of the defendants' evidence. The Solicitor-General, on his side, wished an answer to be given to the question—did the connection with the side plates transmit the excessive piston strain? but that question did not really add to those which the learned judge had expressed his intention of leaving to the jury. But it seemed to him that unless they were convinced that the three bolts A did enable the rivets to bear the engine strain, and that the latter would not otherwise support it, they ought to answer that question in the negative. The jury then retired, and on returning to the Court the following questions were put and answers given:—

1. Have the defendants infringed the plaintiff's invention as described in the first modification? No.

2. Have the defendants infringed the plaintiff's invention as described in the second modification? No.

3. The fitness of the plaintiff's patent to obtain the object stated in his specification being admitted, did other means of obtaining the same result exist before the patent? Yes.

4. Did the defendants attach the bearings of the intermediate shaft to the extended horn plate for the purpose of strengthening the lug bearing the intermediate shaft, and connecting it with the main bearing, and did the defendants in so doing adopt ordinary mechanical means? Yes.

5. Did the connection with the projection of the said plate which the defendants used transmit to the side plates of the boiler the excessive strain which was calculated to injure the attachment to the boiler? No.

This amounted to a verdict for the defendants.

Mr. Aston applied for costs of the issues in favour of the plaintiff affecting utility, novelty, and sufficiency of the specification; his lordship declined to make any order, but gave leave to apply specially for them at Chambers. He also claimed a certificate—under the 44th section of the Patent Law Amendment Act—to the effect that the validity of the patent had come into question, but Mr. Macrory objected, and it was left for argument.

Solicitors for the plaintiff—Messrs. Wilson, Bristows, and Carpmael.

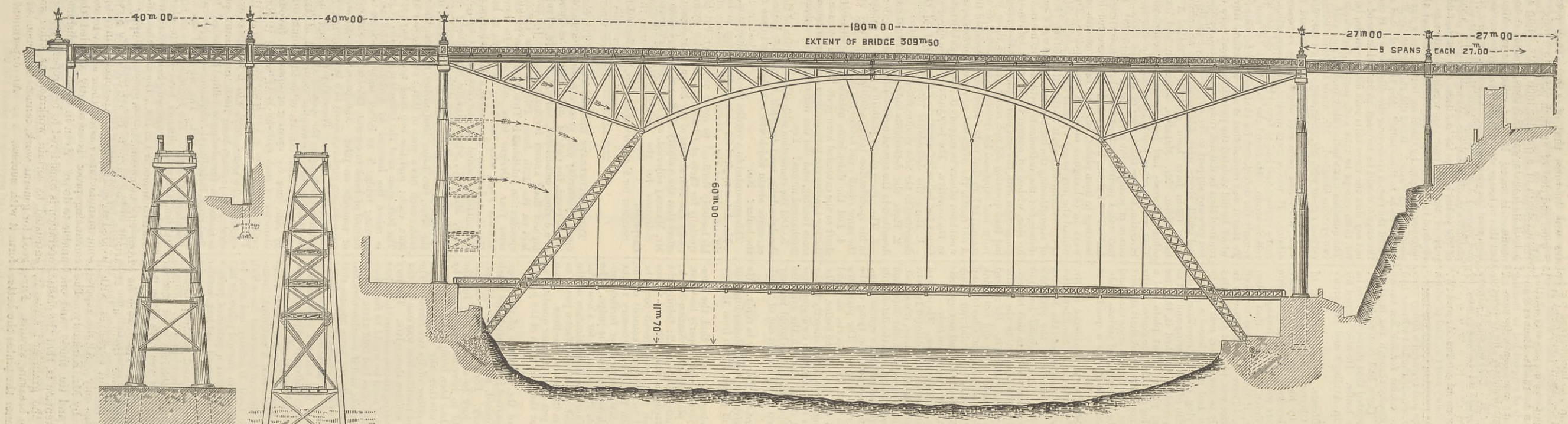
Solicitor for the defendants—Mr. J. Henry Johnson.

The Skeldergate Bridge, York.—This handsome bridge was opened yesterday with great ceremony. Great interest was shown in the event, the date of which will be easily remembered as that of a curious coincidence, namely, that it was accompanied by the highest flood known for many years. The foundation-stone was laid on the 12th June, 1878, and the contract drawings and specification published in The Engineer for the 11th May, in the same year. Designs were submitted for consideration by Mr. Thomas Page, who had been called in as consulting engineer. Mr. Page, however, died before a final selection was made; but the committee obtained the services of his son, Mr. George Gordon Page, M.I.C.E., whose designs were finally adopted. It is of Gothic character, in keeping with the many architectural features of the city. The bridge consists of five arches, three of which cross the river, two being land arches for the waterside traffic. The centre arch has a span of 90ft.; the two side arches have spans of 30ft. each; and the two land arches have spans of 24ft. each. The 30ft. span next the lodge is a Bascule, or opening bridge, and is raised the lowered by hydraulic machinery. Beneath this opening bridge is an invert 10ft. 6in. below the summer level, formed of brick in cement, 2ft. 6in. deep, supported on a deep bed of concrete on piles. The bascule bridge is formed with eight wrought iron girders, affixed to a horizontal shaft 10in. in diameter, on which they turn. These girders are each 53ft. 6in. long, the portions overhanging the opening being about 35ft. The tail ends carry counterbalance weights, and the connections to the hydraulic machinery. This consists of two hydraulic cylinders, placed side by side, one for opening and one for closing the bridge. The diameter of each cylinder is 12in., and the stroke 5ft. 6in. The multiplying power is 4 to 1, giving a travel of 22ft. to the chains. The force-pump is worked directly from the crank-shaft of a gas engine. The accumulator has a ram 15in. diameter and 7ft. 6in. stroke, the pressure being 700 lb. per square inch. The machinery is placed in the abutment behind the lodge. The total length of the bridge, including the abutments of the land arches, is 308ft. 8in., and the width is 40ft. The whole of the work is faced with Bramley Fall stone. The springing line of all the river arches is 9ft. 5in. above the summer level, and the soffit of the centre arch is 13ft. 1in. above the springing line. The gradient of roadway of the river arches is 1 in 108. The centre arch is composed of seven main ribs of wrought iron, springing from cast iron skewbacks The 24ft. land arches are of cast iron. There are wrought iron trams for heavy traffic from end to end of the bridge, the roadway of which is 24ft. wide between kerbs, paved with wood blocks set in bitumen. The footpaths, 8ft. wide, are covered with asphalte. The Corporation invited tenders, as our readers are aware, for the construction of the bridge, but ultimately decided upon intrusting the ironwork to Messrs. Handyside and Co., of Derby, and doing the foundations and masonry by its own workmen, under the direction of Mr. Styan, the city surveyor. Mr. Robert Nunn has been the resident engineer under Mr. Page. The approaches have involved a considerable amount of work, and the total cost of bridge and approaches is about £50,000.

PROPOSED DOUBLE ROADWAY BRIDGE OVER THE DOURO.

DESIGN SUBMITTED BY MR. J. DIXON, C.E., LONDON.

(*For description see page* 175.)



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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.*

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G. V.—*So far as we are aware, wave grooved wheels may be freely used for chain or rope driving without fear of infringing any patent.*

B. H. T. D.—*We can give no further information than that contained in our patents lists and abstracts of specifications. Any published specification can be obtained on sending the price and number and year, to the office for the sale of specifications, Cursitor-street, Chancery-lane.*

P. R. V.—(1) *Forney's "Catechism of the Locomotive" ought to serve your purpose. It is published by Messrs. Spon, Charing-cross.* (2) *There is no book on the theory of the steam engine which is not mathematical. Goodeve "On the Steam Engine" you will, however, find easy reading.* (3) *There is always a gland between the two cylinders in tandem engines.* (4) *Richard's "On the Indicator," published by Elliott, West Strand.* (5) *No.*

J. L. S.—*We cannot give you any other names of authors on the subject than you will find mentioned in Grant's book "On Cement," in the three papers on the subject and the discussions thereon in the "Proceedings" of the Institution of Civil Engineers, vol. lxii.; see also* THE ENGINEER, *vol. xlv., p. 65 and 117. The principal early writer in France was Vicat; and though several monographs have appeared in the past few years, the most important writings will be found in the German, and next the English languages.*

X. L. C. R.—(1) *Multiply the diameter by itself, and then by 0·7854; then multiply the product by the length. If all these dimensions are in inches and the cylinder is cast iron, the sum obtained as above should be multiplied by 0·26 for the weight in pounds. Get Young's "Practical Arithmetic," published by Heywood, London and Manchester.* (2) *There are no books on mechanical engineering generally. You may have books on the elements of mechanism, on practical mechanics, and on different classes of the productions of the mechanical engineer.*

PNEUMATIC STAMPS.

(*To the Editor of The Engineer.*

SIR,—Can any of your readers give me any information as to the merits of Sholl's pneumatic ore stampers, and whether there are any being made and sold for gold quartz crushing; or perhaps some one would give me Mr. Sholl's address? J. D.

Tottenham, N., March 9th.

MINERAL OIL FUEL.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents give me any information as to the methods adopted for burning the petroleum oils under the steam boilers in the American oil regions, or perhaps they can refer me to journals where such methods are described? At the same time I should be glad to know what refinement, if any, is required before using the oil as a fuel. C. J. M.

Manchester, 9th March.

A PROBLEM IN WINDING GEAR.

(*To the Editor of The Engineer.*)

SIR,—I have to thank Mr. Tomkins and other correspondents of THE ENGINEER for their prompt assistance in the question on involutes which you were kind enough to insert for me a few weeks back. Will you please extend your kindness by inserting the following for their further indulgence:—Round two wheels whose circumferences are as 5 to 3, two ropes are wrapped, whose difference exceeds the difference of the circumference by 280 yards. But the largest rope applied to the larger wheel wraps round it a certain number of times, greater by twelve than the smaller round the smaller wheel, and if the larger wheel turns round three times as quick as the other, the ropes will be discharged at the same time. Required, the lengths of the ropes and the circumference of the wheels. A YOUNG MECHANIC.

March 7th.

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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, March 15th, at 8 p.m.: Renewed discussion upon Sir William Thomson's paper on his "Tide Gauge, Tidal Harmonic Analyser, and Tide Predicter;" and, paper to be read, time permitting, "On the Comparative Endurance of Iron and Mild Steel when exposed to Corrosive Influences," by Mr. David Phillips, M. Inst. C.E.

CHEMICAL SOCIETY.—Thursday, March 17th, at 8 p.m.: "On the Volumes of Mixed Liquids," by Mr. F. D. Brown. "On Boron Hydride," by Mr. F. Jones. "On the Action of Aldehydes on Phenanthraquinone in Presence of Ammonia," by Messrs. F. R. Japp and Edgar Wilcock. "On the Action of Benzoic Acid on Naphthaquinone," by Messrs. F. R. Japp and H. J. N. Miller. "On the Alleged Formation of Nitrous Acid during the Evaporation of Water," by Mr. R. Warrington. "On the Absorption of Solar Rays by Atmospheric Ozone, and on the Blue Tint of the Atmosphere," by Professor Hartley. "Note on the Sweet Principle of Smilax Glycyphylla," by Messrs. C. R. A. Wright and E. H. Rennie.

THE METEOROLOGICAL SOCIETY.—Wednesday, March 16th, at 7 p.m.: Exhibition of instruments, consisting of various kinds of hygrometers and of such new instruments as have been brought out since January 1st, 1880. During the evening the president will give an historical sketch of the different classes of hygrometers, and will also describe such forms as are exhibited.

LONDON INSTITUTION.—Tuesday, March 15th, at 8 p.m.: "Sanitary Assurance," by Professor De Chaumont, F.R.S. The President of the Royal College of Surgeons in the chair.

SOCIETY OF ARTS.—Monday, March 14th, at 8 p.m.: Cantor Lectures, "The Scientific Principles Involved in Electric Lighting," by Professor W. G. Adams, F.R.S. Lecture II.—The measurement of electric currents—Efficiency of magneto and dynamo-electric machines—Heating effects of the current. Tuesday, March 15th, at 8 p.m.: Foreign and Colonial Section, "The Diamond Fields of South Africa," by Mr. R. W. Murray. Wednesday, March 16th, at 8 p.m.: Ordinary meeting, "The Compound Air Engine," by Col. F. Beaumont, R.E.

THE ENGINEER.

MARCH 11, 1881.

THE BOARD OF TRADE ON STEEL.

IT has been known for some time that the Marine Department of the Board of Trade has been experimenting with steel plates; and a species of report on these experiments in the shape of a memorandum for the information of Board of Trade surveyors, has just been published. The report is signed by Messrs. Thomas W. Trail, Thomas J. Richards, and Peter Samson. It concludes with the following suggestive words:—"Proofs are not unfrequently given that with the increasing introduction of steel in shipbuilding and boilermaking, considerable variability occasionally occurs in its tensile strength and ductility. One great obstacle to the greater, or even continued, use of steel for the above purposes may, it is feared, be found in the gradual reduction in its ductility, arising from the effects of competition between steel manufacturers." The circumstances under which the memorandum has been prepared are very curious, and throw some light on the passage which we have quoted. The world in general has been for a very long time assured that the only steel in the market fit for ships and boilers is that made on the Siemens system, and those who make Bessemer steel have either been unable or unwilling publicly to contradict the assertion. The action taken by the Board of Trade is no doubt a blow to the Bessemer interest, and a very considerable boon to the Siemens-Martin interest. This will be readily understood when we add that the memorandum applies not only to Siemens-Martin steel alone, but to the steel made by one firm, the Steel Company of Scotland. It does not appear that the Board of Trade is much to blame in the matter, and yet we cannot say that it has acted quite judiciously. The Board of Trade was asked, it appears, by the Steel Company of Scotland to sanction the use of the company's steel in the construction of ships and boilers to be passed by the Board. Mr. Trail, in reply to this request, said that he must have some proof afforded him of the fitness of the material for the intended purpose. "The company very readily acquiesced in the justness of the request," says the memorandum in very queer grammar, "and forwarded for testing a set of plates, ¼in., ½in., ¾in., and 1in. thick. They also caused to be constructed a set of experimental boxes of different thicknesses of steel plate to represent the flat surfaces of steam boilers. These have been burst by hydraulic pressure, and a large amount of valuable information gained respecting the strength of such surfaces when formed of steel plates." Thus it comes to pass, as we have said, that nothing appears in the report concerning the steel made by any other firm save the Steel Company of Scotland; and our readers must judge for themselves whether the concluding passage of the memorandum, which we have quoted above, is meant as a warning to the Steel Company of Scotland not to let competition injure quality, or whether it is a hint to other companies that they should follow the example set by the Scotch firm and eschew competition and its evils.

We do not wish it to be supposed that although the experiments of the Board of Trade dealt with only one make of steel, that they are consequently of little value; on the contrary, we hasten to assert that they are of great value, but that value will be immensely increased if some of the Bessemer firms, such for example as Sir John Brown and Co., will come forward and enable the Board of Trade to carry out a similar set of experiments on steel from the converter. It is not to be denied that the Steel Company of Scotland not only does its work very thoroughly, but is in a position to do a great deal of it. Its works were started at Newton, near Glasgow, in 1872, and have been increased in dimensions year by year. The converting house contains thirty hearths, the greater number of which has, with their Siemens furnaces, been started, and can turn out 65,000 tons of steel every year. The rail mills can make 40,000 tons a year; and there are plate mills which can turn out 25,000 tons a year. The consumption of coal is at the rate of 2000 tons a week; and the operations of the company are being extended, so that ere long its production will equal nearly 150,000 tons of steel per annum. That the steel made by the company is admirable no one seems to doubt. None is made by running direct from the blast furnace; good hematite, steel and iron scrap and iron ore are worked together in the hearth, ferro-manganese or spiegeleisen being added just before taking the charge. It takes about eight hours to work each charge, and this gives, as we have before now pointed out, ample time to ascertain its quality, and in this respect the Siemens-Martin process has a great advantage over that of Bessemer. In saying this, however, we must not be understood to assert that Siemens-Martin steel is necessarily better than Bessemer steel.

The experiments carried out by Mr. Trail were far too elaborate to permit us to notice them all at once. For the present we shall content ourselves with dealing with those on tensile strains only. All the experiments seem to have been made by Mr. Kirkaldy. The plates tested were ¼in., ½in., ¾in., and 1in. thick; and one of the first points deserving of attention is, that the elastic limit was nearly the same with the grain and across it, while the same may be said of the breaking strains. Furthermore, it appears that the thinner the plates the better they were. Thus, while the elastic limit of quarter inch plates was 19 tons, that of a half inch plate was but 15·8 tons, and that of an inch plate 14·9 tons. Again, the breaking strain of a quarter inch plate being 31 tons that of a half inch plate was 28·9 tons, and of a one inch plate 28 tons. It must be understood that Mr. Trail does not use "elastic limit" to denote the strain when permanent setting begins, but the load which causes the rate of elongation to suddenly accelerate. It is certain that the facts thus set forth, although they are not new, are not generally known. It has, indeed, been asserted by many persons that the strength of steel is unaffected by the dimensions of the tested specimen; and that a steel plate 1in. thick is just as good as a steel plate ¼in. thick. It has, however, been pointed out long since in our columns, that what holds true of thin steel plates does not necessarily hold true of thick plates; and the Board of Trade experiments, we are glad to see, confirm this view. Why the thin plates should be better than thick it is not very easy to see, because it is claimed by all makers for their plates that all are equally well worked. Possibly some analogy exists between thin plates and thin wires, which, as is well known, are very much stronger per unit of area than thick wire. But we have not done with this set of experiments yet. It was found that the ultimate extension of specimens 10in. long, augmented with the thickness of the plates, varying from 23·5 per cent. with the grain, and 21·2 per cent. across it, with ¼in. plates, to 30·6 per cent. and 25·6 per cent. in the case of 1in. plates. Thus the thick plates had more ductility and less ultimate strength than the thin. A very interesting comparison may be drawn between steel and iron boiler plates. The breaking stress of the iron plates was 21·2 tons for ½in., 21·40 tons for ¾in., and 20·86 tons for 1in. plates, while the extensions were respectively 9, 10·1, and 9·8 per cent. If we compare these results with those obtained from steel plates, it becomes at once apparent that iron is much the more uniform of the two. Mr. Trail sums up this portion of his report in the following words:—"Comparing the steel with the iron, the ultimate stress of the former is about 36 per cent. greater than the mean of the latter. The contraction of area at fracture of the steel largely exceeds that of the different irons. In the case of the steel lengthway it is 49·1 per cent. against 20·6 per cent. for the Yorkshire iron; 13·07 per cent. for the ordinary iron boiler plate; and 5·4 per cent. for iron ship plates. As the contraction of area at fracture is a guide to the ductility of material, it will at once be understood to how large an extent the ductility of the steel plates exceeds that of the iron, especially the ordinary boiler and ship plates." Concerning the ratio of the elastic limit to the ultimate strength, it is pointed out that while in Yorkshire boiler plates it is about 58 per cent. of the whole, in steel plates it is 55 per cent., and consequently that the steel is really stronger than the iron. But it must constantly be borne in mind that Mr. Trail deals with only one make of steel, and there are no doubt steels in the market which are not only relatively but absolutely weaker than iron. It is possible to buy ductility too dearly. All the experiments to which we have called attention were made in the ordinary way, and it is evident leave much that is speculative concerning the behaviour of steel still lost in doubt; and we cannot help regarding the entire series of experiments as wonderfully incomplete in this respect. Experiments made to ascertain the effects produced by drilled and punched holes illustrate this statement very precisely. We shall probably return at no distant date to the consideration of these experiments, but we may now say that the tests employed throw little or no light on the points now in the dark. It is well known, of course, that punching a steel plate or bar weakens it very much, but that weakness is manifested in a peculiar way. Thus rails with punched flanges infallibly break at the holes when in use. The mere act of shearing a plate may cause it to crack; and it would appear that the failures coincident with punching are manifested most clearly when the bars or plates are exposed to some jarring action. Mr. Trail, to test the question, ignored shocks and jars altogether, and contented himself with exposing the samples to tensile strains steadily applied. The results he obtained are suggestive and valuable so far as they go, but they do not go far enough. He found, for example, that while drilled quarter inch plates maintained a strength of 21·9 tons for the gross area of the plate per inch, punching reduced its strength to 19·3 tons; but in the case of 1in. plates punching reduced their strength from 18·3 tons; drilled, to 13·45 tons. It also appeared that with the drilled plates there was a considerable increase in strength per square inch of net area of plate left between the holes, the gain in some cases reaching as much as 13 per cent.

Altogether the experiments go to show that the Steel Company of Scotland produce a very admirable material when tested by the machine. We do not for a moment assert that it is not equally good in actual use, but on this point the memorandum of the Board of Trade is nearly silent, and when it returns to the points on which much ignorance exists it does not speak in favourable terms of steel as a constructive material, while it concludes with a special note of warning. The question of the day is, how comes it to pass that steel which will pass every test in the machine, will play the most unpleasant pranks in the boiler yard or the ship? The Board of Trade has left this question very much where it was. But this is, we think, not the fault of the Board. We have already pointed out that some of the makers of Bessemer steel should follow the example set them by their Scotch rivals, and we commend to their attention the following passage from the memorandum, which will aptly conclude this article, "The value to be attributed to steel plates when welded urgently requires experimental investigation. Whilst some manufacturers assert their ability to weld steel plates, convincing proof is constantly afforded that others are unable to do so. Even in those establishments where the operation is considered to be properly performed it is only entrusted to certain workmen, as other smiths, equally good for general work, cannot be depended upon to perform it with success. . . An experiment was recently

made to ascertain the value of an apparently perfect weld in a furnace which had been subsequently annealed, and the results showed that the weld was by no means so good as could have been obtained with iron. It is highly important that further experiments should be made in connection with the subject."

THE EFFICIENCY OF A TANDEM ENGINE.

We published in our last impression a letter from Mr. Michael Longridge, criticising the comments which we made, on the 25th February, on a report which he had issued on the performance of a compound engine and boilers at Messrs. Nuttall's works, Oak Mill, Farnworth. It will be remembered that Mr. Longridge stated that the engine in question required, on the 6th October, 1880, only 16·7 lb. of feed-water per indicated horse-power per hour; and to this statement we took exception, expressing our doubts that any such result could be got under the stated conditions. Mr. Longridge has very properly written to support his statements; and to show that he is right, he sets about proving that we are wrong, and that our calculations are erroneous. The principal error which he points out is, that we gave the capacity of the low-pressure cylinder as 133ft. per stroke instead of 68 cubic feet. On referring again to Mr. Longridge's report we see that, in this respect, he is right, and that we were mistaken. It so happens, however, that all the calculations which we based on the erroneous figures in question referred to a supposititious case, and in no way affect the points at issue between us. When we have conceded that the capacity of the low-pressure cylinder was not 133 cubic feet, we have disposed of the greater portion of Mr. Longridge's letter; and yet the case stands precisely where it did. He has not advanced a single step towards proving that his conclusions are right and that ours are wrong. It remains as difficult as ever to believe that the performance of Messrs. Nuttall's engine was not strictly phenomenal, and that the figures given by Mr. Longridge do not need the most careful examination, and call for an explanation. Nothing has been advanced by Mr. Longridge to upset this proposition. The matter at issue between us is very simple, and can be stated very clearly.

The engine, whose performances we are considering, has two tandem cylinders—the smaller 27in., and the larger 45in. in diameter, with a piston stroke of 6ft. A pair of indicator diagrams, published by Mr. Longridge, shows that steam of 87 lb. absolute pressure was cut off in the small cylinder when the piston had traversed 18in. The diagrams are very good, and the action of the Corliss gear very perfect. The admission was the same at both ends. The average clearance for each end of the cylinder is 918 cubic inches, and, including the clearance, the smallest quantity of steam which could have been admitted at each stroke, was 6·25 cubic feet. The clearance at each end of the large cylinder is 3702 cubic inches, and adding this to the whole space swept by its piston per stroke, we have a volume of 68 cubic feet. Now, all the steam admitted to the high-pressure cylinder must ultimately fill the low-pressure cylinder; therefore at each stroke 6·25 cubic feet of steam must be delivered to the low-pressure cylinder, and $\frac{68}{6{\cdot}25} = 10{\cdot}88$ times as the ratio of expansion. We gave it in round numbers as twelve times, and if we divide the initial by the terminal pressure on the diagrams, we get this result approximately. Mr. Longridge gives the expansion as 10·95, which it will now, we think, be seen is inaccurate. Mr. Longridge may urge that more steam than we have mentioned passed into the first cylinder, to which we reply that, no matter how much more entered, while the steam port was open it was condensed, and when the steam port closed there could not be more than 6·25 cubic feet of steam between the piston and the cover of the small cylinder. The question is, for the purpose we have in hand, of little moment, save in so far as that the greater the range of expansion, after about 8 to 1, the greater is the consumption of steam likely to be.

The engine made 42 revolutions per minute, or 84 strokes, and $84 \times 6{\cdot}25 = 525$ cubic feet per minute, and 31,500 cubic feet per hour, and $31{,}500 \times {\cdot}2024 = 6375{\cdot}6$ lb. of steam per hour. The indicated horse-power is said to have been 492·6, consequently the consumption of steam per horse per hour was, by the indicator, 12·94 lb., and not 12·85 lb. per horse-power per hour as stated by Mr. Longridge, whose mode of calculation is new to us, as it will be to most of our readers. Indeed, a contemporary who has undertaken Mr. Longridge's defence, makes the consumption 11·86 lb., so that perhaps our correspondent will admit that he is mistaken, and that his mode of calculating the quantity of steam per indicator by dealing with the low-pressure cylinder alone, if it has the merit of novelty lacks that of being accurate. The total quantity of feed-water supplied to the boilers being 16·7 lb. per horse-power per hour, if we deduct from this 12·94 we have 3·76 lb. per horse per hour left to meet all and every source of loss by condensation and leakage. Let us consider what were the conditions under which the steam was employed. It was led from the two boilers to the engine by 15ft. of 7in. pipe, 66ft. of 10in. pipe, and 68ft. of 8in. pipe, or in all 149ft. One of the great defects of Mr. Longridge's report is that it does not supply information on many essential points. This steam pipe 149ft. long had, he tells us, 343 square feet of surface, but he does not tell us whether it was clothed or not. He does, however, calculate the condensation which took place in it at the rate of 0·002 lb. of steam condensed per square foot of surface per hour per degree of difference between the temperature of the steam and that of the air. It so happens that this is a coefficient for unclothed pipes. Consequently we assume that the steam was led to the engine through 149ft. of unclothed piping—surely not very conducive to economy. The coefficient, 0·002, holds good only for still air; but the steam pipe at Oak Mills crosses a yard in the open air, and we are told expressly by Mr. Longridge that during the trials there was a high wind which affected the rate of combustion. The engine-house, again, was no doubt full of draughts, and under the circumstances we are disposed to believe that the condensation would be at the rate ascertained by Mr. J. Head for the cooling of an unclothed boiler, the coefficient being ·005 instead of ·002. The temperature of the steam was 318 deg. That of the external air we do not know, but we shall assume it to be that of the injection water, or 63 deg. The difference is 255 deg. and $255 \times 343 \times {\cdot}005 = 437$ lb. of steam condensed per hour. This represents ·88 lb. per horse per hour, which deducted from 3·76, leaves but 2·88 lb. to meet all losses in the engine. If Mr. Longridge fancies that all this water would be caught by the water trap he is quite mistaken. Much would be entrained in the steam; and the result would be that the steam would enter the engine wet; and it is well-known by those who have studied the subject that nothing is so fatal to economy as the use of steam with water suspended in it. Mr. Longridge may, perhaps, write and tell us that the steam pipe was carefully clothed; that it was in still air; that the water trap was carefully arranged to "knock" the water out of the steam, and so on. Such a statement would be a part of the explanation we want. There is no mention of favourable conditions in the report, but the reverse; and all that we have written we have, of course, based on the report, and we repeat that it supplies no reason whatever for assuming that the engine was one of the most economical that has ever been produced—which it is, if Mr. Longridge's statements are correct. When he assumes that the loss by condensation in a cylinder is to be estimated by percentages of steam used, he falls into a somewhat curious error; for he forgets that this loss is, to a large extent, independent of the quantity of steam passing through the engine. Experiments made years ago by Hirn showed that there is a definite quantity of steam condensed per stroke, independently of the pressure of the steam, but not independent of the point of cut-off. Nothing that could be done with an engine of the power stated, and worked with wet steam in unjacketted cylinders, could, we believe, bring down the consumption to 16·7 lb. of water per hour. Engines of very similar construction require as much as 20 lb. of steam per horse-power per hour. Mr. Longridge does not offer the least vestige of explanation why Messrs. Nuttall's engine should prove exceptionally economical. He does not, nor can he, adduce a single case in which, under like conditions, an engine is indicating 492·6-horse power with 137 lb. of feed-water per minute; and if he will turn to the reports of Mr. Lavington Fletcher, on the compound engines which he has indicated, our correspondent will find ample support for our assertions. In Mr. Fletcher's annual report for 1879 on the periodical inspection and indication of engines, he will find that out of 4520-horse power of compound condensing engines, the net consumption of coal was at the rate of 3·66 lb. per horse per hour. The best results recorded were obtained with two horizontal compound tandem engines with all the cylinders jacketted, and indicating 334-horse power with 2·1 lb. of coal per horse per hour. The working pressure in the boilers was 73 lb. The boilers were fitted with Green's economisers, and the coal was good Wigan slack; the one boiler was of the Lancashire type, with ten conical water pipes, and the other multitubular with seven flues 15in. diameter. It is not too much to assume that these boilers, if the economisers send in the feed-water at 212 deg., as they will do if fairly efficient, evaporate at least 9 lb. of water per pound of coal, and the consumption of feed-water would be 18·9 lb. per I.H.P. It is not easy to see why Messrs. Nuttall's boilers should on the 6th of October have done as badly as they did, and if they evaporated on the 6th as much as they did on the 8th, then the consumption of steam per horse per hour must have been nearly 19 lb. per I.H.P. It must be borne in mind that the weight of the report hangs on the evidence of the men attending to the feed-water, and nothing was more easy than to make a mistake under the conditions stated. Each cask held, we are told, 90 gallons; but no evidence is supplied as to how this was ascertained. If the feed to the boiler was at the rate of 137 lb. per minute, then a cask was emptied about every 6·5 minutes, and thus a long record had to be kept during the day. Again, we have the extraordinary statement that when the damper was raised no more coal was burned than when it was down, but that 5760 lb. more water was evaporated. The explanation supplied by Mr. Longridge is not satisfactory. Finally we wish to point out to Mr. Longridge once more that he has put forward certain statements which are opposed to all previous experience. If it be really a fact that Messrs. Nuttall's engine is as economical as Mr. Longridge makes out, then may jackets in future be wholly dispensed with, and thus great expense saved; steam pipes are perhaps better unclothed than clothed; and 504ft. per minute is a better speed of piston than any other; Corliss valves should be fitted to all high-pressure cylinders, and Meyer's slides to low-pressure cylinders. In a word, Messrs. J. Musgrave and Sons, of Bolton, have built for Messrs. Nuttall the most economical condensing land engine ever constructed, and all other engineers at home and abroad will do well to follow their example as closely as possible. Considering all the circumstances, and how much interest attaches to this inquiry, we do not, we think, ask too much when we request Mr. Longridge to give his explanation of the causes which have conduced to the exceptional results he records; and to supply a little further information, especially on the manner in which the feed tub record was kept, and the mode in which their contents were estimated or measured.

Nothing is, of course, further from our intention than even to imply that Mr. Longridge conducted his inquiry in a careless or incompetent manner. He appears, however, to have left a great deal in the hands of subordinates, and it is almost impossible to get rigorous accuracy of observation under such conditions. He must not be offended if we point out once more that the statements he has made are startling, and require that full corroboration which his report certainly does not supply. It would be highly desirable to have another trial, and it does not appear that this would be a matter of any difficulty, as it would only be necessary to take the feed-water, and a sufficient number of diagrams; with the coal consumption we need not concern ourselves. If Messrs. Nuttall and Mr. Longridge would carry out a second trial which confirmed the first, then a very important fact would be established; and a careful investigation of the conditions under which the steam is worked might supply valuable information.

THE BARNSLEY MINERS.

By the voice of the ballot the South Yorkshire miners have declared their leaders' demand of 10 per cent. advance in wages to be uncalled for. At the council meeting of the Miners' Association, at Barnsley, last week, it was decided to take the opinion of the men. The questions upon which the men were asked to vote were, whether they should demand: (1) the 10 per cent.; or (2) 7½ per cent.; or (3) 5 per cent., with the examination of the employers' books; or (4) refer the whole matter to arbitration. Mr. Frith, the miners' secretary, who has been prominent in the movement for the 10 per cent. advance, states that the majority of the men have decided in favour of limiting the demand to 5 per cent. The men express a desire to have the coalowners' books examined, to ascertain whether they are entitled to more than 5 per cent., but it is added "that in the event of the books showing that they are not entitled to five per cent. they will not submit to it." Surely the miners are misrepresented. The word "not" here must have accidentally slipped in. Accepting the decision of the ballot, the Miners' Council have passed a resolution recommending the men to resume work at 5 per cent. advance in case the owners will give it; "any further advance—if there be any—to take place from the date of the accountant's report." This resolution has been communicated to the employers, who state that nothing has occurred to alter the decision they arrived at on two former occasions, and they therefore decline to give any advance whatever, but offer the men the option of returning to work on the old terms, with the sliding scale which would enable them to secure advances in wages as coal rose in value. There are now four pits where the men have received an advance of 10 per cent., three where advances of 7½, and nine were 5 had been given. These men on receiving the advances agreed to submit to the district terms, and the 10 and 7½ per cent. people will now have to come down to 5. The men at Edmunds and Swaithe Main Collieries took down their tools on Monday and resumed work next day. At the Denaby Main Colliery the miners received last Saturday the 5 per cent. advance which they conceded over twelve months ago. Denaby Main and Manvers' Main are both very busy, owing to many of the collieries in South Yorkshire being closed. At Norwood Colliery, Killamarsh, an advance of 2½ per cent. is to be given, to date from the 1st March to the end of April. The Staveley Coal and Iron Company's Springwell, Hollingwood, Ireland, Hartington, Seymour, North Staveley, and Barlborough Collieries, are all to have an increase of 2½ per cent. from the 28th February to the last pay-day in April, when the advance will be discontinued or re-adjusted, according to the state of trade.

LONDON WATER SUPPLY.

It is evident from the report on the water supplied by the London Water Companies during February, made upon analyses by Mr. Crookes, F.R.S., Dr. Odling, F.R.S., M.B., and Dr. C. Meymott Tidy, M.B., that when the water is analysed by the same method by competent men, the results indicate what has been practically shown in daily life for a very long time, namely, that the water as supplied in the mains is of good quality. Everyone will remember the weather of the latter part of last January and the early part of February, and will have reason to know that the conditions were such as to put the river water into the worst possible condition. Yet after treatment at the water companies' works, the water even of such a time was made sufficiently clear and of good potable quality. The report concludes, "We are of opinion that, although many of the samples examined by us, as we have stated, were more or less turbid, from finely suspended clay and sand, nevertheless the water supplied during the past month was wholesome, of good quality, and well oxygenated." The analyses furnished to the metropolitan vestries by Professors Wanklyn and W. J. Cooper, and the report of the Society of Public Analysts for January, all show that the Thames water is a perfectly wholesome water as delivered from the mains, and even Dr. Frankland's inveterate dislike to everything but chalk well water begins to soften as other analysts show that the chief requirement of the people of London is the constant supply system.

THE BERLIN ELECTRIC RAILWAY.

The original electric railways which were tried as experiments at the Berlin and Dusseldorf Exhibitions in 1879 and 1880, were worked by locomotives whose mechanism resembled a fixed dynamo-electrical machine. The rails of the line and the wheels of the locomotive engine were made use of to conduct the current of electricity and produce the necessary motion. The second conductor, conveying the current produced by the stationary machine to the locomotive, was connected with a system of brushes attached to the locomotive. These brushes touched a high-edged rail running in the middle of the two other rails, and insulated from the ground by a longitudinal sleeper. In practice, however, it has been found that this arrangement is exposed to serious interruptions. The wet, snow and mud which, according to the season, collect in the ordinary course of traffic upon the middle rail, interfere very seriously at times with its conductive capacity. It has accordingly been determined on the Berlin Electric Line, to conduct the current by means of a copper wire properly insulated and attached to pillars erected alongside the line, the current being conducted from the copper wire to the locomotive by means of contact rollers. We may add that the gauge of this first electric line is 1 metre. Its length is 2500 metres, or rather more than a mile and a-half.

THE PARIS INTERNATIONAL ELECTRICAL EXHIBITION

We have received a circular from the Commissaire Général, M. G. Berger, of the Paris International Exhibition, in which he specially invites all electricians, telegraph engineers, and others interested in the exhibition to apply to him at the Palais des Champs-Elysées upon any matter connected with the exhibition. He remarks that the British Government, having decided that it sees no necessity for appointing a special commissioner, but that the English Post-office Department has already applied for space for exhibiting articles in the name of the Government, and that the Government of the French Republic desires to welcome all British subjects wishing to participate in the exhibition, all will be placed on the same footing as the French exhibitors, and full particulars and regulations may be obtained from M. Berger. As we have informed our readers in a previous impression, all articles sent to the exhibition will be received there free of duty, and if not retained in France, they will be returned without duty, and will be carried by the railway companies at half the usual rates, or

rather the full rates will be charged to Paris, but articles will be returned free. Labels must be obtained from Paris. The exhibition is to be opened on the 1st of August. The Society of Telegraph Engineers is about to form a committee to organise some arrangement that will meet the requirements of British exhibitors.

BRAKES ON THE LONDON AND NORTH-WESTERN RAILWAY.

THE verdict of the coroner's jury on the death of Mr. Bicknell, which resulted from the accident on the North London Railway on the 26th ult., was to the effect that the deceased had met his death in the collision, which was the result of a mistake in the signalling between Mildmay Park and West Junction, but they had not sufficient evidence to enable them to say where the mistake occurred. Granting that the accident, or rather that which made the collision possible, was due to errors in signalling, there still seems every reason for saying that the conditions were not such as should have been allowed to result in a collision. The evidence plainly showed that the driver of the Kensington train which dashed into the tail of the Watford train had not only time to put on the steam brake fitted on his engine, but to whistle for the guard's brakes, and some evidence went to show that he even reversed his engine, and even then time to jump off his engine and save himself from possible injury or death. He saw the collision inevitable at the least fifty yards before it took place, and the train was only going at from 12 to 16 miles per hour. Besides the steam brake on his engine, the driver had brakes on four carriages, and the guards on four more. The driver is said to have applied these brakes as well as the steam brake; and whether this was done or not, it is sufficiently clear that if the driver of the Kensington train had had a good continuous brakes under his control, the accident might have been almost harmless, or prevented altogether. Even if the distance was only 50 yards, as stated by the stoker, and which was the smallest estimate—the distance being given by the guard of the Watford train as from 60 to 70 yards, and by another witness at 100 yards—then at 12 miles an hour the driver had 150ft., and 17 seconds in which to pull up his train. Any really good continuous brake will, it has been proved over and over again, stop a train going at 30 miles an hour in from 320ft. to 350ft., so that it would have stopped the Kensington train in from 80ft. to 90ft. All the evidence shows that the driver was on the watch at a distance of, at least, 150ft., if he had had only the one little handle of the best continuous brakes to move, he could have thus saved the life of Mr. Bicknell, and thirty people from injuries. While he was whistling for brakes he could have applied them; while he is whistling for guards and pottering about with the "emergency brakes" on his train, the emergency had gone and the worst had come. How long is the London and North-Western Railway Co. to carry passengers at the imminent risk of their lives in insufficiently equipped vehicles, and to its own cost? The expense of the accident will be very heavy and the injuries were numerous, and one death resulted. It is only a week or two since the report on an accident, due to the use of that inefficient emergency brake, was published by the Board of Trade, and but a few weeks ever elapse without showing that a brake that can only be used in an emergency is a brake that can never be used in an emergency. Until the London and North-Western Railway Company can better consider the safety of its customers, the travelling public will do well to secure the safety of their lives by travelling by other lines wherever possible.

LITERATURE.

A System of Practical Arithmetic, adapted for the use of schools, containing the fundamental rules and their application to mercantile, cotton spinning, manufacturing and mechanical calculations. By S. YOUNG. London and Manchester: John Heywood. 1881.

THIS arithmetic is published as a book for use in schools, but there is a very large class of young apprentices in mechanical engineering works whose neglected or badly learned arithmetic makes itself felt as soon as its practical application is wanted. Many young fellows have practically to educate themselves in the application of arithmetic to engineering questions after they leave school if they are apprenticed at an early age; and although few boys are sent into the works at the age of fourteen, which was common when an apprentice was bound to serve seven years, there are nevertheless many boys who find that the applications of their arithmetic which were learned at school help them but little when they get into the works and questions begin to crop up. To these this arithmetic of Mr. Young's will be especially welcome, as the old class of exercises, the absurdity, meaninglessness, and inapplicability of which has annoyed most boys of a practical turn, are replaced by exercises which have their likeness in the most common form of calculations met with in works or offices. As will be gathered from the title, the book is of a practical nature, and it is what it pretends to be. The usual rules of arithmetic up to involution and evolution are followed by the various applications to mercantile pursuits of most branches, and then the application of the rules to mensuration of superficies and solids. The rules and examples in the arithmetic of cotton spinning and its mechanics are very numerous. The strength of beams of wood and cast iron, size of journals of shafts, strength of wheels, falling bodies, hydrostatics, hydraulics, water wheels, specific gravity, centre of gravity, and of percussion, central forces, pumps and steam engines, all form the subjects of rules and examples, and many young engineers will gather from this book much more and more readily than he might from several books of much greater pretensions.

It may be remarked that the order in which the different rules are given is that which has been common for many years, except with Colenso and one other writer. Colenso makes fractions follow the four fundamental rules, instead of following practice and proportion. The latter is the usual order, and it is certainly not the best arrangement, for, as Colenso points out, fractions must be learned before practice or proportion can be worked. Fractions cannot be learned too soon after the four fundamental rules. The rules relating to steam engines also need modification; they apply to low-pressure engines, of which none are now made, the statement that the effective force of the piston is generally calculated at 10 lb. per square inch of its surface is therefore misleading, as are some of the examples in which this constant is used. Mr. Young should submit this steam engine part to an engineer for revision, as he has other parts to an architect and cotton mill machinists. It is also a mistake to give "specific gravity or ounces in a cubic foot," and should be corrected in another edition by giving the specific gravity of solids in the usual terms, water being taken as unity. With some amendments, as here suggested, the book will be found most useful to all beginners in mercantile and mechanical trades.

Worked Elementary Examples in Geometrical Drawing, designed to direct and assist the practice of candidates preparing for examination, with an appendix of exercises. By the Rev. JOHN HUNTER, M.A. Longmans, Green, and Co. 1880.

EDUCATION is drifting towards a state of chaos long since foretold by many who, however, are powerless to prevent the catastrophe. A quarter of a century ago the cry for a liberal education was echoed and re-echoed through the land. A spasm of agitation created the modern system of examination. It may well be asked whether the examination system is an unmixed blessing, whether there is not almost as much to be said against it as for it? Whatever might be the result of a thorough consideration of the subject, there is no doubt in the matter of books examinations have done good and evil. We have specialists writing on their special subjects; we have able men bringing the fundamental scientific laws and discoveries within the grasp of any one possessing moderate abilities and endowed with a fair measure of perseverance. We have on the contrary books admittedly written with the sole object of helping to pass an examination. Such books are no good sign of the times, but rather the contrary. The work before us is one of this kind. The system, and the system alone, is to be blamed for such works. Authors, publishers, and crammers must live, and the two former must supply what the latter requires, or be content to be set aside in the struggle for existence. It is well when such books are compiled by competent men; and although Mr. Hunter has in some of his compilations sunk very far below mediocrity, he has generally been fairly successful whenever his task has been of a mathematical character. These worked examples are no exception. The compiler admits "it is published in the belief that a greater number of worked examples, especially in scale construction, is expedient for the preparation of examination candidates than they will find in any other book on the subject; and that the solutions of problems should be given with demonstrations, which are in many instances wanting in the text books." Our opinion, which may be taken for what it is worth, is that real education requires a thorough understanding of first principles, and when these are grasped the mental exercise obtained in the construction and solving of practical problems is of the greatest value, and that the superabundance of worked-out examples tends to diminish this mental exercise. Examinations impose upon us shams; but, taking the world as it is, we must confess that Mr. Hunter has been judicious in his selection of worked-out problems, and that for the purpose for which the book is intended it will be found useful. "Pity 'tis 'tis so."

THE SOCIETY OF ENGINEERS.

GAS ENGINES.

AT the ordinary meeting of the Society of Engineers, held on Monday last, in the Society's hall, Victoria-street, Westminster, Mr. Charles Horsley, President, in the chair, a paper on the above subject was read by Mr. Charles Gandon.

In his opening remarks the author pointed out that the use of gas as a motive power was still in its infancy—which was not a matter for surprise, seeing that its introduction for lighting purposes dated only from the commencement of the present century. So early as the year 1794 a patent was taken out in England for producing an inflammable vapour force by exploding the spirits of tar or turpentine in closed vessels. Between that date and the year 1860 various other inventions were patented for obtaining motive power by the explosion of various mixtures gaseous and solid; but all the descriptions appeared to be somewhat obscure as to the nature of the explosive compounds to be used, and the means for obtaining them. Carburetted hydrogen, a constituent of coal gas, was mentioned by some; but it appeared that the idea of using coal gas, as manufactured for lighting purposes, for working engines, was first practically applied in the Lenoir gas engine, patented in 1860, and first introduced to this country at the Exhibition of 1862, where it attracted much attention. The general principles of the Lenoir engine were described, and it was pointed out that, among other defects of this engine, was the damage done to the working parts by the sudden and violent nature of the explosions, and also the necessity of the use of electricity for the explosion of the charges of gas and air with which it was worked. The latter objection had, however, now been overcome in more modern engines by the employment of gas jets for the same purpose.

Mr. Gandon then described the Otto and Langen gas engine, the chief improvement in which is, however, due to the compression before ignition of the charges of mixed gas and air, by means of which it is found that a much larger proportion of air can be employed than would form an explosive mixture at ordinary atmospheric pressures, and the force thus obtained is gradual and continuous, instead of sudden, resulting in an economy of gas and more regular working. Advantage has been taken of this discovery in several of the more recently designed gas engines, The general principles of the Otto—which are now well known—were described, and its consumption of gas stated to be at the rate of about 21 cubic feet per horse-power per hour, as compared with from 40 to 70 cubic feet with former engines.

The author then pointed out that, on account of the heat generated by the explosions in gas engines, it was found necessary to surround the cylinders with water, and that advantage had been taken of this in a gas engine called the Eclipse, in which the water, instead of being allowed to escape when heated, was stored in a separate chamber, where it generated steam, which was used, together with the gas, to assist in working the engine. Attention was also drawn to the Bisschop gas engine, which is meritorious chiefly on account of the small sizes in which it is made, and which range from one-half man or one-eighth horse-power upwards. This engine, although not comparatively economical in its consumption of gas, was recommended, on account of its simplicity and small size, as available for purposes to which it would otherwise be impossible to apply mechanical power.

Referring to comparisons which have been made between the cost of working steam and gas engines, the author observed that the practice had generally been to take the total cost of working in each case, including labour, and that, when this was done, the comparisons were invariably in favour of gas engines; but he pointed out that such estimates were liable to be misleading. As a gas engine requires little or no attention, the results of the comparisons depend mainly upon the amount estimated for labour for the steam engine with which the comparison is made. With a small steam engine it would in most cases be unfair to estimate the whole time of one attendant, while, as the size increased, the proportionate cost of attendance would diminish. Instances were given where estimates had been made showing steam engines to be from twice to seven times more expensive in working than gas engines; but although such estimates had doubtless been made with every care, they only served to show that it was impossible to frame such comparisons so as to be generally true. By comparing the costs of the gaseous and solid fuels it was shown that gas must necessarily, both theoretically and practically, be more expensive than solid fuel. When, however, the labour, wear and tear, and first cost were also considered, the conclusion arrived at by the author was, that for engines of small sizes, gas would always be the most economical. Even with larger engines, if the same economy could not always be maintained, circumstances would in many cases render gas engines the most advantageous and convenient, particularly where an engine was required for intermittent use.

THE DE BAY PROPELLER.

CAPTAIN CAWLEY, commander of the Cora Maria, has sent in a report to the Secretary, De Bay's Propeller Company, for the past seven months, during which the ship was under his command, in which he says that "the trial trips at Cardiff in July and August last were quite sufficient evidences of the great superiority of the De Bay propeller over the ordinary screw. This superiority has been more fully exemplified and established by the results of our voyages to the Danube, in the North Sea, from Cardiff to London, and also on the Thames."

"The De Bay propeller has performed all claimed for it, viz., greatly increased speed, entire absence of vibration, perfect handiness of the vessel in crowded anchorages, and in river navigation, but it must be admitted that the old crank gearing was defective in its construction, and proved a serious drawback to the success of the voyage."

"The Coria Maria was, with the ordinary screw, an 8-knot boat when loaded, and when in ballast, about 8½ knots was the extent of her speed. With the De Bay propeller she is a 9 to 9½-knot boat when loaded, and 10 to 11 knots when in ballast."

He feels confident much better results will be obtained on a finer lined vessel, as also a much less disparity in the speeds, loaded and light. The entire absence of vibration is, he says, "a grand feature in connection with the De Bay propeller, and every pilot that has been employed during the voyage, of whatever nationality, has been astonished at the rapidity the vessel answers her helm. In going up the Danube against a 2-knot current, as also in coming down, we were enabled to go full speed the whole way, turning the short curves with the ease of an ordinary tugboat. In the Thames, Mr. Ince, the river pilot, expressed himself as being delighted at the handiness of the vessel."

He has no hesitation in stating "that he has full and implicit confidence in the stability of the steel blades of the De Bay propeller. They have been subjected to the most severe tests; in racing, in fresh headwinds, in ballast, as also in heavy gales of wind whilst laying to, especially in a gale in the North Sea, where, bound to Bremerhaven on the 10th and 11th December last, it was blowing so hard and the sea so high that the pilots were unable to board ship for three days. Anyone that has experienced the short wall-like seas of the German Ocean in a gale of wind must acknowledge the severity of the test. It must also be noticed that the gearing was disconnected—owing to some defects in the connecting rods of the crank gearing—off Cape St. Vincent, and the vessel steamed 7¼ knots an hour to Dartmouth with only one propeller, the other towing loose making 32 revolutions to 70 to 72 on the after propeller; and that the vessel held her own off the mouth of the Weser with the one propeller in a gale of wind that washed everything movable off the decks, flooded our engine-room and stokehole, and smashed our boats. In his opinion the steel blades of the De Bay propeller would stand more strain and more rough usage than the ordinary cast iron screws."

As regards fouling the propeller with ropes from the ship, he has repeatedly tried to get a rope in it at sea without success. "The De Bay propeller is admirably suited for the navigation of the Suez Canal, as from its smaller diameter it is less liable to come in contact with the banks than the ordinary screw—the increased handiness in steering, and the direct action of the propellers tending to bring the vessel in a direct line astern. In addition there is no wash from the propeller on the banks; this was particularly noticed on the Danube even when going at full speed."

The present method of gearing adopted he considers is all that could be wished for, easily disconnected, requiring very little lubrication or attention more than the ordinary shaft bearings in the tunnel, and taking up very little space.

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

(*From our own Correspondent.*)

ALL the stamping and best working-up sheet firms are busy this week. They are experiencing a brisk demand from all the centres, and the iron is wanted with less delay than it is possible for the makers to comply with, though they work at the top of their bent.

In baling strip the business doing has increased upon the week. There are firms who have recently secured orders aggregating two thousand tons. Such orders are in the hands of different firms to those I have before cited as possessing specifications for similar quantities. For strips cut to lengths, but not blacked nor otherwise prepared, a few makers have this week accepted as low a price as a little over £6 10s. per ton at the works.

Certain of such orders are being executed in behalf of the States firms who are themselves at work in this district punching and turning down and blacking the strips, and also attaching to them the requisite buckles. American firms are doing in this particular as they did last year. Some ironmasters hereabouts have also laid down the requisite appliances for completing the strips which they roll. Strips so completed have been bought in the past two days at £7 5s. per ton, but that figure would not be taken yesterday in Wolverhampton nor to-day—Thursday—in Birmingham. Makers assert that at £6 10s. they make no profit; but that £7 5s. for the completed article slightly improved their position.

Marked bars are a trifle more in demand upon the week. For these £7 10s. is demanded and obtained, as well for export as for home use; and £8 2s. 6d.—subject to commission—is rigidly demanded for Round Oak bars. Medium bars were much offered to-day and yesterday at from £6 5s. to £6 10s.; and common bars were plentiful at from £6 down to £6 15s.

Light sections such as tip iron and slit rods were in better request.

There was more movement in tank plates, together with roofing and bridge and girder plates; but excepting in tank plates the aggregate of new business is within makers' expectations. The prices of such iron vary with almost every specification.

Galvanising sheets do not improve in demand; but the leading makers have enough work in hand to keep them well on for a few weeks to come. Prices have strengthened a shade upon the week.

The crude iron market has become duller since my last, and the stocks in the hands of the railway and canal carriers awaiting customer's orders to deliver have grown. There were few sorts of crude iron which were not procurable to-day and yesterday at firms a trifle more in consumers' favour. Pigs, which a few weeks ago could not be bought at less than £2 10s. per ton, could yesterday have been bought readily at £2 5s., and customers did not hesitate to express their belief that they could have bought at 1s. 3d. under

that figure. There were offers by consumers to take Tredegar and similar descriptions of hematite pigs at current rates, with deliveries to extend two months into 1882, but the makers would not consent to the conditions of delivery. Cinder pigs were procurable at £1 17s. 6d.

Coke was stronger and less easy to obtain, at the moment. Yesterday Staveley qualities which were last quoted 15s. per ton were held for 17s. Most other descriptions showed a rise of 1s. to 1s. 6d. per ton. Coal, on the contrary, was easier to buy, as well for manufacturing as for working purposes, and colliery owners sought to sell for forward delivery.

Discussing the paper upon the Employers' Liability Bill, read by the ex-president at the last annual meeting, the members of the South Staffordshire Institute of Mining and Mechanical Engineers at their meeting on Monday, showed how seldom the masters would have been liable had the Act been in force during the past forty years. It was held that the masters were not afraid of the Act, but rather feared that the attempts which would be put forth to make them liable would saddle them with heavy legal expenses. For the miners to have an insurance either with the masters or a company would be better for them than dependence upon the owners of small collieries such as abound in South Staffordshire.

At the meeting of the Birmingham Chamber of Commerce the council reported that at the present time there was reason to believe that the worst of the depression in trade was passed, and further that there was reason to hope for a slow but certain improvement. The conviction, unanimously expressed, was that it would be well if something could be done to make the Chamber really representative of the feelings of the commercial men of Birmingham—a position which it was considered the Chamber did not now occupy, since, judged by the attendance at the meetings, the interest shown in it was comparatively small.

The Council of the Wolverhampton Chamber of Commerce have determined that the excessive railway rates which are charged upon iron and hardwares sent from the midlands to various parts of the kingdom shall be made a subject of complaint to the Select Parliamentary Committee, which has been appointed to consider the whole question of railway freightage rates.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron trade of this district continues in a most inanimate condition, and a rather despondent feeling prevails in the market. Very little hope is now entertained of any material improvement, at least this side of next quarter-day. For the last month or so there has been a gradually lessening number of inquiries in the market, and at the Manchester market on Tuesday there was almost a complete absence of any demand whatever. Not only are consumers in this district, as I have pointed out in previous reports, for the most part so fully covered for their present requirements, that they are under no necessity for giving out further orders for some time to come, but in some cases they are re-selling the iron they have already bought. So far as prices are concerned it is almost impossible to say what sellers would be prepared to take, as there has been really no business doing to actually test the market further than to show that there is a want of firmness all round, and buyers who have orders to give out are evidently holding back as long as possible with the object of bringing down prices to their lowest point.

Lancashire makers of pig iron are getting very few new orders, but they have still a considerable quantity of iron to deliver. Nominally they are still quoting 47s. 6d. for No. 3 foundry, and 46s. 6d. for No. 4 forge less 2½ per cent. delivered into the Manchester district, but they are doing no business whatever at these figures, and if offers were made there is little doubt that Lancashire pig iron could be bought at 46s. for foundry, and 45s. for forge qualities less 2½ per cent.

So far as outside brands of pig iron coming into this district are concerned the prices quoted by makers are purely nominal, ordinary brands of Lincolnshire and Derbyshire iron ranging from 46s. to 47s. 6d. per ton less 2½ per cent., and Middlesbrough iron 46s. 4d. per ton net cash delivered equal to Manchester, but these figures do not represent actual sale prices, and if buyers had orders to give out they could place them at very low rates.

In the finished iron trade there is very little doing. Local forges are for the present tolerably busy completing deliveries on account of contracts which were suspended during the recent stoppage of work, but there are very few new orders coming in. The only transactions I have heard of recently are some large orders for bars for Canada, a portion of which have come into this district; but the home demand is dull, and for hoops, sheets, and plates, there is a less active inquiry. For delivery into the Manchester district the average quotations are about £5 17s. 6d. to £6 for bars; £6 10s. to £7 for hoops; £7 to £7 5s. for common plates; and £7 15s. to £8 per ton for sheets.

The Oatwood blast furnace near Manchester has been damped down in consequence of the present depressed state of trade.

In the coal trade, business is now getting back into its normal condition. Work has now been completely resumed at all the Lancashire collieries, and good supplies of local coal are coming into the market. Large consignments of coal from outside districts are also still coming into the market, which is now overstocked so far as round coals are concerned, and there has been a decided downward tendency in prices during the past week. Engine classes of fuel, however, continue rather scarce, and for these prices are generally stiff. In the present state of the market buyers are operating very cautiously, and except for burgy and slack, there is no pressure for supplies. The average prices now quoted at the pit mouth are 10s. to 10s. 6d. for best Wigan Arley; 7s. 6d. to 8s. 6d. for Pemberton four-feet; 6s. 6d. to 7s. for common round coal; 5s. to 5s. 6d. for burgy, and 3s. 6d. to 4s. 6d. per ton for slack according to quality. It is, however, doubtful whether these prices will be long maintained for the better qualities of round coal, the tendency of the market being to return to much about the same rates as those ruling prior to the strike, but for fuel for manufacturing purposes there is every probability that consumers will have to pay higher rates than those to which they have been accustomed of late.

The shipping trade is very quiet, and coal is again being offered at Liverpool at very low prices.

In previous reports I have referred to the mining operations which for the last six years have been carried on at Ashton Moss, near Manchester, for the purpose of winning the "big mine" lying under that district. During the past week these operations have been brought to a successful termination, and the coal has been reached at a depth of 900 yards, which is the deepest shaft yet sunk in England. The seam of coal is 6ft. thick, and is a continuation of the seams which are at present being worked on the east side of Manchester. A boring has been carried to a further depth of 150 yards, which has proved several other workable seams of coal lying underneath the big seam. The work has been carried out under the supervision of Mr. J. Higson, mining engineer, of Manchester. The mine is being developed by a comprny consisting of Lord Stamford and Messrs. Walker, Whitworth, Greenwood, and Wylie, and the coal-field that can be worked by the company is about 2000 acres in extent.

Barrow.—A very quiet tone is observable in the hematite pig iron trade this week, and buyers are not disposed to make heavy purchases. Although large sales have been effected it is observable that the demand is not maintained as it was expected it would have been. Hematites are selling at from 63s. to 65s. per ton, but it is chiefly second-hand parcels which have been disposed of at these figures. I hear on good authority that, although trade is now dull, the works throughout the district are likely to remain fully employed, as orders are likely to come to hand from America, the Continent, and elsewhere, in addition to those which may reasonably be expected from home consumers. Steel makers are very fully employed. Shipbuilders have, generally speaking, enormous order sheets, and it is evident they will have an active time of it for a considerable period. Finished iron workers are indifferently employed. The other industries in the district have a fair amount of work in hand.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

At the Atlas Works—Messrs. John Brown and Co., Limited—there are signs of additional briskness. Twelve puddling furnaces were reopened on Monday. These will give employment to fifty more men. The furnaces have been idle since last Easter, and the iron turned out will mainly be used in the production of the "Ellis" composite armour-plates. The company have now their colliers at work again—the men, after four weeks' self-imposed idleness, resuming employment on the terms against which they struck.

The trade in steel blooms from Sheffield to the United States has fallen off, and appears to have been taken up by Germany. German manufacturers are now sending large quantities to the States.

A few facts came to my knowledge the other day regarding the utility of the telephone to our local trading concerns, and more particularly to those engaged in the iron and steel branches. During the week ending last Saturday the Sheffield Telephone Exchange Company dealt with no fewer than 3702 messages. A year ago the number was only 171, the increase for this year being thus 3541. The iron and steel trades furnish about two-thirds of the subscribers, and their average number of messages are nearly three times those of the remaining one-third of the subscribers who represent mixed interests. 66 of the subscribers show an aggregate of 3194, or 48·3 messages per subscriber for the week; the remaining 33 subscribers show an aggregate of 608, or 18·4 messages per subscriber.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The Cleveland ironmasters' monthly returns for February were issued on Thursday, the 3rd inst. The number of furnaces in blast is 120, or seventeen more than in the corresponding month of 1880. The make of pig iron was 205,951 tons, being a decrease on the production of the previous month of 15,112 tons. The net increase of stocks is 21,753 tons, which is less than was anticipated by many, but at the same time sufficient to prevent any tendency to elation on the part of sellers. At the market held at Middlesbrough on Tuesday, the tone might have been described as steady, with a tendency to firmness. This feature was in consequence of the announcement that the Glasgow market had risen slightly owing to a change for the better in weather, and in political news No. 3 g.m.b., changed hands at 38s. and 38s. 3d. for prompt delivery, and No. 4 forge at 37s. For delivery over the second quarter an additional ninepence per ton was required. Warrants were still 1s. 6d. per ton dearer than the above quotations. Notwithstanding the steady increase in stocks, the contents of Connal's store have been increased by 3665 tons during the week, the total accumulation being now 152,822 tons at Middlesbrough, and 528,659 at Glasgow. Shipments from the 1st to the 5th inst. inclusive have amounted to 13,800 tons, or an average of 2760 tons per working day. This is an increased rate, but not to the extent that might have been expected for the time of year. A cargo of hematite and one of Cleveland iron have been shipped to the United States, but the ship Lamperts containing the latter fell in with bad weather after leaving the Tees and was forced to enter the Tyne with cargo shifted and other damage, besides personal injury to the captain.

Manufactured iron is nominally the same in price as the previous week but really very little business was done. Shipbuilders have again been laid off by bad weather, and so far have been unable to work up the stocks of material accumulated at their yards. Under these circumstancs they will not buy at any price, and specifications against old contracts are given out only tardily and reluctantly. What is really needed to cure the present rather depressed state of things is simply a month of continued fine weather. Nothing else will accomplish the object. It is not a question of price. At no price will consumers order material which at the moment they would rather be without. They must be simply let alone to clear off accumulations, and make room for fresh arrivals. Plates are quoted at £6 10s., and bars and angles at £5 10s., f.o.t. Middlesbrough, less 2½ for cash. Consumers have an abundance of work in hand and still more in view, and the demand for manufactured iron is likely strongly to revive later on in the season, but time is needed. The plate shearers' difficulty is not quite settled yet. At two or three of the Stockton works they have been lying idle so far this week. It has been found that under the new system the helpers are getting far too much and the contractors too little. Consequently the former are continually idling and drinking, and the latter are discontented. From all appearances the question is not likely to be allowed to rest as at present, and a series of strikes may be expected. The opinion has, indeed, been freely expressed, that before the ironworkers as a body can be made to understand, or at all events to adapt themselves to the present necessities of the trade, a general stoppage of a week or two will be necessary.

Following quickly upon the three failures in the iron trade of the western coast recently reported comes now another one in the Cleveland district. The secretary of the Darlington Iron Company, Limited, has issued to his shareholders a circular announcing that owing to heavy losses incurred last year, and the non-success of an attempt to raise £75,000 on debenture stock, payment had been suspended. A petition for winding up has been presented, and a meeting of creditors will be called at an early date. It has since been announced that the Master of the Rolls has appointed Mr. E. Waterhouse provisional liquidator, with power to pay wages and carry out contracts. The Darlington Iron Company, Limited, purchased its works in 1872 from Mr. Wm. Barnigham for £275,000. Its capital was £350,000, and over 30 per cent. was actually paid out of profits. The almost complete cessation of the demand for iron rails was a great blow to the company, which, however, endeavoured to retrieve its position by putting down a steel plant—Messrs. Bolckow, Vaughan, and Co.'s Gorton plant—capable of producing 600 to 700 tons of steel per week. It was intended eventually to work the basic process, and an arrangement was actually made with Messrs. Thomas and Gilchrist for the use of their patents. In the meantime, however, the ordinary or acid Bessemer process was temporarily adopted. The fall in the price of steel, as well as of iron rails, and the failure of certain customers, chiefly in America, to carry out their contracts, had disastrous effects upon the company, and finally it has been compelled to call its creditors together. It is hoped that some scheme of reconstruction will be adopted to prevent the necessity for stopping operations.

Immediately following the failure of the Darlington Iron Company, another similar announcement was made, which, though in a locality far removed from Cleveland, is still likely to have an effect upon it. The firm in question is that of Oswald, Mordaunt, and Co., iron shipbuilders, of Woolston, near Southampton.

Mr. Swan, by a second lecture, has succeeded in re-establishing the reputation of his lamp with the members of the Cleveland Institution, and it will be surprising if it is not largely adopted in North Yorkshire before long.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The tone of the iron market has on the whole been not quite so dull as in the preceding week; but, on the other hand, there is no decided improvement in the demand to report. Failures that were announced towards the close of last week had an unsettling tendency, and to these might be partially attributed the lifeless condition of business, although the chief cause was no doubt greater anxiety to sell than to buy. But the slight improvement visible on some days this week would be misunderstood if it were accepted as an indication of a revived inquiry for consumption. It is due solely to operations of a speculative kind, and unless outsiders should be attracted to purchase in considerable numbers by such apparent turns in prices, nothing can avert a further decline. The severe weather here and abroad has acted most unfavourably upon the course of business, and a change for the better would probably soon exercise a good effect upon the trade. Orders from America and the Continent are still very scarce, but makers steadily maintain the production of pig iron at its former limits. There are 120 furnaces in blast, as compared with 114 at the same date last year, seven of the number being employed in the manufacture of hematite. In the course of the past week 2219 tons of pig iron were added to the stock in Messrs. Connal and Co.'s store, which now amounts to 529,111 tons. The week's exports of pigs were 9902 tons, as against 11,266 in the preceding week, and 17,932 in the corresponding week of last year; while the arrivals of Cleveland iron are 6395 tons, as compared with 5983 last week, and 3400 tons in the same week of 1880.

Business was done in the warrant market on Friday forenoon at from 49s. to 48s. 7½d. cash, and 49s. 1½d. to 49s. one month; the afternoon quotations being 48s. 7d. to 48s. 9½d. cash, and 48s. 9d. to 48s. 11d. one month. On Monday, transactions were effected in the morning at 48s. 6d. to 48s. 8d. cash; and in the afternoon at 48s. 6d. to 48s. 8½d. cash. The market was steady on Tuesday with business at 49s. 5d. to 49s. 7d. cash. There was a fair business on Wednesday, but prices were not quite so firm. To-day—Thursday—business was done at 49s. 1d. to 48s. 10½d., improving to 49s. 2d.

The following quotations of makers' iron are 6d. to 1s. below those of last week:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 59s.; No. 3, 51s.; Coltness, 59s. and 51s. 6d.; Langloan, Summerlee, and Calder, 59s. and 51s. each; Carnbroe, 56s. and 50s. 6d.; Clyde, 50s. 6d. and 48s 6d.; Monkland, ditto, ditto; Quarter, ditto, ditto; Govan, at Broomielaw, 50s. 6d. and 48s. 6d.; Shotts, at Leith, 60s. and 52s. 6d.; Carron, at Grangemouth, 52s. 6d. (specially selected, 56s.), and 51s. 6d.; Kinneil, at Bo'ness, 50s. and 48s. 6d.; Glengarnock, at Ardrossan, 56s. and 51s. 6d.; Eglington and Dalmellington, 50s. and 48s.

Comparatively speaking, the malleable trade is quiet. Common bars are quoted at £6 5s. to £6 10s.; angles, £6 5s. to £7; ship plates, £7 10s. to £8; boiler ditto, £8 to £9; nail rods, £6 5s. to £6 10s.; rails, £8 to £9; railway chairs, £4 to £4 10s.; pipes, £5 to £6.

The shipping trade in coals has not been so good this week, there being only a small quantity shipped abroad, and the coastwise shipments are 6289 tons below those of the previous week. Prices are somewhat easier. In the eastern mining counties there has been a good inquiry for home consumption, but owing to the unfavourable weather, the spring shipping trade has as yet hardly commenced, and exports are small. The Executive Board of the Fife and Clackmannan Miners' Association met at Dunfermline, on Saturday, when Mr. Weir, the secretary, reported that he had communicated with the various districts as to what should be done to secure an advance of wages, and the general opinion seemed to be that no action should be taken till it was seen whether or not there was any improvement in the spring shipping trade.

The shipping trade of the Clyde has been large during the past month, the imports exceeding by upwards of 6000 tons and the exports by 10,000 tons those of the corresponding month of last year. These figures apply to the foreign trade only, and were the coasting traffic added the result would be still more favourable.

The Marquis of Bute has arranged to introduce, at a cost of £1000, a supply of water to the village of Kilchatton Bay in the Isle of Bute, a favourite resort of visitors in the summer months.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

The leading subject of interest lately has been the discussion of Morgan's experiments for preventing explosions in coal pits. He has obtained a patent, and has since given some interesting experiments. Briefly, his plan may be stated thus. An electric battery at every pit; wires communicating with all the underground places; constant action of the battery, so that sparks are incessantly given off which fire the gas as it exudes, and thus prevents any accumulation. Even in the case of a blower issuing at great force, this blower would be at once resolved into a gas jet and be confined to its orifice, not gather in a dense cloud as it does and sweep destructively through a mine. In its elementary state the plan seems hopeful.

There is no falling off in the prosperous run of the Welsh coal trade, though Cardiff exports last week were under 100,000. The coal total sent from all Wales did not exceed 135,000 tons last week owing to the boisterous weather, which told with especial severity on the Swansea totals. The docks at this place are progressing. Official intimation has now been given that the Prince of Wales will honour the opening by his presence. It is expected that the *fête* will have partly a masonic character, and be attended by the craft from all parts of the principality.

It was intended that the plant of the Bwllfa should be dispersed this week by public auction, but the sale has been stopped by injunction. Good work has been done at this colliery of late, and a fine area opened out, so that a much larger quantity of coal could be turned out than has been.

Good work characterises the colliery operations in most of the valleys, and coal owners have plenty of orders before them; some, in fact, are so committed that it impossible to get a quotation. Prices are stiff, and there is more likelihood of an advance than a retrogressive step; 8s. 3d. at pit is easily obtainable for best varieties, and the 9ft. and 6ft. are in good demand.

The sister industry to that of coal—the Welsh iron trade—continues as promising as ever, and all the furnaces and mills are in steady operation from Blaenavon to Swansea. Steel rails are in good demand; iron rails not quite so brisk, though some varieties—the Cyfarthfa, for instance—are much asked for. Bars are quoted at £5 5s.

Tin-plate is still stagnant, and in addition to twenty mills stopped last week and preceding weeks, the Foxhole Works, Llansamlet, are to be closed at the expiration of a month. The Morlais Works, Llangennech, have also given the same notice. Tin-plate manufacturers with whom I have conversed yet express some hope. They say that, though prices are even under 15s. for ordinary coke plate, and the price of tin bar and tin higher than during former depressions, yet the very fact that so many works are stopped insures better prospects to those who may contrive to live out the depression.

The sliding scale committee met this week at Cardiff, when they received and discussed the accountant's report of the prices of coal which were obtained by coalowners in the four months ending December 31. What these were did not transpire, and it was decided should not be made public until next week. The colliers are wanting to receive this, and as soon as known, a meeting is to be called of the representatives, when this and other matters will be discussed. Amongst them I am glad to note the Miner's Permanent Fund. If anything could strengthen the overwhelming argument brought forward in support of this measure, it would be the utter failure of the Penygraig Relief Committee to realise anything like sufficient funds to meet the necessities of the case. After strenuous efforts, about £5000 have been collected. It may be as well to cite in contrast the Gethin Fund. The loss of life at Gethin, February, 1862, was forty-nine; collection in relief, £7528! It is evident from this that the public regard the constant appeals to them with increased indifference.

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.

1st March, 1881.

855. RAILWAY SIGNALS, J. C. Brush, Dublin.
856. TEXTILE FABRICS, W. Mather, Manchester.
857. WATCH CASES, H. G. Grant.—(*G. F. Mertz, Russia.*)
858. DREDGED MATERIALS, F. A. Bishop, San Francisco.
859. ERECTING APPARATUS, J. W. Fletcher, Stockport.
860. CLEANING KNIVES, L. Appleton, London.
861. HANGING DOORS, &c., W. Morgan-Brown.—(*E. Prescott, Hampton Falls, U.S.*)
862. CORKS, A. Clark.—(*R. Robinson, Brooklyn, U.S.*)
863. CALCULATING INSTRUMENT, J. Fearnley, Castleford.
864. FIRE-ALARMS, C. Spratt, Peckham.
865. SAFETY LAMPS, W. P. Thompson.—(*C. Heinzerling and V. Hammeran, Germany.*)
866. STEAM BOILERS, T Moy, London.
867. AIR ENGINES, F. H. Wenham, London.
868. VEGETABLE PRODUCTS, H. Guiliani, London.
869. LIFTS, &c., D. Edwards, Cardiff.
870. WOOD, H. Newton.—(*Challiot and Gratiot, Paris.*)
871. ROWLOCKS, S. S. Hazeland, Cornwall.
872. STEAM, &c., ENGINES, W. Green, Birmingham.
873. CLEANING APPARATUS, T. H. Morgan, Swansea.
874. COMPRESSING FUEL, H. J. Haddan.—(*E. Geisenberger and E. Picard, Brussels.*)
875. TREATING CONCRETE, H. Faija, London.
876. CLEANING MILLS, W. Lake.—(*J. Hoyt, Lynn, U.S.*)
877. GAS-LIGHT APPARATUS, W. R. Lake.—(*J. M. Foster, Philadelphia, U.S.*)
878. WOOL, W. and H. Smith, and S. Stell, Keighley.
879. SIGNALLING, A. Shipley, London.
880. HARVESTING MACHINES, H. Andrews, Wiltshire.
881. MOULDING APPARATUS, W. A. Ingalls, London.
882. CHAINS, &c., W. A. Ingalls, London.
883. CAST STEEL, &c., C. W. Siemens, London.

2nd March, 1881.

884. GOVERNORS, J. Tongue.—(*W. Würdemann, Dresden.*)
885. NAME-PLATES, J. Edwards, London.
886. LOCOMOTIVE CARS, F. E. B. Beaumont, London.
887. JOURNALS, J. Imray.—(*R. Jones, Braddocks, U.S.*)
888. DRYING APPARATUS, J. Smith, Thornliebank.
889. CUTTING APPARATUS, F. W. Paschen, Manchester.—(*H. Waner, Leipzig.*)
890. AIR PUMP BUCKETS, J. Musgrave, Bolton.
891. WHEELS, T. Humber, T. R. Marriott, and F. Cooper, Beeston.
892. ECRASEURS, J. Arnold, London.
893. SIZING MACHINES, T. Singleton, Over Darwen.
894. ELECTRIC LAMPS, J. J. Sachs, Sunbury.
895. LOOMS, H. A. Dufrené.—(*J. Bicking, France.*)
896. REFINING CAMPHOR, W. H. Atkinson, London.
897. SAFETY GUARDS, A. M. Clark.—(*F. Folacci, Paris.*)
898. PUMPS, W. Wright, Plymouth.
899. VALVES, W. Wright, Plymouth.
900. LUBRICATING AXLES, W. James, Abercarn.
901. FILTER PRESSES, H. Newton.—(*A. Dehne, Germany.*)
902. VEHICLES, C. Gülich, Berlin.
903. TANNIC BLACK, W. Gard & T. Cobley, Dunstable.
904. LOOMS, J. Hollingworth, Dobcross.
905. MOTIVE POWER ENGINES, C. T. Wordsworth, Leeds.

3rd March, 1881.

906. STOVES, G. L. Shorland, Manchester.
907. RESERVOIR PENHOLDERS, J. Jackson, London.
908. FINISHING ROLLING MILL, L. A. Groth.—(*E. von Zweigbergk, Smedjebacken, Sweden.*)
909. MUSICAL INSTRUMENTS, H. J. Haddan.—(*W. F. Abbott, Montreal.*)
910. METALLIC PENS, M. Turnor, Birmingham.
911. VELOCIPEDES, J. and C. E. Challis, Homerton.
912. WINDOW SASHES, R. Adams, London.
913. TWISTING WIRE, W. Glover & G. James, Manchester.
914. MINERAL WATERS, &c., W. Whaley, London.
915. BOXES, &c., A. W. Rooke, London.
916. STEAM ENGINES, G. W. Handley, Tunbridge Wells.
917. MOVIVE POWER, H. Newton.—(*L. Genoud, Paris.*)
918. SIGNALS, E. Tyer, London.
919. ROTARY MOTION, E. Edmonds.—(*F. B. Nichols and C. Thomson, Halifax, Nova Scotia.*]
920. PRESSING MACHINES, F. F. M. Pollock, Newtown.
921. SHAVING, &c., LEATHER, A. M. Clark.—(*La Société Anonyme des Brevets Réunis, Paris.*)
922. GALVANISING IRON, J. Elmore, London.
923. HEATING APPARATUS, G. C. Gibbs, London.

4th March, 1881.

924. PILLARS, &c., H. J. Harrison, Liverpool.
925. TELEPHONE TRANSMITTERS, C. Mosely, Manchester.
926. DECORATING BRICKS, &c., G. and A. Maw, Broseley.
927. LAMPS, T. R. Dix, High Wycombe.
928. BALL VALVES, A. E. Lucas, London.
929. VELOCIPEDES, J. Hopwood, Heaton Norris.
930. PREPARING SHIPS, A. C. Kirk, Glasgow, and R. Sim, London.
931. SPINNING, &c., W. Trafford, Leek.
932. LOOMS, T. Hanson, Bradford.
933. CUTTING, &c., LETTERS F. W. Ventris, Manchester.
934. CORE, &c., METALS, T. Hyatt, London.
935. TRAM RAILS, E. Thompson and S. Tomkins, London.
936. UMBRELLA BOXES, J. B. Seel, Daveyhulme.
937. HOLDING BREAD, &c., G. S. Miller, Red Hill.
938. COLOURING MATTERS, C. D. Abel.—(*Bindschedler and Busch, Switzerland.*)
939. COLOURING MATTERS, C. D. Abel.—(*Bindschedler and Busche, Switzerland.*)
940. REED ORGANS, W. Lake.—(*J. Morgan, Brooklyn.*)
941. TICKETS, M. Bebro, Kilburn, London.

5th March, 1881.

942. FIG POWDER, F. Pool, London.
943. ROASTING COFFEE, &c., H. Faulder, Stockport.
944. SNAPS, A. and E. Downing, Birmingham.
945. PIANOS, J. Imray.—(*L. Thibouville-Lamy, Paris.*)
946. PRINTING, J. Imray.—(*F. Champenois and E. Missier, Paris.*)
947. LOOMS, F. O. Tucker, Huddersfield.
948. CHOPPING, &c., MEAT, W. A. Barlow.—(*Wilhelm v. Krause, Germany.*)
949. LIFTING CARRIAGES, P. Bell, Great Ryburgh.
950. INDICATORS. F. J. Hoster, Manchester.
951. FASTENINGS, J. M. Banks, Birmingham.
252. PUMPS, D. McLachlan, Glasgow.
953. BRAKES, E. G. Brewer.—(*P. Prat, Paris.*)
954. PAVING, J. Taylor, London.
955. INDICATING INSTRUMENT, L. Boye, Dresden, and E. Müller, Chrimmitschan, Saxony.
956. MATCH-BOXES, W. P. and C. E. Cherry, Yorkshire.
957. CUSHIONS, S. Newington, Ridgeway.
958. FURNACES, W. R. Lake.—(*P. A. Fauler, Germany.*)

7th March, 1881.

959. KNITTED, &c., FABRICS, E. Whitehall, Nottingham.
960. MINING LAMPS, J. R. Jones, Treherbert.
961. METALLIC BEDSTEADS, C. S. Wood, Birmingham.
962. SIGNALLING, H. Haddan.—(*H. Ventzke, Berlin.*)
963. COPYING INK, H. Haddan.—(*L. Grünwald, Budapest.*)
964. CHLORINE, W. Weldon, Burstow.
965. CHLORINE, W. Weldon, Burstow.
966. CHLORINE, W. Weldon, Burstow.
967. HYDROCHLORIC ACID, W. Weldon, Burstow.
968. CHLORINE, W. Weldon, Burstow.
969. GRATES, R. Crane, London.
970. SAFETY LAMP, F. Foster and H. Fleuss, London.
971. PACKING CASES, D. Grey, Maesteg.
972. TRICYCLES, C. G. Hawkins, Essex.
973. EYE SHADE, G. W. von Nawrocki.—(*C. von Cohausen, Germany.*)
974. GAS BRACKETS, F. W. Thorn, London.
975. ORDNANCE, J. Johnson.—(*N. Clark, Philadelphia.*)
976. SECURING HOSE, W. Lake.—(*J. Hubbell, Boston, and F. T. Raymond, Newton, U.S.*)

Inventions Protected for Six Months on deposit of Complete Specifications.

842. HYDROCARBON FURNACES, H. J. Haddan, Strand, London.—A communication from B. Sloper and W. M. Jackson, Washington, U.S.—28*th February*, 1881.
858. TREATING DREDGED MATERIAL, F. A. Bishop, San Francisco, U.S.—1*st March*, 1881.
876. CLEANING BOTTLES, W. R. Lake, Southampton-buildings, London.—A communication from J. M. Hoyt, Lynn, U.S.—1*st March*, 1881.
901. FILTER PRESSES, H. E. Newton, Chancery-lane, London.—A communication from A. L. G. Dehne, Germany.—2*nd March*, 1881.
909. MUSICAL INSTRUMENTS, H. J. Haddan, Strand, London.—A communication from W. F. Abbot, Montreal.—3*rd March*, 1881.

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

840. DOORS, &c., J. Gresty and J. Mills, Salford—1*st March*, 1878.
831. SCREW PROPELLERS, W. G. Wrench, Glasgow.—1*st March*, 1878.
873. FLYERS, T. Unsworth, Manchester.—4*th March*, 1878.
878. CELLULOID, W. R. Lake, Southampton-buildings, London.—4*th March*, 1878.
843. WOOD DESIGNS, A. M. Clark, Chancery-lane, London.—1*st March*, 1878.
866. RAILWAY SLEEPERS, H. L. Bucknall, Chepstow-place, Bayswater, London.—4*th March*, 1878.
1040. AXLES, A. M. Clark, Chancery-lane, London.—15*th March*, 1878.
893. WEAVING, M. Pearson, Foleshill.—5*th March*, 1878.
903. HYDRAULIC HOSE, S. W. Baker, Providence, U.S.—5*th March*, 1878.
909. CLEANING APPARATUS, E. Cutlan, Crouch-hill, London.—6*th March*, 1878.
1022. ROOFING, T. Shelley, Swansea.—14*th March*, 1878.
1115. ENAMELLED IRON WARE, W. R. Lake, Southampton-buildings, London.—20*th March*, 1878.
1136. SULPHATE of AMMONIA, W. L. Wise, Chandos-chambers, Adelphi, London.—21*st March*, 1878.
877. RAISING, &c., CHAIN CABLES, E. Walker, Leaden-hall-street, London.—4*th March*, 1878.
896. CONCENTRATING SHOT, E. Lancaster, Stony Stratford.—5*th March*, 1878.
905. TREATING WOOL, W. Brookes, Chancery-lane, London.—6*th March*, 1878.
939. OBTAINING MOTIVE POWER from LIQUIDS, T. B. Heathorn, Wilton-place, London.—8*th March*, 1878.
946. CONTINUOUS BRAKES, T. G. Clayton, Derby.—8*th March*, 1878.
1004. BREECH-LOADING SMALL-ARMS, J. Deeley, Birmingham.—13*th March*, 1878.
1023. MOULDS, J. Whitehouse, Birmingham.—14*th March*, 1878.
1172. MOTORS, H. G. Frasi, Cloudesley-road, Islington, London.—25*th March*, 1878,
932. LEATHER, J. S. and B. Stocks, Leeds.—7*th March*, 1878.
955. SULPHUR, G. W. von Nawrocki, Leipziger-strasse, Berlin.—9*th March*, 1878.
1052. TOOLS, J. and G. H. Wakefield, Birmingham.—16*th March*, 1878.

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

743. BRICK-MAKING, &c., J. D. Pinfold, Rugby.—28*th February*, 1874.
802. ALCOHOLIC LIQUIDS, E. W. Phibbs, Coleman-street, London.—4*th March*, 1874.
794. METALLIC PACKINGS, E. Wigzell, J. Pollit, and W. Mellor, Sowerby Bridge.—4*th March*, 1874.
811. SELF-ACTING MULES, J. Clegg, Oldham.—5*th March*, 1874.
828. CLEANING FLUES of STEAM BOILERS, R. Sutcliffe, Castle Mills, Leeds.—6*th March*, 1874.
783. LIGHTING BUILDINGS, T. Hyatt, Gloucester-gardens, Hyde Park, London.—4*th March*, 1874.
1012. HYDROCARBON OILS, &c., W. H. Chesebrough, Upper Berkeley-street, London.—23*rd March*, 1874.
934. PURIFYING GAS, F. C. Hills, Deptford, Kent.—14*th March*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 25*th March*, 1881.

4373. STEERING APPARATUS, J. N. Holliday, Sunderland.—26*th October*, 1880.
4385. FILTER-PRESS, C. Dickenson and J. W. Robson, Hop Exchange.—27*th October*, 1880.
4398. GAS MOTOR ENGINES, J. C. Rhodes, Revoe, Blackpool, and W. Goodbrand and T. E. Holland, Manchester.—28*th October*, 1880.
4402. CONSOLIDATING EXTRACT of MALT, C. Morfit, Southampton-buildings, London.—28*th October*, 1880.
4418. SAVING LIFE at SEA, W. Balch, Greenwich.—29*th October*, 1880.
4421. PRIME MOVERS, G. Wilkinson, Manchester.—29*th October*, 1880.
4439. STRINGS of VIOLINS, R. Holliday, Crewe.—Partly a com. from V. Campiglia.—30*th October*, 1880.
4450. DEPILATING SKINS, V. Lesage, Paris.—Com. from E. Chesnay.—1*st November*, 1880.
4458. METAL WHEELS, &c., R. R. Gubbins, Park-road, New Cross.—1*st November*, 1880.
4461. STEAM, &c., ENGINES, A. M. Clark, Chancery-lane, London.—A communication from A. Johnson.—1*st November*, 1880.
4465. HAND TRUCK, W. Cole, St. Dunstan's-buildings, London.—Com. from S. Sprague.—2*nd November*, 1880.
4466. CLEANING, &c., TEXTILE FABRICS, G. Macaulay-Cruikshank, Buchanan-street, Glasgow.—Com. from V. Cauzique.—2*nd November*, 1880.
4469. PREPARING, &c., FLOWERS, E. C. H. Krueger, Glasgow.—2*nd November*, 1880.
4486. BOOTS, &c., J. Sharp and S. Austin, Bradford.—3*rd November*, 1880.
4525. EMBROIDERING, &c., A. Heaven, Manchester.—4*th November*, 1880.
4602. PRINTING FABRICS, J. Kerr and J. Haworth, Church.—9*th November*, 1880.
4732. FORCING SAUSAGE MEAT, &c., T. Williams, jun., Gee-street, Goswell-road, and W. Sangster, Compton-buildings, London.—17*th November*, 1880.
4798. ROLLING, &c., WIRE, R. A. Hill, Sheffield, and H. B. Barlow, Manchester.—20*th November*, 1880.
4883. KEYHOLES, H. C. Roberts, St. James's-square, London.—24*th November*, 1880.
5234. BEAMING MACHINES, J. C. Sewell, E. Hulton, and J. Bethel, Manchester.—14*th December*, 1880.
386. STARCH, &c., W. R. Lake, Southampton-buildings, London.—A communication from T. A. and W. T. Jebb.—28*th January*, 1881.
426. STEEL, &c., A. J. Boult, High Holborn, London.—Com. from J. Conant.—1*st February*, 1881.
472. PAPER MAKING, J. Collins, Milton Paper Mills, Bowling.—4*th February*, 1881.
476. PREVENTING COLLISIONS, W. L. Wise, Whitehall-place, London.—A communication from Messrs. Ronfaut and Gaye.—4*th February*, 1881.
486. GASSING YARNS, &c., J. M. Cryer, Bolton.—4*th February*, 1881.
535. GAS CONDENSERS, F. Morris, Brentford, and S. Cutler, Millwall, London.—8*th February*, 1881.
542. TELEPHONIC APPARATUS, J. Sax, Great Russell-street, London.—8*th February*, 1881.
568. FIRE-BARS, A. Murfet, Nottingham.—10*th February*, 1881.
634. READING, &c., JACQUARD CARDS, B. Toone, Nottingham.—15*th February*, 1881.
668. BICYCLES, H. J. Swindley, Kensington, London.—16*th February*, 1881.

Last day for filing opposition, 29*th March*, 1881.

4419. GAS ENGINES, M. Benson, Chancery-lane, London.—Com. from A. K. Rider.—29*th October*, 1880.
4471. PRINTING MACHINES, T. W. Woodhouse, Red Lion-square, London.—2*nd November*, 1880.
4474. TOOTHED WHEELS, J. A. Vickers and E. B. Burr, Upper Thames-street, London.—2*nd November*, 1880.
4483. SAFETY VALVES, &c., S. Hallam, Manchester.—3*rd November*, 1880.
4484. SIGNAL BALL, J. H. Shoebotham, Birmingham.—3*rd November*, 1880.
4493. PLANING MACHINES, H. Olrick, Leadenhall-street, London.—Com. from J. H. Greenwood.—3*rd November*, 1880.
4512. GRINDING DYEWOODS, T. J. Pickles, S. Smithson, and C. H. Pickles, Ravensthorpe.—4*th November*, 1880.
4513. LEATHER, O. Wolff, Schloss-strasse, Dresden.—Com. from G. L. Lippold.—4*th November*, 1880.
4518. DISINFECTING CLOSET-PANS, H. Seward, Queen Victoria-street, London.—4*th November*, 1880.
4520. AMMONIACAL LIQUOR, J. S. Stevenson, Dublin.—4*th November*, 1880.
4523. FIRE-ARMS, T. Nordenfelt, St. Swithin's-lane, London.—Com. from H. Palmcrantz.—4*th November*, 1880.
4527. FUSING IRON ORES, R. Lancaster and E. S. Samuell, Liverpool.—4*th November*, 1880.
4530. STEERING SHIPS, &c., A. Porecky, Leconfield-road, London.—5*th November*, 1880.
4531. STEAM HOISTS, T. Archer, jun., Gateshead.—5*th November*, 1880.
4534. CHAMFERING LEATHER BELTING, J. M. J. Fecken, Aix-la-Chapelle, Germany.—5*th November*, 1880.
4539. TARGETS, R. Neilson, King's Cross-road, London.—5*th November*, 1880.
4545. PIPE COUPLINGS, &c., W. Stainton, Liverpool-street, London.—6*th November*, 1880.
4548. SEPARATING IRON, &c., D. MacEachron, Greenock.—6*th November*, 1880.
4554. SHIPS' VENTILATORS, J. W. Shepherd, Tufnell Park-terrace, and G. Lines, Cloudesly-road, Islington, London.—6*th November*, 1880.
4559. LUBRICATING AXLES, W. S. Laycock, Sheffield.—6*th November*, 1880.
4583. VACUUM BRAKE APPARATUS, J. Gresham, Salford.—9*th November*, 1880.
4600. CUT PILE FABRICS, R. Atherton, Bradford.—9*th November*, 1880.
4640. REGULATING, &c., FLUIDS, H. J. Haddan, Strand, London.—Com. from F. de Paula Isaura y Fargas, P. Garcia y Corvera and J. Barrufet y Veciana.—11*th November*, 1880.
4673 PREPARING, &c., COTTON, J. M. Hetherington, Manchester.—13*th November*, 1880.
4728. LAMPS, S. Pitt, Sutton.—Com. from W. B. Robins.—17*th November*, 1880.
4729. LAMPS, S. Pitt, Sutton.—Com. from W. B. Robins.—17*th November*, 1880.
4739. ELECTRIC BATTERIES, H. E. Newton, Chancery-lane, London.—Com. from L. A. W. Desruelles.—17*th November*, 1880.
4758. MEASURING PIECE GOODS, G. Firth, Bradford.—18*th November*, 1880.
4860. LAMPS, S. Pitt, Sutton.—Com. from W. B. Robins.—23*rd November*, 1880.
4991. MACHINE GUNS, T. Nordenfelt, St. Swithin's-lane, London.—30*th November*, 1880.
4993. FELTING MACHINES, G. Yule, Newark, New Jersey, U.S.—1*st December*, 1880.
5013. PRINTING, &c., A. J. T. Wild, Nunhead.—2*nd December*, 1880.
5148. FURNACES, &c., A. M. Clark, Chancery-lane, London.—Com. from S. W. Underhill.—9*th December*, 1880.
5177. LAMPS, S. Pitt, Sutton.—Com. from W. B. Robins.—10*th December*, 1880.
5324. FIRE-ARMS, T. Nordenfelt, St. Swithin's-lane, London.—18*th December*, 1880.
86. RACK for MECHANICAL PURPOSES, W. Powett, Birmingham.—7*th January*, 1881.
136. SLABS for PAVING, W. Page, Josephine Avenue, Brixton-rise, London.—12*th January*, 1881.
142. SEAWEEDS, E. C. C. Stanford, Glasgow.—12*th January*, 1881.
193. PRINTING, &c., FABRICS, W. Mather, Salford.—Com. from Messrs. Shaeffer, Lalance, and Co.—14*th January*, 1881.
226. SHOES for ANIMALS, H. Bland, Luton.—18*th January*, 1881.
254. SELF-FEEDING, &c., FURNACES, L. W. Sutcliffe, Birmingham.—20*th January*, 1881.
318. TOASTING FORK, E. Brookes, Hawarden.—24*th January*, 1881.
338. TRIMMING, &c., WHEAT, W. P. Thompson, High Holborn, London.—Com. from W. Lauhoff.—26*th January*, 1881.
373. SHIPS' SLEEPING BERTHS, W. R. Lake, Southampton-buildings, London.—Com. from the Brunswick Berth Company (Incorporated).—27*th January*, 1881.
395. PRESS, &c., J. S. Sworder, Park-villas, Loughton.—29*th January*, 1881.
402. SHEEP SHEARS, P. Ashbury, Sheffield.—29*th January*, 1881.
440. SUPPLYING, &c., WATER, T. Jackson, Edinburgh.—2*nd February*, 1881.
504. PREPARING MAIZE, J. Boydell, Portland-street, West Dublin.—5*th February*, 1881.
512. BICYCLES, &c., J. White, Coventry, and G. Davies, Manchester.—7*th February*, 1881.
543. STRINGING PIANOFORTES, H. H. Lake, Southampton-buildings, London.—Com. from A. K. Hebard.—8*th February*, 1881.
581. SMOKE-CONSUMING GRATES, F. Edwards, jun., Great Marlborough-street, London.—10*th February*, 1881.
590. MECHANICAL PLAITERS, W. Mather, Manchester.—10*th February*, 1881.
614. PREPARATION of FRUIT, &c., A. J. M. Bolanachi, Daphne Cottage, West Dulwich.—12*th February*, 1881.
615. TENTERING FABRICS, J. Ashworth, Rochdale.—14*th February*, 1881.
620. FILLING, &c., CASKS, A. and J. D. Scott, Greenock.—14*th February*, 1881.
639. PREPARING CARBON, &c., W. R. Lake, Southampton-buildings, London.—Com. from H. S. Maxim.—15*th February*, 1881.
667. SIGNAL APPARATUS, J. Saxby and J. S. Farmer, Canterbury-road, Kilburn.—16*th February*, 1881.
677. SEWING MACHINES, A. Anderson and G. Browning, Glasgow.—16*th February*, 1881.
696. BRAKES, C. W. Siemens, Queen Anne's-gate, Westminster, and A. C. Boothby, Kirkcaldy.—17*th February*, 1881.
697. SLIDE VALVES, P. Brotherhood, Compton-street, London.—17*th February*, 1881.
709. LAYING CONCRETE, &c., PIPES, J. W. Butler and M. Dale, Bridge-street, London.—Partly a com. from C. A. Berthelet.—18*th February*, 1881.
721. LINING STEAM ENGINE CYLINDERS, E. R. Allfrey, Deptford.—19*th February*, 1881.
842. HYDROCARBON FURNACES, H. J. Haddan, Strand, London.—Com. from B. Sloper and W. M. Jackson.—28*th February*, 1881.
858. TREATING DREDGED MATERIAL, F. A. Bishop, San Francisco.—1*st March*, 1881.
909. MUSICAL INSTRUMENTS, H. J. Haddan, Strand, London.—Com. from W. F. Abbot.—3*rd March*, 1881.

Patents Sealed

(*List of Letters Patent which passed the Great Seal on the 4th March*, 1881.)

3612. HAT, &c., CASE, L. Hutchings, Sandymount, Dublin.—6*th September*, 1880.
3621. BILLIARD TABLES, W. R. Lake, Southampton-buildings, London.—6*th September*, 1880.
3627. BRICKS, &c., C. H. Murray, Loman-street, Southwark.—7*th September*, 1880.
3638. HOISTING, &c., APPARATUS, W. R. Lake, Southampton-buildings, London.—7*th September*, 1880.
3641. SALTS of AMMONIA, L. A. Groth, Finsbury-pavement, London.—8*th September*, 1880.
3644. CEMENTS, J. C. Bloomfield, Castle Caldwell, Ireland.—8*th September*, 1880.
3648. COMBINED LAMP, &c., F. MacDonald Robertson, Curtain-road, and J. Joyce, Lower Edmonton, London.—8*th September*, 1880.
3659. STEEL WIRE CARDS, G. and E. Ashworth, Manchester.—9*th September*, 1880.
3666. METAL FENCING, D. Ross, Hilton Farm, Inverness.—9*th September*, 1880.
3670. REGENERATING FLUIDS, &c., A. M. Clark, Chancery-lane, London.—9*th September*, 1880.
3676. PRESSING APPARATUS, W. Marsh, Whitechapel, and J. Morris, Stepney.—10*th September*, 1880.
3680. SUGAR CANDY, T. Morgan, Cockspur-street, London.—10*th September*, 1880.
3716. SEWING MACHINES, T. Chadwick, T. Sugden, and C. Shaw, Oldham.—13*th September*, 1880.
3739. STEAM BOILERS, W. R. Lake, Southampton-buildings, London.—14*th September*, 1880.
3748. ANNEALING BOXES, C. H. Onions, Queen-street, Wolverhampton.—15*th September*, 1880.
3752. TURNING, &c., WOOD. L. Vallet, Liverpool.—15*th September*, 1880.
3755. SPLINTS, &c., H. Hides, Mortimer-street, Cavendish-square, London.—16*th September*, 1880.
3757. BUFFERS, I. A. Timmis, Parliament-street, London.—16*th September*, 1880.
3762. INDICATING, &c., FARES, G. W. Warren, Newington Green-road, London.—16*th September*, 1880.
3784. PRINTING APPARATUS, G. J. Droste, Bremen.—18*th September*, 1880.
3788. COOLING, &c., AIR, A. M. Clark, Chancery-lane, London.—18*th September*, 1880.
3793. STAIR TREADS, F. W. Hembry, Newgate-street, London.—18*th September*, 1880.
3797. STITCHED MACHINE BELTS, M. Gandy, Liverpool.—18*th September*, 1880.
3805. SAILOR'S HAT, J. Christie, Haugesund.—20*th September*, 1880.
3858. EXTRACTING CAPS, S. Pitt, Sutton.—23*rd September*, 1880.
3867. OLEINE, &c., B. Hofmann, Millstream-road, Bermondsey.—24*th September*, 1880.
3923. INDIA-RUBBER, &c., F. G. Henwood, London.—28*th September*, 1880.
4013. LAVATORIES, E. W. de Rusett, Anerley, and F. P. Preston, J. T. Prestige and E. J. Preston, Deptford.—2*nd October*, 1880.
4036. SEWING MACHINES, H. J. Haddan, Strand, London.—5*th October*, 1880.
4044. STEAM ENGINES, G. F. Corliss, Rue Scribe, Paris—5*th October*, 1880.
4193. FIRE ESCAPES, H. J. Haddan, Strand, London.—15*th October*, 1880.
4364. CUTTING PAPER, &c., A. W. L. Reddie, Chancery-lane, London.—26*th October*, 1880.
4426. BEARING SPRINGS, I. A. Timmis, Parliament-street, London.—29*th October*, 1880.
4592. LOOMS for WEAVING, F. O. Tucker, Hartford, U.S.—9*th November*, 1880.
4771. COUPLING, &c., ROLLING STOCK, W. P. Alexander, Draper's-gardens, London.—19*th November*, 1880.
4852. VALVES, &c., W. Bury, New London-street, Mark-lane, London.—23*rd November*, 1880.
5421. SUBSTITUTE for GUMS, C. Estcourt, Manchester, and F. C. Eastwood, Heaton Chapel.—24*th December*, 1880.
5475. ORNAMENTATION, &c., of HARD RUBBER, W. P. Thompson, High Holborn, London.—29*th December*, 1880.
36. WIRE NAILS, &c., H. H. Lake, Southampton-buildings, London.—4*th January*, 1881.
74. DUMPING WAGONS, W. R. Lake, Southampton-buildings, London.—6*th January*, 1881.
119. CLOTH TENTERING MACHINES, H. H. Lake, Southampton-buildings, London.—10*th January*, 1881.

(*List of Letters Patent which passed the Great Seal on the 8th March*, 1881.)

3508. FOLDING SEATS, &c., H. Kinsey, Swansea.—30*th August*, 1880.
3520. STEAM ENGINES, H. A. Bonneville, Rue de la Chaussée d'Antin, Paris.—30*th August*, 1880.
3679. ENVELOPES, N. Contopoulos, Dunstan's Hern, Peckham.—10*th September*, 1880.
3692. DAMASK LOOMS, W. R. Lake, Southampton-buildings, London.—10*th September*, 1880.
3697. FUEL ECONOMISERS, J. Parker, Manchester.—11*th September*, 1880.
3703. SCREW THREADS, G. W. von Nawrocki, Leipziger-strasse, Berlin.—11*th September*, 1880.
3704. SCREW PROPELLERS, C. Jones, Liverpool.—11*th September*, 1880.
3705. PURIFICATION of AIR, &c., J. C. W. Stanley, Barnsdale-road, London.—11*th September*, 1880.
3708. CASK TILTERS, J., H. J. Brookes and F. Mason, Smethwick.—11*th September*, 1880.
3709. BOTTLES, &c., J. Neal, Aston.—11*th September*, 1880.
3712. CUTTING CIRCULAR HOLES, E. H. Bennett, Leadenhall-street, London.—11*th September*, 1880.
3713. RAISING SUNKEN SHIPS, C. Haslett, Southampton-row, and J. G. Thompson, Little Guildford-street, London.—11*th September*, 1880.
3715. TRICYCLES, S. Chatwood, Cannon-street, London.—11*th September*, 1880.
3727. TIN, &c., BOXES, G. F. Griffin, Mandeville-place, London.—13*th September*, 1880.
3730. GAS, &c., A. Pope, Slough.—13*th September*, 1880.
3734. SIGNALLING BALL, A. M. Ritchie, Dundee.—14*th September*, 1880.
3735. LOCKS, &c., W. H. S. Aubin, Willenhall.—14*th September*, 1880.
3736. ROLLING MILLS, G. W. von Nawrocki, Leipziger-strasse, Berlin.—14*th September*, 1880.
3756. RAILWAYS, J. le Clair and J. de Rees, Newport.—16*th September*, 1880.
3789. SODIUM CHLORIDE, &c., R. J. T., A. F., and H. L. Hawksley, Oldham.—18*th September*, 1880.
3810. RECORDING APPARATUS, J. J. Seubich, Dresden.—20*th September*, 1880.
3893. FIREPLACES, &c., J. Russell, Neath.—25*th September*, 1880.
3904. JEWEL, &c., CASES, T. Heath, Glamorgan.—27*th September*, 1880.
3953. HOISTING APPARATUS, B. Hunt, Serle-street, London.—29*th September*, 1880.
3962. CONTROLLING WATER, T. H. P. Dennis, Chelmsford.—30*th September*, 1880.
3991. KITCHEN RANGES, A. MacPhail, Cannon-street, London.—2*nd October*, 1880.
4037. VELOCIPEDES, L. Aviss, Gosford-street, Coventry.—5*th October*, 1880.
4062. TREATING DIAMONDIFEROUS EARTH, J. Richardson, Lincoln.—6*th October*, 1880.
5169. WASHING, &c., CHINA CLAY, J. Lovering, jun., St. Austell, Cornwall.—10*th December*, 1880.
5351. SURFACE CONDENSERS, I. R. Blumenberg, Chancery-lane, London.—21*st December*, 1880.
5387. MICRO-TRANSMITTERS, W. Johnson, Sheffield.—22*nd December*, 1880.
5489. STEAM ENGINES, H. Davey, Leeds.—30*th December*, 1880.
5493. FLANGING BOILER, &c., PLATES, R. H. Tweddell, Delahay-street, Westminster, J. Platt and J. Fielding, Gloucester, and W. Boyd, Jesmond-road, Newcastle-upon-Tyne.—30*th December*, 1880.

List of Specifications published during the week ending March 5th, 1881.

2479, 8d.; 2490, 6d.; 2553, 6d.; 2666, 6d.; 2838, 6d.; 2914, 6d.; 2922, 6d.; 2931, 6d.; 2932, 6d.; 2945, 6d.; 2968, 4d.; 2976, 6d.; 2986, 4d.; 2987, 8d.; 2992, 6d.; 2997, 6d.; 2999, 2d.; 3000, 6d.; 3007, 8d.; 3015, 8d.; 3017, 6d.; 3025, 6d.; 3028, 6d.; 3029, 6d.; 3038, 6d.; 3040, 6d.; 3042, 6d.; 3051, 6d.; 3052, 6d.; 3074, 2d.; 3084, 6d.; 3086, 6d.; 3087, 6d.; 3003, 6d.; 3111, 6d.; 3119, 6d.; 3121, 6d.; 3123, 2d.; 3126, 2d.; 3127, 2d.; 3130, 2d.; 3131, 2d.; 3132, 6d.; 3134, 6d.; 3135, 2d.; 3144, 6d.; 3146, 6d.; 3150, 2d.; 3151, 2d.; 3153, 4d.; 3155, 2d.; 3156, 4d.; 3157, 2d.; 3158, 2d.; 3159, 4d.; 3160, 6d.; 3161, 6d.; 3164, 2d.; 3165, 2d.; 3170, 2d.; 3171, 6d.; 3174, 2d.; 3175, 4d.; 3180, 6d.; 3183, 2d.; 3184, 6d.; 3185, 4d.; 3188, 2d.; 3192, 6d.; 3194, 2d.; 3195, 2d.; 3199, 4d.; 3200, 2d.; 2301, 6d.; 3202, 6d.;

3203, 4d.; 3205, 4d.; 3208, 2d.; 3213, 4d.; 3217, 6d.; 3218, 2d.; 3219, 2d.; 3221, 2d.; 3222, 2d.; 3223, 2d.; 3227, 2d.; 3230, 10d.; 3279, 6d.; 3322, 6d.; 4910, 2d.; 5010, 4d.; 5011, 6d.; 5039, 4d.; 5091, 6d.; 5152, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

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

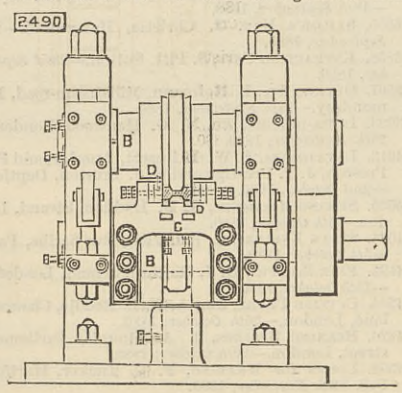
2479. Chairs, Seats, &c., *J. Reilly.—Dated 18th June*, 1880. 8*d.*

This consists partly in making the backs of wooden chairs, seats, &c., separate from the front, and substituting in chairs the lower back rails of the backs for hind rails in the front; and also in fastening the backs and fronts by screws or bolts, thus enabling the second or loose seats to be entirely dispensed with, and the fronts and backs of chairs, seats, &c., to be upholstered separately or together.

2490. Straightening and Curving Railway Bars, *L. Richards.—Dated 19th June*, 1880.—(*Patent dated 8th July*, 1880.) 6*d.*

This invention consists in the combination of grooved rolls with adjustable guides to deflect and direct the bars as desired. The drawing shows a front

2490

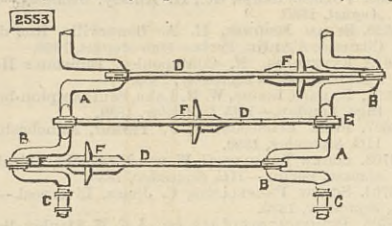


elevation of the machine. The grooved rolls B B are mounted so as to admit of their being opened or closed as required in order to have sufficient pressure to produce the necessary grip to draw the bars or rails through. The rolls are also adjustable endwise, and in other directions by means of set screws, or by other convenient means. C C are rests bolted to the frame of the machine which carry the adjustable guides D D.

2553. Propelling Steam Vessels, *H. P. Boyd, T. T. Pearson, and W. Hooley.—Dated 23rd June*, 1880. 6*d.*

This consists of a system of blades or floats, which are so driven through the water by the ordinary steam power of the vessel as to propel it with great ease and speed through the water. The drawing shows a plan of the arrangement, which consists of two three-throw crank shafts A A, in which the cranks B B make equal angles of sixty degrees around the axis, though

2553



more or fewer cranks at suitable angles may be used if desired. These crank shafts are strongly constructed, and are carried in bearings C C. They are attached together by connecting rods D D at each crank fitted with the usual brasses, cotters, and straps E E to allow of adjustment in case of wear. Upon each of these connecting rods D D is securely fixed perpendicularly to the length of the rod one or more paddles or blades F F made slightly tapering away in thickness towards the edges.

2666. Distillation of Coal Tar, &c., *G. W. Davey.—Dated 29th June*, 1880. 6*d.*

This invention has for its object to employ hot air in the distillation of coal tar. The still being heated by fire, the hot air is at once passed into it by a cock A traversing a pipe B into the branches C C, which

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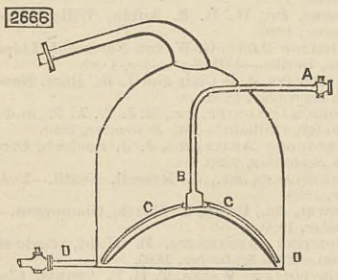

branches are perforated, and so subdivided as to strike upon the crown and ultimately reach the outlet D, striking the gutter, whilst the increased pressure from the increased heat and expansion of the air causes intense agitation of the coal tar in the still, and thus expels the vapours with greatly increased rapidity.

2838. Cutting Keyways or Grooves in Pulleys or Wheels, *W. R. Lake.—Dated 9th July*, 1880.—(*A communication from P. P. Hure.*) 6*d.*

This invention comprises the following features:—

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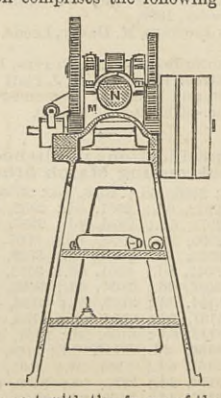


A vertical plate cast with the frame of the machine to receive the objects to be grooved or channelled; mechanism for giving a to-and-fro movement (with an accelerated return motion) controlled by a cylinder, to which the tool holder is attached, and provision for instantaneously changing the direction of travel or stopping the tool, consisting of two racks placed perpendicularly with regard to each other, and operated by two united toothed wheels. M is a support bolted to the machine. The mechanism is placed on this support, and also a solid cylinder N which has imparted to it a to-and-fro motion in guides bolted to the support M. The tool-holder is secured to the end of the cylinder N.

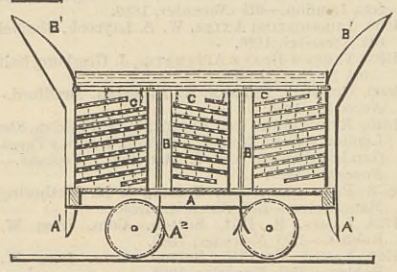
2910. Umbrellas, *W. L. Wise.—Dated 14th July*, 1880.—(*A communication from La Société Meurgey and Cie.*) 6*d.*

To allow the ready detachment of the cover from the stick, the latter is formed with a transverse hole through it fitted with a lining tube, and the notched ring to which the ribs are attached is provided with a tube which fits over the stick, and has two holes corresponding to the hole in the stick. A pin is passed through the hole and secures the cover in position. The runner is fitted with spring catches, which when the umbrella is open engage with a projection on the tube. To prevent the runner rising too far it is arranged to bear against the lower end of the tube.

2914. Chemicals for Purifying Vitiated Air, *R. Neale.—Dated 15th July*, 1880. 6*d.*

The essential feature of this invention is to cause a very large proportion of any existing volume of vitiated air to pass over or to be saturated with the chemical agent employed, thereby more or less destroying or removing the impurities with which the air is loaded. The drawing shows a longitudinal section of one form of apparatus for purifying the air in railway tunnels and other places. A represents a special purifying carriage attached to any train, and open at each end, where it is furnished with wings A1.

2914



Each end is also formed on its upper edge with a large wing, shoot, or baffle plate B1. In the sides and bottom of the carriage A are left any number of openings B, opposite and dividing with longitudinal or projecting wings A2, arranged in pairs so as to face each way, according to the direction in which the train is running. C C are trays containing the chemical substance employed.

2920. Garments, *H. J. Haddan.—Dated 15th July*, 1880.—(*A communication from A. N. Horner.*) 6*d.*

The garment is formed with short sleeves, to which a detachable lower sleeve with a cuff or flounce can be attached by means of a row of buttons engaging with one or two rows of button holes, so that the detachable sleeve can be held up and adjusted in length.

2922. Glazed Roofs, &c., *W. E. Rendle.—Dated 15th July*, 1880. 6*d.*

The roof is formed with the requisite number of horizontal purlins or supports A at a distance from one another somewhat less than the length of the

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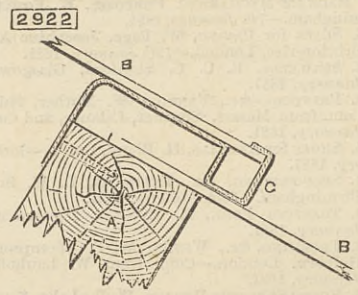

sheets of glass which are to be used; B are the sheets of glass. The upper ends of the sheets of glass lie upon the top of the purlins, and are held down on to them by bars C formed of bent sheet metal.

2931. Facilitating the Removal of Window-sashes, *J. Hayes, jun.—Dated 16th July*, 1880. 6*d.*

A double-sheave pulley is inserted in the pulley style, to clear the sliding pocket. A half of the pulley style is cut from inside lining and parting bead on the right or left-hand side of the frame to the height of the sash which forms a sliding pocket on either side of the frame, which is opened or closed by means of an excentric or crank motion, to be turned on the inside lining by a key or suitable knob, by which, when turned to the right, it shuts the pocket, and when turned to the left, opens the pocket, thus allowing either sash to be taken out into the room.

2932. Steam Generator, *L. Mills.—Dated 16th July*, 1880. 6*d.*

This consists of an outer shell of convenient form is fitted with an inner fire or combustion chamber of such dimensions as to leave a water space all around it, and a steam and water space above it. The lower part of such water space below the level of the fire-grate is enlarged by turning inwards the bottom end of the material of the inner chamber, or by the addition of angles and suitably-formed plates, and by

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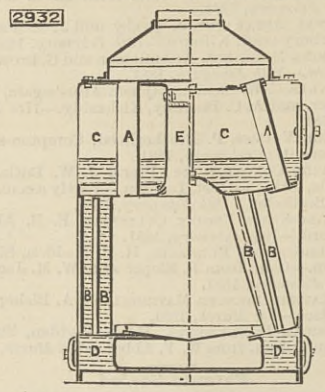

forming sides and a bottom joining at the outer shell. C is the upper steam and water chamber; A are uptake tubes; B B are rows of tubes connecting the upper chamber with the lower water chamber D. The upper and lower end plates of the upper chamber may be stayed by ordinary bow stays, by the tubes forming the uptakes, or in conjunction with them or not, a central tube E may be fitted, which may or may not be used as an uptake tube.

2945. Exhausting Hot Air, Dust, or other Refuse from Millstones, &c., *W. Mooney.—Dated 17th July*, 1880. 6*d.*

A suitable box is divided into two compartments by a partition placed vertically in the centre of same. Within each of these compartments, both of which communicate with the millstone case, is suspended a flour dust separator, consisting of a light framework or cage covered with flannel or other suitable material. Through the meshes or pores of this cage or separator the air coming from the mill is drawn by an exhaust fan, the dust being retained on the outside of the flannel covering. Fig. 1 represents a front elevation of the mechanism for operating the valves and oscillating levers, showing a portion of the closed box. Fig. 2 is a side view of the apparatus complete. A represents the box, B is a driving shaft on which are mounted the cam discs K K1 and the worm B1 gearing

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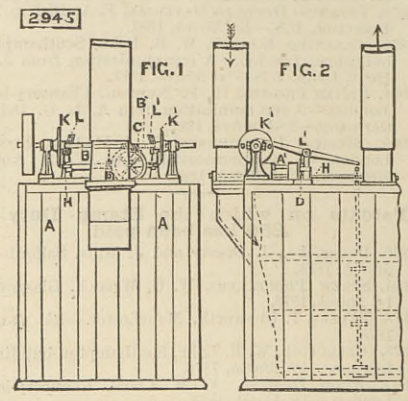

with the spur wheel C. This spur wheel is keyed to the spindle A1, and on this spindle is mounted a cam D. Two slide levers are provided with pivots which are acted on by the cam D. To each of these levers is also fixed a rack, which works into a pinion mounted on a spindle, to the ends of which are secured the throttle valves in the inlet and outlet air shoots. L L1 are the shaking levers which oscillate on the standard H, the latter being pivotted and free to rotate horizontally, so as to admit of the free ends of the shaking levers being brought into contact with the cam discs K and K1.

2962. Clearing or Cleaning Screens or Sieves of Flour Mills, &c., *W. R. Lake.—Dated 17th July*, 1880.—(*A communication from J. W. Collins.*) 6*d.*

A is a suitable frame; B is a reel, and C is a shaft

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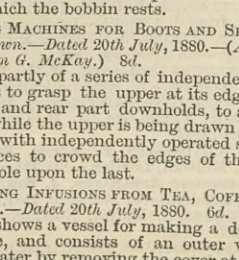

carrying flexible beaters D arranged in proximity to and parallel with the surface of the reel, so that when the shaft C is rotated, the beaters D will strike the cloth of the reel B.

2968. Connecting Warp to the Warp Beams in Looms, *G. D. Sykes.—Dated 19th July*, 1880. 4*d.*

This consists in attaching hooks or rings to the canvas, or fabric, and in placing the rod in the hooks or rings, which is readily and easily done. The hooks or rings may be made of brass other suitable material.

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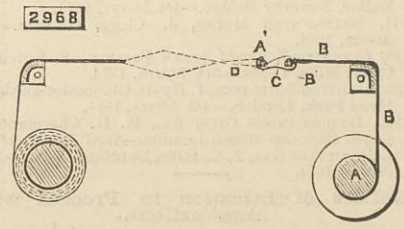

and attached to the canvas or rings by being screwed or rivetted, or by laces or other means. The drawing shows an end view of such parts as are necessary to show improvements. A is the warp beam, to which is attached the canvas B in the ordinary manner; C is the hook employed for connecting the warp D to the canvas B by means of the rods A1 and B1.

2976. Manufacture of Hollow Articles, *F. Walton.—Dated 19th July*, 1880. 6*d.*

This consists in the manufacture of hollow articles by moulding a composition of oxidised or solidified oil and other ingredients upon forms of paper, thin sheet metal, or other material by pressure in dies or moulds.

2986. Ring Frame Bobbins for Throstle Spinning, *H. Southwell.—Dated 20th July*, 1880. 4*d.*

This consists in fixing to the bottom of the wood bobbin A a metallic boss B, which is so constructed externally that, having the upper portion vandyked

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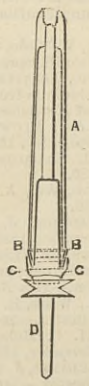

over a smaller part of the bobbin, the points of the same may be compressed so as to firmly secure the boss to the bobbin. C is the cup or socket of the spindle D in which the bobbin rests.

2987. Lasting Machines for Boots and Shoes, *W. Morgan-Brown.—Dated 20th July*, 1880.—(*A communication from G. McKay.*) 8*d.*

This consists partly of a series of independent overhanging pincers to grasp the upper at its edges, combined with fore and rear part downholds, to act upon the inner sole while the upper is being drawn or fitted to the last, and with independently operated side and toe-lasting devices to crowd the edges of the upper over the inner sole upon the last.

2992. Obtaining Infusions from Tea, Coffee, &c., *W. J. Clapp.—Dated 20th July*, 1880. 6*d.*

The drawing shows a vessel for making a decoction of tea or coffee, and consists of an outer vessel A supplied with water by removing the cover at top and an inner vessel B supported a certain distance from the bottom of A by the cover. It is made of wire gauze or other material that will allow of the free circulation of the water through it, so as to act upon the tea or coffee placed therein. A stirrer is mounted

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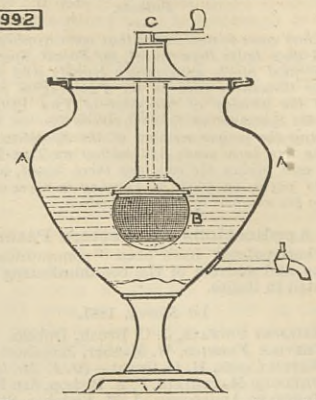

within B, and is rotated by a stem passing out through the cover where it is fitted with a handle C.

2997. Navigable Vessel, *H. C. Bagot.—Dated 21st July*, 1880. 6*d.*

In order to obtain a vessel that can be driven at a great speed and possessing great steadiness and good steering qualities, the passenger or cargo carrying platform A is supported on three or more spherical

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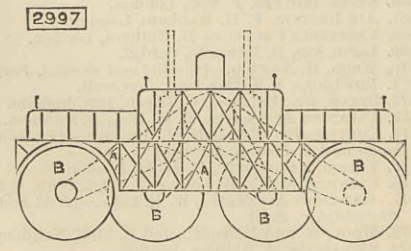

propelling buoys B to axles or shafts in which a steam or other engine is coupled, so that when these buoys rotate the vessel is made to move, as it were, on rollers on the water.

3000. Circular Knitting Machines, *H. J. Haddan.—Dated 21st July*, 1880.—(*A communication from J. Blacklock.*) 6*d.*

This consists First, in the application to vertical cylindrical knitting machines of a ribbing attachment consisting of a stationary cone-shaped ribbing dial or cylinder J, supported centrally above the vertical knitting cylinder B, in combination with an overlying cam cylinder K, from which the ribbing needles are operated with a reciprocating downward and outward movement; Secondly, of a combined cam cylinder and

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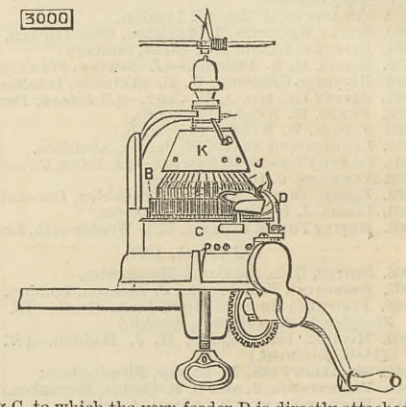

cog C, to which the yarn-feeder D is directly attached, so that the feed is always in position to work instantly backwards or forwards; and Thirdly, in the formation of the vertical knitting cylinder cam—the end portions of which are formed by the edge of pivotted wings—connected to an adjusting thumb screw, so that the degree of inflection of the cam can be varied with the object of lengthening or shortening the stitch.

3007. Measuring, Checking, Controlling, and Registering the Movements, Speeds, and Quantities of Liquids, *J. J. and W. A. Tylor.—Dated 21st July*, 1880. 8*d.*

The drawing shows the improvements in piston meters, and consists of two pistons B working independently in the casing A, and each composed of two plungers connected by a neck of smaller diameter, and working water-tight in suitable chambers E is the valve box into which the inlet pipe F opens, and G is the outlet. A valve is placed over and is operated by each of the pistons B, the one over each piston

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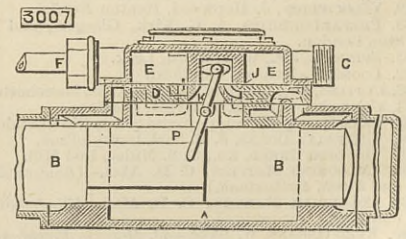

relating to the other piston. I and J are inlet ports governed by one valve, and K the corresponding exhaust port. Levers P act upon and move the valves H as their lower ends are pushed in either direction by the pistons, one lever also actuating a registering mechanism. The invention further consists in improvements in rotary meters, and partly to improvements in apparatus for registering and recording the movements, &c., of liquids or fluids passing through meters.

3015. Machinery for Spinning, *H. J. Haddan.—Dated 22nd July*, 1880.—(*A communication from J. Birkenhead.*) 8*d.*

This relates to spinning frame bobbins and their

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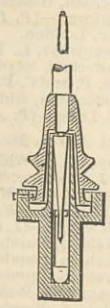

spindles, and consists in the combination of a combined step and elastic bolster with a yielding sleeve

encompassing it and supported in and with a sustaining socket or receiver; also in the combination of the step and boltster with one or more helical slots arranged therein above the step, with a capillary or absorbent sleeve encompassing such step and bolster, and adapted to support it in and with a sustaining socket, and to communicate with an oil reservoir, so as to raise oil up and around the external surface of the step and bolster, and feed it into the helical grooves. There are thirty claims, all relating to different arrangements for supporting and lubricating the bearings of bobbins and their spindles.

3017. PRINTING COLOURS ON FIBROUS MATERIALS WHILST IN THE SLIVER, *A. Benn.—Dated 22nd July*, 1880. 6*d*.

So as to print in one machine, and with two or more colours, the sliver of fibrous materials used in the manufacture of worsted stuffs, the fibre A is passed through an ordinary gill box and pressure rollers B, and delivered to the combined printing apparatus in a

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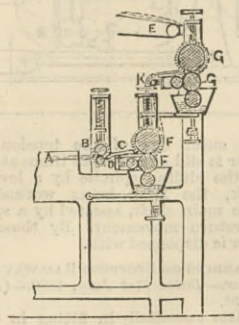

thin flat sliver which passes over a tray C to the first set of printing rollers F, where it receives one colour, and then over guide rollers K to the second set of printing rollers G, where it receives the second colour, and so on through the different colours, and is finally conducted to the ordinary traversing carriage by an endless revolving carrier E.

3025. IMPROVED METHOD OF ELECTRIC LIGHTING, INSURING THE INDEPENDENCE OF THE BURNERS, *P. Jensen.—Dated 21st January*, 1881.—(*A communication from M. Avenarius.*) 6*d*.

To obtain independent action the inventor uses shunt circuits, each containing an electrolytic apparatus. In Fig. 1 C (1, 2, and 3) are electrical burners in the same circuit, and fed by an alternate current dynamo-electric machine. Each of the conducting wires of the burners is connected to the corresponding electrode of the voltameter V (1, 2, and 3), which must be such as to permit of variation in the polarisation of the two electrodes of the apparatus as well as its resistance, according to the polarisation of the carbons of the corresponding burners, and to the intensity of light required. Fig. 2 is an electrolytic apparatus consisting of a cylindrical glass vessel H, with metal

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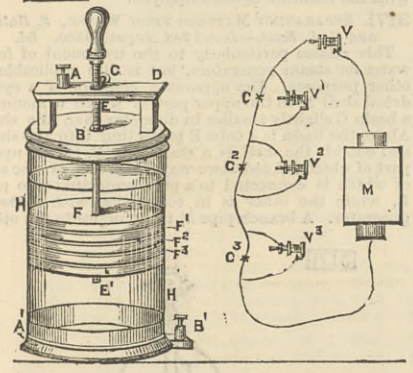

bottom A and wooden lid B, the latter carrying a metal plate D on wooden supports, and with binding screw *d*. D and B have two holes through which passes metal rod E, carrying at its end—inside H—a metal disc F, which has a glass stick E¹, on which are fixed metal discs F (1, 2, and 3). These latter must fit the inside of H well, to prevent transmission of the current by the liquid between the sides of H and the discs. The thickness of the discs should be increased according to their distance apart, and it is well to coat them with platinum. The position of E, on which a scale is marked, and the distance of the lowest disc are fixed by a screw G. The bottom A¹ is provided with a second binding screw B¹, and the vessel is filled with slightly acidulated water. Polarisation is determined by the number of discs, and resistance of the apparatus by their distance apart, particularly by the distance of the lowest disc from the vessel's bottom.

3028. DRY GAS METERS, *J. Foxall.—Dated 23rd July*, 1880. 6*d*.

The object of this invention is to obtain elegance of design, accuracy in registering, a steady and bright light, and to occupy less space than ordinary meters. A are diaphragms so arranged as to open to the full width of the casing in a horizontal direction along guides. D are rods fixed to vertical spindles E and fitting on the ends of rods F fixed on the diaphragms. To the upper ends of the spindles are fixed levers G

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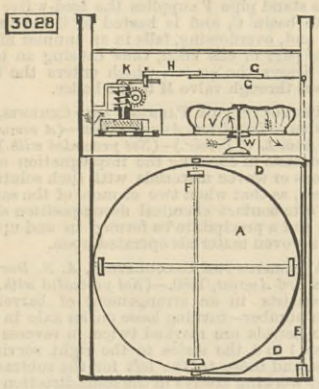

connected by links H to a crank on the spindle K of the valve cover in such a manner that the motion of the diaphragms, as the gas passes through the meter, causes the valve cover to rotate, and open or close the ways through the valve. On the spindle K is an endless screw gearing with a worm-wheel connected with the registering mechanism. The regulator V consists of an expanding chamber, which, under the pressure of gas, more or less throttles the escape W.

3029. ROLLER MILLS, *J. A. A. Buchholz.—Dated 23rd July*, 1880. 6*d*.

This relates to mechanism to render roller mills, in which the feed from one pair of rollers has to be conducted through the delivery of the crushed meal from another pair of rollers, more practicable, by providing an arrangement for the delivery of the crushed meal from one pair in such manner as not to interfere with the feed to another pair, while at the same time it enables the miller to test the action of his grinding or crushing rollers at their opposite ends, and thereby determine if the rollers are set parallel. As applied to a three-roller mill, the mill is fed with two streams of corn, one passing in one direction between the upper and middle roller, and the other in the opposite direction between the middle and lower rollers. At the delivery side of each roller of the upper pair are fitted

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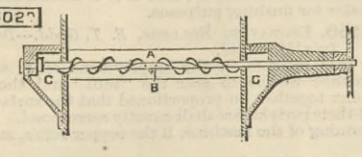

upper and lower scrapers to clear them of meal, and discharge it into a trough A, in which is a spindle fitted with right and left-handed screw threads to deliver the meal to the opposite ends of the trough, where it falls into shutes formed by casings C leading to a common receiver.

3030. TREATMENT OF FATTY MATTER FOR THE RECOVERY OF USEFUL PRODUCTS, &c., *C. A. Burghardt.—Dated 23rd July*, 1880.—(*Not proceeded with.*) 2*d*.

This relates particularly to the recovery of alizarine contained in the stearine or fatty matters resulting from processes whereby such matters are recovered from waste washings or liquor from dye or print works, or from other waste liquors. These matters are subjected to distillation at a temperature of about 360 to 400 deg. Fah., and the stearine or fat is condensed, the residue being treated with methylated spirits or other solvent of alizarine, in order to dissolve or extract the alizarine.

3033. SHAVING APPARATUS AND RAZOR GUARDS, *J. H. Johnson.—Dated 23rd July*, 1880.—(*A communication from P. L. Fontaine.*) 6*d*.

The blade is carried by a holder formed of a flat piece of metal having two small bent tongues to embrace the extremities of the blade and hold it in position. A screw working in a nut carried by the holder bears against the back of the blade and enables it to be adjusted. A portion of the holder is bent to form a handle, and it is formed with slightly curved teeth, which bear against the skin so as to prevent the blade cutting.

3034. COMBINED FLOATING DOCK AND LIFT, *J. Russell. Dated 23rd July*, 1880.—(*Not proceeded with.*) 2*d*.

A flat-bottomed hollow pontoon is fitted with hollow side and fore floating chambers the whole length, for floating the dock or lift when submerged to any required depth in order to take ships on.

3038. MAKING ICE, &c., *W. A. Gorman.—Dated 24th July*, 1880. 6*d*.

This consists in subjecting the ether or refrigerant, on its way from the condenser to the refrigerator, to the cooling influence of the brine or uncongealable liquid that is passing from the freezing tank or ice trough to the refrigerator. The drawing is a plan showing the arrangement of two freezing tanks or ice troughs A A¹ in conjunction with a tank, trough, or vessel B containing a vessel C constructed of copper or of other material that is a good conductor of heat.

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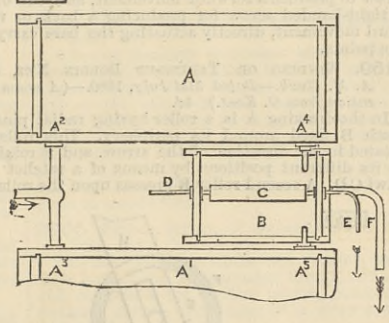

The two tanks or troughs A A¹ may be provided with moulds or cells or with other arrangements, so that water or other liquid may be frozen or refrigerated by the heat-abstracting action of brine, which enters at A² and A³ respectively from any suitable refrigerator. The brine having been utilised in the tanks or troughs A A¹, leaves them by A⁴ A⁵ respectively, and passes into the trough or vessel B containing the vessel C. This vessel C receives the ether or other volatile refrigerant from the condensers—which may be of any suitable construction—by the pipe D, and in passing through the vessel C the condensed or partially condensed ether or other refrigerant—which thence proceeds to the refrigerator by pipe E—is further condensed or reduced in temperature by the heat-absorbing action of the brine in the trough or vessel B surrounding the vessel C, as such brine flows through the said trough or vessel B on its way from the tanks or troughs A A¹ to the refrigerator, to which the brine is conveyed by the pipe F.

3039. HOISTING APPARATUS, *E. W. West.—Dated 24th July*, 1880.—(*Not proceeded with.*) 2*d*.

The motion of the main driver is always in one direction, and the hoist is a double-friction hoist driven from this driver, its parts being so arranged that the barrel can be made to wind or unwind the lifting ropes or chains as required.

3040. OBTAINING FRESH WATER FROM SALT WATER, *E. W. West.—Dated 24th July*, 1880. 6*d*.

This consists, First, in a novel form and arrangement of tubes or chambers which form the condensing surface of the condenser; Secondly, in a novel form and arrangement of chamber and filter through which the fresh or distilled water passes; Thirdly, in the

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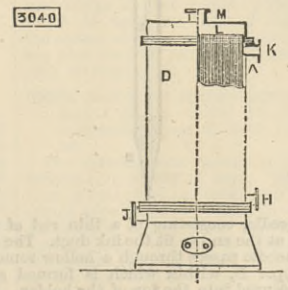

form and arrangement of the condenser, and the construction thereof as a complete apparatus. A are the tubes which are used with open ends and fixed between tube plates provided with india-rubber rings, or rubber sheets, or other packing to form a joint. The condenser consists of a cylindrical casting D, the upper portion of which is provided with a branch K, being the steam inlet, and the lower portion is provided with a branch or port H, being the condensed steam or water outlet. The tubes A open out into the overflow chamber L on the top of the condenser. M is the overflow or circulating water outlet.

3042. REFRIGERATING APPARATUS, *C. Holdsworth.—Dated 24th July*, 1880. 6*d*.

This consists in the employment of a cage constructed of galvanised iron bands to hold the ice, the said cage being suspended just beneath the ceiling or top of the chamber, and having beneath it a wooden metal-lined tray to catch the water that drips from the ice, the surplus water being carried off by an overflow pipe, properly trapped to prevent the entry of air. A is the cage to hold the ice, which cage is

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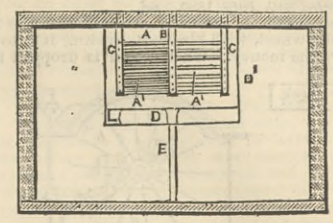

formed of the galvanised iron slats A¹ rivetted to the bands B and angle pieces C. The tray D is suspended by rods D¹. E is the overflow pipe.

3043. PLATING IRON, STEEL, &c., WITH NICKEL COBALT, AND THEIR ALLOYS, *F. C. Glaser.—Dated 24th July*, 1880.—(*A communication from T. Fleitmann.*) 2*d*.

This relates to improvements on patent No. 5127, A.D. 1878, and consists in the application of that process to nickel containing iron or zinc, the quantity of iron in the alloy amounting up to 50 per cent. The principal condition for this mode of plating is the complete exclusion of air, which may be effected by wrapping the metals with thin metal sheets, which are subsequently removed by chemicals.

3045. VARIABLE EXPANSION VALVE, &c., *F. J. Lemouche.—Dated 24th July*, 1880.—(*Not proceeded with.*) 2*d*.

A D slide valve is actuated by a to-and-fro motion, the two conduits which distribute the steam communicating together and having only one port in the upper surface of the slide valve. A partition or bell valve is applied upon the slide valve, and is maintained in position in the length of the steam valve chest by grooves in the sides of the valve chest. The lower edges work on the upper face of the distributing valve, and in its upper part is a hole putting the interior of the steam chest in communication with the cylinder. A valve rests on the opening in the bell valve and stops this port as required.

3051. RECEPTACLES FOR INK, &c., *G. W. von Nawrocki.—Dated 24th July*, 1880.—(*A communication from H. Hoffmann.*) 6*d*.

This consists essentially of two superposed compartments, of which the lower one takes the liquid, and the funnel-shaped bottom of the upper compartment extends into the lower compartment, and the cover of the upper compartment is provided with a neck and bulged down in the middle.

3052. ACTUATING THE SWITCHES ON RAIL OR TRAMWAYS, *B. and S. Robinson.—Dated 24th July*, 1880. 6*d*.

The object is to provide apparatus by which the switches on rail or tramways can be moved right or left by the driver or other appointed person whilst on the car or vehicle. A is a box or framework placed between the rails; B is a shaft mounted in bearings, and on the shaft is a lever D, which is coupled to the

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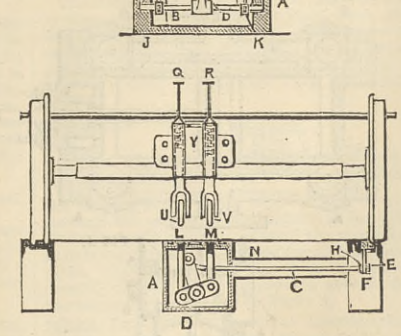

switch at E and F by means of the rod G and the projecting part H on the switch E. On the shaft B are also fixed other levers J and K, placed right and left thereon; these are coupled respectively to the bars L and M fitted within the top or cover N of the box by means of projecting pieces. These bars L and M may be moved down at pleasure by means of a right and left-hand treadle or foot plate Q and R. These are connected to forked spindles, in which are mounted the runners U and V, fitted so as to slide freely in bosses on the bracket Y. Springs are employed to bring back the runners into the position shown in the drawing.

3055. PURIFYING AND DISTILLING WATER FOR FREEZING, &c., *G. F. R. Lauth.—Dated 24th July*, 1880.—(*Not proceeded with.*) 2*d*.

The water is placed in a cylinder into which steam is admitted from a steam boiler, and which heats the water until it evaporates and passes to a second cylinder where its impurities settle to the bottom, when it is again heated and conveyed to another cylinder where it again settles, the operation being continued until the water is sufficiently pure.

3056. LOOMS FOR WEAVING LOOPED FABRICS, *H. Lister. —Dated 24th July*, 1880.—(*Not proceeded with.*) 2*d*.

The wires or rods used to produce looped or pile fabrics are introduced by self-acting mechanism, thus dispensing with one of the workmen usually employed.

3057. GLASS BOTTLES, *C. Kilner.—Dated 24th July*, 1880.—(*Not proceeded with.*) 2*d*.

To produce the recess in the bottom of champagne and other bottles, a loose pusher or die is mounted in the mould, and can be actuated by a combination of levers worked either by hand or foot.

3068. BICYCLES, *W. M. Lett.—Dated 26th July*, 1880. —(*Not proceeded with.*) 2*d*.

In front of the large driving wheel a small wheel is suspended from an arm shaped to clear the driving wheel, such small wheel being kept clear of the ground until the bicycle pitches forward, when it prevents the rider being thrown over the handle.

3072. REMOVING THE BITTERNESS FROM LUPINES, *G. W. von Nawrocki.—Dated 26th July*, 1880.—(*A communication from F. Schlaeger.*)—(*Not proceeded with.*) 2*d*.

The lupines are heated for ten minutes in a kiln or drum to from 210 deg. to 220 deg. Fah., after which they are covered with water and allowed to stand for twenty-four hours, when the water is removed and fresh water added, the operation being continued a third time, when all bitterness will have left the lupines.

3073. ORNAMENTATION OF MOULDINGS, &c., *H. Westman.—Dated 26th July*, 1880.—(*Not proceeded with.*) 2*d*.

The mouldings are ornamented by printing designs thereon in colours, such printing being effected by means of elastic blocks curved to suit the mouldings.

3074. PROTECTORS FOR CORNS, &c., *G. F. Walters.— Dated 26th July*, 1880.—(*Void.*) 2*d*.

This consists essentially in a cover or protection, constructed preferably of india-rubber or other suitable pliable material, punctured with a hole of the requisite size.

3084. LOCOMOTIVE TRAM AND ROAD CARS, *T. Turton. —Dated 27th July*, 1880. 6*d*.

Under the First part of the invention the wheels of the locomotive tram car or vehicle are so arranged that the driving wheel or wheels shall run on the road, and the remaining wheels on the metals. A is the tram car or vehicle mounted on bogie B, carried by two pair of wheels C. The front end of the car or vehicle frame is connected to the boiler frame E by joints F. G is the engine frame carried by the driving wheel D at or near the centre thereof. The wheel D is free to revolve on a vertical axis by means of the rotation of the frame G beneath the frame E. H is a hand

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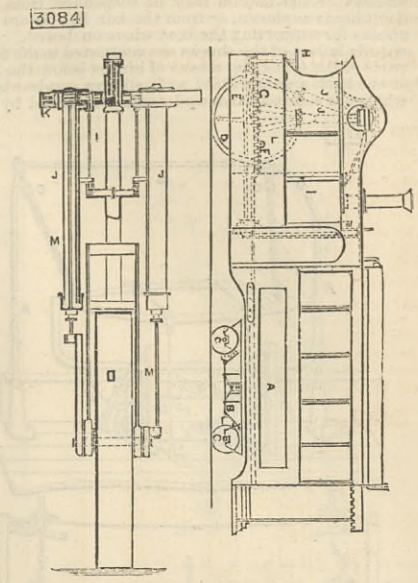

wheel and gearing for moving when desired the frame G; I, steam generator; J, cylinders oscillating on trunnions K, carried by a standard L; M, piston rods. The valve rods are fitted with blocks free to slide in links. According as the links are canted in one or other direction the driving wheel D will be caused to revolve forwards or backwards.

3086. AIR ENGINES, *L. Sterne.—Dated 27th July*, 1880. —(*A communication from J. Ericsson.*) 6*d*.

One part of the invention consists in a novel system of mechanism for transmitting motion from the working piston to a crank and to the exchange piston, whereby, with a short stroke of the working piston, both a long crank and a long movement of the exchange piston are obtained, and the movements of the two pistons relatively to each other are so timed as to obtain the most effective action. Another part consists in a novel arrangement of a pump and its connection with an air engine. S is the cylinder of the engine open at the upper end, and containing two pistons, viz., the working piston A and the exchange piston B. The lower part of the cylinder is closed and heated in any suitable manner. The exchange piston B, which is of considerable length in an axial direction, is so much smaller than the cylinder that an

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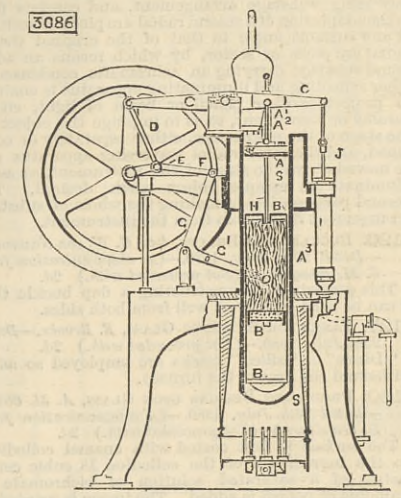

annular space for free passage of air is left between its exterior and the interior of the cylinder. The said piston is hollow, and having its upper part partly filled with cotton or other fibrous material A³, below which is enclosed a stratum B¹ of powdered charcoal or other non-conducting material. The working piston A is connected by a hollow rod or trunk A¹ and short side links A², with a beam C above the cylinder, the connection being at a short distance from the fixed centre of oscillation of the beam. This beam is connected at a much greater distance from the other side of the centre by a connecting-rod D with the crank E on the main shaft. This crank is also connected by a rod F with one arm G of a bell-crank lever, the other forked arm G¹ being connected by side rods H on opposite sides of the cylinder by a yoke with the head. I is a pump arranged on the opposite side of the cylinder S to the crank shaft. The piston or plunger-rod J of this pump is connected with the beam C on the same side of the centre of oscillation of the latter as the engine piston connections, the beam being prolonged beyond the cylinder S for the purpose of making this connection, and so obtaining the advantage of a long stroke for the pump with a short stroke of the working piston of the engine.

3087. ROAD SWEEPING AND CLEANSING MACHINES, *G. M. Truss.—Dated 27th July*, 1880. 6*d*.

This relates to a machine for sweeping roads, whereby the refuse is automatically swept into a suitable receptacle, means being provided, if required, for separating the water from the solid parts of the

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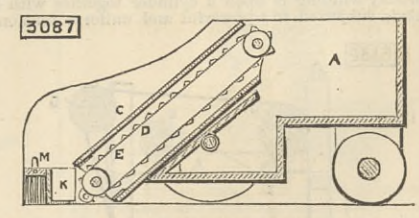

refuse. A is the receptacle mounted on wheels, C is the conveying channel open at top and bottom, D D are scoops or troughs preferably extending entirely across the channel C and connected to the endless band E K is the scraper, and M the brush.

3093. TOBACCO PIPES, *B. J. B. Mills.—Dated 27th July*, 1880.—(*A communication from J. Krisper. W. Fritsch, P. Eichelter, and G. Romisch.*) 6*d*.

This consists in the combination with the pipe bowl and a tobacco receptacle arranged to form an annular passage between it and the pipe bowl of a removable combustion chamber, having a contracted combustion zone and devices to feed the tobacco thereto.

3111. Supporting, Raising, Lowering, and Disengaging Ships' Boats, *J. Donovan.—Dated 29th July*, 1880. 6*d*.

Ordinary boats' davits are placed about a foot clear of each end of the boat, and the davit heads are connected to each other by means of a bar, so that both the davits are moved together, and may be freely worked in and out, the tackles for raising and lowering the boat being suspended either from the said bar or from the davit heads. A are the davits and B the bar connecting the davit heads together. The upper blocks C of the tackles may be suspended from the davit heads as shown, or from the bar B. D are the chocks for supporting the boat when on board. The outside halves of the chocks are connected to the fixed parts of the chocks by means of hinges below the keel of the boat, and are fitted with sliding quadrants F, which are secured when up by catches worked by the

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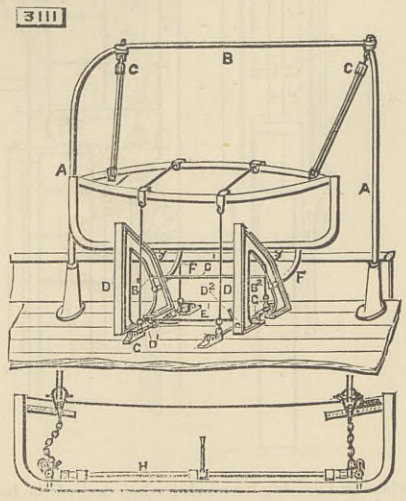

two levers B^1 B^2, and fitting into notches in the sliding quadrants. These levers are connected by the rod C^1, so that both catches are released simultaneously by one movement of the lever B^2. Two turning bars are actuated by two levers D^1 D^2, which are connected by the rod E^1, so that the two turning bars are worked simultaneously by a movement of the lever D^2. A similar turning bar H is fitted in bearings fixed to the bottom of the boat, jointed pins being fitted at each end for detaching or disengaging the boat from the tackles.

3121. Ice-making Machinery, *W. E. Gedge.—Dated 29th July*, 1880.—(*A communication from A. T. Ballantine.*) 6*d*.

The First part is mainly directed to obviating the evil of leakage by providing for the return of any gas which escapes past the piston into the receiver, and to prevent this leakage as far as may be by maintaining a truly right line motion of the piston rod, in spite of wear. The Second part relates to the condenser; and the Third part to congealers or moulds.

3123. Microscopes, *J. Swift.—Dated 29th July*, 1880. —(*Not proceeded with.*) 2*d*.

This relates to improvements on Grubb's radial traversing substage arrangement, and consists first in the adaptation of a second radial arc piece or section, at any suitable angle to that of the original Grubb radial arc piece or sector, by which means an additional substage carrying an achromatic condenser or other reflecting and illuminating apparatus is enabled to project another pencil or beam of light, either parallel or convergent, so as to impinge the object on the stage of the microscope, either separately or combined, and the same radial traversing apparatus can be moved above the stage of the instrument, so as to illuminate an opaque object when desired. The Second part consists in making the whole of substage arrangement detachable from the instrument.

3126. Buckles for Braces, &c., *G. W. von Nawrocki. —Dated 29th July*, 1880.—(*A communication from C. M. Römpler.*)—(*Not proceeded with.*) 2*d*.

This consists in so constructing a flap buckle that it can be used equally as well from both sides.

3127. Tanks for Smelting Glass, *E. Brooke.—Dated 29th July*, 1880.—(*Not proceeded with.*) 2*d*.

"Dinas" or "silica" bricks are employed so as to withstand the heat of the furnace.

3130. Producing Designs upon Glass, *A. M. Clark. —Dated 29th July*, 1880.—(*A communication from D. Scotellari.*)—(*Not proceeded with.*) 2*d*.

The surface is first coated with enamel collodion. To the ingredients of the collodion 18 cubic centimetres of a saturated solution of bichromate of ammonia or potash is added. The image is printed on the surface from a positive. After a few minutes' exposure, the image is developed in the dark room by the application of enamel or glass powder with a badger-hair brush until the image appears with the desired sharpness and intensity. When the development is finished, it is fixed by firing in an oven at a high temperature.

3131. Generation and Employment of Mixed Vapours for the Production of Motive Power, *A. M. Clark.—Dated 29th July*, 1880.—(*A communication from E. L. Brady.*)—(*Not proceeded with.*) 2*d*.

This consists, First, in the use of a mixture for actuating and propelling a piston consisting of a vapour generated from the bisulphide of carbon and saponified paraffine oil; Secondly, in the method for producing a motor for actuating a piston, viz., forcing, admitting, or injecting bisulphide of carbon into a boiler containing saponified paraffine oil and water, which should be first heated to a temperature of from 175 deg. to 200 deg. Fah.; and Thirdly, in the method of operating a piston, viz., supplying the cylinder of the engine with a mixed vapour generated by the action of heat in a mixture of saponified paraffine oil, water, and bisulphide of carbon.

3132. Preparing Paper for Rolling up with Woven Fabrics, *A. M. Clark.—Dated 29th July*, 1880.—(*A communication from M. Vve J. Chavent.*) 6*d*.

This consists in a process of straightening or smoothing out and preparing paper in the roll by forcibly winding it upon a cylinder together with a fabric subjected to a powerful and uniform tension.

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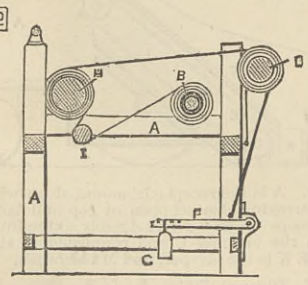

A is the frame of the machine; B is a roller upon which the paper to be stretched is wound; D is a beam, upon which is wound a fabric E, of sufficient strength to sustain a powerful tension produced by levers F and weights G. It is essential that the fabric should be in considerable tension, in order that it may forcibly fashion, so to speak, the paper which is wound up with it upon a roller H after passing beneath a roller I placed in close proximity to ensure the paper passing smoothly on to said roller H.

3134. Receiving and Checking Money, *H. Lyon.—Dated 30th July*, 1880. 6*d*.

This consists of a wheel A something in the form of a paddle wheel, with blades B dividing it into cells to receive the money. When a coin is dropped through

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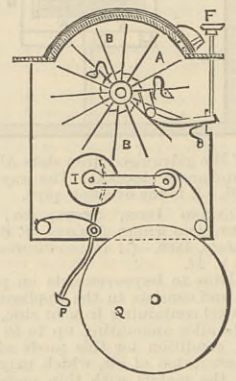

a slit in a glass cover into one of the cells the lever F is pressed down, and causes the wheel A to rotate one cell, and the blades B cause the jumper roller I to be depressed, and thereby cause the hammer P to strike the bell Q.

3135. Apparatus for Holding Matches, &c., *H. Constable.—Dated 30th July*, 1880.—(*Not proceeded with.*) 2*d*.

The receptacle holding the matches contains a catch or saddle broad enough for one match, and forming part of, or being connected with, a movable slide, while the top of the receptacle has a slot placed in the line of motion of the slide, the latter being moved one way by hand, and the opposite way by elastic bands or springs.

3138. Revolving Shutters, &c., *J. Stones and T. Kirby.—Dated 30th July*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to means for lubricating the ends of the roller on which the shutter coils, or the spring box or roller, and consists of a small tube or wick fed with a suitable lubricant, and leading to the part to be lubricated, to which it delivers a determined quantity of lubricant for each revolution of such part.

3146. Pumps, *H. E. Newton.—Dated 30th July*, 1880. —(*A communication from A. L. G. Dehne.*) 6*d*.

This refers to the construction and arrangement of the valve casings in which the suction and delivery valves are placed, the casing forming the seat for the valve, and having its central line horizontal. The valve may either be a clack, ball, or disc valve, and may work within the casing with or without the employment of spring pressure. Fig. 1 is a vertical section of the valve casing containing a suction valve

3146 FIG. 2.

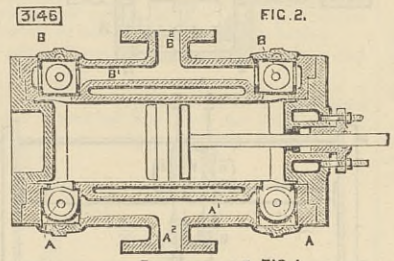

FIG. 1.

of the disc order. The valve casing A, which is cylindrical, is formed with a valve seat B, on which the valve C rests. In order to introduce the valve C into its casing, the upper part D of the casing is made removable, and is capable of being secured by a screw thread to the casing. This part D is formed with a cap or socket which acts as a guide for the valve rod L. Fig. 2 is a sectional plan of a pump cylinder arranged with four valve casings and valves. A A are the suction valves, and B B the delivery valves, A^1 and B^1 are the passages connecting respectively the two suction valves, and the two delivery valves with the supply and delivery pipes A^2 and B^2.

3150. Stoppers for Bottles, &c., *B. Zibach and E. S. Friedeberg.—Dated 31st July*, 1880.—(*Not proceeded with.*) 2*d*.

A plug of india-rubber or other suitable material fits tight into the neck of the bottle, and is provided with a hole through the centre in a line with the longer axis of the bottle; into this hole a piece of pipe of tin or other suitable material is inserted, and stopped at its inner end. One or more holes are pierced in this pipe just under the collar, so that the pressure will force the collar hard against the plug, and so stop the aperture, but if the external end of the pipe be pushed inward so as to expose the hole in the side of the pipe, the liquor within the bottle being under pressure immediately enters the pipe and escapes through it.

3151. Brakes for Carriages, &c., *J. A. Lawton.— Dated 31st July*, 1880.—(*Not proceeded with.*) 2*d*.

The brake is fitted to the axle instead of the body of the carriage, so as to free the brake from all perturbation (relatively to the wheel) from the action of the springs.

3153. Water-closets, *T. W. Hellivell.—Dated 31st July*, 1880. 4*d*.

The object is to construct water-closets and flushing apparatus in such manner that the excrement may

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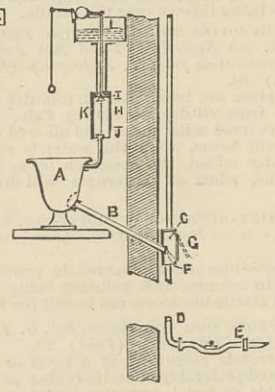
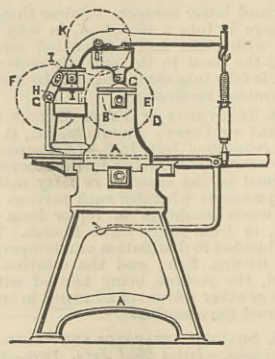


be readily and effectually washed away with one flushing, and the discharge pipe trapped or closed so as to prevent any disagreeable smell from bad gases, and so arranged that no excrement is in the trap or closet when not in use. A is the basin having a discharge pipe B terminating within the box or chamber C in communication with the soil pipe D and sewer pipe E. At the end of the discharge pipe B is hinged a lid or valve F, which opens readily when the basin is flushed and closes again when the flush ceases, thereby acting as a trap and preventing return gases. G is a door for cleaning the pipes. H is the flushing cylinder provided with an inlet valve I and outlet valve J, both attached to the rod K; and L is a cistern containing water for flushing purposes.

3156. Engraving Rollers, *E. T. Gadd.—Dated 31st July*, 1880. 4*d*.

This consists in the employment of a series of toothed wheels to gear the "mill" and the copper roller together, so proportioned that the surface speed of their peripheries shall exactly correspond. A is the framing of the machine, B the copper roller, and C the

3156



mill. Near one end of the shaft D is keyed a spur-wheel E gearing into a similar wheel F keyed on the back shaft G, near the centre of which latter is keyed a spur pinion H gearing by means of two carrier wheels I with a spur-wheel K, which drives a small pinion on the axle of the mill C.

3155. Artificial Manure, *W., E., and T. W. Haslehurst.—Dated 31st July*, 1880.—(*Not proceeded with.*) 2*d*.

Human excreta is emptied into a tank, and to it quicklime is added (about one ton of lime to twelve tons of excreta). This is allowed to rest, and then dried, when it falls to powder and is fit for use.

3157. Creaser for Cartridges, &c., *C. E. P. Gabriel. —Dated 31st July*, 1880.—(*Not proceeded with.*) 2*d*.

This relates principally to creasers for producing the creases in cartridges by which the wad is fixed and the charge retained in the cartridge case. It further relates to additions to creasers by which they may be converted into apparatus for capping and recapping cartridge cases.

3158. Knitting Machines, *H. H. Lake.—Dated 31st July*, 1880.—(*A communication from L. Couturat.*)—(*Not proceeded with.*) 2*d*.

At each end of the machine, which is rectangular or rectilinear, two square-threaded screws are employed suited to the kind of knitting machine on which they are employed, one of the screws being a left-handed screw to produce a forward movement, and the other a right-handed screw for producing a back or rearward movement, directly actuating the bars carrying the points.

3159. Winding or Taking-up Bobbin Net, &c., *A. M. Clark.—Dated 31st July*, 1880.—(*A communication from G. Kent.*) 4*d*.

In the drawing A is a roller having radial pins or teeth B fixed around its periphery. This roller is rotated in the direction of the arrow, and is retained in its different positions by means of a ratchet and pawl C D. A second roller E presses upon the roller A,

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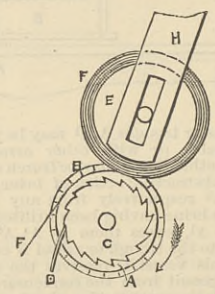
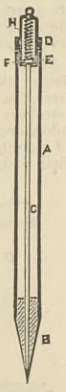


and has a fabric F wound upon it by the rotation of the roller A, the pins B of which penetrate the fabric and bring it up to and wind it on the roller E. The journals of the roller E are free to rise and fall in slots in the frame H.

3160. Fountain Pens, *N. Wilson.—Dated 31st July*, 1880. 6*d*.

This consists partly in effecting an automatic opening and closing of the valve or aperture which admits air to the ink reservoir. The drawing represents one form of pen. A is a hollow holder consisting of a tube forming the ink reservoir; B is a writing tip; C is a

3160



self-acting needle, consisting of a thin rod of metal wire tapered at the end to fit the ink duct. The upper end of this needle passes through a hollow removable plug or stopper D, within which is formed an air chamber H secured into the top of the holder. E is a valve attached to or formed on the needle for the purpose of opening and closing automatically an air inlet aperture F in the lower part of the air chamber and communicating with the ink reservoir.

3161. Sewing Machines, *E. Wiseman.—Dated 31st July*, 1880. 6*d*.

This relates chiefly to improvements on patent No. 2485, A.D. 1879, and consists in the combination with machines for sewing straw plaits or braids, of an arrangement of adjustable automatic tension, which is varied or adjusted by the act of varying the length of stitch, and is also automatically and independently relieved as required during a portion of each revolution of the machine. The arrangement for adjusting the tension with the length of stitch is actuated by the stitch regulator or slide, and consists of a spindle sliding longitudinally within a bearing fixed to the bed-plate. The spindle is so connected by a bell-crank lever with the adjustable stitch regulating mechanism as that on altering the length of stitch the pressure of a helical spring upon one of a pair of tension discs shall be increased or diminished. To effect the automatic release of the thread at one or more points in each revolution the discs are mounted upon a sliding collar projecting slightly through both discs and enters a recess in a washer mounted loosely on the sliding spindle, and pressing

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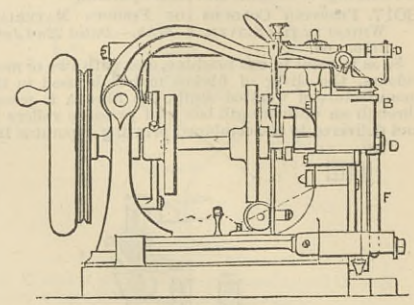


against the outer one of the tension discs. The sliding collar is slid one or more times at each revolution along the sliding spindle by a lever and connecting link, the lever being worked by a cam fitted on the main shaft, assisted by a spring, which gives the return movement. By these means the take-up lever is dispensed with.

3164. Retarding or Stopping Railway Trains, &c., *A. Hunter.—Dated 31st July*, 1880.—(*Not proceeded with.*) 2*d*.

This consists essentially in fitting in combination with the brake apparatus a long pendent lever, or set of levers, which are actuated to apply the brakes, and through the brake mechanism to shut off the steam supply of the engine when the pendent lever comes in contact with, and, in passing, is raised by longitudinal inclined planes, or rails fitted in the path of the pendent lever, preferably between the lines of rails or permanent way.

3165. Propeller Pumps, &c., *P. Jensen.—Dated 31st July*, 1880.—(*A communication from Dr. J. Comperghi.*)—(*Not proceeded with.*) 2*d*.

The pump is made in the form of a wheel formed with vanes and enclosed in a cylindrical case, having an annular space at each side of the wheel in the direction of the axis. The inlet is on one side, the outlet on the other side of the circumference of the case, at the same or at different levels, the one at or near one end cover, the other at or near the other end cover.

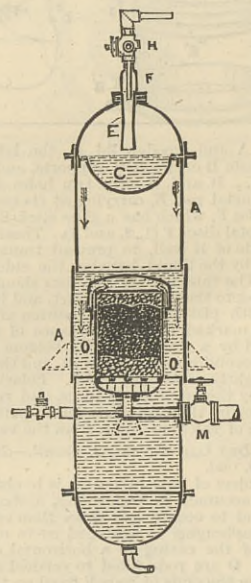
3170. Application of Chemicals for Purifying Vitiated Air, *R. Neale.—Dated 3rd August*, 1880. —(*Not proceeded with.*) 2*d*.

This relates to improvements on patent No. 2914, dated 15th July, 1880, the essential feature of which is to cause a large proportion of any existing volume of vitiated air to pass over, or through, or be saturated with the chemical agent employed.

3171. Separating Matters from Water, *S. Hallam and G. L. Scott.—Dated 3rd August*, 1880. 6*d*.

This relates particularly to the treatment of feed-water for steam generators, but is also applicable to other purposes. The apparatus consists of a cylindrical shell A, in the upper part of which is mounted a basin C slightly smaller in diameter than the shell. Above the basin is a tube E projecting into the shell, and outside the shell is a stand pipe F, to the upper part of which is fixed a two-way steam cock H, one side of which is connected to a pipe projecting into pipe E, while the other is in connection with a steam generator. A branch pipe at right angles to the other

3171



two is connected with a waste steam pipe. A branch from the stand pipe F supplies the feed-water which falls into basin C, and is heated by the steam from cock H, and, overflowing, falls in an annular film into the lower part of the shell, thus causing an upward current nearer the centre, which enters the filter O and passes through valve M to the boiler.

3174. Production of Packing and Cements, *J. H. Johnson.—Dated 3rd August*, 1880.—(*A communication from L. C. Levoir.*)—(*Not proceeded with.*) 2*d*.

This consists in effecting the impregnation of suitable porous or woven materials with such solutions or substances, as that when two or more of the same are brought into contact chemical decomposition shall be effected, and a precipitate be formed in and upon the porous or woven materials operated upon.

3175. Apparatus for Calculating, *A. N. Durand.— Dated 3rd August*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in an arrangement of barrels—say twelve in number—turning loose on an axle in a box. On these barrels are marked twice, in reverse order, the figures 1 to 9, the series to the right serving for additions, and those to the left for the subtractions, so that by working always in the same direction either operation can be effected by reading the results on one or the other series.

3180. Feed-water Apparatus, *F. H. F. Engel.—Dated 3rd August*, 1880.—(*A communication from A. Mayhew and W. Ritter.*) 6*d*.

The apparatus is designed to automatically supply boilers with water, and consists of a bottle-shaped chamber A with an enlarged bottom part, an air vessel B, and float chamber C. The chamber A is by tube *a* connected to vessel B, and such tube is passed through the enlarged part of A and ends at the bottom of A, where it has small openings. The suction pipe D for the feed-water communicates by a valve with the enlarged part of A, and the feed-water is forced out through an opening near the bottom which is closed by a return valve. The valve in valve box F opens towards chamber A. The steam pipe from the boiler terminates under the valve in

the valve box F; a tube communicates with the upper side of the valve and with the float chamber C;

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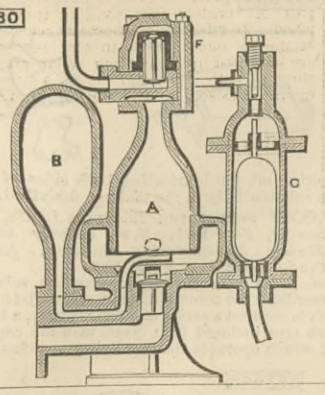

a pipe leads from C into the boiler and reaches down to the normal level of the water.

3183. MAKING JOINTS OF MOULDS FOR CASTING STEEL, &c., *C. J. Allport.—Dated 3rd August*, 1880.—(*Not proceeded with.*) 2*d.*

This consists in the use of either strips or rings of asbestos millboard, or asbestos fibre, made into a gaskin between the bottom of the ingot mould and the bottom upon which it stands, and the lid and top of the mould, and if the mould is made into more than one piece, between the joints of the different pieces.

3184. FLUE OR TUBE FOR STEAM BOILERS, *J. A. and J. Hopkinson.—Dated 4th August*, 1880. 6*d.*

This consists in forming the flue of two or more

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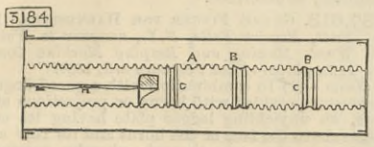

corrugated cylinders A combined with plain cylinders B placed between every two corrugated portions, and serving to receive conical or other water-circulating tubes C.

3185. EDGING GRASS, *P. Adie.—Dated 4th August*, 1880. 4*d.*

For the purpose of edging grass and rapid cutting with shears or scissors, a roller C is combined with the shears and runs along the surface that is to be edged, such roller being mounted on a spindle passing

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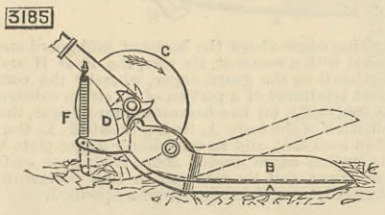

through a boss on the stationary blade A and carrying a set of cam teeth D, which act on a projection of the movable blade B and raise it as the apparatus is propelled, the spring F causing the blade B to descend and effect the cutting operation.

3188. RIVETTING, PUNCHING, AND SHEARING MACHINES, *J. Horlock.—Dated 4th August*, 1880.—(*Not proceeded with.*) 2*d.*

A fluid pressure rivetting machine is constructed with two rams working in the same cylinder, one ram giving motion to a rivetting tool, and the other actuating a holding up or pressing block or die.

3192. RULING AND HATCHING, *W. L. Wise.—Dated 4th August*, 1880.—(*A communication from A. J. Umbach.*) 6*d.*

The guide rails A carry a travelling frame B, on which is mounted a screw spindle C, one end of which extends outwards, and carries a pinion Q gearing with a wheel P fixed on shaft G, which is provided with a handle at one end and a ratchet wheel I at the other. This end of G passes through a stationary disc T having a stop and clamp with a set screw. The nut D is mounted on shaft C, and carries the tool frame E with the tool O. By turning the handle on shaft G the nut D is caused to travel along spindle C. The hand lever F carrying a pawl H, gearing with the ratchet I, a wedge and a cam are free to turn on shaft G. The two levers N and X are acted upon by the cam for the purpose of raising the tool before it travels back. The instrument

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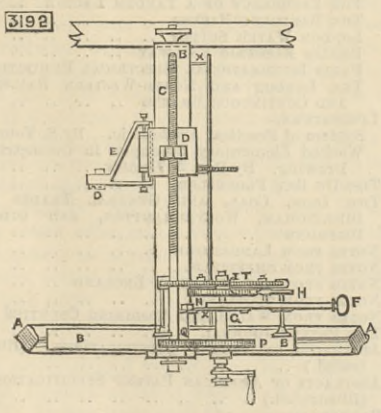

is placed on the surface to be ruled, and the tool placed above its starting point by turning the spindle C. The distance between the lines is then regulated by setting the clamp on the disc T at the desired distance from the stop. The first line is then made by drawing the apparatus to the right by means of lever F. In reversing the motion of the hand the cams through lever N will act on X, depressing it, and through it the rear portion of the tool frame, thus raising the tool. The pawl H will turn ratchet I, and through the wheels P and Q feed the carriage further along.

3194. PIANOFORTES, *W. Robinson.—Dated 4th August*, 1880.—(*Not proceeded with.*) 2*d.*

The rest plank is placed immediately on the top of the bracings or back instead of at the upper part of the front thereof, and the tuning pins are inserted in the top of the plank, and the strings are caused to come over the top edge thereof.

3195. SPRING BED BOTTOMS, &c., *S. Pitt.—Dated 4th August*, 1880. —(*A communication from H. J. Beemer and J. Sullivan.*)—(*Not proceeded with.*) 2*d.*

This consists in combination of the warp wires, or threads of a fastening, easily and speedily secured to the frame, and so constructed as to afford a very firm hold to the wire, &c., and at the same time to allow such to be detached with great facility in case of breakage or of extra tension being required.

3199. PREPARATION OF GRAIN OR CORN FOR BREWING, &c., *E. R. Southby.—Dated 5th August*, 1880. 4*d.*

The corn is more or less completely saturated with water. It is then cooked and afterwards dried, and finally reduced to a fine meal or powder.

3200. APPLIANCE FOR PERAMBULATORS, *J. H. Bailey.—Dated 5th August*, 1880.—(*Not proceeded with.*) 2*d.*

A prop or support is secured to the back of the perambulator, or it may be secured to the springs of the front wheel, or to the springs of the hind wheels, or to any other convenient part of the perambulator, and such prop can, if desired, be made to slide, so that it may be brought as near the ground as possible.

3201. MANUFACTURE OF AQUA AMMONIA, *F. J. Cheesbrough.—Dated 5th August*, 1880.—(*A communication from J. L. Marsh.*) 6*d.*

This consists partly in the combined method of heating and agitating the material under treatment in a tight retort or containing vessel, consisting of a steam jacket enclosing the retaining vessel for heating the material, in combination with a horizontal rotating stirrer, by which the material so heated is thrown around the horizontal axis of the stirrer to obtain a more thorough separation of the material and a more rapid elimination of the ammoniacal gas.

3202. GOVERNORS AND GOVERNING VALVES FOR ENGINES, *W. Chadburn.—Dated 5th August*, 1880. 6*d.*

The object of this invention is to render more sensitive the action of apparatus for governing or preventing the racing of motive power engines. The governor consists of a spiral spring A surrounding a spindle B, the lower end of which is attached to a paddle C immersed in liquid. The upper end of A is

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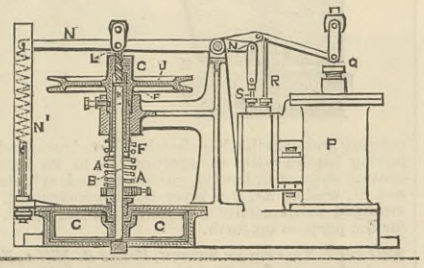

attached to a sleeve F having a nut G, and carrying a pulley J driven from the engine-shaft. Passing through the sleeve and nut and between the sleeve and spindle B is a hollow spindle K, having at top a prolonged spindle L formed with a screw to fit the nut G, and connected at its upper end to lever N arranged to operate the throttle valve, either directly or through an auxiliary valve apparatus forming the second part of this invention. The spring N^1 brings the spindle L back to its normal position, and the pointer indicates the number of revolutions. The Second part of the invention consists in providing auxiliary cylinders P —which are used to work the throttle valve by the piston rod Q—with a cut-off or controlling valve R, worked by the piston movement of cylinder P. S is an admission valve of the equilibrium type, and is worked by the action of the governor.

3203. GAS-BURNERS, *T. Fletcher.—Dated 5th August*, 1880. 4*d.*

A box or chamber is covered with finely perforated sheet metal, and into the interior of the box is introduced one end of a horizontal tube, open at both ends, and at the other or free end of the same tube is placed a gas jet pointing along the inside of the tube, the hole in the jet for the gas supply being so proportioned in size as to draw into the tube the correct proportion of air to mix with the gas, and which mixture burns quietly on the top of the perforated plate in a solid flame.

3205. TINDER BOXES, *F. Grimal.—Dated 5th August*, 1880. 4*d.*

This consists of a tinder box formed with a receptacle for holding inflammable liquid, and a wick tube and receptacle for endless match, combined with a striking device, consisting of a draw rod, hammer, and anvil.

3208. SUSPENDING LADIES' PETTICOATS OR SKIRTS, *H. W. R. Crowle and W. C. Beetles.—Dated 5th August*, 1880.—(*Not proceeded with.*) 2*d.*

This consists in two or more petticoats or skirts being attached to one and the same waistband, whereby the clumsiness and discomfort arising from the shifting and puckering up of two or more bands rounds the waist is entirely avoided.

3213. THERMOMETER, *E. F. Bamber.* — *Dated 5th August*, 1880. 4*d.*

This consists in the use of fusible metals, alloys, or other substances which are solid at ordinary atmospheric temperatures, and which remain in a state of fusion at the temperatures between which they are employed within a tube or other vessel, while in a fused condition, for the measurement of temperature by their expansion and contraction within such a tube or other vessel.

3217. DRIVING BELTS OR BANDS, *J. Tullis.—Dated 6th August*, 1880. 6*d.*

The belts are formed from long strips of leather, equal in width to the thickness of the belt to be made and as long as convenient. In their edges notches A are formed at intervals, and through the centre

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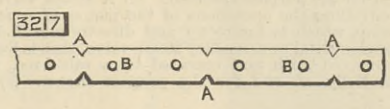

holes B are pierced between the notches. A number of such strips are placed side by side to form the desired width of belt, the holes B being coincident in all the strips, and the notches A breaking bond. Fastening pins are then passed through the holes B and their ends rivetted over.

3218. DISTILLING HYDROCARBONS FROM COAL, SHALE, &c., *J. Imray.—Dated 6th August*, 1880.—(*A communication from R. Rieth.*)—(*Not proceeded with.*) 2*d.*

The carbonaceous matter is put into a retort and heated to a moderate heat. The retort has opening from it two pipes, an inlet and an outlet pipe. The outlet pipe leads to coolers, in which the products of distillation are partially condensed, the condensed matters being collected in suitable vessels with which the coolers communicate. The uncondensed portions of the products are drawn by a pump or fan, and caused to pass again through the retort in contact with the heated carbonaceous matter, from which they take up a fresh portion of condensable matter, and thus the products of distillation are caused to circulate through the retort and the coolers until the material in the retort is exhausted.

3219. IMPROVED METHOD AND APPARATUS FOR OBVIATING THE EFFECTS OF EXTRANEOUS ELECTRICAL DISTURBANCES ON TELEPHONIC LINES, *J. Imray.—Dated 6th August*, 1880.—(*A communication from Dr. C. Herz.*)—(*Not proceeded with.*) 2*d.*

Instead of leading the line wire direct to earth from the receiver, the inventor makes it terminate in a number of fine points extended over a large area, another set of points close to the former set communicating by a wire to earth. The space between the sets of points may be filled with alcohol, oil, or other medium.

3221. LIQUID COMPOSITION FOR WASHING, BLEACHING, AND DISINFECTING, *W. Haworth.* — *Dated 6th August*, 1880. 2*d.*

The composition consists of lime, soda, and water.

3222. ACCUMULATORS, *A. Wadsworth.* — *Dated 6th August*, 1880.—(*Not proceeded with.*) 2*d.*

The accumulator is provided with a table or piston which fits inside it; this table slides on a centre rod or pillar to keep it steady. By means of suitable gearing the table is caused to rise, which allows the accumulator to be filled with water without resistance; the motion of the first motion shaft is then reversed to compress the water without resistance.

3223. SHUTTLES FOR LOOMS, *T. and J. Comstive.—Dated 6th August*, 1880.—(*Not proceeded with.*) 2*d.*

The metal clip is dispensed with, and the interior of the shuttle is formed so as to leave a recess or projection on each side, in such manner that the said recess or projections will retain and secure the head of the bobbin or spool when placed in the shuttle.

3227. MACHINE FOR FINISHING LEATHER, *L. A. Groth.—Dated 6th August*, 1880.—(*A communication from J. T. Liedtkie and P. F. Lenhart.*)—(*Not proceeded with.*) 2*d.*

This consists essentially of a reciprocating table that supports the finishing plate in combination with an oscillating arc-shaped or semi-cylindrical sheet metal shell, which is faced with a layer of elastic material, and acted upon by a central transverse pressure roll.

3230. DISINTEGRATING APPARATUS, *F. C. Glaser.—Dated 7th August*, 1880.—(*A communication from G. H. Pfefferkorn.*) 10*d.*

This relates to means for preventing disintegrating machines running when empty by means of an alarm signalling apparatus, an instantaneous stopping mechanism, and arrangements for separating the working parts. For this purpose the weight of the material is made to bear on a valve D, which when

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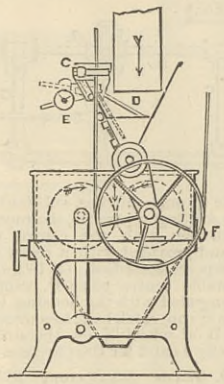

relieved of the load is raised by a counterbalance weight E, thus withdrawing a stop from a recess in the belt-shifting rod C, which is then moved by a spiral spring, so as to shift the strap on to the loose pulley. So as to sound an alarm the loose pulley is fitted with a projection F, which acts on the hammer arm of a sounding mechanism.

3279. PULLEYS FOR BLIND CORDS, &c., *F. A. Harrison and C. Priestland.—Dated 11th August*, 1880. 6*d.*

The frame A of the pulley is made from sheet metal by dies, and is formed with a plain back plate and a slot in front in which the carrier D works. The carrier consists of an oblong bar having grooves in its edges to work upon the edges of the slot in the frame A. The pulley is mounted upon the plain part of

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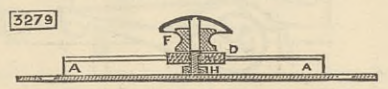
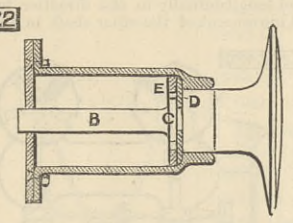


the binding screw F, the screwed part of which works through the carrier D, and carries at its end a ring H. To fix the pulley when adjusted the screw is turned so as to bring the ring H to bear forcibly against the back plate whereby the carrier D is moved outwards, causing the edges of the grooves therein to bind on the edges of the slot in the frame A.

3322. BUFFERS FOR RAILWAY LOCOMOTIVES, &c., *D. N. Arnold.—Dated 16th August*, 1880. 6*d.*

The object of this invention is to prevent the loss of the buffer disc and rod and spring which often occurs, in case of accident, to ordinary buffers. For this purpose the buffer rod B has on the end which occupies the front of the buffer case an oblong collar C. D is a plate fitting the front of the buffer case,

3322



and having in its centre a hole to allow it to pass over collar C; and E is a locking plate with a similar hole in it. On face of E are two rib-like snugs on the longer edges of the hole in its centre. When the plate D has been passed over the collar C it is turned through a quarter of a circle, and when the plate E is placed in position the snugs on it fit into the ends of the hole in D, which it prevents turning round.

4910. ANTISEPTIC FOR PRESERVATION OF MEAT, &c., *G. W. von Nawrocki.—Dated 25th November*, 1880.—(*A communication from O. Leupold.*)—(*Complete.*) 2*d.*

This consists of boracic acid rendered soluble by admixture of either borax caustic soda, or potash, or carbonates of soda or potash.

5010. REMOVING DUST FROM CARPETS, *A. J. Boult.—Dated 1st December*, 1880.—(*A communication from S. B. Ryder.*)—(*Complete.*) 4*d.*

The carpet is placed in the interior of a cage A, the

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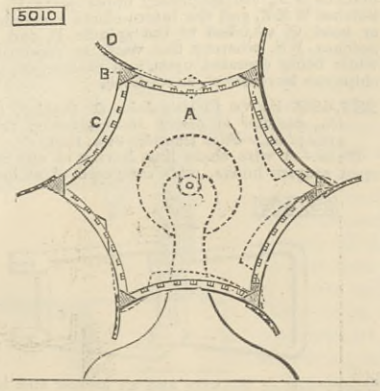

periphery of which is formed of a number of curved surfaces. The two ends are connected by bars B at the angles and slats, secured at equidistant points between the bars so as to leave openings between them. When the cage is revolved the carpet is carried upwards successively by each panel to a point considerably above the centre of the cage, when it falls down and engages with the next lower panel, thus shaking the carpet and causing the dust to pass out between the slats. In order more readily to drive out the dust, flexible flanges D are secured to the bars B and cause air to be gathered inward and forced through the open periphery of the cage.

5011. DIVING APPARATUS, *S. P. M. Tasker.—Dated 1st December*, 1880.—(*Complete.*) 6*d.*

The object of this invention is to so form the diving dress that it shall possess the requisite flexibility combined with a rigidity to resist at every part the pressure of the water; also in an improved construction of armour lifting device, so as to distribute the strain equally over the armour or dress; further in an arrangement of the air inlet and exhaust tubes so as to concentrate them into one; constructing the suit so as to be capable of being readily put on and removed; and finally, in applying floats to the air

5011

tubes, so as to keep them out of the way of the diver. The suit or armour consists of an inner lining of rigid material, such as metal, and an exterior coating of flexible material. The joints of the parts requiring to be flexible are made of a series of excentric rings, the thin edge being placed at the inside of the joint and the thicker edge at the outside, the waterproof coating covering them being left full so as to form a bellows joint. The air tube is made to pass inside the exhaust tube, and round the latter is a rope which branches off into four strands, and is secured to both the outside and inside of the legs, so as to take the weight off the tube when lifting.

5039. SCREW NUTS, *H. J. Haddan.—Dated 3rd December*, 1880.—(*A communication from W. Courtenay.*)—(*Complete.*) 4*d.*

So as to prevent screw nuts working loose they are formed in two parts, one part A being made of iron or other hard material, and being recessed on its bottom face to receive the other part B, which is made of

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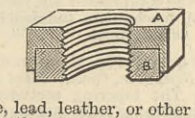

vulcanised fibre, lead, leather, or other material softer or more yielding than part A. The thread is formed through both parts, and when screwed home the bottom of B comes first in contact with the bearing surface, and the continued rotation of the nut will cause the part B to bind on the bolt, and thus prevent the nut working loose. Instead of this arrangement a separate nut made of vulcanised fibre may be placed under the ordinary nut, and act as a jamb nut.

5091. IMPROVEMENTS IN ELECTRIC TELEGRAPHY, *H. J. Haddan.—Dated 7th December*, 1880.—(*A communication S. L. M. Barlow.*) 6*d.*

The inventor, Mr. Barlow, of New York, uses secondary currents to obtain signals. As will be seen from the figure he uses the coil preferably in connec-

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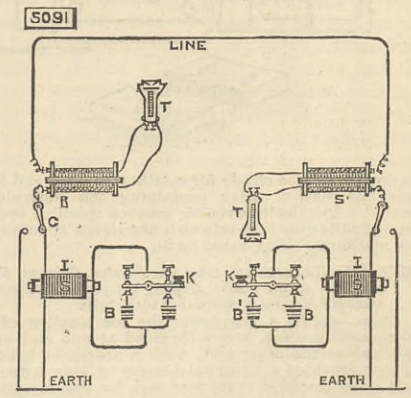

tion with a sounder. His transmitting key oscillates between four stops, two stops being connected to the like poles of two batteries, the other poles being connected to the primary coil and the other contacts.

5152. IMPROVEMENTS IN ELECTRIC DRILLS, *S. Pitt.—Dated 9th December*, 1880.—(*A communication from C. E. Ball.*) 6*d.*

The drawing shows a longitudinal section of this drill. A cylinder B slides freely endwise on the frame, its movement being controlled by an adjusting screw. D^1 is a soft iron arc actuated by the coils C

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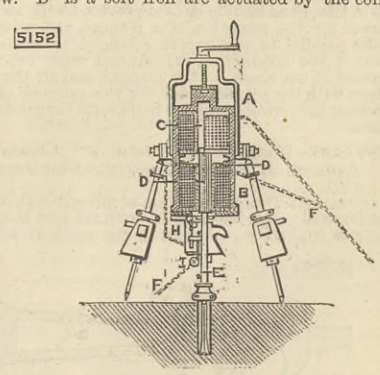


and D. At the upper end of the cylinder is a small air chamber, the air being compressed at each stroke. The current is passed through each coil alternately, one coil drawing drill back, the other pulling it forward to make its stroke.

3144. COOKING-PANS OR UTENSILS, *W. L. Wise.—Dated 30th July*, 1880.—(*A communication from A. Kuntze.*) 6*d.*

This consists in a cooking-pan or utensil for frying or roasting meat provided with a tightly-fitting cover, forming the outwardly curved bottom double, with an interposed layer of asbestos or other material, that is a non-conductor of heat.

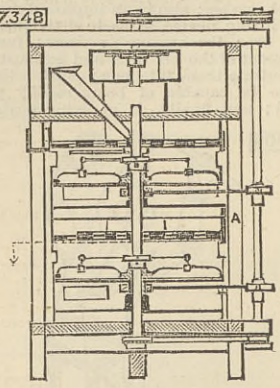
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

237,348. Middlings Purifier, *Nicolas Weber and George H. Rector, La Porte, Ind.—Filed May 18th*, 1880.

Claim.—(1) In a middlings purifier, a horizontal rotating screen of disc form, and means, substantially such as described, for imparting a vibratory motion thereto. (2) In a middlings purifier, the combination of a suspended rotating screen having a central hub or boss, an excentric located at one side of the hub, and a rod or pitman extending from the excentric to

237,348



the hub, whereby the rotation of the excentric produces a vibration of the screen. (3) In a middlings purifier, the combination of the casing A, communicating with an exhaust chamber, a series of screens mounted in said casing, travelling discharge beds located below the screens, and air-tight diaphragms independent of the discharge beds, located between the respective screens, whereby a separate chamber for each screen is provided.

237,359. Air Compressor, *Jno. F. Allen, Brooklyn, N. Y.—Filed November 1st*, 1880.

Claim.—In an air-compressing apparatus, the induction valve of the compressing cylinder, connected directly with the prime motor by means of a connecting rod, so that such valve shall always be moved and

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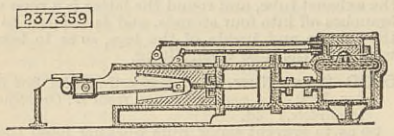

controlled in a positive and uniform manner, in combination with a valve moved and controlled in a positive and uniform manner for regulating the discharge of the compressed air, each of which valves is operated by mechanism independent of the other, substantially as described.

237,364. Machine for Machining Axles, *Francis D. Bliss, Newhaven, Conn.—Filed August 12th*, 1880.

Claim.—(1) The tapering sectional matrix cutter adapted for machining axles and containing numerous short individual cutters *d*, substantially as hereinbefore described. (2) The combination, substantially

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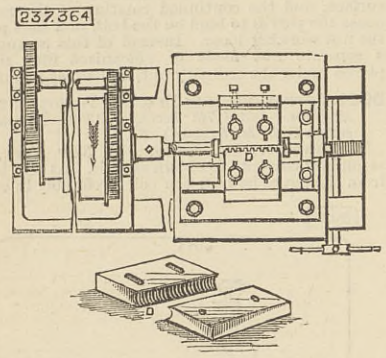

as described, of a chuck for rotating an axle and the sectional matrix cutter containing the individual cutters *d* and the intervening grooves spiralled oppositely to the direction in which the chuck is rotated, for machining axles, as set forth.

237,379. Telephone, *Gay W. Forster, Chicago, Ill., assignor to the Foster Magnet Telephone Company, same place.—Filed September 10th*, 1880.

Claim.—(1) In a telephone, the combination of a permanent magnet, screw threaded at one end and notched at the other end, with a telephone handle or case provided with an axial recess or hole reduced and screw threaded at its rear end for the reception

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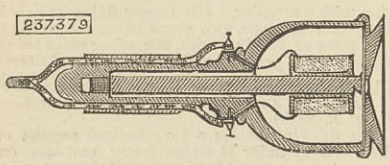

of said magnet, substantially as shown and described. (2) A telephone handle or case provided with an axial recess for the reception of a magnet, and with two holes parallel to said recess arranged to receive and protect the conducting wires, and with two holes formed at an angle to the magnet and in the same plane with the parallel holes, for the purpose of connecting the terminals of the helix with the conducting wires.

237,386. Hose Nozzle, *John H. Johnson and Frederick A. Hoyer, Chicago, Ill.—Filed June 2nd*, 1880.

Claim.—(1) The combination of the valve D, having the forward projecting lugs D^1, with the part B, having the ribs B^1, and part A, having the ports A^1, all con-

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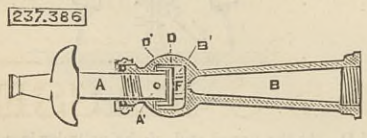

structed substantially as shown, and for the purpose described. (2) The combination of the valve D, having the forward projecting lugs D^1, with the ribs B^1 in the part B, having the open spaces F F between the ribs, arranged and constructed substantially as shown, and for the purpose described.

237,390. Gearing for Grain Drills, *Jacob King, Indianapolis, Ind.—Filed June 25th*, 1880.

Claim.—(1) In a grain drill, the combination of the bevel pinions with the ball-and-socket joint N N^1, with the case E, having the slots R R^1, constructed and operating substantially as specified. (2) In a grain drill, the combination, with the gears, as described, of the case E, having the lugs S, constructed and

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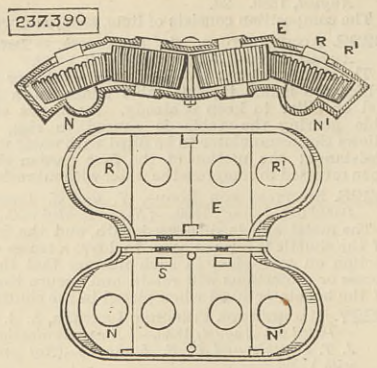

operating substantially as and for the purpose set forth.

237,400. Railroad Track Drilling Machine, *August Loehner, St. Louis, Mo., assignor to St. Louis Polytechnic Ironworks, same place.—Filed July 20th*, 1880.

Claim.—(1) In a drilling apparatus, the tubular bar A, provided with the detachable shoes B, the latter being formed to receive and hold the hook bars C, substantially as shown, for the purposes set forth. (2) The cylindrical tubular bar A of the drilling apparatus, having therein the flat resisting bar, and provided with shoes B, in combination with the hook bars C,

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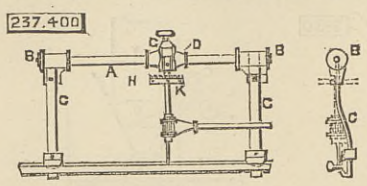

having the thumb clutches, substantially as set forth. (3) In the drilling apparatus, the round tubular bar A, in combination with the centre piece D, sliding thereon, and provided with a screw and plate, as and for the purposes described. (4) In a drilling apparatus, the adjustable centre piece D, supporting the drill spindle, provided with the housing G, containing the adjustable spring catch bolt, to connect, as shown, with the teeth H of wheel K on the drill-feeding screw, substantially as and for the purposes set forth.

237,460. Grain Separator, *William Ackerman, Mansfield, Ohio, assignor to the Aultman and Taylor Company, same place.—Filed July 7th*, 1880.

Claim.—(1) The vibrating straw carrier or shaker, provided with the hinged folding extension projected beyond the machine frame, in combination with the adjusting rod or bar for holding said extension at any

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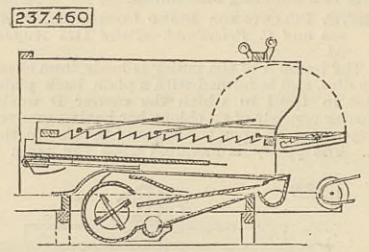

desired angle of adjustment, substantially as described. (2) The hinged adjustable and folding extension of the straw carrier or shaker, in combination with longitudinally arranged lifting fingers applied to and adapted to be folded out of the way with said extension when not in use, substantially as described.

237,479. Machine for Threading Bolts and Nuts, *Henry B. Burin, New York, N.Y.—Filed April 7th*, 1880.

Claim.—(1) In a machine for cutting bolt threads and tapping nuts, the combination, with the sliding rotary shafts B B^1, that carry the tools, of the ring gear teeth N and the equal-armed lever P, having curved crosshead racks upon its ends, substantially as herein shown and described, whereby the one shaft is moved longitudinally in one direction by the longitudinal movement of the other shaft in the other direc-

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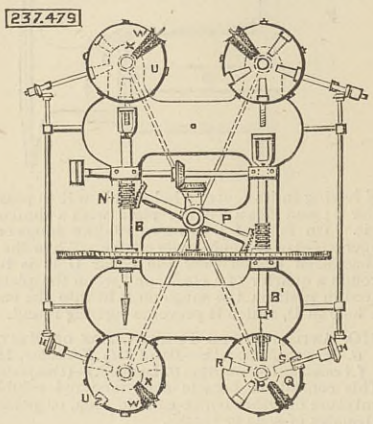

tion, as set forth. (2) In a machine for cutting bolt threads and tapping nuts, the work holders constructed substantially as herein shown and described, consisting of the stationary lower plate T, having notches W X, the stationary upper plate U, having notches W X Z, and the intermediate revolving plate or head Q, attached to the spindle P, and having notches R S, whereby the work is received, held while being operated upon, and discharged, and the chips can be removed, as set forth.

237,489. Drive Chain, *John C. Coonley, Chicago, Ill., assignor to Ewart Manufacturing Company, same place.—Filed December 24th*, 1880.

Claim.—A wire chain link having at one end two open coupler hooks, each composed of at least two

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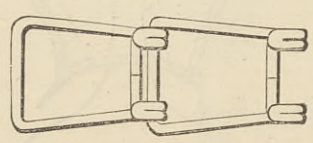

thicknesses of the wire and an arched end bar, and adapted to have coupled with and uncoupled from it the plain end bar at the opposite end of a duplicate link.

237,499. Drive Chain, *James M. Dodge, Chicago, Ill., assignor to Ewart Manufacturing Company, same place.—Filed December 3rd*, 1880.

Claim.—(1) The combination with the two bars of chain links, to be coupled together, of a spirally shaped coupler device adapted to be readily turned on to and off from the said bars, in substantially the manner described, for the purposes set forth. (2) A

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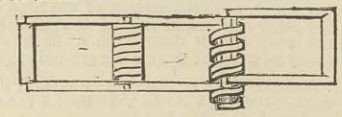

drive chain composed of suitably-shaped links and duplex spiral couplers, substantially as set forth. (3) A drive chain composed of suitably-shaped links and spiral coupler devices, and having the end bars of the links adapted to fit one partially within a longitudinal concavity in the other, the whole substantially as set forth.

237,562. Stencil Brush, *Thomas T. Lotherington, Houston, Tex.—Filed December 30th*, 1880.

Claim.—In combination with the brush F, having a series of vertical perforations between the bristles, the perforated rubber gasket G, flange E, forming the per-

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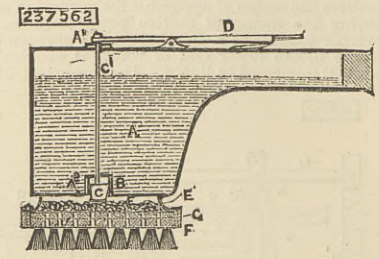

colating and distributing chamber E, and receptacle A, having handle with an aperture A^2 in its bottom, conical stopper C, having guards, slotted cylinder B, rod C^1, washer A^1, and lever D, all constructed and arranged substantially as shown and described, and for the purpose set forth.

237,577. Telephone Switch, *Homer R. Miller, Framingham, Mass.—Filed September 24th*, 1880.

Brief.—The switching in of any telephone in the line by means of the increased resistance thereby caused locks out all other telephones in the line. *Claim.*—(1) In combination with the shunting mechanism of a series of telephones in a circuit, locking mechanism, substantially as described, and electro-magnets, said locking mechanism being operated through the magnets by the weakening of the current when any telephone is shunted in, substantially as set forth. (2) In combination with the shunting mechanisms of the series of telephones of a circuit, locking levers and electro-magnets in the main line operating to hold said levers in unlocking position only when no telephone is in the circuit, said locking levers being combined also with mechanism, substantially as described,

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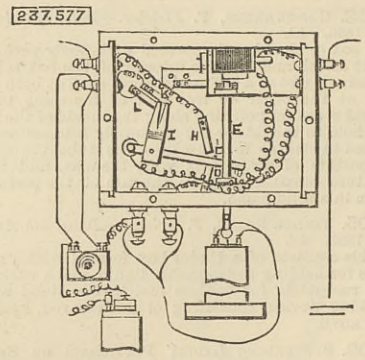

whereby the unhooking of any one of the telephone receivers prevents the station of that instrument from being locked out, as set forth. (3) The combination, with an electro-magnet situated in the main line of a series of telephones, of a lever and notched rod E, provided with hook at its lower end and with spring at the upper, said lever being connected to the shunting devices, substantially as described. (4) The combination, with the lever E^1, locking devices, and rod E, of the points D and H and connecting wires, substantially as described. (5) The combination, with the lever E^1, rod E, and locking devices, of insulated prong plate I, points K and L, and battery connections, substantially as described.

237,602. Steam Valve, *George J. Roberts, Dayton, Ohio.—Filed November 20th*, 1880.

Claim.—(1) In combination with the pistons of a sliding steam valve, and with cylinders which receive said pistons, a separate frame which supports said cylinders and moves with and conforms to the vertical and lateral positions of said valve, substantially as and for the purpose specified. (2) A steam valve for controlling the operations of the piston of a steam pump, which is indirectly and directly moved by a supplemental or secondary steam valve, that is loosely connected with and operated by a valve rod, substantially as and for the purpose shown. (3) The

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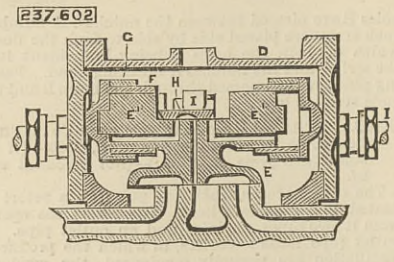

secondary valves H, provided at each end with lugs, in combination with the operating arm I, attached to the valve rod I′, and provided with lugs, substantially as and for the purpose set forth. (4) The combination of the main valve E, provided with the pistons E′, the cylinders F, the separate supporting frame G, and the steam chest D, substantially as and for the purpose shown and described. (5) The combination of the main valve E, provided with the pistons E′, the secondary valve H, the cylinders F, and the moving supporting frame G, with each other, the steam chest D, and with means for operating said secondary valve, substantially as and for the purpose specified.

237,604. Oil Cup for Saws, *Frank Rousseau, Detroit, Mich.—Filed December 21st*, 1880.

Claim.—An oil cup provided with a bifurcated discharge nozzle, each bifurcation containing a separate oil passage for the purpose of delivering oil simultaneously on both sides of a saw-blade substantially in the manner described and shown. (2) As a new article of manufacture, a hand-saw, provided with an oil cup located in the handle, having a bifurcated nozzle that embraces the saw blade, and containing passages for

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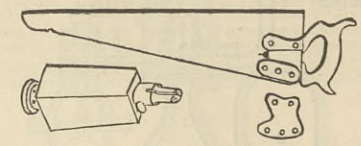

delivering oil for lubricating both sides of the saw blade substantially in the manner described.

237,608. Switch for Electric Lamps, *William Sawyer, New York, N.Y., assignor to Eastern Electric Manufacturing Company, Middletown, Conn.—Filed August 21st*, 1880.

Claim.—(1) In an electric lamp switch, substantially as described, the combination of an insulated plate, to which is secured a series of contact plates, a traversing switch arm inclosed in a fixed metallic case, with a shaft which operates the traversing switch-arm and a

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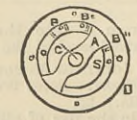

metallic cap secured to said shaft, substantially as described. (2) In an electric lamp switch, the combination of an insulated plate D, having the stop-pin S, and the contact plates B B′ B″, with the switch piece A substantially as described. (3) The combination of the switch piece A, slotted shaft, spring, and recessed case substantially as described. (4) The combination of the switch piece A, shaft C, secured to said switch piece with a spring, recessed inclosing case, and movable cap secured to the outer end of the cap substantially as described.

237,613. Guard Finger for Harvesters, *Walter Scott, Hoosick Falls, N.Y., assignor to Walter A. Wood, Mowing and Reaping Machine Company, same place.—Filed February 3rd*, 1880.

Claim.—(1) In combination with a guard finger of a harvester provided with horns or projections at each side, an unyielding ledger plate having its cutting edges above the face of the horns and its rear end in line with the rear thereof, whereby gumming is prevented, substantially as specified. (2) The combination, with the guard finger of a harvester, of the unyielding ledger blade thereof, having its bottom and

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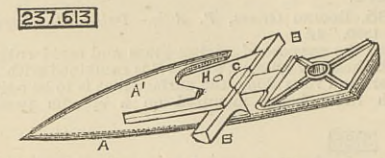

cutting edges above the horns of said guard and provided with a recess at its rear, the rivet H and projection G on the guard-finger, whereby the confining rivet is relieved of a portion of its strain substantially as specified. (3) In a harvester guard-finger, the combination of the body A, its top or shield A′, the horns B on each side, and an unyielding ledger-plate having its cutting edges located above the upper surface of said horns and its rear end in line therewith, substantially as and for the purpose specified.

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The Engineer, March 11th, 1881.