FIRES IN THEATRES.

In consequence of the recent catastrophe at the Ringstrasse Theatre in Vienna, the Austrian Society of Architects and Engineers—a very flourishing body, numbering some 2500 members—appointed a special committee to investigate the conditions of safety in theatres, the causes of accidents, and the means of preventing them. This committee has just issued its report, and in view of the universal interest felt in the subject, and its close connection with engineering construction, we feel fully justified in presenting to our readers an abstract of their inquiry and conclusions.

First, as to the general history and circumstances of theatre fires. These have occurred at intervals ever since the modern construction of theatres was developed—towards the close of the middle ages—out of the courtyards or barns in which the old miracle plays were acted. From these, in the opinion of the committee, are derived the flimsy materials, and the narrow and tortuous entrances, which offer such a contrast to the free and massive construction of the great theatres of antiquity. It must be admitted that in this branch of architecture science has not kept pace with the requirements of the times, as is shown by the ever-increasing frequency of fires. The average life of a modern theatre is calculated by two authors, Fölsch and Rigione, at about twenty-two years only. Many improvements have doubtless been made of late years, both as to the use of fireproof materials and as to means of exit; but they are by no means complete, especially as regards the protection of those in the galleries and upper boxes. That this is so is sufficiently shown by the great and progressive increase in the number of theatre fires—an increase which, of course, is due in great measure to the increase in the number of existing theatres, but still proves clearly that this increase in numbers has not led to greater safety. Fölsch gives a list of no less than 460 theatre fires as having taken place between 1761 and 1877. In all these cases the destruction was complete, minor fires not being taken into account; and whereas at the beginning of the period the number from 1761 to 1780 was seventeen, at the end of the period, from 1861 to 1877, it was 187; while since 1877 the rate has been more than thirteen fires per year.

As to the hour at which the fire begins, Fölsch gives the following analysis of 289 fires:—Begun in daytime, 19·4 per cent.; begun within one hour before admission of public, 5·2 per cent.; begun during the performance, 12·4 per cent.; begun within two hours after the performance, 23·9 per cent.; begun during the night, 39·1 per cent. It will be seen that the number of fires which begin when the theatre is full is happily small as compared with those when it is empty; and that the greatest danger occurs after the performance, doubtless due to unextinguished lights, inflammable substances left about, &c. The time of year at which fires take place is, of course, influenced by the season in each particular town. They are, however, much more frequent in winter—doubtless on account of the heating arrangements which are then necessary.

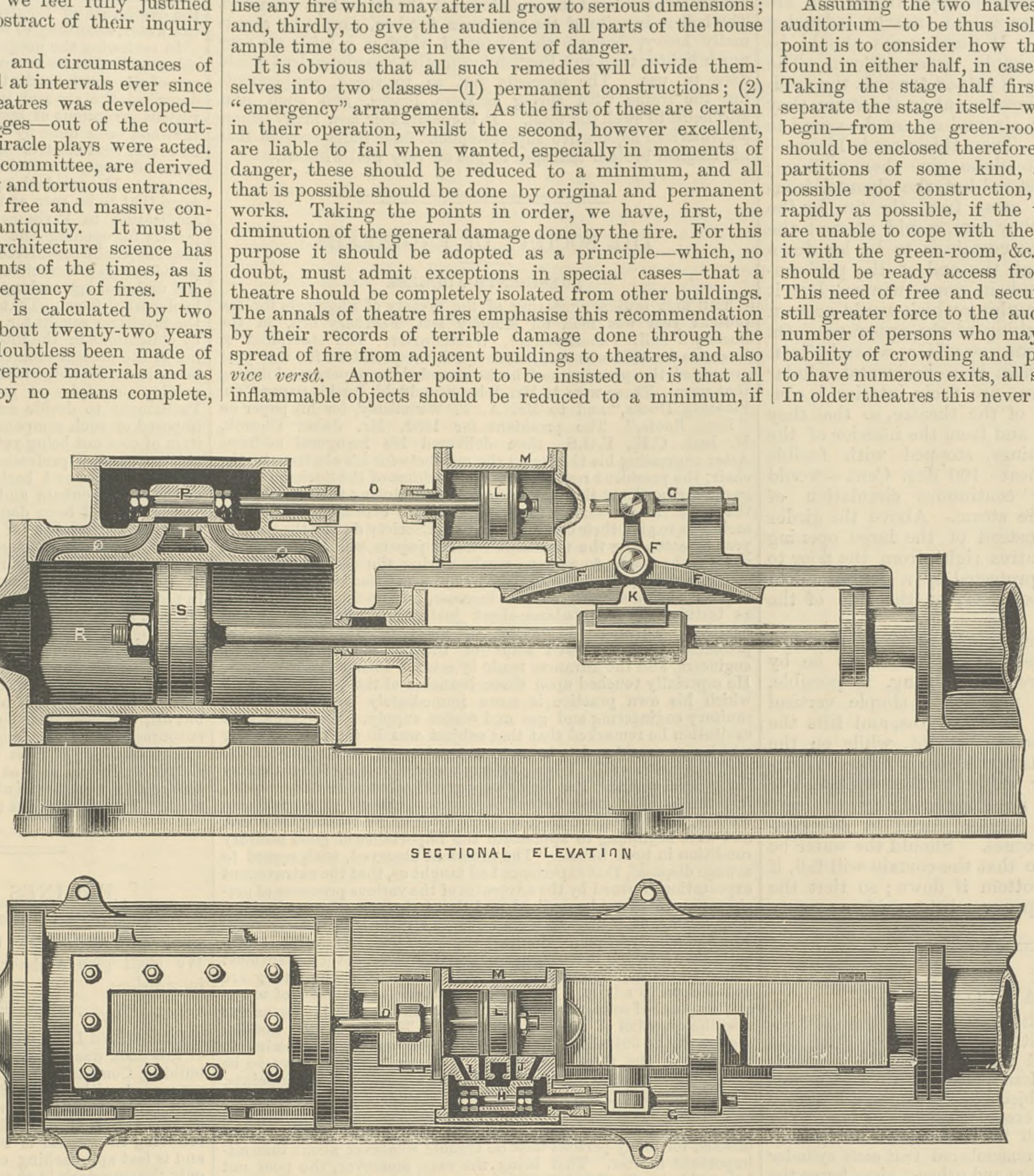
With few exceptions the fires break out upon the stage, which, in view of the great quantity of inflammable material, and the use of naked lights, fireworks, explosives, &c., is not to be wondered at. No successful means of confining fires to the stage when they originate has yet been discovered. In almost all cases they spread to the auditorium, where the ventilation shafts above the gaseliers act as natural chimneys to produce draught, and the destruction of the theatre is then assured; all experience showing that when once fire has got firm hold of a theatre attempts to extinguish it are hopeless. Even a so-called fire-proof construction would be no defence against the overwhelming power of the flames. The consequent destruction of property is estimated at £25,000,000 during the last century, and the loss of human life is far more lamentable; for in no single instance where a fire has broken out during the performance has a loss of life failed to be recorded. This is not due to the fire alone. The vast volumes of smoke emitted by the scenery and other inflammable materials when lighted tend to stifle and bewilder the audience, and would prevent their escaping even if ample means of exit were provided.

But the means of exit are not ample. Especially is this the case with the galleries. Very often two galleries are approached by the same stair, or the two stairs open on the same passage. The result is a meeting of two confluent streams of persons—which is sufficiently troublesome at ordinary times, but in cases of fire is simply fatal. Again, if the passages are not straightforward and simple in their directions, if they are broken into unequal and numerous lengths, and especially if they are interrupted by pillars, a block is almost sure to take place sooner or later during the escape from a fire. Men and women are thrown down and heaped above each other, and those behind lose all chance of escape. The extinguishing of the gas—which is often done on purpose if an alarm of fire is given—of course increases the difficulty.

Police regulations, which are sufficiently strict in Vienna as to private houses, are yet sadly insufficient with regard to theatres. Thus no provisions are made for isolating the fire in the spot where it first appears; fireworks, which are forbidden in the streets, are used on the stage; and passages are common in theatres whose height and width would be considered quite intolerable in a private house.

The causes of theatre catastrophes are thus plain enough, and the remedy must be in stringent arrangements and regulations adopted, first, to prevent fires altogether, or stamp them out at their commencement; secondly, to localise any fire which may after all grow to serious dimensions; and, thirdly, to give the audience in all parts of the house ample time to escape in the event of danger.

It is obvious that all such remedies will divide themselves into two classes—(1) permanent constructions; (2) "emergency" arrangements. As the first of these are certain in their operation, whilst the second, however excellent, are liable to fail when wanted, especially in moments of danger, these should be reduced to a minimum, and all that is possible should be done by original and permanent works. Taking the points in order, we have, first, the diminution of the general damage done by the fire. For this purpose it should be adopted as a principle—which, no doubt, must admit exceptions in special cases—that a theatre should be completely isolated from other buildings. The annals of theatre fires emphasise this recommendation by their records of terrible damage done through the spread of fire from adjacent buildings to theatres, and also *vice versâ*. Another point to be insisted on is that all inflammable objects should be reduced to a minimum, if they cannot be altogether dispensed with. The stores for decorations, the rooms for dresses, &c., the painters' and carpenters' shops, and other premises of that kind, should be outside the actual building of the theatre; and the inflammable articles belonging to such premises allowed within the walls should be strictly limited to the day's requirements.



SECTIONAL ELEVATION

PLAN

PEARN'S STEAM PUMP.—(*For description see page* 107.)

Great part of the machinery, scenes, &c., now made of wood, might with ease and advantage be constructed of iron. Where this is impossible, the wood should be impregnated with some fire-resisting liquid, as should be also the canvas, and other inflammable parts of the decorations. There will be, as there has been, strong opposition to this on the part of the painters, wardrobe keepers, &c.; but this opposition must be once for all faced and conquered, and the technical staff must be compelled to adapt themselves to the new state of things.

There seems no reason why, with improved appliances and construction, the auditorium in itself should not be rendered perfectly secure against the breaking out of fires. If the walls and main partitions are of brick, the floors, secondary partitions, and fittings generally of iron, and the stuffing of the seats, the curtains, &c., of wool, and if refreshment rooms, lounges, &c., are kept outside the building, there is really nothing which can cause a conflagration. It will be long, however, before the stage can be put in a similar condition of safety, and it therefore becomes essential that the stage and auditorium should be completely separated, so far as fire is concerned, from each other.

On either side of the proscenium this can be provided for by a thick party wall, resembling that between two ordinary dwelling houses in a street, and pierced only by a few small openings, protected by self-closing doors. There remains, of course, the opening for the proscenium, and this is the cardinal difficulty of the whole question. Attempts have been made to meet it by providing an iron partition, or a curtain of wire netting, to be let down in case of need. Experience shows that, almost without exception, these have failed, from some cause, to give protection when needed. Indeed, the utility of the wire curtain is questioned by the committee altogether. They hold that a partition regularly used, proof against fire, and impervious to burning gases, alone offers adequate protection. In other words, the stage curtain must itself form the fireproof partition, which can be let down in a moment, and which will effectually isolate the stage and auditorium from each other. Thus the moment an alarm of fire was given, the curtain would be dropped, effectually shielding the audience from all sight and from all danger of conflagration; and the knowledge of their safety would prevent the panics and struggles to escape, which in such cases have been answerable for a large proportion of the lives sacrificed.

The design for such a curtain has been specially studied by a sub-committee, under the direction of Herr Carl Pfaff.

Assuming the two halves of a theatre—the stage and auditorium—to be thus isolated from each other, the next point is to consider how the safety of those who may be found in either half, in case of fire, is to be provided for. Taking the stage half first, the principle should be to separate the stage itself—where the fire is nearly sure to begin—from the green-room, &c., behind it. The stage should be enclosed therefore, on all four sides, by fire-proof partitions of some kind, and should have the lightest possible roof construction, so that it may burn out as rapidly as possible, if the various fire-brigade appliances are unable to cope with the fire. The passages connecting it with the green-room, &c., should be fire-proof, and there should be ready access from these latter to the street. This need of free and secure exit applies of course with still greater force to the auditorium, in view of the large number of persons who may be found there, and the probability of crowding and panic. The principle should be to have numerous exits, all short, direct and independent. In older theatres this never seems to have been thought of, and the recent theatres are better off in this respect; but they generally fail in another important point, namely the supply of fresh air and light from without. As a theatre is used only at night, this is usually thought needless; but the fact that in theatre-fires the chief loss of life is always from suffocation, and the difficulty of otherwise maintaining proper ventilation, unless by costly artificial methods, are sufficient to show its vital importance.

The question of the number and size of the exit passages to be provided for a given number of seats cannot receive an exact solution, on account of the great variation in circumstances. The following general rules may, however, be laid down:—(*a*) There should be at least two stairs for each level, each of which should be completely independent, proportioned in size to the number of seats, and as short as possible. (*b*) The above proportion should be larger as the staircase is longer. (*c*) Several moderate staircases are better than a few very broad ones. (*d*) Turnings should all be easy, and in one direction; and landings should be at regular intervals. The steepness of the stairs should be the same throughout. (*e*) Single steps in a passage should be forbidden. (*f*) Direct staircases are to be preferred to spiral. (*g*) Cloak-rooms, &c., should not interfere with the general flow, and must themselves have easy entrance and exit. (*h*) All doors must of course open outwards. (*i*) All passages* should have windows, opening outwards for ventilation. Here, as with the curtain, the committee place no faith in emergency appliances of any kind; whatever is required must be arranged permanently, and must be in constant use.

The committee have not attempted to deal with the complex subjects of heating and ventilation. With regard to lighting, they point out that the brilliant lighting of the stage is the most frequent of all the causes of fire, and especially where the hot flame of gas-lights raises to a high and even dangerous temperature the masses of inflammable scenery, &c., which are generally in close proximity. They look forward with confidence to a vast improvement here by the substitution of the electric light, though they do not venture as yet to recommend any particular system. For the auditorium they look upon the employment of gas or electricity as indifferent from the point of view of safety. In any case the light should not be dependent on any single source, an accident to which may at any moment plunge the theatre in darkness—in itself no inconsiderable catastrophe. There must be some supplementary system, and this, again, must be in daily use, not an emergency appliance. It should consist of oil lamps or other lights, giving so large a part of the total illumination that it will not be possible to do without them on ordinary occasions. In the passages, vestibules, &c., these should be the only lights allowed. If the general lighting is by gas, the pipes leading from the main to the stage and the auditorium should be quite separate from each other.

The above suggestions of course apply as a whole to new theatres only; but existing theatres should be adapted to them as far as is possible. All theatres should be subject to strict regulations as to safety, enforced by some competent authority, exactly as is the case with railways, steamers, &c. The report suggests the appointment of a special commission at Vienna, to supervise the construction

* Still better, the passages might be mere covered galleries outside the main walls altogether, and winding spirally round them, not in steps, but in mere foot-holds, if possible, to be like the bridges at a wharf. Once through the door a person would then be in perfect safety.

and arrangements of theatres; and finally dwells on the desirability of emancipating architects from the official control, which in Austria appears to weigh heavily upon them both as a body and individually.

The general idea of a fireproof curtain is to make the ordinary stage curtain in daily use perform the functions of a fire and smoke-proof partition between the stage and the auditorium. For this purpose the curtain is formed of about fifteen horizontal strips of sheet iron, each bent into a segmental section, and supported at either end by a light channel iron. The curtain is supported by four ropes at equal intervals; these pass over pulleys above, and are connected to a single counter-weight, nearly balancing the weight of the curtain. If these ropes should be burnt the curtain would simply remain down. The convex side of the iron strips is turned towards the auditorium, so that when a fire breaks out on the stage they will be surrounded by cooler air, and cannot be raised to any dangerous temperature. Their thickness is $1\frac{1}{2}$mm.—·06in.—and their bent form tends to give them stiffness; while, even if they should get red-hot, the channel irons at the sides, which are kept away from the fire by the strong iron guides in which they run, would prevent the whole from collapsing. If the curtain is to be let down between the acts, as well as at the end of the performance, it should be ornamented in some manner, but it should not be covered with anything which would prevent the access of air, and the working of the apparatus. On either side of the proscenium stands a wrought iron pillar, and on the top of these is a horizontal cellular girder. To protect these from fire their interior is connected with the water pipes of the theatre, so that they are constantly full of water; and from the interior of the cross girder there are openings, stopped with fusible metal, so that a moderate heat- 100 deg. Cent.—would suffice to melt, and allow continuous circulation of the water, and escape for the steam. Above the girder the wall is filled in solid, instead of the large opening which exists in ordinary theatres right from the floor to the roof. This wall will be protected by a double shield of sheet iron, as in a fireproof door, on the side of the stage.

The working of the apparatus, instead of by the slow process of hand-crabs, as used at present, is to be by hydraulic power, the pressure water being, if possible, supplied from the ordinary mains. A simple vertical cylinder stands at one side of the apparatus, and lifts the curtain by the aid of the counter-weight, while on the water being withdrawn it falls by its own weight. Variations in the pressure of water will only affect the speed of lifting. The arrangements are regulated by a single valve, to be worked by a handle placed at any convenient place behind the scenes. Should the water be cut off, the only result will be that the curtain will fall, if it is up, or remain at the bottom if down; so that the arrangement fulfils the proper conditions of a safety apparatus.

EXPRESS LOCOMOTIVE FOR THE PENNSYLVANIA RAILROAD.

We complete this week our illustrations of the express locomotive of a new type, designed by Mr. Ely for working fast trains between New York and Philadelphia. The engine is an excellent example of American practice, with certain features that will always appear objectionable to English eyes—such as the bar frames and the excessive use of cast iron. The connections of the cylinders with the frame appear to be comparatively slight; but it must remembered that each cylinder with its valve chest and long steam and exhaust pipes forms the half of a very heavy casting, which supports the leading end of the boiler above and the bogie pin below. We suppose that Mr. Ely's engines enjoy unusual immunity from split cylinders, otherwise he would hardly have adopted a casting in which the cylinder may almost be said to play a subordinate part. If a cottar should come out or be sheared, and the piston went through the cylinder lid with the usual result, the necessary repairs would be very heavy indeed.

The wagon-top boiler, as it is called in the States, has been recently much criticised, and lastly condemned by United States railway men, and we cannot ourselves see much in it to recommend it. Mr. Ely has, however, retained it. It is of steel throughout; the grate is of enormous size, the fuel being anthracite, which will not burn properly in a thick mass; water tubes are used instead of fire-bars, as is invariably the practice when anthracite is burned. The principal dimensions are as follows:—

Boiler:—	
Diameter	4ft. 2in.
Length of grate	10ft.
Width of do.	3ft. $5\frac{3}{4}$in.
Mean height of fire-box crown above grate	3ft. $1\frac{1}{2}$in.
Thickness of boiler plates	0ft. $0\frac{3}{8}$in.
,, ,, internal fire-box	0ft. $0\frac{1}{4}$in.
,, ,, tube plates	0ft. $0\frac{1}{2}$in.
No. of wrought iron tubes	201
Inside diameter of ,,	0ft. $1\frac{5}{8}$in.
Length of tubes	10ft. $10\frac{3}{4}$in.
Grate surface	35 sq. ft.
Total heating surface	1205 sq. ft.
Engine:—	
Diameter of driving wheels	6ft. 6in.
,, ,, bogie ,,	2ft. 9in.
Wheel base of coupled wheels	7ft. 9in.
Total wheel base	22ft. $7\frac{1}{2}$in.
Diameter of axle boxes	0ft. 8in.
Length of ,,	0ft. $10\frac{1}{2}$in.
Diameter of cylinders	1ft. 6in.
Stroke	2ft.
Centre to centre of cylinder	6ft. 5in.
Lap of valves	0ft. $1\frac{1}{4}$in.
Width of ports	1ft. $4\frac{3}{4}$in.
Length of do.	0ft. $1\frac{1}{2}$in.
,, exhaust ports	0ft. $3\frac{1}{4}$in.
Weight full:—	
On drivers	15 tons 0 cwt.
On trailers	14 tons 3 cwt.
On bogie	12 tons 4 cwt.
Total	41 tons 7 cwt.

The engine is fitted with a steam reversing gear, which appears to us to be a mistake. A properly-designed hand reversing gear is sufficient for all practical purposes. It will be seen, indeed, on examination that the engine is abundantly supplied with what have been uncourteously termed rattletraps. But Mr. Ely has not found the way to put a glass water gauge on his boiler, the drivers being left dependent in this year of grace 1882 on those barbarous relics of the past—try cocks—for information concerning the level of the water inside.

Although there is much about the locomotive which deserves censure, there are also some excellent features. For example, the valve gear is well worked out, simple, and good, the distribution of weight satisfactory, and all the bearing surfaces, especially in the journals, large. The engine, too, is externally more pleasing to the eye than most American engines. It is fitted with the Westinghouse brake, the air pump being fixed on the right-hand side of the fire-box in a horizontal position, the receiver being placed between the frames forward.

This is an enormous weight for an engine with 18in. cylinders, and a tractive force of but 100 lb. per pound of cylinder pressure, and is mainly due, as we have pointed out, to the excessive use of cast iron, and the abundance of the rattletraps aforesaid. The boiler, in spite of the enormous fire-box, cannot be abnormally heavy, because the plates of which it is made are very much lighter than any English locomotive superintendent would dare to use. The necessity for, so to speak, supplementing the frame with spring hangers, braces, and such like, also helps to swell the total. It is remarkable how many things an American locomotive superintendent finds indispensable that his English brother manages to get on very well without.

THE SOCIETY OF ENGINEERS.

PRESIDENT'S ADDRESS.

The first ordinary meeting of the Society of Engineers for the present year was held on Monday last, February 6th, in the Society's hall, Victoria-street, Westminster. The statement of accounts for 1881 was read, after which the president for last year presented the premiums of books awarded for papers read during that year. These were to Mr. John Standfield, for his paper "On Floating Docks," and to Mr. A. T. Walmisley, for his paper on "Iron Roofs." The president for 1882, Mr. Jabez Church, M. Inst. C.E., F.G.S., then delivered his inaugural address. After expressing his thanks to the members for his election to the chair, the president reviewed the proceedings of the Society for the past year, noticing the various papers read during the session, and the visits made during the vacation. He cordially invited the members to give their best support to the Society during the present year by attending the meetings, reading papers, and joining in the visits to be made to various works during the coming vacation. The general status of the Society was in a satisfactory position, its members being steadily on the increase, and its financial position, as testified by the balance-sheet just read, being sound and healthy. Turning to matters of more general interest, the president next reviewed some of the work accomplished by engineers, and the advances made by science during the past year. He especially touched upon those branches of the profession with which his own practice is more immediately connected, viz., sanitary engineering and gas and water supply. With regard to sanitation he remarked that that subject was in the past a matter which was considered to be more or less beneath the dignity of the civil engineer, whilst it was utterly unworthy of consideration by the general public. But times were greatly changed in this respect, for this subject now formed a distinct branch of engineering science, and the public took a keen interest in sanitary matters, and were beginning to appreciate the importance of good sanitary condition in town houses. The president observed, with regard to sewage disposal, that experience had taught us, that the extravagant expectations formed by the advocates of the various processes of precipitation could not be realised, and that irrigation schemes had not been the means of making large fortunes for those local authorities who had adopted them. Sanitary engineers had, however, less difficulty than formerly in recommending with confidence the system most suited to the requirements of the local authorities whom they are called upon to advise. The various systems for drainage of towns and disposal of sewage in operation were then touched upon, as was also the question of the pollution of the Thames by the London sewage at the outfalls at Barking and Crossness; where, owing to the state of the river, some steps, he thought, would have to be taken before long to improve its sanitary condition at these points. The president suggested that intending occupiers of houses should obtain the opinion of a competent surveyor as to whether the drains and plumbers' work complied with proper sanitary conditions, for many persons took no trouble whatever about that all-important matter. That being the case, moreover, the poor not being able to afford to take that precaution, he hoped that before long Parliament might be induced to pass a measure to compel owners to see that proper sanitary arrangements were carried out, and that before a house could be let it must have a certificate from the local sanitary authority confirming that, and that no house should be let except upon these conditions, under heavy penalties. Some such measure as that would materially increase the health and comfort of the public, and in a great measure assist in overcoming the fatal influence of the various epidemic diseases. The president then went on to review what had been done in the development of gas for lighting, cooking, and other important purposes. He considered that great as had been the stride made with electric lighting, even greater had been the development attained in gas lighting; and as the electric light was considered by many to be only in its infancy, so he felt sure also that the same thing might be said of gas lighting; that was to say, gas lighting conducted upon scientific principles, which hitherto had been strangely neglected. He pointed out that the great value of the residuals in gas manufacture, by the aid of chemical research was being surely increased, thereby materially aiding in reducing the price of gas. In that respect gas had a great advantage over its brilliant rival, for there was no residuum for sale in the manufacture—if he might be allowed the term—of electric light, and electricians could only hope materially to reduce the cost of its production. He said he thought that the two sources of light in the interest of the public should rather be regarded as friendly rivals, who could and would materially assist each other, than as enemies opposed to each other. That healthy competition was putting gas engineers on their mettle, and urging them on to show the world what latent sources of power and wealth could be further developed from gas. He then reviewed the progress that had been made in the various apparatus used in the manufacture of gas, and the many new gas-burners that had been recently invented, and the various uses to which gas was now being put for domestic and industrial purposes. He also glanced at gas legislation for the past year. With regard to the question of water supply, which the president went fully into, he insisted upon the necessity of an ample supply of wholesome water being one of the first requirements of life, and upon the desirability of every town in the kingdom being well provided in that respect. He pointed out that in many places, owing to the adoption of shallow wells, which were, as a rule, sunk in close proximity to cesspools, the water was more or less poisoned by the contamination of sewage matter, much sickness and death being the result. There was also another aspect to this question which, he said, should not be overlooked. In most towns waterworks, when designed by a competent engineer, should be a remunerative undertaking, and as nothing could supersede water, no security could be better. He ventured to think that the inhabitants of towns would do wisely to invest their savings at home in such sound property, by which they would not only receive a fair return for their money, but at the same time secure the many blessings to health and comfort that a good supply of wholesome water insured. The various important waterworks which were in course of construction during the past year were then noticed, as was also the question of the water supply of London, which the president said was a subject that should be considered by Parliament with as little delay as possible. When the present Government came into power London was led to believe that a Bill would be at once brought forward to create a water trust, which would take charge of the question of water supply to the metropolis, and definitely settle what was to be done in the matter; but as no parliamentary notices were given last November, he supposed that important business would have to stand over until a more convenient season. In the meantime the water companies' property was daily increasing in value, and many who thought the £33,000,000—the valuation of the undertakings made by Mr. E. J. Smith for Sir Richard Cross—was excessive, now regret too that the matter was not then settled, as the growing prosperity of the companies pointed to the increasing value of their property, which would have to be paid for. As to the quality of the Thames water, many scientific chemists reported favourably of it, although Dr. Frankland continued to condemn it; yet, singularly enough, the death-rate of London was steadily decreasing as the quality of the water, according to some chemists, was gradually getting worse.

In reviewing the progress made with the electric light, the president said that its remarkable development had doubtless formed one of the most marked scientific features of the last year. He described the arc and incandescent systems, and enumerated the various inventions of lamps and electrical apparatus, and the work that had been done by these in various places. He considered, however, that electric lighting had not yet gone beyond the experimental stage, nor could a just opinion be formed at present as to its cost. He touched upon the Paris Electrical Exhibition, and upon that to be seen at the Crystal Palace. He also noticed the application to Parliament by electric light companies, seeking powers for opening the streets, &c., for public lighting. Upon that subject he considered that the principle which had always guided parliamentary committees in relation to all promoters of commercial undertaking seeking to obtain statutory authority would not be departed from. That vital principle, he stated, was briefly that the privileges sought for, if granted, must be fairly counterbalanced by obligations in the interests of the public. With electric lighting at the present moment, however great its progress might have been, it could not, he thought, be shown that the knowledge of guiding principles at present possessed was sufficient to enable Parliament to decide as to what obligations might be reasonably imposed on such companies. As he had stated, the very important item of cost not being yet known. He then reviewed the considerable amount of professional work executed in the past year with regard to docks and harbours, and he noticed the new schemes for docks at Dagenham and Tilbury, on the Thames. He reviewed also what had been done in shipbuilding, and pointed out that the large number of ships launched from our principal yards was greatly in excess of previous years. He called attention to the Naval and Submarine Engineering Exhibition, to take place in April next, pointing out its importance and value to all interested in naval and submarine engineering. Many other subjects were noticed, and the president, before concluding his address, touched upon the centenary of George Stephenson, and held him up as an example to his younger professional brethren, and urged upon them to emulate his unwearying energy, his love for his profession, and his stern determination to overcome every obstacle that crossed his path. "Such genius," he said, "as he possessed is given to few; but all, whatever their powers may be, cannot but be refreshed and encouraged in their work by studying the life of such a man." This interesting address was attentively listened to by an appreciative audience, and at its close a cordial vote of thanks was tendered to the president, who briefly acknowledged the compliment. The proceedings then terminated.

ENGINES OF S.S. LA FRANCE.

We commence the illustrations this week of the three-cylinder compound engines of the Atlantic mail steamer La France. We shall give a description of these engines in succeeding impressions.

Depositing Dock for Barrow-in-Furness.—The first portion of this dock was launched on the 4th inst. from the Barrow Shipbuilding Company's works, and the second half is being rapidly proceeded with. This dock, of which Messrs. Clark and Standfield are the designers, will, when complete, be able to dock and deposit vessels of about 3200 tons displacement; the staging for receiving the vessels is being constructed on Old Barrow Island, and is fast approaching completion. We believe this will be the only floating dock in the kingdom.

Utilisation of English Canals.—Attention is called by Mr. Charles Frederick Clark, president of the Wolverhampton Chamber of Commerce, to the two following resolutions in reference to canals:—"(1) That in order that commerce and agriculture may be able to take every advantange of the easily and cheaply worked traffic of the canals of Great Britain, it is greatly to be desired that canals be entirely emancipated from the control of railway companies. The traffic on them requires no organisation like that on railways, and hence should be as free from the control of the railway companies as the high roads now are, thus making canals here what they are in other countries—namely, the cheapest means of conveying goods and agricultural products to markets, and not the obstructive instruments of railway companies. (2) With the object of encouraging canal companies to adopt and promote the working of canal traffic by steam power, which has been proved to effect a saving of 20 to 40 per cent. over the obsolete plan of horse-power, the canal companies should have the power to sell the towing-path to the adjoining landowners, should the towing-path eventually become useless, or be allowed to include the towing-path in the water-way, and so enable the companies to double the present wharf frontage, with the chance of greatly increasing the traffic." In illustration of these resolutions Mr. Clark suggests that the Government should take the canals on the same terms as the railway companies did in many cases—*i.e.*, guaranteeing $3\frac{1}{2}$ to 4 per cent. dividends to shareholders, and by making more use of them for the general good of the public make a profit where the railway companies now make a loss. Why should not canals be used as channels to carry off surplus water and thus prevent floods, also as irrigation works and to work turbines? Mr. Clark considers that canals have been confining themselves too much to doing the traffic from town to town which the railway companies can do quicker, and in some respects, better; and the intermediate agricultural traffic which the railways cannot do has been sadly neglected. He suggests that at certain short distances on the canals straight wharves should be built on each side, so that a farmer could get a boat close to the bank to load grain, roots, hay or straw for market, and bring back manure, lime, or coal. The farmer could then dispense with a number of horses and reap the advantages of steam cultivation, and as each horse dispensed with would save the farmer at least £50 a year he could well afford to pay his landlord or the canal company a good interest on the cost of building a side wall to the canal to form a private wharf, and at the same time there might be fixed a water gauge and valve, by which in a dry season he might irrigate those fields adjoining the canal. As now constructed, if a boat be brought to the side of a canal to unload, there is a risk of what is called "pricking the puddle," and on the towing-path side there is also the risk of giving great offence to the officials through crossing their but little used towing-path. A sinking fund should be formed, as suggested by the late Mr. J. R. M'Culloch twenty years ago, of all the profits made over the guaranteed dividend, out of which the Government or the county board from time to time should take powers to purchase canal shares at par, so that in the course of a few years the tolls would be gradually reduced. Mr. Clark adds that he would let railway companies buy each other up as much as they like, but would no more let them buy up a canal than a turnpike road,

RAILWAY MATTERS.

THE Metropolitan Company notifies that on and after the 1st proximo parcels will be carried over its main system and extensions, and will be received at the stations and Regent-circus for the lines of other companies.

ON Monday at the Bromfield petty sessions, North Wales, Thomas Cross, Charles Cross, and Edwin Davies, were charged with placing trolly wheels on the Moss Valley Railway, a branch of the Great Western system. An engine and trucks ran into the obstruction a short time since, but fortunately no one was seriously hurt. The engine was greatly damaged, and the line blocked for several hours. The case was adjourned for a fortnight to enable the prosecutors to complete the evidence. It may be hoped that some of the wretches who do this sort of diabolical work are caught.

A COLLISION occurred on the 26th December at Plaistow Station, on the London, Tilbury, and Southend Railway. Fifteen passengers were injured, and much stock destroyed. In concluding his report on this collision, Major-General Hutchinson says:—"Had there been a quickly-acting brake under the driver's control applied to the engine and to all the vehicles composing the North London train, the collision would doubtless have been avoided. As it was, with the comparatively low speed at which the train was running, the chain brake acting on the three front vehicles—which brake the driver states he applied—would be slow to take effect."

COL. RICH, in reporting on the accident that occurred on the 21st December, between Stow-on-the-Wold and Chipping Norton Junction, on the Great Western Railway, when the train ran off the rails, owing to the engine having burst the railway, and after pushing the rails and chairs from 1in. to 4in. alternately to the right and to the left, it broke the road, ran down the bank on the left side of the line, and fell over on its right side, says:—"I think it most desirable that the passenger traffic on the line from Cheltenham to Chipping Norton Junction, which is a railway with heavy gradients, should be worked as far as possible with tender engines of not too heavy a class, and that turntables should be provided at each end to turn the engines without the necessity of uncoupling them; and further, that so long as any portion of the line consists of a light permanent way, the trains should be worked at moderate speed."

AT the meeting of the Metropolitan Board on Friday, the 3rd inst., the Parliamentary Committee presented a report recommending that if in any Bill proposing to authorise the formation of railways underground power is sought to make openings for ventilation in the public thoroughfares, the Board should oppose such power being granted. Mr. Selway said that the nuisance which was felt from the ventilating shaft of the present underground railway was a disgrace to the present day, and it was greatly to be lamented that the Legislature had ever granted powers to make an underground railway without requiring proper modes of ventilating the tunnels through which it passed. He felt sure that among the engineers of the present day they might be able to devise some plan by which these tunnels might be rendered wholesome to travellers. For himself he might say that he travelled as little as possible on the underground railway in consequence of the nuisance he found in the tunnel, which ought to be ventilated in a proper manner. The ventilating shafts, as they were called, were mere holes in the ground, through which was passed a large quantity of steam, but the nuisance of vitiated air in the tunnel remained. The report was then seconded and adopted. The Parliamentary Committee further recommended that in the case of any Bill, by which it is proposed to construct a new railway bridge across the river Thames, within the limits of the metropolis, the Board do ask in its petition that the company may be required to provide free accommodation for foot passengers by the side of the railway.

A REPORT or work, compiled under orders of the Prussian Government, has recently been published on the origin and development of the railways of the world to the end of 1880. According to this document, there were completed at the end of 1880, 215,249 miles of railways, which had been constructed at a cost of, in round numbers, £3,750,000,000. The following table gives the mileage, capital expended on construction, and net profits of railways in the principal countries of the globe for the year 1879:—

	Miles open for traffic.	Capital expended.	Net profits.
		£	£
United States	81,087	952,500,000	43,985,000
Great Britain	17,665	717,000,000	28,345,000
Russia	16,685	345,750,000	7,900,000
Germany	16,673	340,800,000	14,610,000
France	14,125	395,250,000	17,895,000
Austria	12,378	240,800,000	8,215,000
British India	8,596	123,100,000	5,370,000
Canada	6,907	74,200,000	1,340,000
Italy	5,171	100,750,000	2,540,000
Spain	4,196	50,000,000	320,000
Sweden	3,475	22,150,000	535,000
Belgium	2,488	60,000,000	2,265,000

The interest paid on capital invested seems to have been higher in France than elsewhere, except America. In France the average percentage yielded was 4·53 per cent.; in Germany, 4·11 per cent.; in Austria, 3·4 per cent.; in Great Britain, 3·9 per cent.; in Russia, 2·3 per cent.; in Italy, 2·5 per cent. In the United States the capital expended yielded, on an average, a return of 4·6 per cent.; in Canada, only 1·8 per cent.; but in the British West Indies, 3·4 per cent.

AFTER mentioning the application of electric lamps for lighting railway stations, the *Zeitung des Vereins deutscher Eisenbahnverwaltungen* says: As regards the application of the electric light to railway trains, trials have already been made in England and Austria, while up to the present time nothing in this direction has been done in Germany. The Imperial German Post-office, however, is said to have it under consideration, whether the introduction of the electric light for the illumination of the travelling post-offices would be of advantage, but the matter is still an open question. A conference has, however, lately taken place at Frankfort-on-the-Maine, in order to discuss the question of lighting railway carriages by electricity, and during it the president of the Main Neckar Railway pointed out that this mode of lighting trains could merely be a question of time. He added that his railway, not having adopted the gas lighting system—Pintsch's—would not think of any other means of lighting trains but by electricity. As Bell's telephone in consequence of many improvements had fully established itself during the short space of four years, so would electric lighting in a very short time take gigantic steps ahead and soon be generally introduced. Most likely would not only a brighter light for the engine and carriage lamps be obtained, but also great economy, if the power of the locomotive and the motion of the train were used to work a dynamo-electric engine for producing the light. The article, after mentioning the trials of the electric light on the Brighton Railway, says that the accumulator would of course be an essential point in lighting carriages in order to maintain the lights whenever the engine is detached from the train. The Austrian Kronprinz Rudolf Railway made successful trials in reference to the engine head lights last March. The dynamo was driven by a steam engine attached to the locomotive boiler, and the electric head light was so arranged that the driver could easily move it without leaving the foot-plate. The lamp gave a perfectly steady light, not affected by the shaking of the engine. The road could be clearly seen, where straight, for 400 to 500 yards, and owing to the possibility of turning the lamp, for 200 yards on a curve, it was astonishing how clearly the signals could be seen and their colour be discerned. Several railway companies have taken this important matter up, and it is hoped that Germany will not be behind other countries in this matter.

NOTES AND MEMORANDA.

THE number of patents issued during the past year by the Dominion Government of Canada was 1700, or 350 more than in 1880. The total amount paid by the patentees in fees was £10,571, or £2143 more than in the previous year.

GRANULAR vegetable carbon saturated with sulphuric acid, of which it holds about seventy-five times its own volume, is now being tried as a destroyer of phylloxera. Buried amongst roots, it gradually gives off sulphuric acid gas, and this being heavier than air, not only permeates the soil, but hangs about on the surface, and asphyxiates the phylloxera.

THE coal-tar or aniline dyes differ but in their molecules and the quantities of hydrogen and oxygen. Water may be made to furnish these gases by electrolysis, and M. Goppelsruder, of Bale, has submitted water holding certain colouring material in solution to an electric current, and has obtained various dyes, such as noir d'aniline and violet d'aniline.

THE average production per acre of the three principal cereals grown in America is, for the whole country: Corn, 28 bushels; oats, 25 bushels; and wheat, less than 13 bushels. Of the great wheat-growing States, Ohio has the largest average yield, 18 bushels per acre; and Iowa the smallest, 10½ bushels per acre. Iowa takes the Johnny cake in corn yields, 42 bushels per acre; and Minnesota in oats, 38 bushels per acre.

THE Geneva correspondent of the *Times* says that the *Bund* announces that Herr Karl Gehmia, of Berne, after a series of experiments extending over several years, has succeeded in producing artificial mother-of-pearl, undistinguishable in every respect from the natural article. It can be moulded in any shape, produced in any colour, is impervious alike to summer heat and winter cold, and its price will be much less than that of ordinary mother-of-pearl.

M. HERIN has recently made a series of experiments which lead him to the conclusion that the resistance of a gas to the motion of a solid body does not vary with the temperature when the density is maintained constant. He states that the pressure and temperature of gases are not constituted by motion of atoms. His experiments were made with an apparatus consisting chiefly of a pendulum having a rectangular glass plate in a large globular glass vessel, the pendulum being suspended by a steel wire which passed through an india-rubber stopper, and the temperatures employed ranged between 11 deg. and 50 deg. Those deputed to report on the paper for the Belgian Academy do not seem to accept M. Herin's results, which necessitate a disavowal of some of the ideas upon which the kinetic theory of gases is based.

AT a recent meeting of the Chemical Society a paper was read on "A New Apparatus for the Determination of Melting Points," by C. F. Cross and E. J. Bevan. The apparatus consists of a small platform of thin ferrotype iron or silver, having an opening for the reception of a thermometer bulb and a small indentation or depression about 1·5 mm. deep and 2 mm. in diameter. A very small quantity of the substance is melted in the little depression, and while still liquid a thin platinum wire bent like an L fused into a glass float is immersed in the liquid and held there until the substance solidifies. A thermometer is then inserted in the opening and the whole apparatus plunged under mercury; the mercury is gently heated and the thermometer is carefully watched. As soon as the substance melts the float rises instantly and the temperature is noted. Stirring is unnecessary; the whole of the substance is surrounded with mercury, and the attention can be concentrated on the thermometer.

HERR BOAS has recently described experiments on the colour of water, the first of which were qualitative, sunlight being sent through water in a zinc tube about 46ft. long, closed with glass plates. Distilled water thus gave a fine deep blue-green colour; the red was quite gone, the yellow feeble, while the maximum brightness was in the green. Water of the Kiel supply let no light through the length of the tube stated; with half the length it appeared deep orange; blue and green failed. In his quantitative experiments the author illuminated two screens with the some light-source, before which was placed red glass, or sulphate of copper solution. The light from one screen went through water in a tube; that from the other along the tube outside. Both beams were brought into a position for comparison by means of total-reflection prisms; the screens were shifted till equal brightness was reached, and from their position the coefficients of absorption could be approximately inferred.

AN experimental inquiry by Herr Graetz into the heat-conductivity of gases and its relation to temperature results have been given in *Nature* as follows: (1) Heat-conduction in the gases, air, hydrogen, and (with low temperatures) carbonic acid, consists in transference of progressive energy only; intramolecular energy contributes immeasurably little. The molecules thus behave like material points. (2) The relation of heat conduction to temperature is found by experiment to be such (approximately) as Clausius' theory requires. (3) All results for gases and vapours, showing divergences from the values calculated from theory, are without evidential force, for they only gave the apparent heat-conducting power, in consequence of absorption of radiant heat. (4) The divergence of the temperature-coefficient of friction from that calculated from theory cannot have for cause—or not alone—the decrease of the molecular diameter with rising temperature; some other explanation must be sought.

AT a recent meeting of the Paris Academy of Sciences, January 16th, a paper was read on the velocity of propagation of explosive phenomena in gases, by MM. Berthelot and Vieille. These experiments were fuller and more exact than the former. An explosive mixture of H and O in a straight horizontal lead tube about 40 m. long and 0·005 m. internal diameter, was fired at one end with an electric spark, and the travelling flame broke two electric circuits in passing, by acting on fulminate of mercury. Again, the tube was divided into a series of connected parallel pieces. For both cases the high general average of 2841 m. per second was obtained. The same with a caoutchouc tube, excluding the idea of a vibratory motion of metal inducing rupture of the circuits. With narrower capillary glass tubes the mean was 2341 m. The velocity was not affected by one or other orifice, or both, or neither, being open. The propagation was uniform in the tubes. The velocity was independent of pressure. CO and O gave a velocity of 1089 m., and dilution of the other mixture with air reduced the velocity.

AT the annual dinner of the Cleveland Institute, on the 20th ult., Mr. E. Windsor Richards said he "he had just received a statement of the output of ingots from the Edgar Thomson Works for the week ending December 3rd, 1881. As it is probably the largest quantity obtained from an American plant of two 8-ton converters—and at this time next year the three 10-ton converters will be in full operation—it will be interesting to note this output for future comparison. Commencing work on Sunday night, and finishing at 4 p.m. on Saturday, they made 496 casts, yielding 3813 tons of ingots. Their best twenty-four hours' work was 700 tons. There are several reasons why England is so much behind this in quantity, but the chief one is that with such hurried work, which we term 'driving,' we could not fulfil the conditions of the exacting specifications of English and continental engineers; and so, requiring more time, we are compelled to do with four converters and four sets of men what the Americans do with two converters and three sets of men. It is found in practice that 33 per cent. more men will not work the third shift, but that 50 per cent. more are required; so that it is difficult to see the economy of working with so few appliances. I am of opinion that if any English firm, having four converters making 3800 tons of ingots per week, stopped two of them, and worked two with three sets of men, and obtained the same output, the labour-cost per ton of ingots would be quite as great with two converters as with four, leaving the matter of regularity of quality of product entirely out of the question.'

MISCELLANEA.

THE new Eddystone Lighthouse was successfully lighted for the first time on Friday last, the 3rd of February, 1882.

AT the annual meeting of the Phosphor Bronze Company on the 7th inst., the usual 10 per cent. dividend was declared.

WITHIN the last month the deaths have been recorded of four celebrated scientific men: Dr. Draper, Samuel Sharp, E. W. Binny, and Theodore Schwann.

MESSRS. BARNETT AND FOSTER, the well-known makers of mineral water machinery, have recently published a new edition of the catalogue of their very numerous manufactures.

A USEFUL annual on waterworks statistics is published by Mr. C. W. Hastings, London. Names of towns, source of supply, quantity raised, assessment or meter charge, price, dividend, &c.

THE South Staffordshire Waterworks Company in their report which will shortly be laid before the shareholders, recommend the creation of additional capital to the extent of £42,500, to meet half finished and projected new engineering operations.

DURING January the Cape Government emigration agent sent to the colony 313 emigrants, as against 188 in the corresponding month of last year. They consisted of 234 artisans in various trades and domestic servants, 55 agriculturists, and 24 recruits for the Cape Mounted Riflemen.

THE *Bollettino della Finanza, Ferrovie e Industrie* states that the Venetian Society of Public Works has asked the Government for authorisation to make surveys for a project of railway communication between Sicily and the main land, by means of a submarine tunnel under the Straits of Messina.

THE delegates of the various vestries and district boards of the metropolis meet this morning at the vestry hall of St. Martin-in-the-Fields, at 11 o'clock, to consider the prospect of legislation on the water supply question in the coming session. The metropolitan members of Parliament have been invited to attend.

MR. JOHN SHIELDS states that he has "succeeded in laying down in a permanent form outside the North Harbour at Peterhead an apparatus for throwing oil on troubled waters, thereby making the entrance to the harbour safe in all weathers." He adds that he only now awaits a warning from the Meteorological Office of a storm or full gale from the north or north-east to put this apparatus to the test.

IT is stated in the *Oswestry Advertiser* that a bar of pure gold weighing 130 oz., being the produce of 1300 lb. of visible gold ore, was brought into Dolgelly from the Clogan gold mine, on the 30th ult. The present appearance of the strata at this mime is said to be most encouraging, and to bid fair to yield a larger quantity of gold than at any time during the past twenty-five years. The amount of visible gold found in the quartz during the last week or two is larger than was ever found before by the oldest miner.

AT a meeting of aëronauts, held on Saturday at the Aquarium, Mr. Simmons stated that he should probably start from Canterbury or Ashford about the 14th inst. in a balloon to cross the Channel. Colonel Brine, R.E., will accompany Mr. Simmons, who refuses to take any other passengers. Referring to the fatal accident to Mr. Powell, M.P., Mr. Simmons said he felt sure the balloon then used, the Saladin, had too many passengers and too little ballast. The Saladin was similar in size to the india-rubber balloon in which Mr. Simmons intends to travel, but the Saladin weighed 600 lb., while his only weighed 400 lb.

AT the annual dinner of the Cleveland Institution Mr. E. W. Richards said:—"There is nothing very striking in American rail rolling practice. The rail trains are all three-high, and work well and do good work. They are driven some by vertical and some by horizontal direct-acting engines, with cylinders from 40in. to 46in. diameter, stroke from 4ft. to 5ft., with heavy fly-wheels about 30ft. diameter. The rolls are about 23in. pitch. The blooms are about 7in. square, and rolled in eleven passes to a single length of 56 lb. or 60 lb. of flange rail, 30ft. long. The two saws are fixed to that distance, and cut off both ends at the same time. If there is a bad end it is afterwards cut off when cold by a disc of soft iron without teeth ¼in. thick, driven at 2200 revolutions per minute, and will cut through a steel flange rail in 1¼ minutes."

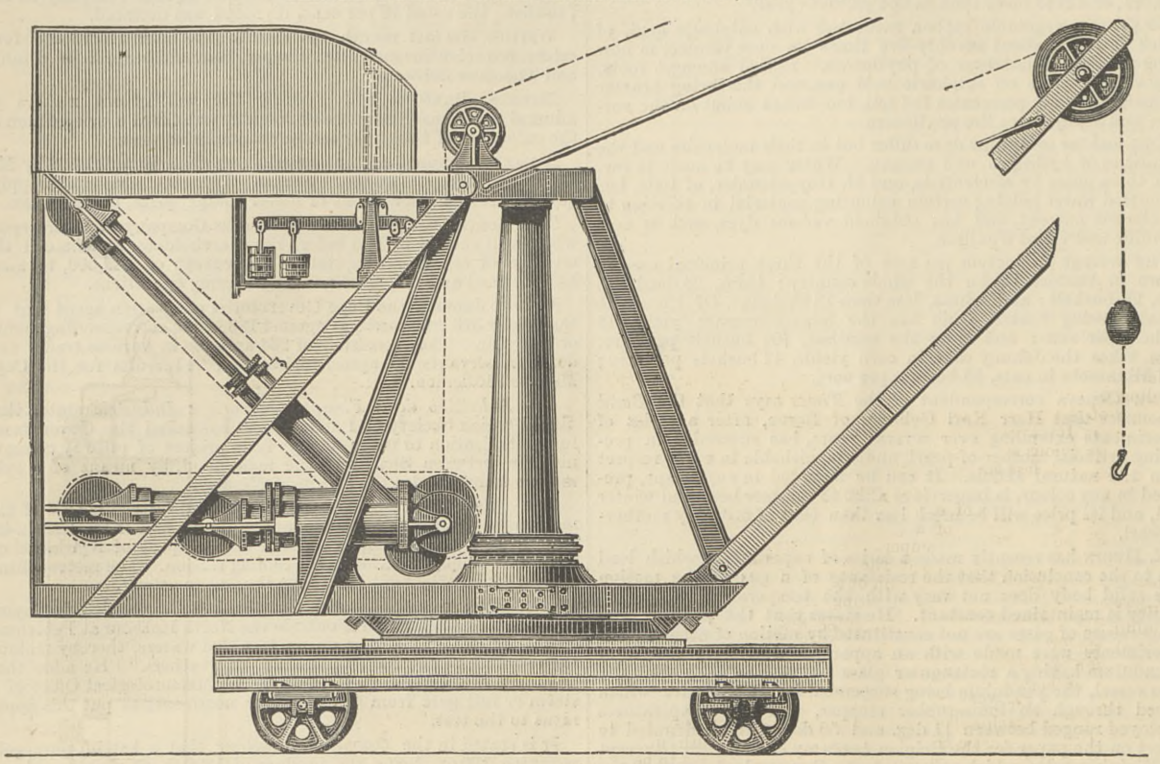
AT 1.30 p.m. on Tuesday, a number of the friends of Mr. Edgar Gilkes assembled in the board-room of the Middlesbrough Exchange, to present him with a testimonial. After forty years residence in Middlesbrough, Mr. Gilkes is about to leave for Stockton, where he has entered into partnership with Mr. T. J. Thompson, ironfounder, the new style of the firm being "Thompson and Gilkes." The board-room was crowded, several ladies, including Mrs. and Miss Gilkes being present. The testimonal consisted of a silver salver, a gold watch for Mr. Gilkes, another for Mrs. Gilkes, and a cheque for 530 guineas. The presentation was made by the mayor, Mr. Alderman Archibald, and his eulogistic remarks were supported by others from Mr. Fallows, Mr. H. F. Pease, chairman of the Tees-side Company, and other gentlemen. Mr. Gilkes replied in language which showed he had been deeply touched by this spontaneous act of kindly feeling from his fellow townsmen and friends.

A CORRESPONDENT gives the following as an addition to the usually cited reasons for reducing the first costs of a patent: "All patents granted during the six months prior to the day on which A applies for provisional protection are sealed to him. However careful he may have been in searching the history of invention in the direction of his own, he cannot know what has been done in these six months. He is therefore bound to take out a patent as a speculation, his hope being that out of the 2500 or so patents, which are a sealed book to him, there may not be one anticipating him. There may not be one; but there may be several. He cannot tell or by any means find out. B may have taken a patent out for the same thing five months and three weeks before A, and then A perhaps only loses the cost of the first fees. But C may have taken out a patent only a day or two before A, and then A proceeds with his patent, and probably pays the whole cost for the three years' protection, and has absolutely nothing of any value in return. The first cost should therefore be reduced, though the total cost might remain as much as now."

THE Local Government and Taxation Committee of the City have published a second edition of the report on the City day-census of 1881. The following figures from the report are of interest:—The City stands second of the thirty-nine parishes and districts, represented on the Metropolitan Board of Works as regards population; Islington coming first with 282,628; the City of London and Liberties next with 261,061; Lambeth, 253,569; St. Pancras, 236,209; Wandsworth, 210,397, and then follow Camberwell, Hackney, Kensington, Poplar, Marylebone, Greenwich, Bethnal-green, Shoreditch, Fulham, Newington (Surrey), Paddington, Mile End Old Town, &c. The rateable annual value of the City of London and Liberties is £3,535,494; St. George, Hanover-square, £2,005,350; St. Mary Abbott, Kensington, £1,969,501; St. Pancras, £1,791,099; St. Mary, Islington, £1,756,673; St. Marylebone, £1,656,874, then Lambeth, Wandsworth, Paddington, and Hackney, all about a million and a-half; then Camberwell, St. James's, Westminster, Greenwich, &c., which are under a million, but considerably above £600,000; and next follow Chelsea, Fulham, and a long list under £600,000. Each of the 198 incorporated cities and towns in England and Wales have a less rateable value than the city of London, the rateable value of Liverpool being £3,211,344; Manchester, £2,296,537; Birmingham, £1,454,329; and Leeds, £1,102,691; these four being the only places with a rateable value above £1,000,000. The amount of the assessment under the commercial and trading schedule D of the income tax of the city of London for 1879-80 was £39,263,424; Marylebone, £11,744,016; Westminster, £9,476,160; Finsbury, £6,976,056; Southwark, £4,543,776; Lambeth, £2,896,512; Tower Hamlets, £2,563,152; Chelsea, £1,509,792; and Hackney, £1,370,688

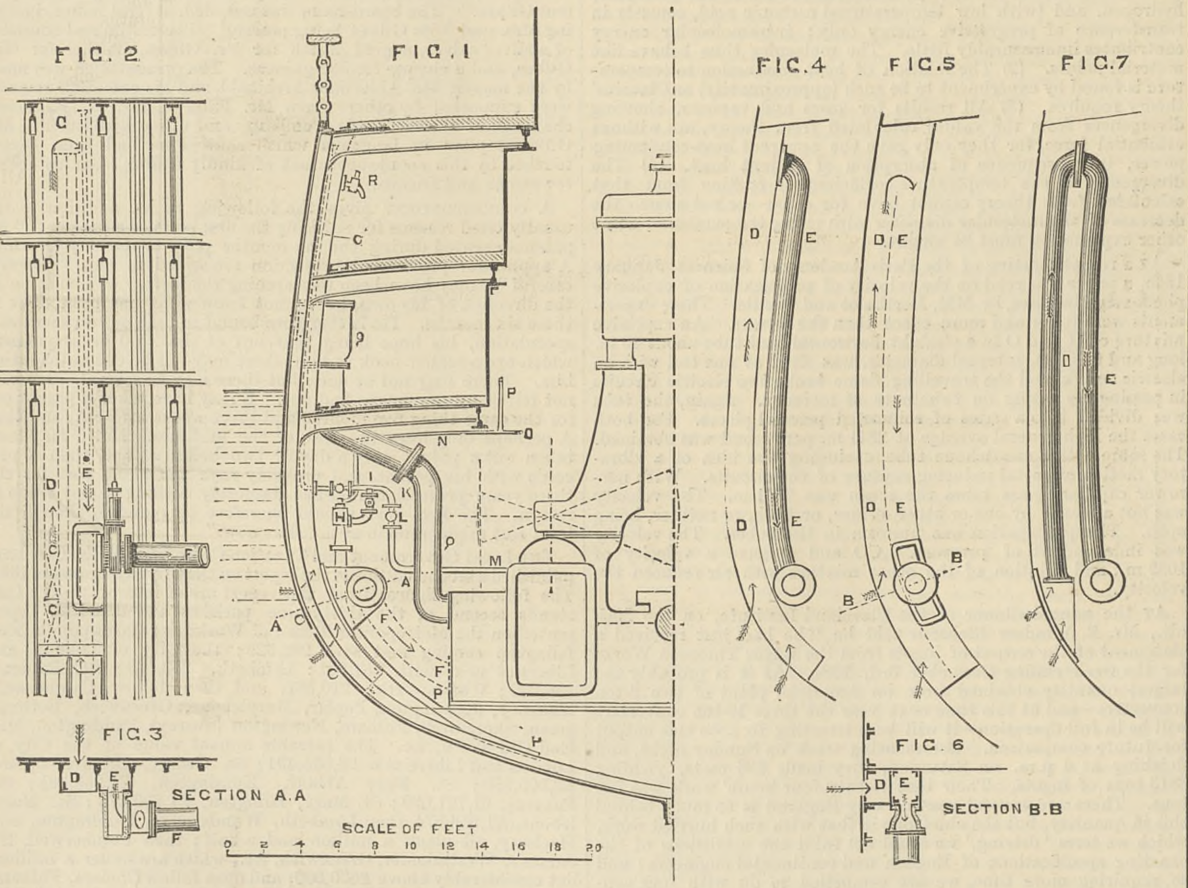
PORTABLE HYDRAULIC CRANE.

THE EAST FERRY-ROAD ENGINEERING CO., ENGINEERS.



We illustrate herewith a type of portable hydraulic crane patented by Mr. C. R. Parkes, managing director of the East Ferry-road Engineering Works Company, Millwall, a firm which has given special attention to the manufacture of hydraulic machinery. The illustration shows one of its most recent developments of portable hydraulic crane, and has been designed to meet a want much felt by users of hydraulic machinery for a crane of this class which could be placed in successful competition with the ordinary movable steam cranes. One of these machines has just been supplied to an eminent manufacturing firm having waterside premises. The crane travels on the ordinary gauge rails running round the works and connected to the railway. The radius of jib is 26ft., its height from rail to jib is 25ft., and the lift with the maximum power is one ton. The water under pressure is conveyed from the accumulator by pipes placed underground between the rails, and having branches to the surface at suitable intervals, to any one of which the crane may be connected. The water after leaving the main passes up through an adjustable telescopic pipe on the crane, and thence through the centre of the column to the valves for operating the cylinders, the revolving connection being made by a cup of simple construction. The column is fixed to the carriage of the crane, but the cylinders, valves, and man working the crane revolve with the jib and act as a counterpoise to the load to be raised and the weight of the jib. The exhaust water after leaving the cylinders may be discharged into a tank at the back of the crane, if additional counterweight is required, and from this tank the water overflows into a circular recess cast round the column, so that whatever the position of the revolving portion may be the water is discharged with equal facility, and can then be led away to the return pipe or drain. A barge of coal or raw material is brought alongside the wharf, and the crane is moved to the best position for loading the trucks. The time taken in connecting the crane to the main pipe is only three minutes, and the screwing up of two bolts and the opening and closing of the stop valve is the only work that must be done before the crane can be used. The exact cost of working has not as yet been ascertained, but the following will give some idea of the system. A small steam pump and an accumulator are placed close to the main engine-house and work a fixed crane of 2-ton power in addition to the portable crane. The pump only requires visiting two or three times a day by the engineman who has charge of the main engines, as its working is controlled automatically by the accumulator to the requirements of the cranes. As the sole expenses incurred are the steam and oil used by the engine, and the boy's time working the cranes, it may be confidently predicted that considering the engine works under the most favourable conditions, at a slow speed against a constant load with automatic adjustment to the work done, and care is taken that the capacities of the buckets are adjusted as near as possible to the power exerted by the crane, the cost of working will not exceed one-half that of the steam cranes displaced. The weight of all goods loaded or unloaded is taken by Duckham's patent self-indicating weighing machine suspended to the hook of the crane. This is a very convenient crane, and well adapted for dock work.

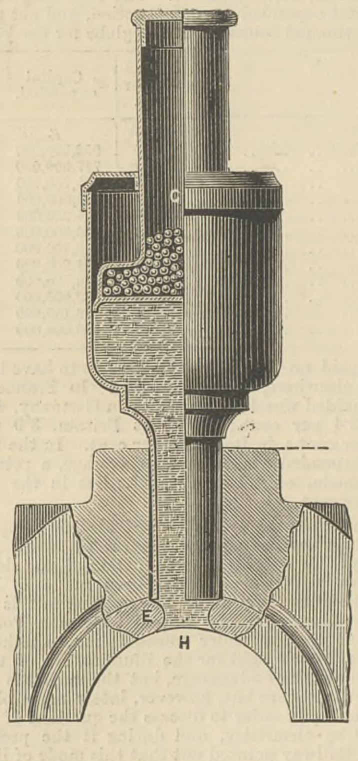
HALPIN'S MARINE ENGINE SEA CONNECTIONS.



Owing to the number of steamers formerly lost due to the inflow of water through the discharge orifices when anything went wrong with the communication between the condenser and the ship's side, so long as the delivery was below the water level, the practice of placing the discharge below water has long ago been abandoned. Numerous accidents have occurred when it became impossible to close the discharge valve when this was most wanted, owing to its being obstructed by some foreign substance. In such cases the ship had either to be taken into dry dock or else to sink, unless the aperture could be closed by some means from the outside. These dangers are now completely obviated by the simple expedient of taking the discharge orifice well above the water line, but the same danger and difficulty still remains as regards the injection supply, for although the pipes are always most carefully fitted with valves on the ship's skin, these often go wrong and allow ships to sink, as underwriters know to their cost. The arrangement we now illustrate, which has been designed and patented by Mr. Druitt Halpin, of No. 9, Victoria-chambers, Westminster, is intended to remove this remaining source of danger. It consists simply in the application of a properly arranged and constructed syphon chamber, preferably built into the side of the ship while she is being constructed or subsequently added in any of the forms we shall describe presently. Fig. 1 in the accompanying illustrations shows the cross section of a steamer, in which the discharge pipe *q* is, as is now usual, taken well above the water level. The suction pipe is made square, as shown in sectional plan at Fig. 3, Fig. 2 being an inside view of the ship's skin. The frames of the ship in particular here illustrated are composed of angle irons placed back to back, and between three of these sets of angle irons plates are rivetted, forming the sides and middle partition of the injection supply pipe. The water enters through the orifices *c c*, Figs. 1 and 2, and rising up over the partition plate dividing the two channels *d* and *e*, Fig. 3, descends and passes to the condenser through the valve *a* and the pipes *f*. This valve *a*, it will easily be seen, is moved by a regulating valve for controlling the quantity of water admitted to the condenser. When it is wished to start the engines a vacuum is formed in the syphon chamber by means of the ejector *h*, which sucks the air by the pipe *g* from the top of the syphon, this ejector being supplied with steam either from the main or the donkey boilers by means of the pipes *n*, *o*, and *p*. This ejector can also be used for forming a vacuum in the condenser before the main engines are started by means of the pipe *m*, and by closing the steam cock *k* close to the ejector, any small quantity of air lodging in the top of the syphon can be withdrawn by keeping the pipe *g* in communication with the condenser. Should it at any time be desired to examine the regulating valve *a* while the vessel is at sea, this can always readily be done by opening the air-cock *r* at the top of the syphon chamber, thus breaking the vacuum and arresting the flow of water. It is, of course, intended to place all the cocks drawing water from the sea on the syphon chamber, so that there may not be any necessity for having holes in the ship's skin in direct communication with the water. Should the strums at *c c* become choked by seaweed, these can readily be blown clear by admitting steam through the ejector and the air pipe *g*. Other modifications of the arrangement are shown by Figs. 4, 5, 6, and 7; in Fig. 4 the ascending leg of the syphon is made box-shaped, the descending leg being formed of a copper pipe. Figs. 5 and 6 show the application in the corner formed by the ship's skin and one of the transverse bulkheads either inside or outside a coalbunker as may be found most convenient. Fig. 7 shows the most convenient method of fitting the syphon to existing vessels, two pipes being taken up well above the water-line. In the three cases last illustrated it is, of course, understood that the ejector is always applied so as to enable the syphon to be readily started. The invention is being introduced by Messrs Bolling and Lowe, of 2, Lawrence Pountney-lane, and steps are also being taken to apply it on the Continent, where it is secured by several patents. We regard the scheme as excellent. The only wonder appears to be that no one has thought of it before. It entirely obviates a serious source of danger, and it does this without introducing any impracticable or objectionable device. Nothing can be more simple or less liable to get out of order, and it deserves the patronage of the Board of Trade and Lloyd's.

TOVOTE'S LUBRICATOR.

The annexed woodcut illustrates and sufficiently describes a very ingenious arrangement of tallow or paraffin lubricator, in



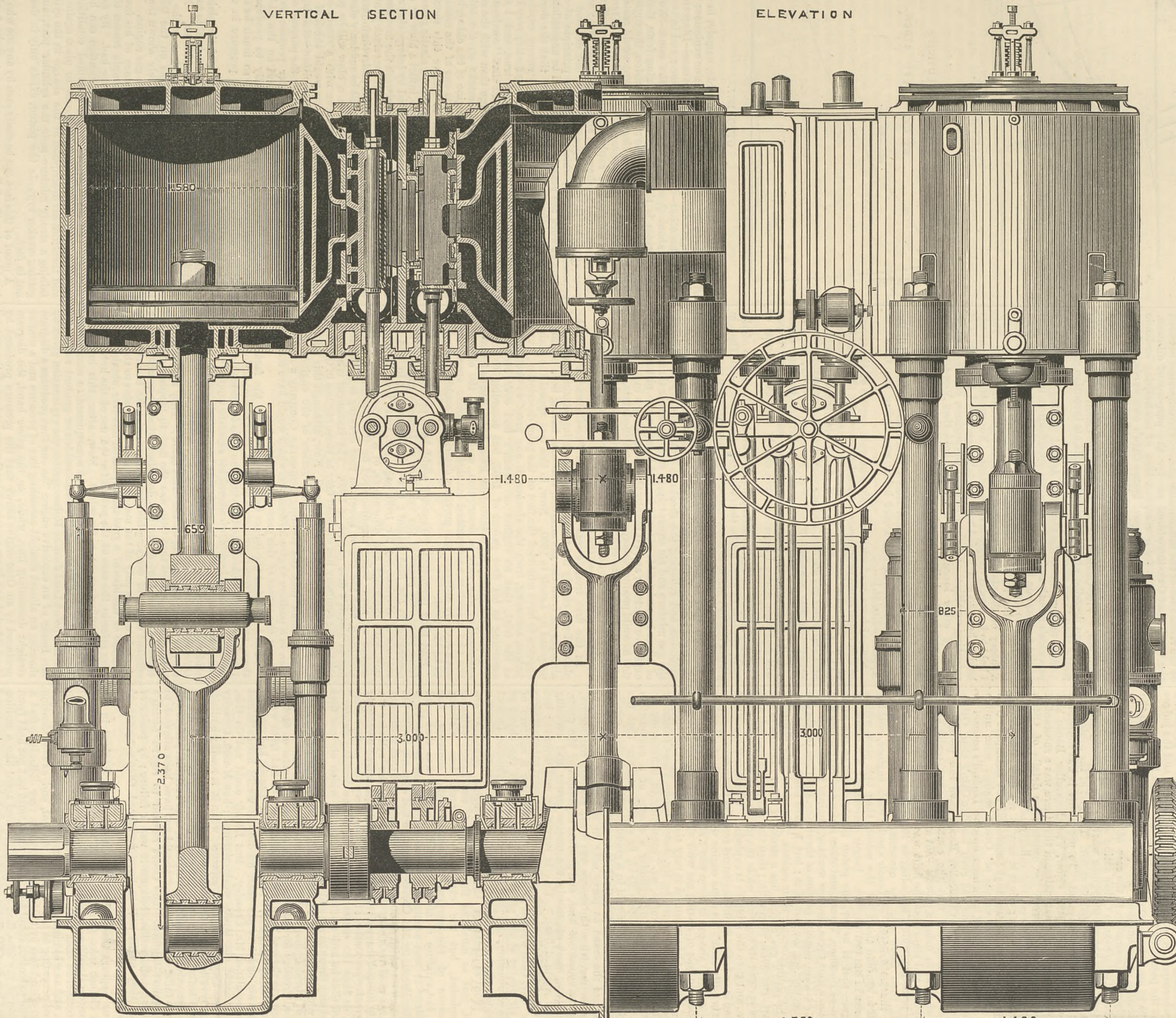
which the supply of lubricant to the bearing is regulated by the quantity of shot placed in a hollow piston above it. The lubricator is made by Mr. F. Tovote, Hanover.

S.S. Lady Longden.—On Monday, the 6th inst., Messrs Forrestt and Son launched from their Britannia-yard at Millwall a steamer of the following dimensions:—Length over all, 125ft.; length between perpendiculars, 120ft.; breadth, extreme, 20ft.; depth, moulded, 8ft. 8in. The christening ceremony was performed by Miss Bond, representing Lady Longden, who had returned to India. The vessel is built of steel to take the highest class at Lloyd's. She is fitted with a bridge-deck amidships, poop and topgallant forecastle, and will be schooner rigged. The engines are of the compound condensing type, 15in. and 28in. diameter of cylinders, with a stroke of 21in. The vessel has been built to the order of Mr. T. A. Tambeyah, of Colombo, and is intended as the pioneer vessel of a line of coasting steamers for Ceylon. The construction of small vessels on the Thames is not a lost art, for Messrs. Forrestt and Son alone have also in hand four large iron steamers for a London firm, a large twin-screw barge for her Majesty's Government, a powerful screw tug for London owners, four 80ft. iron barges for India, besides numerous smaller iron and steel launches.

THREE CYLINDER COMPOUND ENGINES OF THE S.S. LA FRANCE.

LA SOCIÉTÉ NOUVELLE DES FORGES ET CHANTIERS DE LA MÉDITERRANÉE, MARSEILLES, ENGINEERS.

(*For description see page* 101.)



Revolutions per minute	58
Mean speed per hour ..	10·25 knots

SCREW.

Griffith's four blade—	
Diameter	16ft. 8·79in.
Pitch	22ft. 7·63in.

CYLINDERS.

Number	3
Diameter	4ft. 11·85in.
Stroke	4ft. 1·24in.
Diameter of steam pipe	1ft. 4·54in.
Diameter of exhaust pipe	1ft. 5·53in.
Area of ports of main valve	235 square in.
Range of expansion ..	11·8in. to 23·6in.

PISTON RODS

iameter of piston-rods	6·88in.

SCREW SHAFT.

Diameter, mean, of screw shaft	1ft. 0·99in
Length of shaft	147ft.

CONDENSERS.

Number	2
Number of tubes in each	1045
Diameter of interior of tubes—tinned copper	0·87in.
Diameter of exterior ..	0·94in.
Length	4ft.
Surface, total for condensation	5113 square ft.
Diameter of injection pipe	7·08in.
Surface for condensation per horse-power	3·44 square ft.
Number of stay tubes..	16

AIR PUMPS.

Number	2
Diameter of pistons ..	2ft. 9·08in.
Stroke	2ft. 8·29in

FEED PUMPS.

Number	2
Diameter of plunger ..	7·87in.
Stroke of plunger ..	2ft. 8·29in.
Capacity per stroke ..	5·5 gallons
Capacity per hour per horse-power	26 gallons

BILGE PUMPS.

Number	2
Diameter of plungers..	6·29in.
Stroke	2ft. 8·29in.
Volume of one pump ..	3·5 gallons
Capacity per hour ..	23,385 gallons.

BOILERS.

Number	4
Number of furnaces in each	4
Pressure	40 lb.
Number of tubes	832
Number of stay tubes..	16
Diameter, interior, of stay tubes	3·35in.
Diameter, exterior, of stay tubes	3·74in.
Length of stay	8ft. 1·64in.
Length of ordinary tubes	7ft. 10·65in.
Length of grates	7ft. 6·5in.
Width of fire..	3ft. 1·4in.
Number of bars	69
Length of bars	2ft. 6·16in.
Grate surface..	22 square ft.
Heating surface, furnace	118·4 square ft.
Heating surface, tubular per furnace	446·72 square ft.
Heating surface, total per furnace..	565·12 square ft.
Per boiler	2260·5 square ft.
Diameter of the chimneys, two	5ft. 10in.
Ratio of section of chimney to grate surface..	0·1332

LETTERS TO THE EDITOR.

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

OTTO *v.* LINFORD.

SIR,—The case of Otto *v.* Linford is so important, and the judgment of the Court of Appeal affects so many interests, that I venture to hope you will permit that judgment to be discussed in your correspondence columns.

Before saying anything on the subject, I beg to explain that I am not an inventor, a maker, a buyer, or a seller of gas engines. I have no interest in them whatever of a commercial nature. If the judgment of the Court of Appeal did not cover a far wider field than that of gas engines, I would not trouble you with this letter; but it does cover a much wider field, and it seems to me to establish the dangerous precedent, that a man may patent, and intend only to patent, one thing, and that judges may interpret it to mean another thing, and give him the benefit of that pseudo meaning. To make this clear I must use a somewhat exaggerated illustration. A patents a wheelbarrow, and never intended to patent anything else; but some years afterwards B patents a bicycle, whereupon A sues him for infringement, and the judges hold that the patent for the wheelbarrow covers the bicycle. Now this seems to me to be a very dangerous doctrine to admit into the administration of patent law.

To apply this illustration to the case of Otto *v.* Linford is very easy. Linford's defence to Otto's action was that Otto had not a valid patent. It is not worth arguing whether Linford's engine was an infringement of Otto's patent or not. The gist of the contention was that Otto's patent was bad. To prove this it was contended that Lenoir anticipated Otto. Now, Vice-Chancellor Bacon and the Court of Appeal did not maintain that there was a substantial patentable difference between the constructive details of Otto's engine and Lenoir's. Indeed, the validity of none of the patents cited turned on this point; nor is it easy to see how they could, because if it had been argued that Lenoir did not anticipate Otto because the constructive details of Otto's engines were unlike those of Lenoir's, it would have been open to Linford's counsel to retort that Linford's engine was even less like Otto's than Otto's was like Lenoir's. Vice-Chancellor Bacon gave this point very clearly, and pointed out that the contention was really about priority of right in using a process—not an engine—and I shall go a step further and state that the fight was about priority of invention of a principle, which, according to English law, is not patentable. If then there was no contention about the difference between the construction of Lenoir's and Otto's engines, nothing remained to contend about but the action that took place within the cylinder in the two engines. Lenoir introduced a mixture of air and gas—that is to say, the piston inhaled both at the same time, just as Bisschop, Turner, and other makers of gas engines do; and I believe that there are now working, engines which inhale air alone for half the inhaling portion of the stroke, and then inhale gas and air together for the rest of it; but I have not heard that Mr. Otto proposes to prosecute their makers. To make this plain, let us suppose that a gas engine has a stroke of 12in. It inhales air alone while the piston moves 2in.; then the gas port is opened, and it inhales gas and air together while the piston makes another inch of stroke, and then the mixture is exploded. Whether this method of working is or is not an infringement remains to be seen.

Now it is quite clear that a gas engine will not work at all unless air be mixed with the gas in some way; and it is not possible to patent the principle of mixing gas with air and exploding it in a cylinder. What Otto patented is very clearly stated in his specification, and it was also stated by Mr. Aston, before Vice-Chancellor Bacon in the following words, as "consisting in introducing or admitting into the working cylinder a charge of a combustible mixture and an incombustible fluid, in such a manner that the combustible fluid was dispersed in a gradually disseminated condition among the incombustible fluid; more dispersed at parts distant from and less dispersed at parts near to the point of ignition; thereby effecting, when the charge was fired, gradual combustion, gradual development of heat, and gradual expansion of the gases, and so utilising most effectively the motive power and avoiding shocks and waste of heat." This is very clear and definite; but the Master of the Rolls and his colleagues do not seem to have understood it. Mr. Otto wanted to have in his cylinder a mixture of gas and air weaker at one place than another, with the object of retarding combustion, and producing prolonged combustion instead of explosion. But as a matter of fact he failed to secure such a result. The contents of the Crossley engine cylinder are exploded, just as much as the contents of the Lenoir cylinder were exploded, but the explosion is much less violent; not because of the varying richness of the contents, but because the mixture is much more dilute than was that used by Lenoir. It was admitted in cross-examination before Vice-Chancellor Bacon, by Mr. Crossley, that he had dispensed with the stratification on which so much stress was laid, and that instead of the charge used by Otto, he introduced into the cylinder "a uniformly diluted charge, that is, combustible gas mixed uniformly with a greater proportion of air than is necessary for perfect combustion, so that the entire charge is of a slow burning nature." He stated that he had made large engines in which air was first admitted and then the air and gas, but he did not say how many or with what results, and I believe I am right in stating that the method of working described by Otto has been entirely abandoned by Messrs. Crossley for some time, and that as a matter of fact no advantage was derived from it other than could be had from working with a dilute mixture. In one word, if Lenoir had worked with more air and less gas than he did, he would have attained the same results as Mr. Crossley. But Lenoir could not do this, because he could not ignite weak mixtures; but Messrs. Crossley can, because they compress the mixture, when it is readily ignited.

The really valuable feature about Otto's invention was compressing the charge before it was exploded; but according to the Court of Appeal, compression was old. Thus, then, Otto's original patent was virtually a failure, and as such it should not have been allowed to operate against Linford. The Court refused to regard Lenoir's patent as an anticipation, because it was a failure; by parity of reasoning they ought not to have permitted Otto's patent to anticipate Linford.

It thus appears that what Otto supposed took place in his cylinder did not take place, or that if it did, precisely the same results are obtained by any dilute mixture; but the Court of Appeal held nevertheless that Otto's patent is good; but as compression was old, and as what is and what is not a dilute mixture could not be defined according to the Court of Appeal, and as stratification had been abandoned by the plaintiff, it was very difficult to find a leg for the patent to stand on. Now the Court had got hold from Mr. Aston of the idea that the air introduced acted like a cushion interposed between the piston and the exploded charge, and so saved the engine from shock, and it is for this cushion that the Court have decided in favour of Otto. If your readers will turn to your excellent report of this case, page 76 of your last Friday's number, they will find in the second paragraph of the first column what I mean: "The first objection," says the Master of the Rolls, "is that this is not the subject matter of a patent, because what is claimed is a principle, or as it is sometimes termed, the idea of putting a cushion of air between the explosive mixture and the piston of the gas motor engine." Then he goes on to say that of course this could not be patented by itself, but he points out that the patentee, Otto, "not only tells us that that is the idea that he wishes to carry out, but he also describes machines which will carry it out; that is the subject of a patent." This means that Otto claimed the introduction of a cushion of air between the piston and the exploding charge, and invented a machine to carry the idea into practice. This is a clear statement of what the Master of the Rolls held that he patented.

Now will it be credited that Otto's patent does not contain a syllable about a cushion of air? That he makes no claim to have invented the use of a cushion of air; that it has never been proved that any such cushion exists, and that it is admitted by Messrs. Crossley that they have abandoned the stratification principle, and get precisely the same results from a dilute mixture?

Thus then we have the judges of the Court of Appeal actually saying that a man patented what he did not intend to patent, and about which his specification is totally silent. Cushioning was first heard of from Mr. Aston; and it is on this word that the whole case has turned. Vice-Chancellor Bacon would have none of it, and he points out that Lenoir patented the introduction of air distinct from air and gas. Lenoir's specification expressly uses the word "stratification." Here are his words, "The valve is so worked and adjusted as to open the air inlet a little before the gas inlet, and consequently a supply of air is drawn into the cylinder by the piston before the gas enters therein, the air and gas being made to form distinct strata under the piston in lieu of being mixed together." Vice-Chancellor Bacon may well say this is identical with Otto's specification. The object of introducing the supply of air into the cylinder before the gas is allowed to enter is to neutralise the effect of the carbonic acid gas formed by the combustion of the first portion of the inflammable gas, as the carbonic acid gas without being thus neutralised might prevent the ignition of the remainder of the inflammable gas. The difference between the two is that Otto introduced air for the purpose of dilution. Lenoir introduced it for a mistaken idea of neutralising carbonic acid gas. Tho Court of Appeal ignore Otto's own words, and say that he—Otto—introduced air to form a cushion, which, as a fact he does not do, and hold that Lenoir did not anticipate him because he introduced air, not to form a cushion, but to neutralise carbonic acid gas. Vice-Chancellor Bacon said of Lenoir's patent, "No words can describe what the plaintiff calls his invention more perfectly than these words do."

Here then we have the Court of Appeal putting words into a patentee's mouth and expounding his specification in a way that he did not explain it himself, and which explanation is wrong from beginning to end, the action supposed to take place not taking place, and then ruling in favour of the plaintiff on what is purely a theory of the plaintiff's intentions from beginning to end. This I hold to be a most dangerous precedent. No one is safe; patents held to be dead and buried may be taken and used as a means of extorting royalties. I do not refer to gas engines, but to a whole host of other inventions. I for one hold that Vice-Chancellor Bacon understood the whole case much better than did the Court of Appeal, which heard no witnesses. NEMO.

London, February 6th.

[It should be borne in mind that a shorthand note of all the evidence elicited in the Court below was before the Court of Appeal.—ED. E.]

SIR,—I have read with astonishment your report of the appeal in this remarkable patent case—remarkable both for the magnitude of the interests involved and for the extraordinary assertions which have been made on behalf of the plaintiff respecting his own and other gas engines, and accepted by the defendant without apparently any question whatever. You, Sir, however, in your remarks respecting this case, appear to be the first to even suggest a doubt respecting the correctness of these statements, and if you will grant me space, I hope to prove clearly that those doubts of yours are well founded.

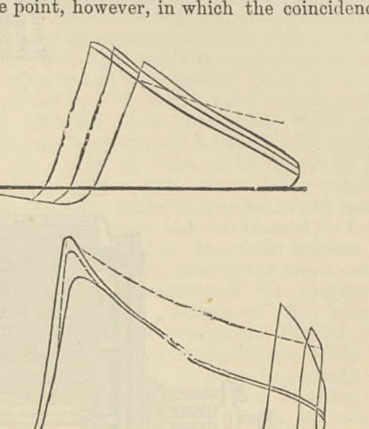
The plaintiff in his specification, and during the course of the trial, appears to have made the following assertions:—(1) That in all gas engines hitherto constructed a sudden explosion is produced, resulting in serious shock and injury to the machine, besides loss of heat; (2) that he could overcome this defect by making the explosions gradual; (3) that for the purpose of producing the gradual explosion and relieving the shocks it was necessary to introduce the gas mixture and air separately, in such a manner that a cushion of air or incombustible gas was formed between the piston and the explosive mixture; and (4) that by the means shown in his specification he could produce this approximately stratified state, as it is called, of the contents of the cylinder. Now, I will proceed to prove that these assertions made during the trial are at complete variance with the real facts of the case.

In the first trial it was held by the Vice-Chancellor that the plaintiff was clearly not the first to propose introducing a charge of air separate from the gas mixture, that idea having been originally proposed by Lenoir in 1860. Now, in this last appeal the plaintiff appears to have admitted the fact of the prior description, but the judges, assuming, from the absence of any proof to the contrary at the trial, that no engines of Lenoir's had ever been made according to his first patent of 1860, but according to another improvement which he patented in 1861, have decided that the anticipation was only in description, and that as the objects of the two inventors as described in their respective specifications were entirely different, the previous description could not be held to be identical.

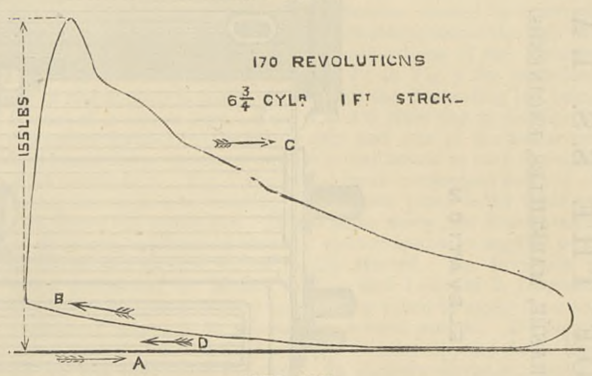
Had time permitted, I expect I could have produced evidence from your own pages of the existence of Lenoir's engines, made according to his first patent; but I do know that in the first volume of *Engineering* for 1866, page 183, there is a full description, with drawings and dimensions, of a 2-horse power Lenoir's engine as then being manufactured by the Reading Ironworks Company, and the engine shown in that drawing is made according to Lenoir's first patent of 1860. The statement is also made that "the company has supplied fifty of these engines in the course of the year, principally in London." Now, although this may not be legal proof of the actual construction of the engines, yet I should think that the Reading Ironworks Company would have been in a position to give information which would have materially altered the aspect of this part of the case.

Then I find that the judges have assumed from the facts before them, and also from the absence of facts, that the explosion in the Lenoir engine is sudden, and that of the Otto is gradual, and they have decided that Lenoir introduced his separate supply of air for the purpose of hastening his explosion by neutralising the carbonic acid, and therefore for a totally different purpose to that which Otto intended to use it; and it was principally on this ground that they reversed the finding of the court below. They appear also to have clearly decided that Otto was the first to propose a gradual explosion, and that as he has described what is assumed to be efficient means of carrying his idea into practice he is entitled to the sole use not only of the means described, but also to the exclusive use of the idea of a gradual explosion however obtained, and they refer to the case of the patent for the use of the hot-blast in iron manufacture as a precedent. Now, after this important decision it is certainly of the utmost consequence to ascertain, if possible, what is meant by the terms sudden or gradual explosion. On this point Lord Justice Holker quotes the explanation given by Mr. Imray of an explosive engine "as one that produces a diagram showing an almost straight ascending line of pressure and a similar straight descending line, while, on the other hand, the diagram produced by an Otto engine shows that the pressure produced by the explosion has been sustained by the expansion of the gases." Now, this definition of a gradual explosion engine will, I think, be found to include every engine at present made, with the exception, perhaps, of that class of engines with free pistons of which the Otto and Langin vertical is an example. All other engines would produce a diagram showing an explosion closely approximating to the Otto, with a more or less sustained pressure during the rest of the stroke, and could, therefore, under this ruling be considered infringements of the Otto idea.

Now I would ask, is it really a fact that there is this extraordinary difference between the action of the gases in the Lenoir and Otto engines? Any information on this point must obviously be obtained from indicator diagrams, and as these gas engines usually work at a quick speed and with high pressures, we require to use an indicator that is specially adapted for this purpose, such as the well-known Richards indicator. Now I find in your number for July 13th, 1877, page 24, a diagram of the Otto engine, and I suppose we may accept this as a sample of a gradual explosion and expansion diagram. I also find in your number for May 18th, 1866, page 357, two diagrams taken with a Richards indicator from a Lenoir engine in America, and this I suppose—if the evidence at the trial as to the explosive character of the Lenoir engine be correct—we ought to take as a type of an explosive engine diagram. I think if you could find space to reproduce these diagrams side by side for ready comparison it would afford your readers an interesting study. Anyone can at once perceive the similarity between these diagrams, especially when they remember that the first part of the Lenoir engine diagram is equivalent to the first out-stroke in the Otto engine drawing in the various gas and air mixtures behind it, and that the second half of the Lenoir stroke, beginning with the point of ignition, is represented by the second out-stroke of the Otto engine. When this difference is kept in mind it will be seen at once that the two diagrams are practically identical in form and character. There is one point, however, in which the coincidence



LENOIR, 1866.



OTTO, 1877.

between the diagrams is most remarkable, namely, in the evidence afforded as to the actual speed of ignition or explosion, which in the Lenoir engine occupied a time of, in one case—Diagram A—$\frac{1}{27}$ sec., and in the other—Diagram B—of $\frac{1}{30}$ sec.; and in the case of the Otto of about $\frac{1}{28}$ sec., or practically the same. Now, which of these engines is the infringement, judging from their respective diagrams? According to the recent decision, the engine at work in 1866, which produced the diagram shown, would certainly have to be considered an infringement of the Otto patent of ten years after, owing to its gradual explosion and expansion. Surely nothing further is needed to show the absurdity of the case; and yet from your remarks it would appear that if the decision is not now opposed, this patent, which claims the principle of action of an engine at work ten years previously, will be unassailable.

Respecting the claim of the plaintiff that the duration of the explosion was increased by keeping the strong explosive mixture distinct from the other contents of the cylinder, very little need be said. It is obviously the reverse of true, and I see that Mr. Crossley, in his examination, admitted that "combustion would be slower with the uniform dilute charge than with the stratified."

I would wish to make a few remarks on the subject of the dangerous shocks to which a gas engine of the old style is supposed to be subjected, and which is given as one of the reasons why Otto proposes to use a cushion of air to receive this shock—that is to say, it is supposed that a body of perfectly elastic gaseous matter is able at the moment of explosion to inflict a blow or shock on the piston, and that this can be prevented by interposing another body of perfectly elastic gaseous matter between the first and the piston. Of course the thing is impossible. If there are slack joints or bearings which allow the piston to move free when under the influence of a pressure, and acquire a velocity which will be suddenly checked when it comes home in the loose parts, then a blow will be produced, but exactly the same blow would occur with a steam engine under similar conditions. Yet no engineer would think of proposing to interpose a layer of steam against the piston—that is, give a large clearance at the end of the cylinder for the purpose of preventing this shock; neither would any engineer propose to modify the blow by dispensing with the usual lead on the slide valve, and admitting the steam pressure gradually to produce a diagram similar to the Otto. Then why should so much be said as to the shocking effects of a suddenly applied pressure in one case and not in the other?

I now come to refer to the last assertion of the plaintiff, that by the means described in his specification he is able to produce the stratified condition he desires in the cylinder. No objection appears to have been offered at either trial as to the feasibility of the means indicated, but in your remarks on the trial, however, you say, "It has never been conclusively shown that cushioning such as Otto claims does take place in a gas engine. Yet it would appear that this action is the very essence of his invention." It has never been demonstrated for the simple reason that it has no existence in the Otto cylinder, and never had. By neither of the forms of admission shown in his specification can he obtain the slightest approach either to the stratified condition or to the cushion of air, &c., which he proposes to place against the piston, and therefore his description of the charge in the cylinder as containing a strong mixture near the cylinder port, and gradually getting weaker towards the piston, exists only in description and not in fact.

A proof of this fact can be easily seen by anyone who will take the trouble to try the following experiments:—Take a glass cylinder open at both ends—a large Argand glass chimney will do—secure air-tight against one end a piece of cardboard or wood with a hole in the centre, of such a size as to represent proportionally the port as shown in Otto's first modification. The effect of the moving piston can be produced by immersing the open end of the tube in water. On lifting the tube up the falling level of the water in the interior will act in exactly the same manner as a piston. Now arrange to connect, when necessary, the top hole or port by a flexible tube with a reservoir of smoke, which will represent the explosive mixture. Then, first, lift up the glass tube a short distance and allow the space above the water piston to represent the cushion of air, as it is called, first introduced next the piston; then connect the smoke-pipe and still further raise the glass vessel. If this is done slowly the smoke as it is drawn in will be seen to proceed direct from the entering port down the centre to the surface of the water piston, where it is deflected, and, returning up the sides, is again drawn into the centre by the friction or lateral action of the entering jet, the result being a more or less uniform mixture of the whole, especially if it be drawn in at any speed. If now we push the end of the tube through the orifice, and allow it to project into the cylinder, we will have approximately the form shown in Crossley's patent of 1877, in which he dispenses with the stratified charge, and obtains an uniform mixture. On repeating the experiment with the smoke it will be found that exactly the same result occurs as with the plain hole described in the first modification of Otto's patent of 1866. Then remove the flat end and fix on instead a conical funnel of the shape and proportion shown in Otto's third modification, and repeat the experiments. The result will be found to be nearly the same as before, but the effect of the cone will be to partially spread the entering jet of smoke and cause it to be uncertain in its movements, any slight disturbing cause being sufficient to deflect the smoke down one side of the tube or cylinder instead of in the centre; the final effect, however, will be to cause a mixture as before either uniform or of a confused streaky nature, and not at all resembling that described by Otto, the fact being that the explosive mixture in the Otto engine, as it enters the cylinder at a speed of something like half to one mile a minute, could not by any possibility stop quietly at that end of the cylinder behind the cushion of air, but is at once projected through that body of air on to the piston, and from there it is deflected and mixes with the general contents of the cylinder. These experiments with smoke have the same result in whatever position the cylinder may be placed, or whatever the kind of smoke employed. Those who cannot try these experiments I would refer to a new work on "Fluids," by W. F. Stanley, and especially to the following illustrations in that book, viz., Figs. 102, 103, and 104, page 221; also Figs. 106, 107, and 108, page 227, where he gives results of his experiments on the motion of fluids in confined chambers, which fully bear out my statements.

If, therefore, these facts be correct—and I do not think any candid mind can doubt it—it follows that the engine seen by the scientific witnesses—constructed according to the first modification of Otto's patent—was nothing more nor less than a Lenoir's engine, constructed and working in exactly the same manner as described in Lenoir's patent of 1860. It should also follow as a natural conclusion that as Otto never showed or described any sufficient means by which the contents of the cylinder could exist in a stratified or separated state, that he has no right or title to his claim to the idea of the stratified state or to the exclusive use of a cushion of air against the piston.

I think I have said sufficient to prove that a grave miscarriage of justice has occurred, due entirely to the incorrectness and incompleteness of the evidence submitted to the judges, and on which they had to base their decision, and that if effective steps are not taken to reverse the decree very serious injustice will be done to the whole gas engine trade, both old and new style. It is, therefore, to be hoped that those possessing any information as to the construction or working of Lenoir and other early gas engines will make that information public before the manufacture of all gas engines is assigned as an exclusive monopoly to one firm, who, although they have done a great deal towards the further improvement of the gas engine, are not by any means the first or only workers in that field. Lenoir used mixtures very nearly as dilute as Otto; for I find M. Tresca, in giving a report of the trial of a Lenoir engine with different mixtures of gas, says that the strongest mixture obtainable according to the construction of the machine was only about 8½ per cent. of gas, and that in ordinary course of working weaker mixtures than this would be used. The defects of his engine were undoubtedly the troublesome nature of the electrical firing device and the consumption of gas, which appears to have been from 50 to 70 cubic feet per indicated horse-power per hour. In this latter respect the Otto is a decided advance, but this improvement has not been due to any of the causes to which it was attributed at the trial, as these are fictitious, but principally to the fact that by compressing the explosive mixture before ignition, the size of the cylinder, and therefore the extent of cooling surface per horse-power acting on the gas to absorb its heat wastefully, has been considerably reduced. The use of a 5 per cent. mixture—the ignition of which is rendered more rapid and certain by the compression—in place of the 7 or 8 per cent. mixture in the Lenoir, would also have a slight effect on the economy, but the actual working temperatures in the cylinders of the Otto and the Lenoir are, I find, very much the same—as a reference to your article for May 18th, 1866, will show.

I trust I have succeeded in placing clearly before your readers some few facts relative to gas engines, and the importance of the subject at the present moment must be my excuse for trespassing so much on your valuable space. I have given all particulars where necessary for verifying my statements, and there is therefore no need for me to further authenticate these by publishing my name. I only wish for FAIR PLAY.

February 8th.

THE DITTON PUMPING ENGINES.

SIR,—In your issue of December 16th, 1881, you discuss the results of the Ditton pumping engines lately constructed by Messrs. Simpson, and in comparing amounts of feed-water used, say:—"The best results we can compare these figures with, are those got from a Saltaire engine, mentioned by Mr. Clark, which required 17·4 lb. of steam. It has also been stated that some pumping engines in the United States, constructed by Mr. Leavitt, get on with 16 lb., but of this we have no trustworthy proof."

While quite agreeing with your general remarks, may I lay before your readers for comparison the figures reported by the Park Benjamin Expert Office on the Lawrence engines of Mr. Leavitt in 1879? The report is published by them at 37, Park-road, New York, and the figures reduced to comparison with the Ditton report in THE ENGINEER of December 9th last are as follows:—

Engines A and B—Engine A tested.

Engines:—	
High-pressure cylinder	18in. by 8ft. stroke.
Low-pressure cylinder	38in. by 8ft. stroke.
Pumps	26·125 by 8ft. stroke.
Boilers:—	
Two, tubular combustion chambers internally fired, and return flues beneath. One used in test..	diameter, 5ft. 3in.; length, 25·46ft.
Grate surface	28·75 square feet.
Observations:—	
Average steam pressure	89½ lb.
Head on pumps	76·6 lb. per square in.
Temperature of injection	119 deg.
Average revolutions per minute	13·62
Barometer	29·81
Results:—	
Duration of trials..	15 hours.
Total indicated horse-power of engine	147·91
Horse-power of water actually delivered ..	135·55
Difference	8·36 per cent.
Measured quantity of water	91·64 of theoretic capacity.
Coal used per indicated horse-power per hour	1·63 lb.
Actual duty of 112 lb. of coal	114,550,247 foot-pounds.
Water fed into boilers per indicated horse-power per hour..	16·48 lb.
Water evaporated per lb. of coal, including ashes	10·13 lb,

The above amount of feed-water also supplied the jackets, which used 282 lb. per hour. This test seems to have been made with the utmost care, and with similar precautions to those adopted by Mr. Cowper.

The Calumet and Hecla Mining Company, of Michigan, have a hoisting engine designed by the same engineer, which was tested by them on a trial extending over ten days in December, 1880, when the consumption of coal was found to be 2·13 lb. per horse-power per hour, and that of feed-water, 16·3 lb. per hour. The dimensions of this engine are:—High-pressure cylinder, 22⅜in.; low-pressure cylinder, 38in.; revolutions, 48.

These figures are from a paper read by the designer before the Am. S. M. E. last year.

In both these engines, it must be borne in mind, no reheaters are provided, they being of the well-known type adopted by Mr. Leavitt, with the back ends of the two cylinders inclined to and closely approaching each other, reducing the connection to a very small percentage of cylinder capacity. All parts are thoroughly jacketted. Mr. Leavitt has lately abandoned this type in favour of the intermediate receiver, placing both cylinders vertical, and constructing a box-receiver of surface condenser type, with small brass tubes through which the live steam for heating is taken. Of this design are the new Boston sewage engines now being erected at Old Harbour Point, and the 1500-horse power hoisting engine for the Calumet Mine, also in course of erection, and their working performance will probably give interesting results. REGINALD BOLTON.

Nottingham, January 25th.

GAS ENGINES AND THE ELECTRIC LIGHT.

SIR,—There are some points in your leading article of 27th January on which I beg you will allow me to make a few remarks. I have referred to Prof. Ayrton's lecture, and find that he makes the following quotation from Sir William Armstrong's address:—"Taking a good condensing engine as an example, we may roughly say that, dividing the whole heat energy into ten equal parts, two escape by the chimney, one is lost by radiation and friction, six remain unused when the steam is discharged, and one only is realised in useful work." With this clear statement as to where the chief losses of heat energy occur in the boiler and engine, I fail to see how anyone can take this to mean that the engine alone "wastes nine-tenths of all the heat generated," or how its sense can be "so readily mistaken, that Prof. Ayrton would have done well to explain" his meaning.

The lecturer shows by Sadi Carnot's formula, $\frac{S-T}{S+273}$, that with the temperatures which can be used in condensing engines, the efficiency of even an imaginary engine without friction, and losing no heat from the boiler, cylinder, &c., by conduction, radiation, or convection, cannot exceed $\frac{1}{10}$, or only double the efficiency of a good modern steam engine.

There surely is no ambiguity in this statement, and the question at issue is really not the efficiency of a steam engine only, but of the whole combination of engine, boiler, steam pipes, valves, &c., compared with the efficiency of an externally-heated hot-air engine, and an internally-fired gas engine. The figures given by Prof. Ayrton show unmistakeably a much higher efficiency for the latter. Apart from the question of efficiency is, of course, that of economy in working, and in order to make a close comparison, the lecturer took the case of a steam engine and a gas engine of the same indicated power, the power being that of the largest single-cylinder Otto engine then made—30-horse power. The fuel consumption for this size steam engine was taken at 6 lb. per indicated horse-power per hour, and although we all know that a high-pressure compound engine of this size can be worked at something like 3 lb. if the work is very regular, if the boiler is new, and if the fire is fed in the most careful manner, yet in average practice I much doubt the fuel consumption of a good engine and boiler of this size being less than 6 lb. Many users of steam engines of this size would be glad to have their coal bill reduced even to this.

You have referred to the working of the gas engine with the gas made in my apparatus, and I should like to add that from experience extending over two years' practical work in various places, I am able to state that 1000 cubic feet of this gas can be produced from about 12 lb. of anthracite and 7 pints of water. The only other item of working cost is for the attendant's wages, about one-third only of his full time being required. The cost of making the gas depends to a certain extent on the size of the generator, as the larger the production for the same item of wages, the cheaper it is. With the smallest size generator, producing 1000 cubic feet per hour, the following is the total working cost:—

		s.	d.
Anthracite to make gas at the rate of 1000 c. ft. per hour = 12 lb. × 9 working hours = 108 lb., or say 1 cwt., at 20s. a ton		1	0
Allowance for wages of attendant		1	0
Repairs and depreciation of generator, gas holder, &c. (5 per cent. on £125), per working day		0	5
Interest on capital outlay, ditto, ditto		0	5
		2	10
Gas produced	9000 c. ft.		
Less gas used for generating and superheating steam..	1000 c. ft.		
Total effective gas for 2s. 10d...	8000 c. ft.		

Net cost, 4¼d. per 1000 cubic feet.

Two other sizes of generators give the net cost at 3½d. and 2¾d., or a mean for the three sizes of 3½d. per 1000 cubic feet. Actual trials with some 3½-horse power Otto engines have proved that 1-horse power indicated per hour is obtained with a consumption of gas derived from under 1½ lb. coal. Messrs. Crossley Bros. have thoroughly tested the gas, and are so far persuaded of its great economical advantages that they have decided to work an aggregate of 200-horse power at their new works with this gas. At the present moment my apparatus is at work at the Smoke Abatement Exhibition, South Kensington, and my gas is there being used to drive an Otto engine which is working a Siemens dynamo and some Swan lights, and I venture to say the combination is one of great interest. J. EMERSON DOWSON.

3, Great Queen-street, Westminster,
January 30th.

THE INSTITUTION OF CIVIL ENGINEERS.

SIR.—In your last impression you record that the members of the Institution of Civil Engineers round about Manchester dined together with a view to acquaintance. This, Sir, gives me an opportunity of asking why the London and surburban members of the Institution of Civil Engineers do not arrange a meeting of the kind at least once a year, and perhaps a day excursion to some place or work of interest. I do not see why such a mode of meeting should be derogatory to the dignity of the Institution more than a *conversazione* and visit to a museum, while it would certainly forward one of the chief purposes of the Institution, namely, acquaintance and exchange of views among its members. There is the annual dinner of the president and council and their friends, to which members are invited at a cost of at least double the charge for a similar dinner with the members or fellows of other equal institutions or societies; but at this dinner, which may have its object and serve a purpose, few members are present.

London, February 5th. MEMBER.

COLD AIR MACHINES.

SIR,—Mr. Lightfoot, in his letter in your issue of the 27th ult., begins by complaining of being misunderstood, but he does not show in what or where the misunderstanding lies; and in a very few sentences he falls into that very error himself by reiterating the erroneous statement that the pressure maintained in the Sturgeon machine is only 30lb.; this in spite of Mr. Sturgeon's having informed him that he is not tied down to any particular pressure or temperature, and I may add "even in the same machine." It is only a short time since I was working one of the Sturgeon's machines, to produce a very low temperature, and the air pressure stood at 75 lb.

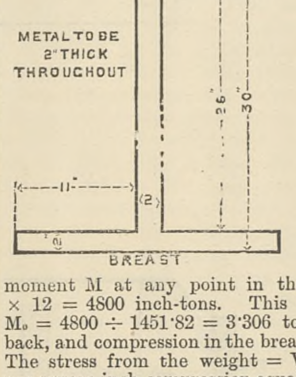
Mr. Lightfoot says: "As to speed, it is well known that there is no difficulty in making compressors to run efficiently at the rate adopted by Mr. Sturgeon." Now, in the first place, Mr. Sturgeon has not adopted any specific rate; and in the second place, I am surprised at Mr. Lightfoot making the above assertion at all; inasmuch as he ought to know that, from a variety of causes, the very greatest difficulty was experienced in working compressors at even a moderate piston speed—difficulties so apparently insurmountable as to lead to its abandonment by firms of great experience. Happily this, however, has been overcome since the invention of the patent trunk compressor; to which, possibly, Mr. Lightfoot may be alluding. I have always had my doubts as to the utility of the primary and secondary expansion as a means of abstracting the moisture; and my suspicions of its inutility have been confirmed by my becoming acquainted with the fact that long before Mr. Lightfoot brought it before the public it was tried and found wanting by Messrs. Hick, Hargreaves, and Co., of Bolton. The expression of inutility may be misunderstood; I will, therefore, say that any contrivance may be set down as comparatively useless so soon as there is a simpler and equally applicable means of arriving at the same end.

One more word on the subject of the formula for finding the weight of water in 100 lb. of atmospheric air at certain pressures and temperatures. A little thought will show that this formula, assuming it to be correct in the main, is not by any means of universal applicability; for were it so, it would be equivalent to saying that the air contains no more moisture in foggy weather than in clear, nor after a shower of rain than after a week of drought. Y. W. DE V. GALWEY.

February 2nd.

STRAINS ON CRANE POSTS.

SIR,—I think it is a pity that this lengthened discussion, which you have been good enough to allow in your columns for some time past, should close without some practical result being obtained; and with your permission I offer a suggestion proposed a few weeks ago by Mr. Ward. Below I have worked out the strains on a crane post of certain dimensions. Will any of your correspondents who have ventilated their ideas on the subject lately, work out from their methods their versions of the strains, using the same data as I have done, and employing any mathematical refinements they may think advisable; the weight of the crane and post being neglected? If their results differ from mine by one per cent. I shall be somewhat surprised, and the correct solution of the problem must then be left to the independent judgment of your readers. The adjoining figure represents the section of an ideal crane post having the dimensions attached thereto. The moment of inertia I = 21777·33in. units; the moment of resistance at one ton per square inch on the extreme fibres M_o = 1451·82 inch-tons; the sectional area A = 148 square inches. The length l from the centre of gravity of the weight to the centre of gravity of the section = 20ft. The weight W = 20 tons; and if anyone thinks the height exerts any appreciable influence on the stresses, let the distance h from the centre of gravity of the jib to the ground level, at which the bottom of the post is supposed rigidly fixed both in position and direction = 20ft.



Those, I think, are all the necessary materials required for the proposed calculation, if we suppose the structure to be composed of ordinary wrought iron. The method I used in my first letter—written last October—I shall not depart from, it is as follows:—The bending moment M at any point in the post is equal to $Wl = 20 \times 20 \times 12 = 4800$ inch-tons. This gives rise to a strain of $M \div M_o = 4800 \div 1451{\cdot}82 = 3{\cdot}306$ tons per square inch tension at the back, and compression in the breast of the post of the same amount. The stress from the weight $= W \div A = 20 \div 148 = 0{\cdot}135$ tons per square inch compression equally distributed all over the section. The total resultant stresses in the extreme fibres are, then, $3{\cdot}306 - 0{\cdot}135 = 3{\cdot}171$ tons per square inch tension in the back, and $3{\cdot}306 + 0{\cdot}135 = 3{\cdot}441$ tons per square inch compression in the breast. . . . . .

One question I ask Mr. Ellis, who thinks I am wrong in making the stresses caused by the action of the weight alone to be equally distributed over the sectional area of the post, is this—If the post be of, say, a square section and solid, what would be the compression on the extreme fibres at the breast caused by the action of the weight, considering the bending moment in this instance to be eliminated? ALFRED FYSON.

13A, Great George-street, Westminster, S.W.

THE BURSTING OF FLY-WHEELS

SIR,—Seeing in the papers another accident caused by the bursting of a 60-ton fly-wheel, whereby loss of life and destruction of valuable property were caused, I thought I would submit the following idea to your impartial criticism. It occurred to me some years ago, when a similar mishap took place—at Bolton, was it not? I propose instead of the present cast iron wheels to construct a wrought iron or steel drum having inside radial partitions, the whole drum or wheel being rivetted to a central cast iron boss. The wheel could be rivetted up around the boss after the shaft was fixed, and when the engine was finished the fly-wheel would be filled up solid with water and plugged up. By making the drum a bit larger in diameter and wider, a wheel sufficiently heavy could be obtained within a reasonable space, as the whole of the space within the circumference would be utilised, which would help to make up for the much less specific gravity of water compared with cast iron.

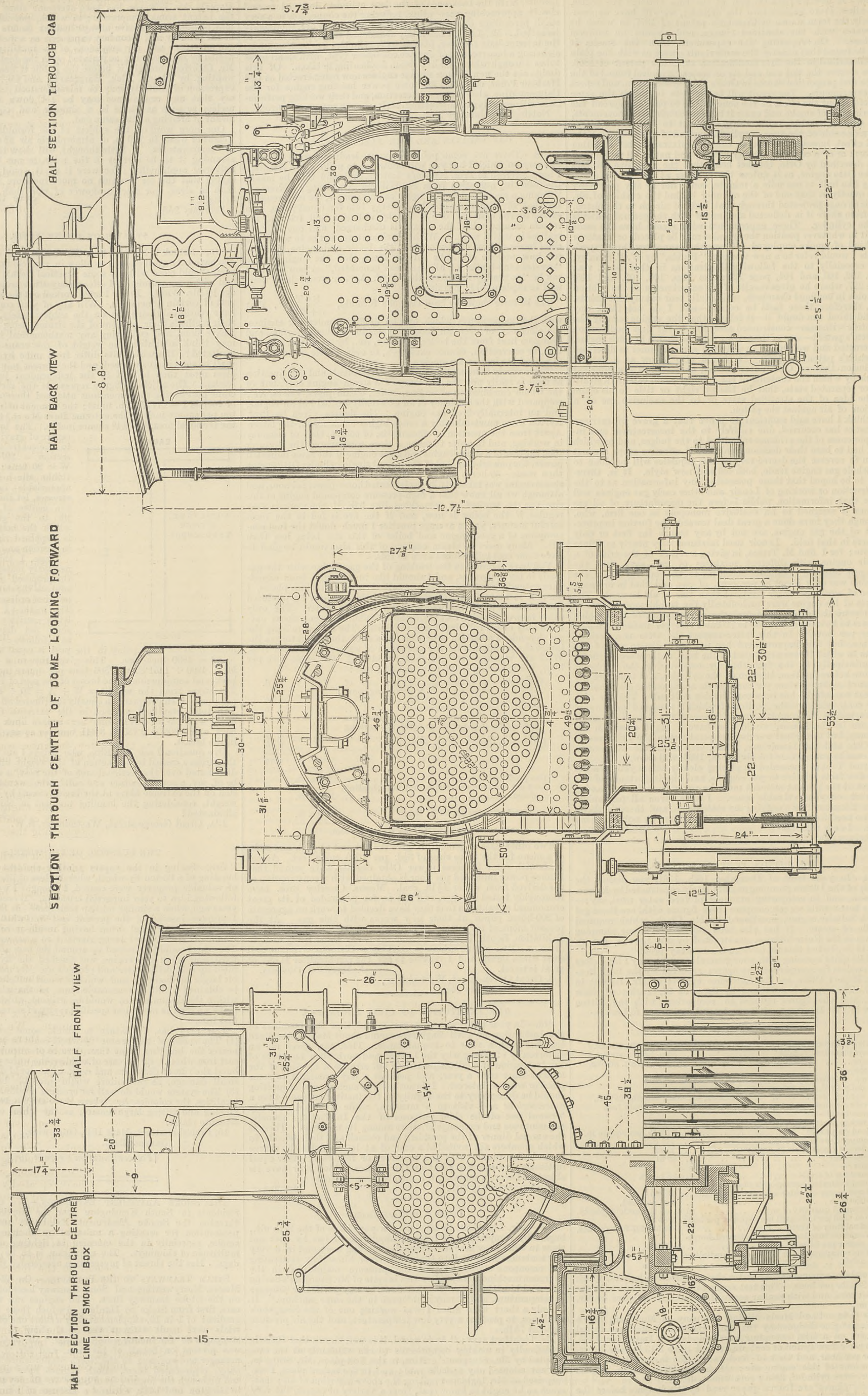
This plan has, I venture to think, some great advantages: (1) The speed of this water fly-wheel could be increased to much nearer the bursting point than dare in practice be neared with a cast iron wheel. (2) In case of accident the water would, no doubt, burst the rim of the drum and escape, but could do comparatively small damage, as the failure would probably be more gradual. (3) The system would do well for erecting machinery in inaccessible localities, the colonies, &c., where there are limited appliances for moving and lifting large masses, as the wheel could be sent in separate plates. J. FOSTER.

15, Frobisher-street, Maze Hill, Greenwich.
January 24th.

[*For continuation see page 106.*]

THE SMOKE ABATEMENT EXHIBITION.—We understand that residents in South Kensington near the Horticultural-gardens, threaten the Smoke Abatement Exhibition authorities with a prosecution for creating a nuisance by discharging volumes of smoke, especially in the morning at lighting up time, from a multitude of chimneys. The exhibition is to be closed in a few days. Has the threat of prosecution accelerated its decease?

STEAM TRAMWAYS TO THE POTTERIES.—On Wednesday two of Messrs. Merryweather and Sons' tramway locomotives were tested on the Stoke tramway lines. The engines ran with full-loaded cars, first from Stoke to Hanley, on which there is a long heavy gradient of 1 in 16, supplemented by a short one of 1 in 14. These trials were made without the least show of steam, though stoppages on the incline were frequent. Mr. J. C. Merryweather was present on behalf of his firm, and Mr. J. S. Ayton, the manager and engineer to the North Staffordshire Tramways Company, represented them. Both engines have water condensers, and although the journey from Stoke to Hanley and back, thence to Longton and back, exceeds a distance of nine miles, the temperature in the condenser on returning to the running shed did not exceed 200 Fah., a result considered to be most satisfactory.



EXPRESS LOCOMOTIVE, PENNSYLVANIA RAILWAY.

MR. T. N. ELY, ENGINEER, ALTOONA.

(*For description see page 93*)

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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 1d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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T. L. S. (Mater, near Thunis).—*The invention is very old. It has been patented probably fifty times. Much money has been spent on it, and it is wholly useless.*

STUDENT.—*The inside dimensions of an ordinary cement barrel are 28in. high, 18in. diameter at centre and 15½in. at ends. Weight when full, 400lb. Cost of testing machine, £24.*

O. H. N.—*If you will get a drawing of a semaphore post as actually made with its attachments, and a drawing of the back end of a locomotive and the foot-plate, and will then set to work to carry your idea into practice, you will see how beset with difficulty it is; and inasmuch as there is always a probability that the thing might fail to act and thus deceive the engine-driver, the adoption of your plan would be tantamount to the substitution of one danger for another.*

REASON WHY.—*V-shaped teeth are used because they work more quietly than straight teeth. They are a modification of the well-known step gear, in which a wide tooth is divided into three or more portions, each a little in advance of the next. In this way jerking as each driven tooth is taken up by the driving tooth is almost avoided. The same result has been got by spiral gear, but this tends to force one shaft endways in one direction and the other in the opposite direction.*

TURBINE.—*In reply to your inquiry, we may say that Whitelaw and Stirrett have been dead some years. The turbine which was the patent of the former gentleman, was manufactured, we understand, at Paisley, near Glasgow, probably at works of their own. The Rajawelle turbine, illustrated in* THE ENGINEER, *the largest of the kind ever made as far as we know, simply had on it the words "Whitelaw's patent." The pumps were made in Glasgow by Messrs. McLellan and Co., but they knew nothing of where the turbine came from. Whether any one represents the late firm we do not know.*

P. P. (Wexford).—*The Electrical Exhibition may be visited now or within a week with interest and utility. With respect to the power to drive a small dynamo, we cannot now answer your question, as we have not preserved your other letter giving the pressure of the water. The gas engine will cost you about 1d. per indicated horse-power per hour, or, say, 1½d. per brake horse-power, with gas at the price you mention. Taking the water pressure as 40 lb., the cost at 1s. per 1000 gallons would be at least sixteen times that for gas. The best colour to paint machinery for photographs is light lead colour, or any good neutral tint, and the machine should be placed before a green baize or other screen in the open air. See "Practical Photography," by O. E. Wheeler. London:* The Bazaar *office, Strand.*

DECORTICATING COTTON-SEED.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents kindly inform me where I could obtain a machine for decorticating cotton-seed? OIL.

London, February 8th.

THE GREAT EASTERN.

(*To the Editor of The Engineer.*)

SIR,—I shall be obliged to any correspondent who will tell me whether or not the Great Eastern steamship was launched with her paddle-wheels in place. R. L.

Belfast, February 7th.

GREENOCK WATERWORKS.

(*To the Editor of The Engineer.*)

SIR,—Could any of your readers inform me where I might obtain a report or full description of Shaw's Waterworks in the town of Greenock? Mr. Glynn, in "Power of Water," mentions a few details.

London, February 7th. A TEN YEARS' SUBSCRIBER.

AUTOMATIC THERMOMETRIC VENTILATOR.

(*To the Editor of The Engineer.*)

SIR,—Some time since a description was somewhere published of a ventilator for rooms which was actuated by the expansion and contraction of, I believe, a metal under the influence of the heat of the room. By this apparatus it was said that the ventilators were opened and air admitted or allowed to escape from a room as soon as the temperature of a room rose above a determined maximum, and closed them when the temperature fell below a certain minimum. I want some ventilators of this kind, and shall be glad to know of the name of the maker, or where I can find a description of the apparatus. E. J. S.

Burton-on-Trent, January 30th.

GUN-METAL CASTINGS.

(*To the Editor of The Engineer.*)

SIR,—Replying to "Pneumatic" in your issue for Friday last in reference to gun-metal castings, I beg to say that I am much interested by his letter, as one seldom sees the point in question so effectually explained as "Pneumatic" has done. I know there is some trouble with this class of casting, particularly if the sand is not right. For his information I may say that the mesh of the sieve does not matter so much; I think the quality of the sand, and the way in which it is mixed into loam, is most important. If you have a good open sand, say something approaching sea sand, mix it with Mansfield sand, hair, and horse dung; grind it in a loam mill—not too much—just long enough to make it tough; use it in the usual way for loam moulds; take every care to get the gases properly away by using fine ashes or hay, and vent well with vent wire; dry properly and well; black your mould with patent plumbago blacking. I think the casting should come out about right. If "Pneumatic" will give particulars about size, thickness, and weight of casting, I might be able to help him. I have made similar castings to the one he names, and in all cases cast them open end downwards. I have the metal properly mixed and melted in Morgan crucibles with a Fletcher furnace, and watch the metal cool to a proper heat for casting. Then cast rather quickly so as to keep the runner full, and keep the mould from drawing air; then the casting should be all right and sound.

Ashford, February 8th. FOUNDRY MANAGER.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Feb. 14th, at 8 p.m.: Paper to be read and discussed, "Air-Refrigerating Machinery and its Applications," by Mr. Joseph James Coleman.

CHEMICAL SOCIETY.—Thursday, Feb. 16th, at 8 p.m.: "On the Luminous Combustion of Ether at Temperatures Below Redness," by Mr. W. H. Perkin. I. "Contributions to our Knowledge of the Composition of Alloys, for the most part Ancient;" II. "On the Preparation of Pure Nitrogen, and on the Action of Nitrogen and Hydrogen on Meteoric Silicates;" III. "On the Action of Sodium Carbonate and Hydrate on Felspars and Wollastonite," by Dr. Flight. "Benzyl-phenol," Part II., by Mr. E. H. Rennie. "On the Buxton Thermal Waters," by Mr. J. C. Thresh. "On Retrograde Phosphates," by Mr. F. J. Lloyd. "On the Dissociation of Chlorine," by Mr. Percy Smith.

THE METEOROLOGICAL SOCIETY.—Wednesday, Feb. 15th, at 7 p.m.: "Notes on Experiments on the Distribution of Pressure upon Flat Surfaces Perpendicularly Exposed to the Wind," by Messrs. C. E. Burton, B.A., F.R.A.S., and R. H. Curtis, F.M.S. "The Principle of New Zealand Weather Forecasts," by Commander R. A. Edwin, R.N., F.M.S. The electrical thermometer, lent by Messrs. Siemens Bros. for observing the temperature of the air at the summit of Boston Chnrch Tower, will also be exhibited.

SOCIETY OF ARTS.—Monday, Feb. 13th, at 8 p.m.: Cantor Lectures, "Recent Advances in Photography," by Captain W. de W. Abney, F.R.S. Lecture III.—Dry plate processes. Instantaneous pictures. Instantaneous shutters. Enlargements, direct and otherwise produced. Colour of developed prints. Applications of photography to science. Wednesday, Feb. 15th, at 8 p.m.: Eleventh ordinary meeting, "The Art of Turning," by Mr. P. N. Hasluck. Friday, Feb. 17th, at 8 p.m.: Indian Section, "The Depreciation of Silver as it Affects India," by Mr. J. Maclean. Mr. A. J. Balfour, M.P., will preside.

THE ENGINEER.

FEBRUARY 10, 1882.

RAILWAY UNPUNCTUALITY.

IN the article which appeared in our last impression "On the Conduct of Metropolitan Railway Traffic" we made no reference to unpunctuality as a source of accident. There is no reason to believe that it is so dangerous an element in the working of railways as some persons imagine. Under certain conditions of traffic it is liable to bring about an accident; but the precise nature of these conditions is but little understood, and is worth explanation. The theory of the working of a crowded metropolitan line is very simple. From each terminus trains are started every five minutes, let us say. The trains follow each other in succession throughout the day. There is always an engine waiting at each terminus, which backs on to the train as soon as it arrives, and makes the return journey with it, the engine which takes each train into the station taking the next succeeding train out. If the trains all kept perfect time there would be five minutes always between them; but they do not do this, and the block system comes in and compensates. Want of punctuality in the running of any one train will, however, tend to retard all the rest. Thus, if the first train of the day loses time on the road, the next succeeding train must also arrive late at the terminus, and so on. Something may be gained, however, by running a little faster than usual between stations, which is, however, seldom done. But unpunctuality of this kind cannot well cause an accident. The Metropolitan Railway was thus worked when it was opened in 1862 from Farringdon-street to Bishop's-road; the trains ran at first every half-hour.

Such simplicity of working arrangements has, however, long ceased to exist on our metropolitan lines, and trains succeed each other on certain sections of the road at most uneven intervals. This is due to the fact that over most lines of the kind various companies have running powers. Thus, for instance, trains belonging to the London Chatham and Dover, the Metropolitan Extension, the Great Northern, the Midland, the South-Eastern, and the South-Western Companies run through Ludgate-hill Station, subsequently branching off at various distances from Ludgate-hill on to their own systems proper. The points and crossings near the station are limited in number by the circumstance that there are only four lines of rails. All the trains we have named use the bridge over the Thames, but the means of getting on to the bridge are restricted; each train has to take its turn. All this is provided for in the private time-tables of the London Chatham and Dover Company, to whom this station and bridge and approaches belong, and it is expected that each train will keep time and be ready to take its chance of, let us say, crossing the bridge when its turn arrives. If, however, it is not ready it will lose its turn, and some other train will cross. If this occurs once, time-tables become useless, and everything then depends on the skill and energy of the signalmen, on whom devolves the whole duty of regulating the traffic, and deciding what train shall have priority. The influence of a block of this kind is felt for miles down the line, and a stoppage or *bouleversement* of the traffic at one spot, such as Ludgate-hill, may make itself felt at King's-cross, St. Pancras, the Elephant and Castle, Aldersgate-street, Farringdon-street, and London Bridge. The signalmen at all these places will be in communication; and a signalman at Ludgate-hill may send on trains to Kentish Town or to the City, not because of any "first right to the road," but just according as he gets "line clear" first for the Kentish Town or the City train, no regard whatever being paid to the time-tables. For the benefit of the uninitiated we may say that the destination of each train is indicated to the signalmen by the arrangement, number, and colour of lamps on the front of the engine at night, and by variously shaped and arranged plates of iron which take the place of the lamps during the day. Now there can be no question but that we have here a condition of affairs which is more or less perilous, because so much work is thrown on the signalmen. Indeed it would be absolutely impossible to carry on traffic at all under the conditions if it were not that the points and signals are interlocked, and even with this precaution collisions occur now and then at cross-over roads, because of mistakes made by drivers. Here, then, is the true source of danger in unpunctuality. A time-table is prepared which provides a place at a given time for each train. If the train is not there the time-table becomes useless, and more or less confusion ordinarily reigns rampant.

The causes of unpunctuality are five-fold: (1) Want of skill on the part of the preparer of the time-table, who insists on impossible conditions. In one instance which came under our notice a train was expected to traverse half a mile in half a minute on a metropolitan line. (2) Want of organisation or energy on the part of platform superintendents in getting trains away quickly. (3) The transferring of horse-boxes, carriage wagons, or saloons from one company's line to another. Thus two trains may be delayed for five or ten minutes while a horse-box is being taken off one and attached to the other, and the entire traffic of a crowded station disorganised. During Ascot week as many as six trains may be seen on almost any day delayed outside Ludgate-hill Station while horse-boxes are being transferred from a Great Northern train to a South-Western, or *vice versâ.* This is simply bad management. (4) Delay due to fog or bad weather. This may be disregarded, because it is practically beyond control. Lastly, (5) the overcrowding of lines—a fruitful source of evil. It is sometimes urged by railway companies that the public themselves are the cause of unpunctuality by arriving late, with quantities of luggage, at stations. This has nothing to do, or very little, with metropolitan traffic; and when it has it should be remedied by the companies. The remedy is in their own hands. We are well aware that the traffic managers of most metropolitan lines have great difficulties to contend against, but they are in no case insurmountable; and it can hardly fail to strike the least observant that on some lines excellent time is kept, while on others unpunctuality rules supreme. We may cite as examples the London Chatham and Dover, and the South-Eastern—punctuality is the rule on the former, unpunctuality the rule on the latter. In the same way we find on some lines excellent carriages, clean and well kept; on others carriages old and filthy. Unpunctuality always accompanies the latter. Such things mark the difference between the well-managed and the badly-managed railway. It is a favourite excuse with railway men that their lines are so crowded that they cannot run their trains with punctuality. The answer is in all cases, "Then your time-tables are in fault to begin with, and your station management to end with." Not a few instances could be cited were it necessary where one traffic manager has done with ease what another found to be impossible; but a good traffic manager is not to be had for the asking, and when found he is worth much more than his weight in gold. If railway companies were wise, something might be effected by giving premiums to station masters or platform superintendents who succeeded in despatching their trains with the most punctuality.

There is a phase of the question which it will not be out of place to touch upon here—we allude to the effect of unpunctuality on the travelling public. A very large proportion of the travelling public is made up by men of business who cannot be away from their offices after a certain hour without great loss. There are clerks, again, who are always fined when they are late. The effect of unpunctuality on this section of the public is very serious. If a train reaches its destination half an hour late—and such things happen now and then—the arrangements of a business man are upset for the whole day. Again, when he returns to his home in the evening, it is not pleasant to be kept waiting for half or three-quarters of an hour either on the platform, or in a train which crawls out of a station, and remains outside it minute after minute. We repeat that on any line where such things occur there is gross mismanagement. The constant recurrence of unpunctuality on a metropolitan railway is simply inexcusable; and it may yet be found by directors that their best interests are being sacrificed by incompetent officials. A railway company has no right whatever to contract to convey a passenger to a given place at a given time, and then break the contract; and compensation has been over and over awarded to travellers when railway companies have failed to keep their engagements. We fully appreciate the difficulties met with in conducting metropolitan traffic. We know that the traffic manager does not repose on a bed of roses, and we have repeatedly interposed to screen the railway companies, and to say a word in their defence when unintelligent and ignorant criticisms have been passed upon them. What we say now will therefore have, perhaps, the more force, and we repeat that systematic unpunctuality on a metropolitan railway supplies direct evidence that the traffic managers who are responsible do not know their business, and might with benefit to the interests of the public seek some other employment more suitable for the exercise of their talents.

PHOTOMETRY AND THE ELECTRIC LIGHT.

THE real illuminating power of the different electric lights is now a question of some importance. The paper read and discussed at the Institution of Civil Engineers on Tuesday night conjures up a number of thoughts in the mind, and is suggestive of several things which it may be worth while to discuss still further. It will surprise no one who is familiar with the report of Profs. Ayrton and Perry relative to the electric light at

Paris, and the experiments of Principal Jamieson, first published in our columns, to hear that the doctors differ in all that concerns photometric measurements. Prof. Sir W. Thomson, if our memory is correct, at the last meeting of the British Association gave somewhat emphatically his allegiance to the simpler methods of photometry. Profs. Ayrton and Perry point out that they have come to the conclusion that atmospheric conditions play a very prominent and hitherto but little understood part in photometric measurements. It has become so common to estimate the value of the electric light in candles, that it would be difficult to suggest any other mode of comparison. The so-called standard candle is a candle made of spermaceti, weighing $\frac{1}{6}$ lb. and burning $\frac{1}{4}$ oz. of the fat per hour. The light given under these conditions is the unit. The ordinary methods of photometry are known as Bunsen's, Rumford's and Foucault's methods respectively. These may be described very shortly. The first, or Bunsen's method, requires the candles to be placed one yard on one side of a small screen of tissue paper, which, with the exception of a central disc, has been made transparent by treatment with a solution of wax in benzol. A measuring rod completes the apparatus. The light to be measured is on the other side of the screen, and is placed at such a distance that the central spot is undistinguishable from the rest of the screen. The value of the light varies as the square of the distance. Rumford's is a shadow method. The screen may be of tissue paper or ground glass. A vertical rod is fixed in front of the screen. The candle and the light to be measured are placed so as to form equal angles with the perpendicular from the screen, passing through the rod, and that the shadows falling on the screen are of equal depth. Foucault's method requires a similar screen to Rumford's, with an opaque movable partition opposite the middle running in a groove at right angles to the face of the screen. The sources of light are placed one at each side of the partition, and forming equal angles with it. The partition is moved forward till it casts no shadow on the screen, and one half is illuminated from one source and the other from the other. Bougeur's photometer is somewhat similar to Foucault's. In it the partition is fixed and the lights adjusted till each portion of the screen from the back appears equally bright. Mr. Sugg says the standard candle is a delusion and a snare, and as a rule these methods cannot well be used when powerful lights are to be measured because of the room required—even supposing atmospheric conditions had no part in the investigation. It is then important that some method should be devised that would give correct results, and that could be easily carried out.

The consideration of these circumstances, we should imagine, led Dr. Paget Higgs to write the paper above referred to, entitled "The Candle Power of the Electric Light." In this paper it is suggested that "the most salient point for a unit of comparison is the number of heat units represented by electrical measurement, as in ratio with the candle power measured optically." The question, as a whole, is far too long to be fully considered in this short article, and all we desire to do is to lay the case before our readers. It was stated on Tuesday evening, and the statement was tacitly agreed to by the other speakers, that the heat radiation had no relation to the light-giving powers of the light. It happens singularly enough that in the "Journal" of the Society of Telegraph Engineers, issued but a few days ago, is the abstract of a paper on the temperature of the electric arc—which appeared last September in *Elektrotechnische Zeitschrift.* The first part of this abstract is as follows:—"In 1860 Becquerel found that the temperature of an electric arc produced by eighty Bunsen cells was from 2070 to 2100 deg. C., and he laid it down that the illuminating power of the arc increased in direct proportion to the heat radiated, a law which had already been established by Dulong and Petit." It is unfortunate that the abstract does not give us the result of Rosetti's re-investigations with regard to this law. If, however, it can be shown that Becquerel was correct—or even correct within certain limits—the subject of measuring the candle-power of the electric light will be considerably simplified. The heat developed by electric currents in overcoming the resistance of conductors has been determined by Dr. Joule, and the measurements required to obtain the value of the heat as well as the calculations are comparatively simple. Dr. Joule verified the equation $J\,H = C^2\,R\,t$, where J is Joule's dynamical equivalent of heat, H the number of units of heat, C the strength of the current, and t the time during which the current flows. If the unit of time be taken, viz., the second, then the mechanical equivalent of the heat given out per second is $J\,H = C^2\,R$. It is not necessary to pursue this idea further, as it depends entirely upon the verification of Becquerel's conclusions. Pursuing a different method, Dr. Higgs deduces from his own and from Sir W. Thomson's measurements the law "that the light in an electric system varies as the fourth power of the current, whose resistance or potential is constant, or as the second power of the work in circuit." If this deduction is correct the method suggested should be adopted. The discussion, however, ignored altogether this deduction, and was confined to the incidental questions of cost and the correction of some of the figures. It has been pointed out by Mr. Crompton that in measurements of the candle-power of the electric light the results obtained would depend a good deal upon the quality and condition of the carbons at the time; and that horizontal measurements were with arc lights quite fallacious. The crater in the upper carbon forms a capital reflector, and having say an angle of 80 deg., the intensity of light should be measured in a different position to that taken when the incandescent light is under investigation. Another point not brought out in the discussion is the effect of area of incandescent material giving the resistance opposing the passage of the current. It is the concentration of heat that is required at one part of the circuit—a part, however, whose resistance when compared with that of the rest of the circuit will allow the latter to be neglected. There is no doubt that Dr. Higgs's paper will direct attention to the interdependence of light and heat, and even if his conclusions are found to be incorrect, may lead to valuable results.

METERS OR RATES.

It was well that Mr. Hawksley made two supplementary speeches in explanation of his first and main speech during the discussion of Mr. Tylor's paper on "Water Meters" at the Institution of Mechanical Engineers' meeting on the 26th inst. Previous to the explanation the minds of the members were evidently in a somewhat misty condition. If an unknown, or well-known but not-much-accounted-of, speaker fails to make his meaning clear, nobody is much put about. But it is otherwise when one, such as the venerable and venerated designer and responsible constructor of more than a hundred waterworks, deliberately gives his views to an audience of engineers, and those views "apparently will not hold water." Mr. Hawksley was at first understood to say that if water companies were forced to sell water for household consumption by meter instead of by rate, it would increase their cost of outlay by 50 per cent. Speaker after speaker rose to express surprise that the necessary stock of meters should cost so much, and then the explanation came. Mr. Hawksley says the average cost of supplying 1000 gallons of water for domestic purposes throughout the country is about 7d., and that of this only $\frac{3}{4}$d., or say one-ninth, is the actual cost of pumping. He virtually puts the case thus:—An average householder paying by rate uses a certain liberal quantity of water. If he paid by meter he would be stimulated to exercise the utmost economy, and would use a much smaller quantity in a given time. Taking this into account, as well as the cost of providing meters, Mr. Hawksley considers 50 per cent. more outlay would be required—not per household, but per 1000 gallons consumed. This, he contended, would be a fatal result as regards dividends to shareholders, and would be equally objectionable from a sanitary point of view. He is therefore against payment by meter, and in favour of payment by rate in all cases where water is supplied by companies for household purposes.

We venture to think that however sound Mr. Hawksley's arguments may be so far as they go, they are very far from being either conclusive or exhaustive. We agree with him that excessive economy in the use of water in households is not a thing to be desired or encouraged. The old proverb that "Cleanliness is next to godliness" is still true. Were water companies always private commercial enterprises, we should hesitate before permitting them to regulate public morals in this or any other way. But as the supplying of water has in one notable case fallen to the municipal corporation of several districts, and as this is likely to be followed, we are disposed to adopt Mr. Hawksley's view, that a consumption sufficient for sanitary purposes should be encouraged by the water sellers. But on the other hand we must bear in mind that payment by rate leads to wasteful habits, and that waste is always detrimental to the public interest. That more water should be drawn off than is really necessary for any purpose, and that its place should have to be supplied by pumping a fresh quantity, is equivalent to a loss to the community of at least the cost of pumping. But it is sometimes much more than this. "Wilful waste makes woeful want." No one can tell what disasters may sooner or later result from the operation of deeply-rooted wasteful habits. For example, there is a notion prevalent in the North of England, and possibly elsewhere, that if water taps are kept partially open, so as to allow a certain quantity of water to run to waste, then the water pipes are not liable to be affected by frost, however severe. Last winter this idea was so generally acted upon within the district of the Stockton and Middlesbrough Corporations waterboard, that it became impossible to pump sufficient water to supply the waste in addition to the proper consumption. The district named contains, as is well known, numerous ironworks and other industrial establishments, employing large numbers of boilers. A deficient supply of water to these boilers means stoppage of all operations; it involves throwing out of employment large numbers of workmen, and in some cases danger of explosion. Occurring in a hard frost it is even more disastrous. At such times it is specially necessary to keep up the circulation of steam and hot water in the vast network of pipes interweaving such places; otherwise the pipes get cold, their contents are immediately frozen, and they burst in all directions. This adds greatly to the delay and intensifies the seriousness of the stoppage. All this actually occurred, resulting in serious loss. Now suppose that instead of paying by rate the wasteful householder who caused the deficiency had paid by meter. Suppose that each one knew that leaving his tap running all night meant paying ten times as much as usual for the supply of that day. Would he not have thought twice before doing or allowing such a thing, even at the risk of having his own pipes frozen? We think so. To digress for a moment; the great majority of the delinquents in the above case were cottage householders, who could only have had a single tap, and that in the back yard. Is it not possible so to encase such outside taps in some non-conducting substance as to keep them from freezing, and thus take away any excuse for leaving them running?

Returning to the main question, we agree with Mr. Hawksley that water suppliers, and especially if municipal corporations, should encourage the use of sufficient water for sanitary purposes. We differ from him in thinking that payment by rate is the only way to accomplish this desirable end. We have shown that that method leads to waste, and in some cases to heavy losses and possible disaster. We think water suppliers are just as much bound to do all in their power to discourage waste as they are to encourage sanitation. There is no practical way of preventing waste except by throwing the onus thereof upon the person responsible for it. There is no alternative but payment by meter; not according to a fixed rate as apparently assumed by Mr. Hawksley when he condemns that system, but according to a well-considered sliding scale. Bearing in mind Mr. Hawksley's statement that pumping alone costs only something like one-ninth of the total average charge for water supply, we would have the sliding scale in some proportion thereto. In framing it a normal price per thousand gallons should be taken; that price being about equivalent to the average rate now payable on the proper amount usable for sanitary and other purposes, according to the size of the household. If the householder was of an economical disposition, and by great care managed to use less, let him get some benefit by the scale, but not sufficient to tempt the great bulk of humanity to use less than was good for them. If the householder was careless and used more than was necessary, let him pay for his extravagance at such a rate as would prevent it being largely done. The proposed system will be best understood by taking an imaginary case. Let a householder be supposed to occupy a house for which sixty gallons per diem was considered an ample allowance excluding waste. Then let the scale be so arranged that for that consumption the price per thousand gallons would be about as remunerative as at present to the water suppliers. Let us suppose that price to be 1s. per thousand. If now the householder were to consume at the rate of 100 gallons per day, then let him pay for the excess at, say, 1s. 6d. per thousand. And if he were to consume at the rate of only thirty gallons per day, then let him be credited with, say, only 6d. per thousand on the deficiency. If our supposed householder occupied a house for which 180 gallons per diem was considered an ample allowance excluding waste, then according to the above system he would be charged 1s. per thousand on that quantity, and at the higher or lower rate on any surplus or deficiency. In this way various advantages would be secured which are absent or imperfectly obtained now. Sanitation would be promoted without waste. Liberty to exceed or to economise would be given to each consumer, but his pocket would be affected sufficiently to prevent him from sacrificing the general good to his own convenience. All would be treated alike, or rather in equitable proportion.

Concerning water meters, the discussion alluded to disclosed some rather curious facts and ideas. Engineers have been accustomed to regard the large, lumbering, noisy Kennedy piston meter as suitable only for trade purposes where the consumption was heavy. They have fancied that the neat little polished brass meters of the turbine class, originally invented by Dr. Siemens, were suitable for household purposes, or where the consumption was small. These views appear to be entirely erroneous; in fact, just the reverse is the fact. Turbine meters will not register very small flows at all. With the very best of them it is possible for an artful householder to obtain all the water he requires without any registration whatever; but for trade purposes, for which they are seldom or never used, they were shown to be quite trustworthy and accurate. On the other hand, meters of the piston class appear to be generally accurate either for large or small flows; but they are under the disadvantage that they require examination and oiling about once a fortnight in order to keep them in order. We think we may summarise the present position of the question thus: Water must be in future sold by meter, and not by rate; payment must be by sliding scale, so arranged as to put pressure on every householder to use sufficient for sanitary purposes, but not more than sufficient. This must be done without destroying liberty of action more than is necessary for the general good. The piston type of meter is the only kind as yet known applicable for household purposes, and improvements in detail are needed, and will doubtless be made. There will soon be in all probability an immense demand for good meters. Meters will have to be placed as far as possible in the back yards of houses, so that the inspector need not enter the house and disturb the householder. A more efficient means must be found for preventing the freezing of meters, taps, and pipes outside houses. Finally, we hope and believe that the discussion to which we have called attention will prove an important step in the advancement of a department of engineering which powerfully affects the health and comfort of every civilised community.

WEBB'S COMPOUND LOCOMOTIVE.

To Mr. Webb, locomotive superintendent of the London and North-Western Railway, is due the credit of being the first English engineer who has in recent years produced a startling novelty in locomotive engines. In France, Belgium, and Austria, remarkable specimens of locomotive construction are turned out every now and then; and America has recently come to the front with the Fontaine locomotive. But in England we have preferred to follow the even tenor of our way, simplifying details, adopting better methods of putting work together, and rendering engines more substantial and more serviceable, refraining from making excursions into unknown regions of invention; and it can hardly be disputed that the result of this policy has been on the whole satisfactory. This, however, is no reason why departures should not be made now and then from the beaten path of locomotive construction, and to condemn Mr. Webb's design hastily or without due thought would be rather worse than foolish. For the present Mr. Webb is reticent about the engine, and naturally so. It will be time enough to bring it prominently before the world when it has done some work. It will then form the subject, no doubt, of a paper to be read before the Institution of Mechanical Engineers. Meanwhile, we can at least satisfy the curiosity of our readers concerning its prominent peculiarities, though we can do little more.

The new engine has been constructed at Crewe, and is similar as regards boiler, wheels, and so on, to the four-coupled express engines of the London and North-Western Railway, with which all English engineers, at least, are tolerably familiar. The trailing drivers are driven by a pair of outside cylinders, 11½in. diameter and 24in. stroke, secured to the side frames at a point just in advance of the leading driving wheels. The piston-rod heads are guided by two flat bars, one at each side, instead of four, as usually employed, the crosshead being channelled to slide on the bars. The slide valves are worked by Joy's patent gear, and the connecting rods lay hold of pins in the wheel bosses. So far we have a complete engine with outside cylinders and a pair of driving wheels behind the fire-box, the whole closely resembling Crampton's patent engines, of happy memory. In the smoke-box, right beneath the funnel, is fixed a third cylinder, 26in. diameter and 24in. stroke, the connecting rod of which lays hold of the pin of a single crank in the middle of the length of the leading driving axle. The exhaust steam from the two small cylinders passes into a kind of gridiron of pipes between the engine frames, which pipes act as an intermediate receiver, and from thence it is led into a copper pipe coiled in the smoke-box, in order that it may be reheated and dried. Thence it goes into the valve chest of the large cylinder. We have thus a locomotive with a single pair of driving-wheels in advance of the fire-box, driven by a single cylinder. It must be understood that the Crampton engine and this single-cylinder engine are quite independent of each other—that is to say, each may run at any pace it can. There are no coupling rods, nor is there anything to maintain a fixed relative position between the cranks of the single and double cylinder engines, save the rails. The single engine depends for its supply of steam on the double-cylinder engine, and should the latter slip, more steam is sent into the receiver than the large cylinder will take, and the back pressure rises, and so tends to check slipping; while for the same reason the pressure on the large piston is augmented, and it may slip its wheels. If, on the contrary, the single engine slips first, it will take more steam away than the other engines can supply, and its own pressure will fall off while the effective pressure in the other cylinders will be augmented. It is found that this controlling action operates very effectually, each engine doing its own share of the work fairly. No inconvenience results from the changing position relations of the crank pin, the size of the intermediate receiver being sufficient to prevent irregularities in the amount of back pressure of much moment. With a boiler pressure of 120 lb. the pressure in the receiver averages about 50 lb. Such, then, briefly stated, is Mr. Webb's compound locomotive. It is a handsome engine, and has been run at very high speeds with perfect steadiness.

Mr. Webb has not, we need hardly say, adopted so abnormal a design for a whim. On the contrary, he expects to derive important advantages from this system of construction; and it is not too much to say that of the many compound locomotives which have been proposed and patented this is immeasurably the best. He claims, in the first place, that he gets all the advantages of a coupled engine without its disadvantages. Now, practically, the advantages and disadvantages of coupled and uncoupled engines resolve themselves into a question of coal bills. Mr. Stirling has stated that a coupled engine will burn from 1 lb. to $2\frac{1}{2}$ lb. of coal more per mile than an uncoupled engine; but other locomotive superintendents say that on the whole the advantage is with the coupled engines, because they do not slip, and nothing wastes fuel more than slipping, which tears a fire to pieces, besides throwing away steam. In lieu of two coupling rods, with such frictional resistance as they set up, Mr. Webb gets an extra complete engine. It can hardly be possible that the frictional resistances of all kinds caused by coupling an engine can be as great as the resistance of a piston, valve gear, crosshead, and connecting rod. Secondly, Mr. Webb claims that by working his steam through two engines in succession, he will get great economy of fuel. On this point, also, there is much room for doubt. The first cost of the locomotive is, of course, in excess of that of a locomotive of the same power of the ordinary type; and there are three engines to be kept in repair and lubricated instead of two. These points must not be overlooked. Now, the objections to sending an engine into the shops for repairs are so great that all locomotive superintendents are straining every nerve to get the largest possible mileage out of their stock; so there is reason to conclude that there must be not only a saving in fuel, but a very substantial saving effected by Mr. Webb's engine, before it can be regarded as a success. The locomotive has already done a good deal of hard work in, we understand, a most satisfactory manner, and so far as can be ascertained, there is reason to anticipate that a saving of fuel will be effected; how great no one at present knows. Mr. Webb is very well satisfied with the results he has obtained so far. The experiment will be watched with interest by railway engineers all over the world, and we wish Mr. Webb that success which his skill and inventive talent deserve.

THE FINANCIAL CRISIS IN FRANCE.

THE failure of the Union Générale, and the subsequent collapse of the minor undertaking established under its auspices, are not without interest to English engineers, who, indeed, may look for some ultimate advantage from the *eclaircissement*. The capitalists and contractors in this country who undertake public works abroad have continually presented to them enterprises of evident usefulness, which, if carried out on equitable terms, would afford employment to English manufacturers and profit to all concerned. Englishmen are not afraid of the legitimate risks which must always attend the execution of works abroad, but during the last few years they have found themselves distanced by continental competitors, who have been able apparently to offer terms of a kind quite beyond those acceptable here. English capitalists and contractors have a past history to guide them, and are not without experience of what is euphoniously called "payment in paper," but even those who are not unwilling to assist a promising enterprise by providing some of the capital, or by postponing profit till success is established, draw the line at a point far within that which has in recent years ruled in France. In the poorer European countries, such as Italy, Spain, Hungary, Servia, and the provinces lately freed from Turkish rule, there are railways and other works urgently needed for which financial aid is sought; and when Englishmen demand safeguards in regard to payment which prudence suggests, they are reproached for their pedantic and stubborn adherence to an obsolete system, and are told that continental bankers conduct their business more liberally, and, in short, that such matters "are managed much better in France." The art of financing new projects has been carried to great perfection in Paris—which is far more than London the happy hunting ground of the promoter, who, having at some small cost in bribes and promises obtained from the impecunious officials of a city or province permission to supply an urgent need, hawks the concession about Europe for sale. Not only is rash speculation fostered by the financial societies who aid in these affairs, but the works carried out under such auspices are generally so loaded with commissions as to render ultimate profit impossible. The real investors who have been beguiled into furnishing money for these so-called banks and credit companies are finding out their mistake, and the partly finished works which alone represent the outlay nominally bestowed on them, will probably have to be pledged to the capitalists—English or other—who will be called in to complete them. Those abroad who are really interested in the accomplishment of works necessary to the development of their country, are finding that English methods are best after all, and that it is better to rely on those who are accustomed to finish what they begin, even though on terms which may appear stringent, than to entrust them to the more dazzling but less trustworthy financiers who look only to their own immediate profit with but little regard to ultimate value.

PASSENGER CONTROL OF CONTINUOUS BRAKES.

THE evidence which has come to hand on the recent horrible accident to an American train on a curve at Spuyten Duyvil throws considerable doubt on the propriety even in America of placing in every carriage a cord in connection with the automatic valve of the continuous brake, within the reach of every passenger. It will be remembered that a passenger train containing among others, Senator Wagner, was stopped on the Spuyten Duyvil curve, and there run into by another train, the guard of the first having failed to go back far enough to give proper warning to the second train. In this he not only neglected duty, but acted in contravention of strict rules on this subject, which are necessary because the block system is not used on this part of the line. It was at first said the Westinghouse brake with which the train was fitted had gone on of itself, but it appears that a considerable number of the passengers in the smoking car at least were drinking and revelling very freely, and that there is evidence that the safety cord was pulled by one of them, and the train thus stopped. The safety cord was thus the cause of the death of eight people and considerable loss. It is suggested that fires are of so common occurrence in Amerieau trains that passenger control of the brakes is necessary. There can, however, be few cases in which the application of the brakes could not be sufficiently quickly made by going either to the engine end of the train or to the conductor. The verdict of the coroner on the Spuyten Duyvil inquiry states that the cord has much more of evil than of good in it, and censures almost all the train officials and the company. Writing on this accident and the coroner's inquiry, the *Railroad Gazette* says:—"Responsibility for an accident may attach to a great many people. In the case of the Spuyten Duyvil accident it appears that the express train was stopped, not by the brakes getting out of order, as was first reported, but by some tipsy passenger tampering with them in the car closet. But then the stopping of the train need not have caused an accident, and would not if the brakeman had done his duty and gone back with a danger signal, as the rules plainly prescribe; and so the brakeman is responsible. But if this section of the road had been worked by the block system then there would have been no approaching Tarrytown train south of Spuyten Duyvil to run into the express; and here we have the company responsible. And each and all are truly responsible." There are of course several views to be taken of the relation between merit and demerit in extending simple communication between passengers, guards, and drivers to control of brakes. Certainly it would not be permitted in this country.

ACCIDENTS ON FRENCH RAILWAYS.

THE French Minister of Public Works is calling the attention of the French railway companies to the circulars of September, 1880, and November, 1881, requiring the adoption of the block system on all lines traversed on some part of their length by five trains per hour. He says he has examined and weighed with great care the replies of the companies to these circulars, and he is convinced that the measures already taken or projected by the companies at present are insufficient, both on double and single lines, to secure safety. For double lines and trunk lines generally he insists on the adoption, with as little delay as possible, of the absolute block system. He defines the conditions to be observed, making it necessary that signals shall block the roads whenever signalmen make mistakes, or when either the signal apparatus or electric communication is at fault. The conditions are, he says, fulfilled by the electro semaphores of Lartigue, Tesse, and Prud'homme, already satisfactorily at work on some lines in France. For working single lines, he withdraws the restrictions which have of old existed on the use of bells, and he very strongly recommends the electric bell systems such as those illustrated in THE ENGINEER for the 30th September, 1881, and known as the German or Austrian and Siemens systems. Particularly he recommends the Léopolder system, because this gives the line men power when required to give an alarm signal. In speaking of the system to be adopted for the double lines, he refers to the Tyer system as unsatisfactory, particularly because it assumes and requires continual care and attention. On the other hand, Tyer's system for working single lines has just been recommended in this country by Col. Rich in his report on the accident on the 8th December near Wimborne.

THE PETER THE GREAT.

IN the course of the past ten days several speed trials of the war ship Peter the Great have been made on the Clyde. The engines were found to work smoothly, and the speed developed at the earlier trial was about $12\frac{1}{2}$ knots, and at the last trial, which took place on Saturday on the measured mile, it is said that a speed equal to $14\frac{3}{4}$ knots an hour was obtained. This, however, was not got without great vibration. Formerly the vessel seemed to have been too heavy for her engines, but now it would appear as if this were reversed. It is stated that the commander of the vessel has telegraphed to St. Peterburg, suggesting the propriety of having her stiffened before she leaves, and if this is correct she will probably remain for some months longer in the Clyde.

LITERATURE.

Simple Hydraulic Formulæ. By T. W. STONE, C.E. London: E. and F. N. Spon. 1881.

THIS little book is rather more than its short title indicates, as the simple formulæ are supplemented by clearly-written descriptive and explanatory information, and a well executed set of diagram illustrations. It is not a treatise on hydraulics, but is rather a compendium of those formulæ which an active engineer engaged in water supply for various purposes would collect as experience dictated his requirements, and to these the author has added notes suggested by daily practice.

The formulæ, it is almost needless to say, relate to the flow of water through pipes and channels of many forms, and under all conditions or circumstances of which experience has been obtained, while in three short appendices are (1) some special formulæ for miners and others engaged in sluicing, &c., (2) a number of worked-out examples not given in the body of the book, and (3) tables of coefficients for short level troughs, and for discharges generally. The first of these appendices may be looked upon as a result of the author's residence in Australia while resident district engineer for water supply under the Victorian Government. To young engineers a very valuable feature of the book is the fact that a worked-out example of almost every special application of the formulæ is given, and the second appendix renders these more complete. Several of the formulæ given are new, and some others are changed in form with a little advantage, as, for instance, the expression for the discharge of weirs, which is not quite so simple as that given by Box, while the result is rather more accurate. The units of measurement employed, however, are of feet instead of inches, which makes it necessary to convert inches and parts of an inch into a fraction of a foot in making a calculation. This, of course, is not noticed when calculations are made with the aid of the tables given, but many engineers prefer to make their own calculations, even when the table contains the particular measurement they may want to use. Thus Mr. Stone gives the discharge of weirs in cubic feet per second per square foot area, the depth being in feet, while Box gives the gallons per minute per inch width of weir, the depth being taken in inches, which is handier for all except very large weirs.

A very useful part of the book is that dealing with the distribution of water in towns. Here some new information is given, and much care is devoted to a difficult problem. Few books have dealt satisfactorily with this question; and it may, perhaps, be said that a theoretically complete solution of the problem of determining the relative sectional areas of a large series of branch pipes from a main is next to impossible. From the point of view, however, of the waterworks' engineer, Mr. Stone has, by the aid of certain assumptions, shown how a sufficiently accurate result for practical purposes may be obtained. Reference has been made above to Box's little book, "Practical Hydraulics," and this work is probably sufficiently well known to enable our readers to estimate the value of the volume before us when it is said that Mr. Stone's book is an improvement upon its predecessor. Some of the space devoted in the older work to fountains, and the strength of pipes, for instance, is not here repeated; but several questions of flow and discharge are treated with more completeness. The work is essentially of a practical character, and seems to be free from error, except in one instance of small importance, where a letter A is printed in place of *c* in the explanation accompanying Diagram 4, Plate IV. These illustrations are printed on pages double the width of those of the book, so that, when opened out, they remain in view for reference without turning the leaves backwards and forwards to read and for reference. Though a small book, it is rendered incomplete by the absence of an index. This is a grave omission in a work of the kind, however good otherwise. A table of contents, or rather a list of the heads of the chapters, is given; and in this respect Mr. Stone has done more than Mr. Box; but both books are stores without storekeepers. With a good index this new book will be one of the most useful of its class.

SIR W. PALLISER.

WE announce with regret the death of Major Sir William Palliser, which took place suddenly on Saturday afternoon. Sir William had been suffering from disease of the heart for a considerable period, but we believe that no one anticipated that the end was so near. For some twenty years Sir William had devoted himself to the improvement of guns, projectiles, and armour. To him is attributed the invention of the chilled-headed projectiles which are known by his name. There seems to be no doubt that chilled projectiles were suggested at Woolwich Arsenal, and even made, before Sir William took the matter up, but there is excellent reason to believe that Sir William knew nothing of this, and that the invention was original with him; at all events, he, aided by the efforts of the foundry and the laboratory at Woolwich, brought these projectiles to perfection, and unless steel-faced armour defeat them they cannot be said to have as yet met their match. A most valuable invention of the deceased officer was the cut-down screw bolt for securing armour plates to ships and ports. It was at one time feared that no fastening could be got for armour plates, as on the impact of a shot the heads or the nuts always flew off the bolts. The fracture usually took place just at the point where the screw-thread terminated. Sir William adopted the bold course of actually weakening the bolt in the middle of its length by turning it down, so that the screw stands raised up instead of being cut into the bolt, and by this simple device he changed the whole face of affairs, and the expedient applied in other ways, such as by drilling holes longitudinally down bolts, has since been extensively adopted where great immunity from fracture is required.

It is, however, for the well-known converted gun that Sir William Palliser's name will be best remembered. When our smooth-bore cast iron guns became obsolete they were converted into the rifled compound guns by a process which led to their being known as Palliser guns. The plan was to bore out a cast iron gun and then to insert a wrought iron rifled barrel consisting of two tubes of coiled iron one inside the other. By the firing of a proof charge the wrought iron barrel was tightened inside the cast iron casing. By this means we obtained a converted gun at one-third of the cost of a new gun, and saved £140 on a 64-pounder and £210 on an 80-pounder. The process of conversion involved no change in the external shape of the gun, and it could, therefore, be replaced upon the carriage and platform to which it formerly belonged. The converted guns were placed upon wooden frigates and corvettes and upon the land fronts of fortifications, and were adopted for the defence of harbours. The many services Sir William Palliser had rendered to the science of artillery secured him the Companionship of the Bath in 1868 and knighthood in 1873. In 1874 he received a formal acknowledgment from the Lords of the Admiralty of the efficiency of his armour bolts for ironclad ships. His guns have been largely made in America and elsewhere abroad; and in 1875 he received from the King of Italy the Cross of Commander of the Crown of Italy. The youngest son of Lieutenant-Colonel Wray Palliser—Waterford Militia—he was born in Dublin in 1830, and was therefore only fifty-two years of age. He was educated successively at Rugby, at Trinity College, Dublin, and at Trinity Hall, Cambridge, and, finally passing through the Staff College at Sandhurst, he entered the Rifle Brigade in 1855, and was transferred to the 18th Hussars in 1858. He remained in the service to the end of 1871, when he retired by the sale of his commission. At the general election of 1880 Sir William Palliser was returned as a Conservative at the head of the poll for Taunton. In the House of Commons Sir William gave his chief attention to the scientific matters on which his authority was so generally recognised. Under the many disappointments and "unkind cuts," which fall to the lot of the most successful inventors, Sir William Palliser displayed qualities that won hearty admiration. The confidence with which he left his last well-known experiment to be carried out in his own absence almost under the directions of those whose professional opinions were adverse to his own, may be called chivalrous. His liberality and kindness as Colonel of the 2nd Middlesex Artillery Volunteers had gained him the affection of the entire corps; in short, where it might naturally be expected that he should win respect, he won the love of those who were thrown with him.

ALEXANDER LYMAN HOLLEY.

We announce with regret the death of Mr. Holley, the well-known American engineer. Mr. Holley died on the 29th of January, aged 49. He was the son of Governor Holley, of Connecticut, and was well educated at the Brown University. At 21 he left college and began active work as an engineer at the works of Mr. Corliss, of Rhode Island. In 1855 he became associated with Zerah Colburn, with whom he made his first appearance in England in 1857. They were sent by some of the leading American railway companies to learn all that could be learned, and report accordingly, about English railways. Colburn and Holley together, as a result, wrote "The Permanent Way and Coal-burning Boilers of European Railways" published in 1858. Both Holley and Colburn subsequently devoted themselves to journalism, although they took different paths.

In 1862 Holley was sent over to this country by Mr. E. A. Stevens, of Battery fame, to learn all he could about guns, &c. His standard work on "Ordnance and Armour" was the result of this trip. But Holley also saw much of the Bessemer process, then in its infancy, became attracted by what he saw, and thenceforth he became the prophet of steel in his own country. We have not sufficient details of Holley's career to tell here all that he did; his life would fill a large volume. But it may be said that what he did not know about steel was not worth knowing; and that he probably did more than any other man to build up the gigantic steel industry of the United States.

Mr. Holley died of break-up of the system due to overwork. The proximate cause of his death was liver complaint. Mr. Holley was in every sense of the word a remarkable man in his own country. He was an educated gentleman, and twenty years ago engineers in the United States who were highly educated were the exception not the rule. His manner was charming. He was an admirable speaker, and a lucid and even brilliant writer. His place will not easily be filled.

AN IMPROVED DYNAMOMETER.

A new form of dynamometer, designed by William P. Tatham, has been described in the *Journal of the Franklin Institute*.

Referring to Fig. 1, the arrows show the movement of the belts; the frame of the machine is omitted, the more clearly to exhibit the working parts. Let A represent the first motion pulley of the dynamometer, upon a shaft receiving power from any source outside; B B′ two semicircular vibrating frames, having freedom to move around their central knife edges C C′, which play in valleys formed by the intersection of two small planes. These frames are linked together by two links at D and D′, also on knife edges. The frame B carries two pulleys E and F. The pulley E is adjusted and centred upon the frame so that the central knife edge C coincides with the point of tangency of the belt (*a*) with the pulley E, the tangent point being taken at the middle of the thickness of the belt. By this arrangement the force of the belt passes directly through the fulcrum of the frame B, and therefore exerts no influence to vibrate it.

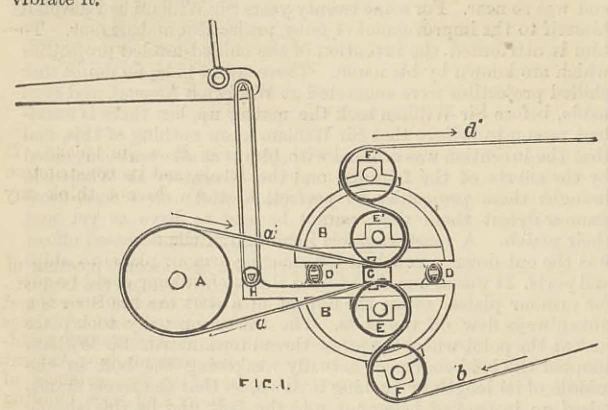


FIG. 1.

The pulley F is adjustable around the circumference of the frame B, and is placed in such a position that the belt (*b*), passing from the machine on trial, makes at its point of tangency with the pulley F a right angle with a straight line joining the tangent point to the central knife edge C. The frame B has an arm attached to it, to carry the knife edge H, to which the link of the scale beam is attached. The distance of this knife edge H from knife edge C is equal to the distance of the latter from the point of tangency of pulley F and belt (*b*), taken as before at the middle of the thickness of the belt.

The result of this disposition is that the only influence to cause a vibration of the frame B is the reaction of the belt (*b*), which is exactly equal to the action of the same belt upon the machine on trial. In the same manner the action of the slack belt (*b*′) upon the frame B′ is exactly equal to its reaction upon the machine on trial. The frames B and B′ being connected together by the links and knife edges, the difference of the tensions on (*b*) and (*b*′) is exerted to vibrate the two frames, and this difference alone is felt by the scale beam, all friction being eliminated except the friction of the knife edges. The rudely constructed working model which has been tried indicates with surprising accuracy when tested by a brake. To prove the elimination of the friction, the wheels E′ and F′ were chocked without change of indicated power.

Mr. Tatham thinks, however, that this lacking is one very essential quality of a good machine—it would not work well when out of order.

When the journals of the wheels on the vibrating frames become worn by long use these wheels will be displaced, and their points of tangency with the belts will be displaced also, and the accuracy of the indications will be impaired.

In order to meet this requirement he has embodied his ideas in a different form, represented in Fig. 2. The arrows, as before, show the direction of the belts. A is the first motion pulley and shaft; *a* and *a*′ the tight and slack belts to the pulleys carried on the vibrating frame B. These belts do not pass through the point of tangency, but their direction does. The vibrating frame B is balanced upon the knife edges C, and is provided with knife edges H, which engage the links of the scale beam.

The distance from C to H is equal to the effective diameter of the pulleys E E′ upon the vibrating frame; *d* and *d*′ are the tight and slack belts from these pulleys to the pulley M, which now takes the place of the machine on trial in the description of the machine represented in Fig. 1. It is important that the belts *d d*′ should not make a less angle with the vertical line than the belts *a a*′.

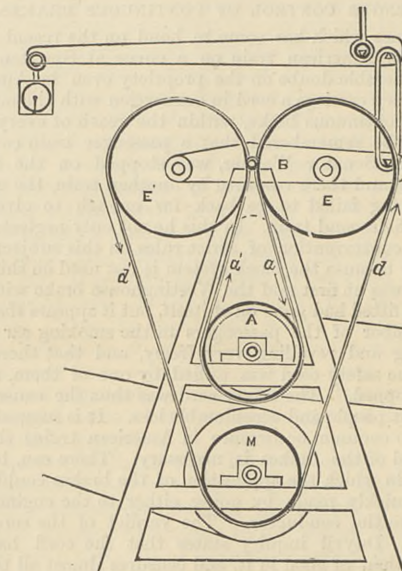


FIG. 2.

The index will show the force exerted on the pulley M, whose friction will be included. The friction of the pulley and shaft M can be estimated accurately by providing simple means for weighing the combined tensions of the belts *b* and *b*′ upon the pulley M, and then, with the indications furnished by the dynamometer when running light and loaded, the friction when loaded can be calculated.

The speed of the belt may be measured by the counter, and the whole indication of power may be ascertained by combining a multiplied movement of the vibrating frame with a regular movement of a paper band fed from one of the shafts.

A critical examination of the last-described machine will show that no probable wear and no probable change of the thickness of the belt can interfere materially with the accuracy of its indications. The vibration of the frames need be very small. In the working model—if it were strong enough to bear it—320 lb. would be indicated by the spring balance on the scale beam, and would correspond to a movement of ·0375in. of the knife edge H. In estimating the middle of the thickness of the belts as the points from which to measure the effective diameters of the pulleys governing the feed of belt and transmission of force, he has followed the books which have been confirmed by my preliminary experiments. In constructing an exact machine this point should be carefully examined.

A third form of the dynamometer, combining the accuracy of No. 1 with the wearing properties of No. 2, may be constructed by dividing the vibrating frame B of No. 2 into two frames, connected together by links, each frame having its own fulcrum C in the line of the middle of the thickness of the belts *a a*′, all the belts to be made vertical and pull at right angles to the levers.

LETTERS TO THE EDITOR.

[*Continued from page* 101.]

EFFICIENCY OF TURBINES.

Sir,—Messrs. McKenzie's letter, which I found in your issue of the 20th, appears to call for reply from me.

These gentlemen allude to the "mining case" as possessing all the advantages claimed by Messrs. Gilbert Gilkes and Co. It would have been interesting if they had given an illustration of the same. Your readers would then have been in a position to compare it with its prototype, that of the vortex wheel of Professor Thompson, illustrated in conjunction with the letter from Messrs. Gilbert Gilkes and Co., published page 471 of vol. lii.

I do not know what Messrs. McKenzie mean by a wheel being "constructed on the basis of 75 per cent. useful effect;" but I adhere to my statement that no turbine can be relied upon to give more. It is quite true that, as stated by Messrs. McKenzie, my original table of powers of turbines—which was not calculated by me—give a higher percentage; but, after a careful consideration of the tests on record, I calculated a new table on the basis of 75 per cent. efficiency, and it is now in the press.

Emerson's Turbine Reporter gives the results obtained from all wheels tested from August, 1868, to January 1st, 1875; the highest result obtained being given, and the average of all tested of the same make.*

Now in the face of the results given above being prominently brought to their notice, will Messrs. McKenzie continue to issue their 90 per cent. tables, or will they act as I have done, and revise one on a basis which they may expect to realise in practice.

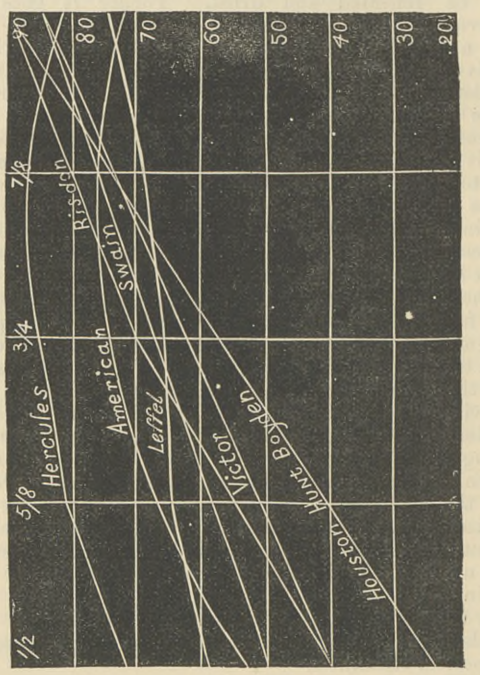
I have referred to Mr. Brown's letter, which appeared in February, 1880, and will be found on page 102, and thank Messrs. McKenzie for calling my attention to his (Mr. Brown's) testimony in favour of my contention.

Mr. Brown says, when referring to the trial of a 52in. Leffel wheel, "The results were such as to satisfy me that there are turbines which will, without doubt, give at least 75 per cent. of efficiency." Mr. Brown further points out that the turbine used more water than it should have done according to their list.

Charles L. Hett.

Ancholme Foundry, Brigg, Jan. 14th.

Sir,—Owing to my absence in the far North, I had no opportunity of seeing the letters on this subject by Mr. Charles L. Hett and Messrs. Thomas Mackenzie and Sons, Limited, until to-day I have, however, to thank these gentlemen for the temperate manner in which they are disposed to take part in ventilating this important subject. The "Hercules" turbine, which is the best that I know of in the meantime, is comparatively unknown in this country, although it is now about six years since the first was set to work in America. I am sorry I have not an illustration to send you to show the internal arrangements of the "Hercules;" but I may say that it has not a central division in the buckets. Each bucket is in one casting, the upper half having three projecting ledges cast on, and the lower part being shaped like the segment of a sphere, curving in towards the central axis. It is carried on a foot-step pretty much like that of the Leffel wheel, and although the buckets stand slightly higher than the Leffel, the reason of the wheel itself appearing so high arises from the fact that the gate is a cylinder moving perpendicularly, and consequently requiring space to move in.



Messrs. Hett, Mackenzie, and A. M. Brown seem to think that the fact of a "Hercules" of a given diameter doing the same work requiring a considerably larger diameter of another make is no advantage; but they surely forget that a less size of case is required, where casing is necessary; and where no cases are required a less size of flume will do; so that you have not only a cheaper wheel to begin with, but the parts in connection therewith are consequently cheapened in the same proportion. You can only dispense with the case where the power is taken off at a height greater than the top of the mill-race, and it is by no means frequently that this opportunity presents itself. I will give you one or two cases in point. I am at present putting in a "Hercules" to use up 14,000 cubic feet of water per minute on a 23ft. fall. This I can do with a "Hercules" turbine 54in. in diameter. The nearest Leffel I could get for this quantity was one 87in. in diameter. Again, for 11,000ft. of water I am using a 48in. "Hercules," whereas a 74in. Leffel is required for the same purpose. Again, for 8000ft. of water I use a 42in. "Hercules," the nearest Leffel for this quantity being 61in. in diameter. In each of the above instances the wheels are to be provided with cases having branched connections for the conducting pipes, and it will be apparent at once how much more conveniently the "Hercules" can be adapted than any other turbine that I know of.

Mr. A. M. Brown, in his letter in your last issue, again suggests the desirability of a public competition of turbines, to bring about which I shall be very glad to co-operate. At the same time I would point out that the tests published in Mr. Emerson's treatise were made in the most careful manner and without either fear or favour. I enclose a diagram prepared from those tests as published, from which it will be seen that those turbines giving the highest full-gate results fall off considerably when the quantity of water is reduced to one-half. At the same time it will be noticed how superior the performances of the "Hercules" are when compared with other well-known wheels.

I might add that Messrs. J. Dickinson and Co., of Nash Mills, Hemel Hempsted, Herts, have had five "Hercules" turbines at work for a considerable time, and have ordered other two a few weeks ago.

J. Turnbull, Jun.

Glasgow, January 30th.

Sir,—We observe in your publication of the 27th ult. that a correspondent refers to the Girard turbine. We should be glad if you would allow us the opportunity of stating that we have purchased the late M. Girard's patents and business, and the drawings of all the turbines erected by him, including those used for the supply of the City of Paris with water, which are of very large dimensions.

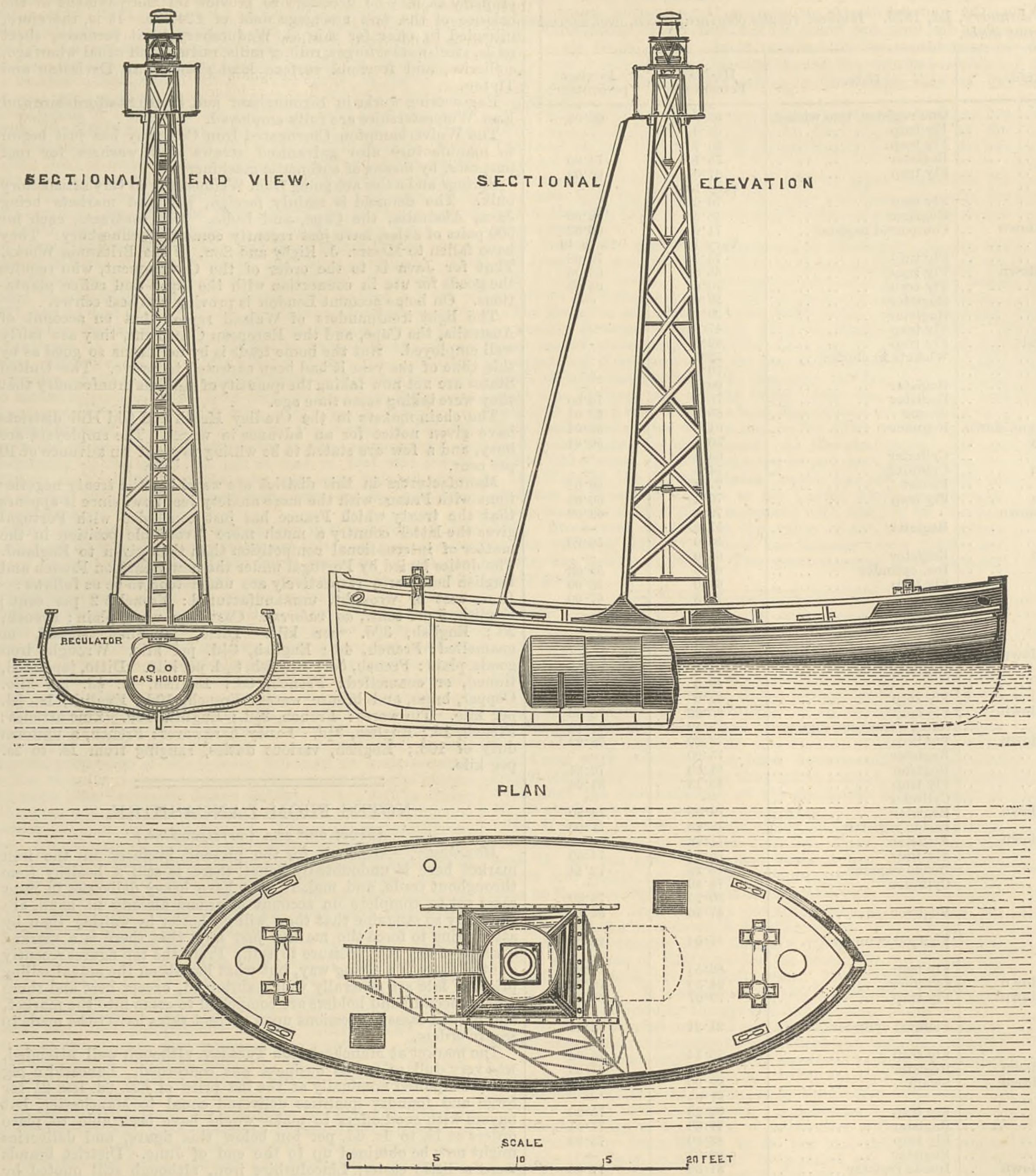
Gwynne and Co.

London, February 8th.

Steam Boiler Explosions.—At the monthly meeting of the Executive Committee of the Manchester Steam Users' Association, on the 3rd inst., Mr. Lavington E. Fletcher, chief engineer, presented his report, from which we learn that during the past year 12,138 boiler examinations had been made. No explosion had arisen from any of the boilers under the inspection of the association during the year, but twenty-five explosions had occurred throughout the country outside its ranks, killing thirty-five persons, and injuring forty others. These explosions had all arisen from simple causes repeatedly met with, and the greater number at all events might have been prevented by competent independent inspection. Nine explosions, killing twenty-one persons and injuring twenty-five others, arose from the defective condition of the boilers, in one case accompanied with excessive pressure. Seven, killing four persons and injuring twelve others, arose from malconstruction, coupled in three cases with defective condition, and in another with caulking under steam pressure. Five, killing four persons and injuring three others, arose from excessive pressure. Three, killing six persons, arose from overheating through shortness of water. As to the remaining one no particulars had been obtained. In addition to these twenty-five steam boiler explosions, forty-one explosions, killing eight persons and injuring eleven others, had arisen from kitchen boilers during the frost at the beginning of the past year. The report attributed the recent locomotive boiler explosion on the North-Eastern Railway at Stockton, by which five persons were killed, to overheating of the furnace crown through shortness of water. The boiler was lifted from the ground, turned bottom upwards, and thrown on to a truck in a goods train standing in advance. The association had recorded sixty-six locomotive boiler explosions since the year 1861, a large proportion of which arose from internal grooving at the longitudinal seams of rivets in the barrel. The average working results of thirty-three economiser or feed-water heaters under inspection were as follows:—Temperature of gases on entering the economiser 584 deg., on leaving 392 deg. fall 192 deg. Temperature of the feed on entering the economiser 95 deg., on leaving 217 deg., rise 122 deg.

* This table we give on page 108.—Ed. E.

GAS LIGHTSHIP FOR THE CLYDE.



THE illustration above shows a new gas lightship made for the Clyde Lighthouse Trustees by the Pintsch's Patent Lighting Company, New Broad-street, London. The company has already supplied the trustees with a number of gas-lighted buoys similar to those made for the Trinity Corporation, and for lighting the entrance to the Suez Canal The lightship for the Clyde Lighthouse Trustees is 40ft. in length, 14ft. in beam, and 7ft. in moulded depth to rail. The gas cylinder is of wrought iron, very carefully put together, and of a sufficient capacity to keep three small jets burning in the lantern for 40 days, burning day and night, gas being passed into this holder at a pressure of about seven atmospheres. The regulator, by which the pressure is reduced in the burner to about 2in. of water, is placed just above the cylinder, and not immediately underneath the lens, as is generally the case in gas-lighted buoys. In the space usually occupied by the regulator is clockwork, which gives motion to a drum within the lamp and surrounding the light. This drum or cylinder is slotted with a given distance or distances between the slots or a given width of slot, so that as it revolves it alternately covers and discloses the light, giving a flashing light with determinate intermission. In this ship the drum makes one revolution per minute, and gives four white light flashes. The weight for driving the clockwork descends through the tube shown in the centre of the framework carrying the lantern. The clockwork only requires winding once in forty days. It may be here mentioned that the application of Pintsch's system of lighting in the Dublin and Holyhead steamers has proved very successful, and is much appreciated by the passengers.

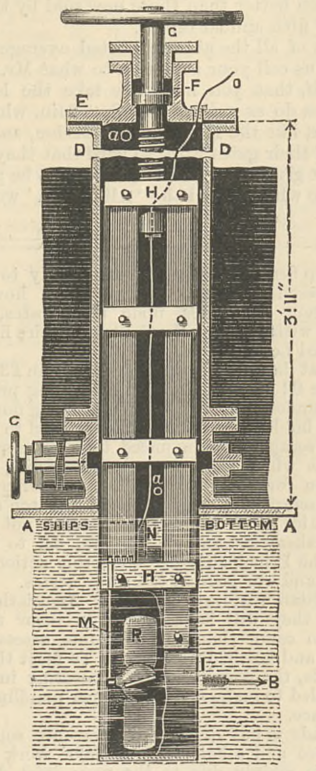
PEARN'S PUMP.

WE illustrate on page 95 a new steam pump, manufactured by Messrs. Pearn, Manchester. The tappet A is carried on the cross-head B, which connects the piston-rod C and the pump-rod D, and with its alternate motion on the fulcrum E, gives a motion to the lever F, causing the valve spindle G to move to and fro, according to the position of the tappet A, thus giving motion to the auxiliary slide valve H—in the same manner as an ordinary excentric—opening and closing the steam ports I alternately, steam exhausting through the ports J and K. The small piston L in the steam cylinder M, after passing the exhaust ports J, closes the connection between the exhaust, thereby cushioning the piston L, preventing it striking the covers N. The movement of the piston L gives motion to the valve spindle O, which works the valve P in a similar manner to an ordinary cylinder slide valve, allowing the steam to pass through the ports Q into the cylinder R and upon the piston S, exhausting by the ports Q T.

KELWAY'S ELECTRIC LOG.

THE accompanying engravings illustrate an electric log for registering the velocity of solids moving in water, or the velocity of water currents, to which we have previously referred. In Fig. 1, the line A A denotes the bottom of the vessel, travelling in the direction shown by the arrow B. C is a sluice valve, bolted to the bottom of the vessel, shown open, and allowing the sea full access to the iron box D. The iron box D is bolted to the upper flange of the valve C, and is closed at its top by the metal plate E, which effectually prevents the ingress of water to the ship's hold. Through the stuffing-box F in plate E passes the metal rod G, the screw-thread on which raises or lowers the metal cage H. To the bottom of the cage H is affixed the cylinder I, having its opening for the passage of water in a fore-and-aft direction, or in a line with the keel of the vessel. The passage of water through I causes the screw R to rotate with the

FIG. 1.



spindle L. On the spindle L is an endless screw, which revolves, by the intervention of a wheel, the vertical spindle M, which in its turn actuates a series of wheels in the box N. The last of these wheels, termed the "mile" wheel, makes one revolution while the vessel passes through the water one nautical mile. On the spindle of this "mile" wheel is affixed a second wheel, having eight ratchet teeth; and these teeth, by moving a lever, cause an electric circuit to be completed—obviously eight times in a mile—the current passing through the electric cable O to the indicating dials and bells. On the dial, Fig. 2, there are eighty graduations on the outside circle, and as the pointer in front of the dial jumps one graduation at each completion of the electric circuit, one revolution of the larger pointer represents ten miles. Ten revolutions of this pointer cause the smaller one to make one revolution, recording 100 miles—the mechanism of this dial being similar to a gas meter index. The bell is placed within an audible distance of the officer on watch.

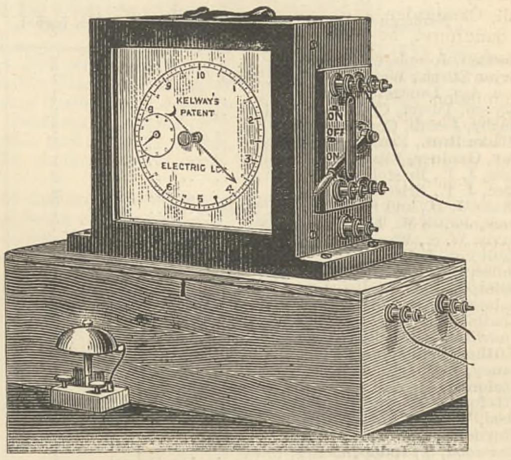
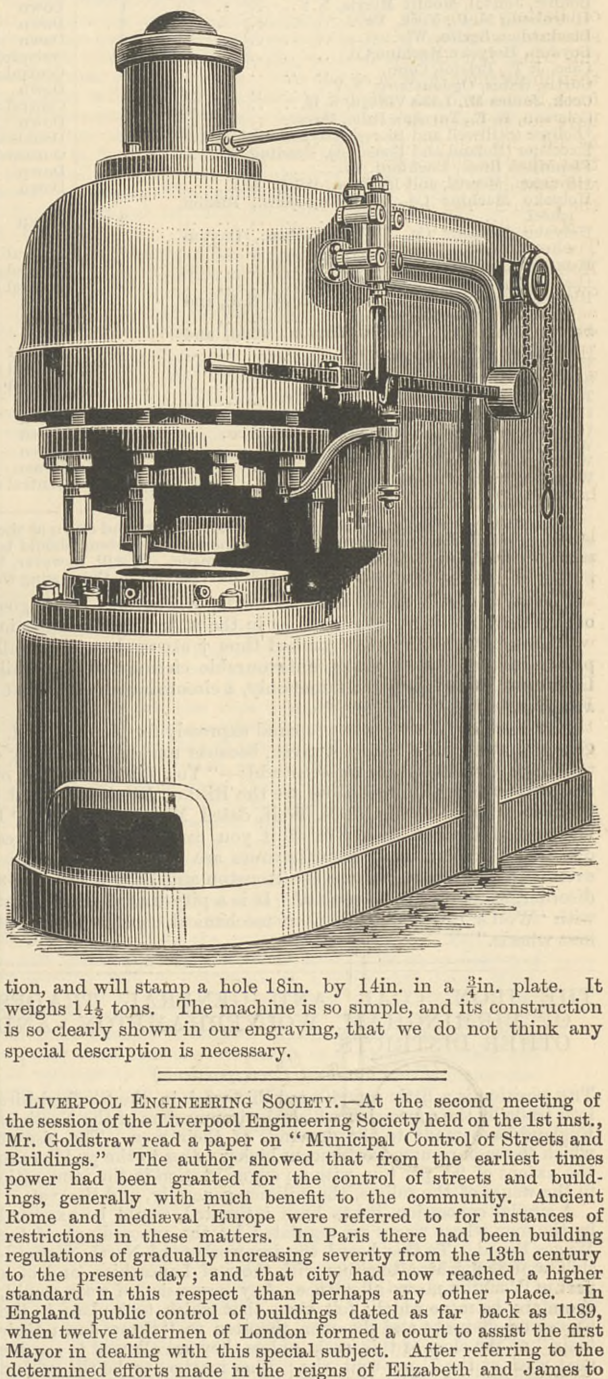


FIG. 2.

The log is made by Messrs. Kelway and Dyer, 29, New Bridge-street, and is now at the Crystal Palace International Electrical Exhibition, between the Chinese Court and Pompeian House; and in a few days will be shown in action, hy means of a current of water created by a rotary pump, which passes it through the log cylinder placed in a glass tank.

HYDRAULIC PUNCHING MACHINE.

THE accompanying engraving illustrates a very large punching machine, constructed by Mr. R. H. Tweddell, of Delahay-street, Westminster, for Messrs. Raylton, Dixon, and Co. It is intended for stamping out manholes in marine boiler plates at one opera-



tion, and will stamp a hole 18in. by 14in. in a ⅞in. plate. It weighs 14½ tons. The machine is so simple, and its construction is so clearly shown in our engraving, that we do not think any special description is necessary.

LIVERPOOL ENGINEERING SOCIETY.—At the second meeting of the session of the Liverpool Engineering Society held on the 1st inst., Mr. Goldstraw read a paper on "Municipal Control of Streets and Buildings." The author showed that from the earliest times power had been granted for the control of streets and buildings, generally with much benefit to the community. Ancient Rome and mediæval Europe were referred to for instances of restrictions in these matters. In Paris there had been building regulations of gradually increasing severity from the 13th century to the present day; and that city had now reached a higher standard in this respect than perhaps any other place. In England public control of buildings dated as far back as 1189, when twelve aldermen of London formed a court to assist the first Mayor in dealing with this special subject. After referring to the determined efforts made in the reigns of Elizabeth and James to impose limits on builders, the author dwelt on the rules for rebuilding London after the Great Fire of 1666. The Act then passed was in many points the prototype of all Building Acts; in some respects it went further than modern regulations. The author traced the history of these enactments and of many attempts to consolidate and amend them; and showed that both in London and the provinces the number and intricacy of the various laws and authorities on the subject were causes of great annoyance and perplexity. The remedy he suggested was a general Building Act for the whole country. As a beneficial example the Public Health Act, 1875, was referred to. The author believed that the Model Bye-laws issued by the Local Government Board in 1877 would pave the way for a general statute; and that body appeared to be the only one able to frame and carry such a scheme. The president announced that the next meeting of the Society would take place on the 15th, when the discussion on Mr. Goldstraw's paper would be resumed, and owing to the importance of the subject a large attendance is expected.

THE EFFICIENCY OF TURBINES.

As the efficiency of turbines is just now attracting a good deal of attention, we give an extract from Emerson's *Turbine Reporter*, vol. iii., 1877, a work regarded very generally as an authority:—

Reports of results obtained from all wheels tested from August, 1868, *to January,* 1st, 1875. *Highest results obtained, given, and average of all tested of same make.*

Name and place of manufacture.	No. tested.	Discharge.	Gate.	Highest Percentage.	Average percentage.
Bastion, Joseph, Canton, N.Y.	3	Down	One register, two wicket.	69·9	68·08
Bryant Bros., Westchesterfield, Mass.	1	Down	Fly trap	65·0	—
Bee, Asa, Lancaster, Mass.	1	Down	Fly trap	50·7	—
Bryson, Turret, Cincinnati, Ohio	2	Down	Register	75·14	74·06
Buzby, Josiah, Crosswick, N.J.	2	Down	Fly trap	67·6	66·08
*Blake Bros., East Pepperill, Mass.	3	Down	—	Very low	—
Cox, Gardner, Ellsworth, N.Y.	1	Down	Fly trap	70·0	—
Case, J. T., Bristol, Conn.	2	Down	Register	48·3	48·00
Case, J. T., Bristol, Conn.	2	Central and down	Compound register	71·6	66·03
Chase, J. D., and Sons, Orange, Mass.	7	Down	—	Very low	25 to 40
Cook, James M., Lake Village, N.H.	3	Down	Fly trap	73·11	72·08
Davis, W. S., Warner, N.H.	4	Central and down	Fly trap	68·6	65·06
Faulkner, J. J. and E. T., Louisville, Ky.	2	Down	Fly trap	70·0	64·04
Fuller, Olney, Bennington, Vt.	1	Outward	Register	59·0	—
Gillespie, J. E., Turner's Falls, Mass.	2	Outward	Register	59·4	—
Holman, O. D., Adams, Jefferson Co., N.Y.	1	Down	Fly trap	47·0	—
Kindleberger, Dr., Cincinnati, Ohio	1	Double central	Fly trap	62·5	—
Knowlton Bros., Sacarrappa, Maine	2	Down	Wickets in chutes	59·1	—
*Luther, Pennsylvania, Rhode Island, and Iowa	2	Down	—	70·0	—
Raney, James, New Castle, Pa.	1	Down	Register	66·7	—
Risdon, T. H., and Co., Mount Holly, N.J.	2	Down	Register	78·7	76·06
†Risdon, T. H., and Co., Mount Holly, N.J.	2	Down	Zigzag	85·9	83·01
Reed, Willis, Danbury, Conn.	2	One central, one down.	Register	61·8	56·04
*Reynolds, New York, N.Y.	2	Up and down	—	50·1	50·01
Sherwood, S., Independence, Iowa	1	Outward	Cylinder	63·4	—
Stevenson, J. E., New York, N.Y.	1	Up and down	Cylinder	74·5	—
Small, E. L., Urbana, Ohio	2	Down	Faucet	72·4	69·02
Trullinger, J. C., Oswego, Oregon	2	Up and down	Fly trap	70·4	60·05
*Tyler, John, West Lebanon, N.H.	5	Central and down	—	73·8	62·09
Terry, E. C., Terryville, Conn.	1	Outward	Register	57·9	—
Tuttle, various places in Maine	2	Central	—	58·0	56·00
Tice, Cincinnati, Ohio	1	Up and down	Register	66·0	—
Teller, D. C., Fort Plain, N.Y.	2	Down	Ins. cylinder	64·5	59·03
Upham, J. W., Worcester, Mass.	4	Central	Fly trap	68·0	56·00
*Upham, J. W., Worcester, Mass.	4	Central	—	72·8	67·00
Vandewater, Henry, Rochester, New York	1	Down	Cylinder	77·5	—
*Whitney, Waldo, Leominster, Mass.	1	Down	—	40·0	—
Whitney, Waldo, Leominster, Mass.	10	Down	Register	71·8	53·00
Wheeler, Willard M., Berlin, Mass.	1	Central and down	Register	73·0	—
Wheeler, Willard M., Berlin, Mass.	2	Down	Register	74·5	72·01
Watson, Jonval (old), Patterson, N.J.	1	Down	—	49·0	—
Wynkoop (perpetual motion), Owasso, Mich.	1	Central and down	Fly trap	55·0	—
Angell, Providence, R.I.	4	Central and down	Fly trap	85·39	78·09
Allentown, Allentown, Pa.	2	Down	One fly trap, one register.	78·19	77·12
†Barber, B. J., Ballston, Spa, N.Y.	3	Central and down	Fly trap	79·29	78·29
Bodine, Jonval, Mount Morris, N.Y.	1	Down	Register	75·90	—
†Burnham, N. F., York, Pa.	4	Down	Register	81·00	79·31
Blackstone, Berlin, Wis.	2	Down	Fly trap	83·13	81·04
Boydon, Holyoke Machine Co.	1	Outward	Cylinder	—	—
Case, J. T., Bristol, Conn.	6	Central and down	Register	79·03	74·80
Curtis, Gates, Ogdensburg, N.Y.	3	Down	Inside register	78·80	77·00
Cook, James M., Lake Village, N.H.	1	Central and down	Register	77·32	—
Coleman, E. E., Turner's Falls, Mass.	2	Down	Fly trap	75·84	74·60
†Eclipse (Stillwell and Bierce), Dayton, Ohio	2	Double central	Inside register	76·28	72·44
Excelsior (Roland and Benedict), Reading, Pa.	1	Outward	Cylinder	78·80	—
Flenniken Bros., Rockford, Ill.	2	Down	—	80·25	79·69
†Houston, Merrill, and Houston, Beloit, Wis.	14	Down	Register	87·16	82·12
Holyoke Machine Co., Holyoke, Mass., Risdon wheel	9	Down	Flanged cylinder	87·04	80·95
Holyoke Machine Co., Holyoke, Mass., Dayton wheel	13	Central	Fly trap	82·55	74·85
Hunt, Rodney, Orange, Mass.	6	Central and down	Cylinder	84·33	78·40
†Leffel, James, Springfield, Ohio	15	Central and down	Fly trap	79·07	68·08
Risdon, Taylor, and Co., Mount Holly, N.J., and Holyoke, Mass.	16	Down	Flanged cylinder	91·21	82·23
Stout, Mills, and Temple, Dayton, Ohio, and Holyoke, Mass.	25	Central	Fly trap	83·14	75·92
†Stetson, Bradford, Fitchburg, Mass.	6	Central and down	Register	79·26	77·33
Swain, A. M., Lowell, Mass.	8	Central and down	Swain	82·20	76·08
Tyler, John, Claremont, N.H. (Scroll)	1	Down	—	81·64	—
†Thompson and Holcomb, Silver Creek, N.Y.	2	Down	Fly trap	76·20	75·20
†Upham, J. W., and Libbey, Worcester, Mass.	6	Down	Register	77·80	71·04
Walsh, C. B., Waupaca, Wis.	2	Down	Fly trap	83·00	73·09
Wetmore, Claremont, N.H.	1	Down	Register	82·91	—
Whitney, Waldo, Leominster, Mass.	4	Central and down	Inside register	81·30	77·02

* Denote scroll wheels. Such have gates that slide up and down at the entrance of scroll. † Abandoned through infringement of patent. To th above, as wheels rendered obsolete through the testing system, should be added the "Warren," "Kilburn," and "Lincoln and Collins," though it is possible one of the latter may occasionally be made It will, however, be remembered that a manufacturer who had purchased one at a very high price sent it to be tested, and that Mr. Collins replevied it, thus losing the sale rather than risk the trial.

"Some of these wheels are well made, others not; some good at whole, but very poor at part gate; some will clog with a leaf, others with nothing that should be in the water. Discrimination should be used in purchasing.

"The averages of wheels marked thus † are made up from all tests of those wheels, whether made at Holyoke, Lowell, or other places, and sometimes under unfavourable circumstances; while the others, with the exception of the Bodine, are the averages of tests made at the Holyoke flume only, a circumstance somewhat favourable to the latter. Future tests are likely to change relative averages.

"The Bodine Jonval was prepared expressly for the test, and, I think, was much better than those now sold by the Mount Morris Company. Boyden tests not given, because unreliable, as fully explained in my fifth annual report."

The publishers of the *Reporter* add:—"You will notice that only three wheels of all the above reported average 80 per cent. and upwards at full gate, and those are the Risdon, Blackstone, and Houston. Let us call your attention to what Mr. Emerson says of them in a letter to Mr. A. N. Wolf, dated May 12th, 1877:—'I think, Mr. Wolf, that you may now take the lead in the wheel business, and make money in it, if you can show that you can make all sizes do as well as your first 24in. wheel. There is no question now but what manufacturers are throwing out high per cent. wheels, like the Houston and Risdon, and replacing them even with the Leffel, because the Houston and Risdon are poor at part gate, and their gates work so hard that they are in continual disorder, and give great trouble.' It is a pity that their part gate results are not given; but we know them to be poor as compared with 'Wolf's Eureka,' while their mechanical construction is still poorer. The wheel called the 'Allentown' was one of Wolf's first wheels."

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

(*From our own Correspondent.*)

THE position is a little complicated this week in the Staffordshire iron trade by the concession which the ironmasters of the North of England have made to the demands of their men. The rise at which the men resume work means higher wages to the puddlers to the extent of 9d. per ton, with an augmentation in the same ratio in the wages of the rollers, the millmen generally, and the rest.

A similar concession, it has been intimated, would be expected by the men whose wages are regulated by the proceedings of the Wages Board. To this board the ironworkers of North Staffordshire and Shropshire, together with those of Lancashire, and of a part of Yorkshire, owe allegiance. Any suspension of work would, therefore, be more widely felt than that which took place in the Cleveland district; and the men threaten to "throw down their tools," at the close of this week, unless they are allowed to resume next week at the $7\frac{1}{2}$ per cent. rise; other matters to be the subject of discussion and arbitration. Business to-day in Birmingham, as well as yesterday in Wolverhampton, was prejudiced by the action which the men have inaugurated.

It was, however, believed that the Wages Board would be able through the operatives' secretary to give the men such assurance as would induce them to continue their employment without break.

Leading pig iron firms spoke very positively touching the excellent prospects of the early future. They do not believe that prices of crude iron will be at all lowered for some time to come. On the contrary, they are of opinion that some advance will be manifested; for the demand for steel making-purposes shows no signs of abatement, and rolled iron makers have of late been ordering very largely.

The general rates for unmarked bars now vary between £6 15s. and £7 per ton. Marked brands are £7 5s. and £7 10s., with £8 firm for Messrs. Bradley's, and £8 2s. 6d. firm for the Earl of Dudley's.

Certain hoop firms were to-day quite ready to accept orders at £7 15s. delivered London. Other firms, however, asked an advance of from 5s. to 10s. upon these rates, and no business could be done with the best North Staffordshire houses at less than £8 5s. delivered London.

Quotations at date for all-mine pigs are from £3 7s. 6d. to £3 10s. For part-mine £2 17s. 6d. to £3 is the selling price, and common sorts are 10s. under. A fair business is being done in cinder iron, at £2 5s., and holders are not at all disinclined to sell.

Holders of scrap iron announced their determination to obtain the full terms which they are now demanding—from £3 10s. to £3 15s. per ton for manufacturers' scrap. Offers were made for South Wales scrap at a good 12s. 6d. per ton advance upon the Midsummer price: but the commodity was not to be got at the figure, the makers demanding from 2s. 6d. to 5s. more money. The firms in the Principality defended this action by stating that the home demand was good at their own terms.

The South Staffordshire Ironmasters' Association consider it not unlikely that they will have shortly to incur more than usual expenditure in connection with poor-rate assessments on certain blast furnaces and finished ironworks. To meet this probable drain upon the funds, the Association, at a meeting in Birmingham on Tuesday, decided to make a call of 5s. per puddling furnace and £2 per blast furnace.

The coal trade is but quiet, and there are some pits at which only from three and a-half to four days' work a week is being made. This is mainly due to the very quiet demand for house coal. Prevailing prices are:—Thick furnace coal, 9s. and 8s. 6d. per ton; forge and steam coal, 8s. and 7s.; bright and steam screenings, 7s. and 7s. 6d.; engine slack, 4s. 6d., 4s., and 3s. 6d., according to quality; "heathen" forge coal, 9s.; engine slack, 4s. 6d.; "new mine," 8s. 6d.; engine slack, 4s. 6d. It is not at present expected that any material alteration will be made in these rates during the spring.

Progress is being made in the draining of the collieries which were last week flooded by the accidental inundation in the Pelsall district, but the progress is only slow.

The interim dividend of the Sandwell Park Colliery Company, Limited, for the past half-year will be at the rate of 5 per cent. per annum.

The directors of the Darlaston Coal and Iron Company, Limited, have decided to dispose at once of so much of the company's property as may be necessary to provide for the payment of the balance of the first mortgage debt of £24,000. It is, therefore, intended to offer for sale at Wednesbury blast furnaces, sheet mills, steel-works, forges, rolling mills, railway and canal wharfage, collieries, and freehold surface land situated at Darlaston and Tipton.

Engineering works in Birmingham and South Staffordshire and East Worcestershire are fully employed.

The Wolverhampton Corrugated Iron Company has just begun to manufacture also galvanised screws and washers for roof purposes, by means of automatic machinery.

Springs and axles are going from Wednesbury in very satisfactory bulk. The demand is mainly foreign, the best markets being Java, Austialia, the Cape, and India. Two contracts, each for 500 pairs of axles, have just recently come to Wednesbury. They have fallen to Messrs. J. Rigby and Son, of the Britannia Works. That for Java is to the order of the Government, who require the goods for use in connection with the sugar and coffee plantations. On home account London is proving the best centre.

The light ironfounders of Walsall report that on account of Australia, the Cape, and the European Continent, they are fairly well employed. But the home trade is by no means so good as by this time of the year it had been expected to prove. The United States are not now taking the quantity of saddlers' ironfoundry that they were taking some time ago.

The chain makers in the Cradley Heath and Old Hill districts have given notice for an advance in wages. The employers are busy, and a few are stated to be willing to grant an advance of 10 per cent.

Manufacturers in this district are watching the treaty negotiations with France with the more anxiety just now, since it appears that the treaty which France has just concluded with Portugal gives the latter country a much more favourable position in the matter of international competition than that given to England. The duties levied by Portugal under the new treaty on French and English hardwares respectively are understood to be as follows:—Iron, cast or wrought, unmanufactured: French, 2 per cent.; English, 5 per cent., *ad valorem*. Cast iron ware, plain: French, 2d.; English, $3\frac{3}{4}$d. per kilo. Ditto, japanned, tinned, or enamelled: French, 4d.; English, $6\frac{1}{4}$d. per kilo. Wrought iron goods, plain: French, 5d.; English, $8\frac{3}{4}$d. per kilo. Ditto, japanned, tinned, or enamelled: French, 8d.; English, 1s. $\frac{1}{2}$d. per kilo. Copper, brass, and bronze wares: French, 10d.; English, 1s. $\frac{1}{2}$d. per kilo. Tin wares: French, $2\frac{1}{2}$d.; English, 10d. Zinc articles: French, 1d.; English, $3\frac{1}{2}$d. Fancy hardwares: French, a uniform duty of 10d.; English, various duties, ranging from 1s. to 2s. per kilo.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Although for the present business in the iron market here is undoubtedly quiet, there is still a healthy tone throughout trade, and makers, who have heavy deliveries in most cases yet to complete on account of orders already in hand, are generally so sanguine that they will do better by waiting than by attempting to force the market just now that there is a marked absence of any real pressure to sell. From the top figures recently quoted there is a giving way, but what have been the actual selling prices of late are generally well maintained, except here and there where second-hand holders are compelled to come into the market, and in such cases concessions upon current rates have to be made to secure orders.

The market at Manchester on Tuesday, although well attended, was very dull so far as business was concerned. Lancashire pig iron was quoted nominally at the list price of 52s. 6d. less $2\frac{1}{2}$ for forge and foundry qualities delivered equal to Manchester, but buyers with good offers to make would have been able to place orders at 1s. to 1s. 6d. per ton below this figure, and deliveries might now be obtained up to the end of June. District brands were a little easier, Lincolnshire iron, although still quoted by some makers at 52s. to 53s., less $2\frac{1}{2}$ delivered equal to Manchester being obtainable at 1s. below this figure, and Middlesbrough brands were offered at 50s. 4d. per ton net cash. Finished iron makers are still so well supplied with work, that although new inquiries are not coming in quite so freely as of late, there is a firmer tone in manufactured iron than in the raw material. Quotations such as £7 2s. 6d. to £7 5s. for bars delivered into the Manchester district, which were current a short time back, seem, however, to have disappeared from the market, and any business now being done is on the basis of about £7 per ton, at which makers are firm. Second-hand lots, however, are offered at under this figure.

There is no material change to notice in the condition of the engineering trades of this district. The principal firms are well employed, and considerable orders for fire-proof work required in the construction of new cotton mills have recently been placed in this district. This branch of industry seems likely to furnish a good deal of work as one firm of local architects have no less than five new mills in hand at the present time.

The threatened strike in the engineering trade has been averted by the concession to the men of the advance in wages asked for. In accordance with the resolution come to by the Iron Trades Employers' Association this advance of 2s. per week will come into operation on the 1st March, but in one or two large establishments it is already being paid.

The important question to this district of colliery winding engines and ropes was dealt with in an interesting paper read by Mr. C. M. Percy, of Wigan, before the members of the Manchester Geological Society on Tuesday. A winding engine, he admitted, in consequence of the intermittent action, was not one with which economical results were usually obtained, and the chief aim had been to have a powerful engine, quick in motion and easy of control. There seemed, however, to be two principal directions in which efforts might be made for effecting economy in winding engines—first by the application of condensers, and secondly by improved appliances in connection with the winding drum. In Lancashire they have for many years practically turned their backs upon condensing winding engines, and had gone in nearly universally for high-pressure non-condensing engines, which, although they possessed the very best examples of that kind of engine, were very expensive to work. In the North of England, however, condensing arrangements had been adopted with good results, and a condensing engine always ensured an effective pressure from the same steam of 15 lb. in excess of anything obtained from a non-condensing engine. Although a single vertical was not equal to the usual Lancashire engines, horizontal and working in pairs, he would urge that they might take the better parts of each class and have the usual Lancashire engine with a condensing arrangement attached. With regard to improved appliances in connectien with the winding drums, what they wanted to secure was that the load upon the engines should be as uniform as possible. In the North of England counterbalance chains were used, and in Lancashire they had various descriptions of winding drums, but all these drum appliances only partially met the matter. In his opinion the Koepe system of winding, largely used on the Continent, and recently introduced at the Bestwood Collieries, near Nottingham—of which I gave a short description at the time—went into the matter thoroughly, by altogether dispensing with drums, the principle being that winding drums were not necessary, and instead a pulley was placed upon the crank shaft. This abolition of the massive winding drums was a step in the right direction, and the Koepe system of winding seemed to give a less, and more uniform, load upon the engines than any other arrangement. He thought that by combining, without injurious complication, the benefits derived from the condensing arrangement of the North of England and the advantages derivable from the Koepe system, they would be in possession of an almost perfect winding appliance.

Arrangements have been made for holding in Manchester an exhibition of the smoke-preventing appliances embraced within the London Exhibition. An excellent and central building for the purpose, in the new covered-in Campfield Market, and the staff of the London Exhibition, has been secured to assist in organising the one to be held in Manchester, which will be opened in March.

The coal trade of this district continues in a depressed condition. All descriptions of round coal are bad to sell, and stocks are accumulating, notwithstanding that most of the pits are on short time. Engine fuel moves off fairly well, but is plentiful in market. There is a good deal of underselling to secure orders, and prices, consequently, are very irregular, but may be given as averaging about as under at the pit mouth: Best coal, 9s. to 9s. 6d.; seconds, 7s. to 7s. 6d.; common round coal, 5s. to 6s.; burgy, 4s. 6d. to 5s.; good slack, 3s. 9d. to 4s. 3d.; and common, 3s. to 3s. 3d. per ton.

The eighth annual report has just been issued to the shareholders of Messrs. Andrew Knowles and Sons, Limited. The total profit shown by the balance-sheet is £37,331, to which it is proposed to add £5906 from the reserve fund, making a total of £43,237, and to deal with the whole as follows:—Interest on mortgage debenture bonds, £24,453; interest on calls paid in advance, £734; interest on reserve fund, £424; to write off preliminary expenses, £2000; dividend at the rate of 2½ per cent., £15,625. The directors report that although the trade of the year has been by no means so good as could have been wished, yet they have satisfaction in stating that the results of the year's working are better than those of the previous year to the extent of £37,088. Owing to the strike and the disturbance in the labour market at the beginning of the year, the get of coal in 1881 was less by 66,628 tons than in 1880, but the sales were only reduced to the extent of 5847 tons, the difference being provided for by taking coal from stock.

Barrow.—The output of Bessemer pig iron in this district, which for some time back has been very large, has this week been further increased by the blowing in of two more furnaces. I can also positively state that other furnaces are likely to follow, so that in a short time the make of pig iron will be enormous. The demand, however, is sufficiently large to swallow it up, and the business done this week has been brisker than at any period of the present renewal of good trade. From my own observations, and what has come to me in the way of reliable information, we may expect to see this demand still further augmented, as the wants of American and continental users appear to increase as the year advances, and some little display of anxiety is exhibited to place orders in the hands of makers before prices get much higher, an event not at all unlikely. The output of the furnaces is very large, but at present the greatest proportion of this is being delivered on home account. When the shipping season is opened the export of metal abroad will be more than ordinarily heavy indeed. I am safe in saying that this year will show the heaviest export of metal for this district which has ever been experienced. Prices are practically unchanged, 65s. 6d. per ton being quoted for No. 1 Bessemer at works, or f.o.b. 2½ per cent. less at local ports at a month; mixed qualities at 63s. 6d. and No. 3 and 4 forge, 62s. 6d. per ton. Makers who are well sold forward are able to command for all best qualities, 67s. 6d. Second-hand dealers in a few cases have disposed of mixed Bessemer qualities at 62s. 6d. per ton. Present quotations must in a short time show an advance, and it would not surprise me to see prices reach the same figure which makers who are in receipt of plenty of work are able to get. Steel is in good request in all departments, and a heavy tonnage of Bessemer pig iron is being consumed. Iron shipbuilders are working off a few contracts, and have secured one or two orders. The minor industries of the district still maintain their activity. Iron ore has advanced, and is selling at from 16s. 6d. to 18s. 6d. per ton, and we may shortly expect to hear of business being done at 20s. Coke and coal selling well.

The present active state of the iron trade has had the effect of increasing the efforts of mine owners to augment their output of ore, and in the West Cumberland district boring operations in several localities are being actively and successfully carried on. The Crown Iron Company in its operations near Cleator Moor has been most successful, and it is the intention to sink another shaft at Jacktrees. Near to the same place Messrs. Hamilton Dixon are about to open a mine, while in the Woodend and Egremont districts the Moss Bay Company, Messrs. Lindon and others are very actively engaged in boring operations. At the Todholes Royalty Mr. Jenkinson has made an inclined drift, so as to be able to raise the ore quicker and easier. A rich vein of ore has been found by the Glasgow and Cumbrian Iron Company near Hensingham, where a quarry has been started. Other districts on the West Coast are also developing their mines, and in a short time the output of iron ore will be very largely increased.

A furnace has just been put in blast by the Hematite Steel Company at Barrow, which has now thirteen out of fourteen furnaces which are producing Bessemer and ordinary hematite iron. At Carnforth the Hematite Company has started its fifth furnace, and has but one in a state of inaction, but it is hoped that in a week the whole of the plant will be working. The steel works there are still in a condition of idleness, as the production of pig iron is found more profitable than the production of steel under present conditions.

There is a great want of rolling stock for the iron ore traffic in West Cumberland, notwithstanding a large augmentation in the number of private wagons.

The Workington Iron and Steel Company is about to erect another blast furnace.

The Moss Bay Company's iron and steel shares are in great demand.

The new dock at Whitehaven, which has been closed for some months owing to an accident with the gates, will be ready for reopening, it is expected, in course of a few days.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The Engineer recently gave a description of the new 9-ton goods wagons, for which the Great Northern Railway Company had solicited tenders. The number required was 550, and the order has come to Messrs. Craven Brothers, carriage builders, Darnall. The order is the largest of the kind ever received in Sheffield. The price, I hear, is not very high. The North British Railway Company is about to give out tenders for 500 goods wagons.

Permanent way is still being as freely ordered as ever, particularly in steel rails. One company is completing a 10,000 ton contract for the United States—for Mr. Vanderbilt—and there are other orders for North America, South America, Australia, and India, as well as for home railroads. Considerable interest is being excited by the prospect of a remarkably heavy order in rails being competed for in this country. I hear that an Australian firm have contracted with the Government of Victoria, who contemplate extensive additions to the State railway system, to supply from 130,000 to 155,000 tons of steel rails. The work is certain to come to this country, and the Sheffield makers expect to have a goodly share of it.

In armour-plates Messrs. Charles Cammell and Co., Limited, are favoured with heavy orders from the French Government, but the spirit of protection is still strong enough there to prompt the payment of a royalty to work Mr. Alexander Wilson's patent for compound plates, and have them made in France, rather than continue to order them from the manufacturers, Messrs. Cammell and Co. This company, by the way, has just booked an order from our Admiralty for the turret plates of the Colossus; and Messrs. John Brown and Co., Atlas Works, for the turret plates of the Majestic. There will be no scarcity of employment in the armour-plate mills this year.

The development of the Australian trade continues, and is causing quite a revival in several branches which have long been depressed. Chief among these may be mentioned the manufacture of saws, which had seriously fallen off. Now, I hear, all the leading houses in the Australian trade are exceedingly busy in the saw departments. The prospect of the heavy order for rails is also causing all kinds of edge tools required in the construction of permanent way to be called for heavily, and the principal establishments have at present more orders in hand than they can get completed.

The trade with the Cape is also picking up, though business has been somewhat adversely affected by over speculation at the Diamond Fields. Picks of all kinds are largely in demand for the diamond district.

Sheep-shears are being manufactured in great quantities for Australia and the Cape, and there are excellent prospects for South America, from which orders will soon be pouring in as the season opens.

In fine tools a noticeable improvement has taken place in the call from the continent and New York for carver's tools of the "S. J. Addis" brand. The makers report that they have more orders on hand than they can well supply in any reasonable time.

The Bessemer steel trade is remarkably brisk. Steel, generally, —crucible Bessemer—has rarely been so briskly called for. A steel manufacturer was heard the other day to say he would be disappointed if his profits for the year did not amount to £20,000. If his partners had anything like that sum, the firm must have had what the Yankees call a "big boom" last year. I heard, and believe it to be a fact, that one local firm of steel makers presented their head steel-melter with a cheque for £120 on the results of their year's trading being disclosed. As this steel-melter can earn £15 to £20 a week, his situation must be put down as a good one.

Dr. Webster, the United States Consul, has just completed his statistics of Sheffield exports to the United States for January. The gross value is £96,722, as compared with £54,733 for January, 1881. Steel was exported to the value of £30,145, and cutlery to the value of £17,317. Steel has increased over £9000, and cutlery has decreased £4000. The great increase is in rails and heavy goods.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

There was a somewhat better feeling on 'Change at Middlesbrough on Tuesday last. Although the ironworkers' strike still continued at some of the works, it had terminated at most of them, and, generally speaking, was thought to be virtually at an end. Having obtained the victory, and being impoverished by the fight, it seemed pretty certain that the ironworkers at the rolling mills would now work steadily for at least three months. This belief helped materially to strengthen the pig iron market, which has been weak since the dissatisfaction of the operatives at the result of Mr. Waterham's last ascertainment began.

No. 3. g.m.b. pig iron was sold at 42s. 3d. per ton for prompt, and 42s. 6d. per ton for forward delivery. Forge quality was the usual 1s. per ton less. Not much business was, however, done, buyers and sellers not yet having sufficiently harmonised their ideas as to the probable effect of recent influences upon the course of the market. The tendency toward weakness shown by the Glasgow market also assisted in deciding buyers to keep back their inquiries. The returns from Connal's stores at Middlesbrough showed a decrease of 1269 tons for the week, the total quantity remaining in stock being 174,417 tons. The foundry trade continues very quiet. It is strange that this branch should have been so far so little affected by the general improvement in trade. The value of manufactured iron has not altered much. The quantity of iron contracted for has recently about kept pace with the quantity run off. Much more might probably have been booked, but makers prefer to keep out of the market until they see how far their cost of production is likely to be affected by concessions to labour. The tendency is now towards firmness. Concessions actually given at the recent meeting of the Board of Arbitration will affect the cost of production by from 2s. 6d. to 3s. per ton, and the consumer will ultimately have to pay this. Ship-plates are quoted at from £7 5s. to £7 10s. per ton delivered Middlesbrough, less 2½ per cent. discount. Sales, however, have been made in quantity at rather higher prices, and for small lots £7 7s. 6d. has been pretty freely given. Bars and angles are quoted at £6 10s. to £6 12s. 6d., terms and delivery as above.

The Cleveland Institution of Engineers occupied itself on Monday evening in discussing a paper previously read by Mr. Head on "The Society of Arts' Proposed Patent Bill." The reader of the paper led the way, stating that his only object was to get the matter thoroughly discussed by the engineers and leaders of industry of Cleveland, and to obtain their united opinion in the form either of the resolution in favour which he had submitted, or of some other which they might prefer to pass. The discussion was conducted with great earnestness by Mr. Wrightson, Mr. Hammond, Mr. Vyle, Mr. C. Wood, Mr. Outridge, Mr. Hart, Mr. A. Hill, Mr. Parry, the president, Mr. E. Winsor Richards, and several other gentlemen. The great preponderance of opinion was:—(1) In favour of the existence of a patent law of some sort; (2) against the operation of the present law; (3) in favour of a lower and easier scale of fees; (4) in favour of more assistance being given by Patent-offiice officials to inventors; (5) in favour of patents dating from application instead of from completion; (6) in favour of keeping secret and finally destroying the provisional specification; (7) in favour of twelve months duration of the provisional specification; (8) against the upsetting of patents once granted, unless upon substantial and equitable grounds. Finally the following resolution, moved by Mr. Head, was unanimously carried, viz.:—"That this meeting of the Cleveland Institution of Engineers desires to record its general approval of the Society of Arts proposed Bill for the amendment of the patent law. That it considers the same a substantial improvement upon the existing law, and requests the council to take such action as may appear advisable to give effect to this resolution."

The death of Mr. Alexander Holley, the well-known American engineer, is deeply regretted in Cleveland, which district he frequently visited and where he was well known. Great sympathy is expressed for the members of his family, who were, it is understood, absent in London at the time of the sad occurence.

Mr. Waynman Dixon, brother of Mr. Raylton Dixon the Middlesbrough shipbuilder, was admitted into the firm of R. Dixon and Co. on the 1st January last. He has for some years been acting as manager, and as a partner will certainly be a great acquisition to the business. It will be remembered that Mr. W. Dixon was in Egypt some years since, and whilst there superintended the encasing and shipment of Cleopatra's Needle to England.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The iron market has been considerably stronger during the past week, the evil influence of the financial crisis on the Continent having to a great extent passed away. It is now seen that the failure of the Paris bank will not affect the trading circles to such an extent as more was feared, and the tone of the market has consequently been cheerful in expectation that the business with the Continent will begin to extend, and that probably a very good spring trade will be enjoyed. This week, too, the market has been favourably affected by the Board of Trade returns, which are regarded as very satisfactory, and likewise by the amount of the shipments, which are nearly double what they were in the corresponding week last year. Nearly 3000 tons of pig iron were shipped in the course of the week to the United States, 1700 tons to France, and 1600 tons to Italy. Shippers are still experiencing a difficulty arising from the exorbitant rate of freights; the latter are, however, this week a little easier.

For the first time for many months the stock in Messrs. Connal and Co.'s stores shows a slight reduction on the week of 30 tons. This is also regarded as a favourable element in the trade, and is believed to be the result, partially at least, of the large extent to which No. 3 Scotch iron is now going into consumption.

Business was done in the warrant market on Friday morning at from 49s. 10½d. to 49s. 8d. cash, and from 50s. 2d. to 50s. one month, and in the afternoon at from 49s. 9d. to 49s. 8½d. cash, and from 50s. 1d. to 49s. 11d. one month. On Monday forenoon business transactions were effected at from 50s. 1d. to 50s. cash, and 50s. 4d. to 51s. 3½d. one month. At the opening on Tuesday the market was rather flat, with business at 49s. 10d. one month; in the afternoon a large business was done from 49s. 6d. cash to 49s. 10½d. one month. Business was done on Wednesday between 49s. 7½d. and 49s. 3d. cash and 49s. 8½d. to 49s. 10½d. one month. To-day (Thursday) the market was flat, with business down to 48s. 11d. cash.

The prices of makers' iron this week show very little alteration, the quotations being as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 60s. 6d., No. 3, 53s.; Coltness, 60s. 6d. and 54s.; Langloan, 61s. 6d. and 55s.; Summerlee, 60s. and 52s.; Calder, 60s. and 52s. 6d.; Carnbroe, 55s. 6d. and 51s. 6d.; Clyde, 51s. and 49s.; Monkland and Quarter each, 50s. 6d. and 48s. 6d.; Govan 50s. 6d. and 49s. 6d.; Shotts at Leith, 61s. and 55s.; Carron, at Grangemouth, 51s. 6d. (a specially selected, 56s.) and 51s.; Kinneil, at Bo'ness, 51s. and 49s.; Glengarnock, at Ardrossan, 54s. 6d. and 51s. 6d.; Eglinton, 50s. 6d. and 48s. 6d.; Dalmellington, 50s. 6d. and 49s. 6d.

The manufactured iron trade continues busy with the single exception of the light and ornamental founders, most of whose works are almost stopped in consequence of the strike of moulders. The marine engineers have work on hand that will serve them for a considerable time to come. Several new contracts have been placed within the past week. These remarks apply to bolt and nut manufacturers, the bulk of whose work at present is for the shipbuilding trade. There is a steady demand for malleable bars, sheets, plates, rods, and angles, both steel and iron. Common bars are quoted at £7 to £7 5s. per ton, the best qualities running from £7 15s. to £8; ship plates, £8; boiler plates, £8 5s.; angles, £7 to £7 5s.; steel ship plates, £12; boiler do., £12 7s. 6d.; steel angles, £11. These prices are all subject to 5 per cent. discount. Our iron manufacturers are expecting to profit considerably from the activity now going on in France and Germany in the construction of harbour and railway works, and also by the undertaking of additional public works in India by the Government. The past week's shipments of iron manufactures have not, however, been large. They embrace £13,000 worth of machinery, £610 worth of sewing machines, £15,000 other iron manufactures, and £3744 worth of steel blooms for New York.

A fair business has been done in the coal trade. Shipments from Glasgow are not quite so large as they were in the preceding week, but taking the returns from all shipping ports of the country, they show an increase of 10,000 tons. The supply is very abundant. Although there is little or no alteration in prices of coals on board ship, the coalmasters of Lanarkshire have intimated a reduction of about 1s. per ton on household coals at the pits.

The miners in the Rutherglen district have held a meeting, at which they resolved to restrict the output of coals and to demand an increase of wages. The association, however, is not believed to be influential enough to make this policy general throughout the mining districts.

At the monthly meeting of the Executive Board of the Fife and Clackmannan Miners' Association, held at Dunfermline on Saturday, it was reported that the trade had fallen off very considerably during January, and that stocking and restricted time had been the rule at a number of the collieries.

The Scotch Wagon Company has held its fourteenth general meeting at Edinburgh, and declared a dividend of 5 per cent. for the half-year ending 31st December. During the half-year 1281 wagons had been added to stock at a cost of £51,624, and, on the other hand, 1553 wagons had been sold out of stock. The addition of £551 was made to the reserve fund, bringing it up to over £10,000.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

There has been a good deal of ferment during the week at Cardiff, and in the coal supplying valleys, Rhondda, Aberdare, and Merthyr, on account of a statement made by Mr. J. O. Riches, at the Cardiff shipowners' meeting to the effect that the present rate of output would bring the best coals to an end in twenty-five years. This has caused a good deal of discussion, but it has been satisfactorily established that this view is simply an alarmist one. In proof of the duration of our coalfield for a couple of hundred years, at a much larger output than at present, we have the testimony of Mr. Wm. T. Lewis, Mr. Vivian, and in fact all the best authorities. In the report of the Royal Commission, 1871, the estimated quantity in South Wales at a depth not lower than 400ft., and not less than in seams of 1ft. thick, was 32,456,208,913 tons. Then it is well known that the great centre, accessible by sinkings of from 700ft. to 800ft. would increase this great total. As one of the disputants urged, there is no need for present anxiety, even at an output of 7 millions, but every reason why Cardiff should press on with new docks and enlargements. Last week the total export from Cardiff was 115,000, or a falling off to the extent of 16,000 tons. Still trade is good, and prices are maintained. I note with some degree of surprise another sale of ironworks at Cardiff—the East Moor, plant, &c. It has all along been considered that the future of the steel trade was near the place whence the supplies of foreign ore could be more cheaply obtained; that is on the Moors. It is, however, very clear that the advantage of a seaside position and saving of carriage up the valleys are neutralised by the higher cost of labour, higher rents, and dearer food at the ports.

There has been some expectation aroused that the lawsuit now waging between Hankey and the West of England Bank may result in some start at Plymouth. I confess to the hope, but am afraid the prospects are poor.

A short line in connection with the Great Western Railway has brought some valuable seams of the Rhondda into the benefit of railway service. There is no doubt a large acreage yet remains for future opening out by means of the railway to Swansea. Few more important railways have been brought under the notice of the Railway Committee. In fact the destinies of a very wide district are hanging on the decision.

The coal trade at Swansea continues brisk, 26,239 tons left last week, and Newport sent away 23,998 tons and local industries are well maintaineed. Prices are firm "all round."

I note at Swansea that the patent fuel trade maintains a good place; nearly 6000 tons were shipped last week. Trade with Ireland, which was becoming considerable, though attended by rather more speculation than old-fashioned traders liked to see, has fallen off materially and this is attributed to financial excitement in France. From the same cause also a decline in tin-plate has taken place. This, however, I expect to see changed. The spring generally brings about a flush of new orders for tin-plate. The falling off in the demand for tinned meats has had something to do in keeping prices low, and it is evident that American requirements are much less now than at this time last year.

One of the large coal steamers of Cardiff, the Cosmo, owned by Tellefsen, Wills, and Co., has foundered at sea.

The iron and steel trades continue firm, and business for a considerable time is secured at several of the works. At most of them changes are being carried out, principally elevating furnaces, and so increasing yield and reducing cost in coke, &c.

A petition has been brought by the Blaina and Nantyglo Company for the reduction of capital, and has been granted.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

31st January, 1882.

464. TRICYCLES, &c., W. S. Rock, Jersey.
465. KNITTING MACHINES, J. Byfield, London, Canada.
466. SEWING MACHINES, J. F. M'Laren, Glasgow.
467. BICYCLES, &c., J. W. Golding, London.
468. SUSPENDING APPARATUS, E. Wilkins, London.
469. BOILERS, &c., J. Parkinson, Caton.
470. DYEING, &c., W. W. Richardson, Leeds.
471. FURNACES, &c., H. L. Williams and J. T. Simnett, Manchester.
472. DYNAMIC COOLING, H. E. Newton.—(*L. Allen, U.S.*)
473. MANURE, J. Brock, Widnes.
474. BINDER, H. R. Stutchbury, London.
475. REFRIGERATORS, A. Samuel.—(*J. Lissons, Canada.*)
476. VALVES, W. C. Church, Brixton.
477. SPRINGS, H. J. Haddan.—(*W. Barnes, U.S.*)
478. DISINTEGRATING JUTE, &c., H. J. Haddan.—(*A. Angell and W. B. Cunningham, New York, U.S.*)
479. FEED APPARATUS, J. Hayes.—(*E. Fromentin, Paris.*)
480. MITIGATING BLOOD APPARATUS, L. A. Groth.—(*C. Vorberg, Cologne.*)
481. CRINOLETTES, E. Baker, London.
482. LATCHES and LOCKS, E. R. Wethered, Woolwich.
483. LIQUOR FRAMES, &c., W. Edge, Birmingham.
484. FINGER RINGS, W. R. Lake.—(*R. J. La Grange, U.S.*)
485. TAPS, W. Rose, Halesowen.
486. STOVES, E. A. Cowper, London.
487. HEATING APPARATUS, W. R. Lake.—(*Gillet and Sons, Lyons.*)
488. PACKING, W. R. Lake.—(*Matthews Steam Spring Packing Company, Boston, U.S.*)
489. ELECTRICAL BATTERIES, G. Skrivanoff, Anerley.
490. SPRING MOTOR APPARATUS, W. R. Lake.—(*W. T. Larimore, St. Louis, U.S.*)
491. MACHINE GUNS, O. Jones, London.

1st February, 1882.

492. LOOMS, R. S. and E. Collinge.—(*R. Collinge, U.S.*)
493. ASBESTOS, C. J. Allport, London.
494. LUBRICANTS, G. L. Scott, Manchester, and H. Kenyon, Altrincham.
495. SAWING WOOD, J. Smith, Rochdale.
496. CARTRIDGES, C. S. Bailey, Waltham Abbey.
497. ELECTRO-MAGNETS, G. Little, Passaic, U.S.
498. CUTTING MACHINERY, A. Muir, Manchester.
499. SIZING, &c., HANKS, J. Conlong, Blackburn, and J. Robertshaw, Manchester.
500. BRAKES, W. B. Holbech, Huncote.
501. STEAM ENGINE GOVERNOR, J. Rettie, London.
502. MARINE BOILERS, A. Gibb, Greenwich.
503. SUSPENSION LAMPS, H. Salsbury, London.
504. RAILWAY BRAKE APPARATUS, H. H. Lake.—(*A. Rudolf and M. R. von Pichler, Vienna.*)
505. DRESSING, &c., APPARATUS, J. D. Brunton.—(*F. B. J. Trier, Boston, U.S.*)
506. PICTURES, H. H. Lake.—(*S. Czieger, Vienna.*)
507. CLOCKS, H. H. Lake.—(*A. M. Lane, Winsted, U.S.*)

2nd February, 1882.

508. AERATED LIQUORS, F. E. Wood, Workington.
509. SALT-CAKE, &c., G. S. Hazlehurst, Runcorn.
510. SLIPPING APPARATUS, G. Jenkins, Kingswood.
511. TURNTABLES, W. Morris, Birmingham.
512. STEERING GEAR, T. Archer, jun., Dunston.
513. ELECTRIC-METERS, C. V. Boys, Wing.
514. FURNACES, J. Brown, London.
515. SILVERING GLASS, J. E. Pratt, London.
516. SPRINGS, F. Wirth.—(*J. A. Widemann, Basel.*)
517. SADDLE, W. R. Lake.—(*F. G. Burley, Boston, U.S.*)
518. VELOCIPEDES, A. G. Meeze, Redhill, and A. G. Salamon and R. E. Phillips, London.
519. FIREPLACES, G. W. von Nawrocki.—(*R. Müller, Berlin.*)
520. DRIVING VELOCIPEDES, J. D. Ellson, Coventry.

3rd February, 1882.

521. CIGARETTES, R. Wallwork, Manchester.
522. VACUUM APPARATUS, E. Hunt.—(*A. R. Mackenzie, Mackay, Queensland.*)
523. ROUNDABOUTS, F. W. Woollacott, Nottingham.
524. VALVE-GEAR, J. Jensen, Birkenhead, and C. W. King, Liverpool.
525. BOOTS and SHOES, E. Turner, Ross.
526. WEIGHING MACHINERY, F. Wheeler, East Cowes.
527. PRESSING, &c., MACHINERY, A. V. Wagner.—(*P. C. Hudson, Fort Dodge, U.S.*)
528. JOINTING PIPES, J. H. Moore, Bournemouth.
529. CLARIFYING CONCOCTIONS, S. C. Davidson, Belfast.
530. CLARIFYING JUICES, S. C. Davidson, Belfast.
531. SIGNALLING APPARATUS, J. Mayers, Kidderminster.
532. BOILERS, T. A. Bickley, Birmingham.
533. GRAIN, A. W. Reddie.—(*H. F. St. Requier, Paris.*)
534. SIGNALLING APPARATUS, F. B. Brewer, London.
535. WINDING MACHINERY, B. M. Knox, Kilbirnie.
536. OVENS, D. and W. H. Thompson and W. J. Booer, Leeds.
537. GAS-BURNER, B. Verity, London.
538. ELECTRICAL ACCUMULATORS, W. R. Lake.—(*J. J. Barrier and F. T. de la Vernède, Paris.*)
539. BEDSTEADS, J. R. C. Taunton, Balsall Heath, and G. O. Aston, Birmingham.
540. DYNAMO-ELECTRICAL MACHINES, J. D. F. Andrews, Lanarkshire.
541. MAGNETIC MOTOR, T. Morgan.—(*J. C. Cuff, Singapore, and W. Judd, Penang.*)
542. HEATING, &c., W. R. Lake.—(*M. Levy, Paris.*)

4th February, 1882.

543. THROSTLE, &c., FRAMES, A. M. Fletcher, Oldham.
544. CUTTING APPARATUS, G. Otway, Brixton.
545. GATE LATCH, R. Lee, jun., Salford.
546. FOG-SIGNALLING, E. Moxon, Tunbridge Wells.
547. LAMPS, J. Pain and W. H. Gritton, jun., London.
548. STOVES, &c., R. George, Tufnell Park.
549. BLEACHING FIBRE, P. Thomas, Elberfeld.
550. VELOCIPEDES, R. Harrington, Wolverhampton, and T. Fuller, London.
551. TREATING FIBROUS MATERIAL, F. Wirth.—(*The Society for the Manufacture of Wood-pulp, Grellingen.*)
552. KNIFE-CLEANING MACHINES, W. H. Jones, Brixton.
553. METALLIC CASES, T. R. Bayliss, Northfield.
554. CONCENTRATING MILK, F. Springmuhl, London.
555. GRAPE JUICE, F. Springmuhl, London.
556. VENTILATING WINDOWS, E. and J. M. Verity and B. Banks, Leeds.
557. DYEING, F. A. Gatty, Accrington.
558. GAS FIRES, G. W. Wigner, London.
559. PRINTING, W. R. Lake.—(*The Société Secondo Roos and Francesco Ostrogovich, Florence.*)
560. BOILERS, &c., J. S. Williams, London.

6th February, 1882.

561. DUST COLLECTORS, P. V. Gelder, Sowerby Bridge.
562. VELOCIPEDES, E. R. Settle, Coventry.
563. ELECTRIC LAMPS, A. J. Jarman, London.
564. COFFER-DAMS, H. H. Lake.—(*H. P. Kirkham, U.S.*)
565. PACKING GLASS PLATES, A. Cowan, London.
566. FIREPLACES, T. Redmayne, Sheffield.
567. BLASTING, E. S. Clark, Cefn-y-bedd.
568. CHIMNEY COWLS, C. D. Abel.—(*H. Hahn, Berlin.*)
569. ROPES, S. Simmons and J. Tullidge, London.
570. PURIFYING GASES, W. S. R. Jackson, Llansamlet.
571. MILLING MACHINERY, J. W. Crawford and W. Mellor, Leeds.
572. DRYING WOOL, J. Shaw, Huddersfield.
573. SWELLS, W. Haythornthwaite, Blackburn.
574. COMPOSITION, J. Pover, Liverpool.
575. PURIFYING WATER, H. R. Lipscombe, London.
576. ROLLERS, W. Barford, T. Perkins, and E. J. Chambers, Peterborough.
577. COCKS, T. Morgan.—(*The Société Anonyme de Produits Chimiques.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

448. SCREW-NAILS, H. H. Lake, Southampton-buildings, London.—A communication from the American Screw Company, Incorporated, Providence, U.S. — 28th *January*, 1882.
478. DISINTEGRATING JUTE, &c., H. J. Haddan, Kensington, London.—A communication from A. Angell and W. B. Cunningham, New York, U.S.—*31st January*, 1882.
479. AUTOMATIC FEED APPARATUS, J. Hayes, Leadenhall-street, London.—A communication from E. Fromentin, Paris.—*31st January*, 1882.
507. CLOCKS, H. H. Lake, Southampton-buildings, London.—A communication from A. M. Lane, Winsted, U.S.—*1st February*, 1882.

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

433. ELASTIC ROLLERS, J. Burbridge, R. C. Thorpe, and T. Oakley, Tottenham.—*3rd February*, 1879.
437. SEWAGE WORKS, W. H. Denham, Southsea.—*3rd February*, 1879.
468. PRINTING MACHINES, W. L. Wise, London.—*5th February*, 1879.
478. IGNITING FUSES, W. B. and G. J. Smith, Tuckingmill.—*6th February*, 1879.
507. CARRIAGE STEPS, E. T. Phipson, Balsall Heath, and G. F. Abel, Birmingham.—*13th February*, 1879.
414. STAMPING APPARATUS, R. J. Edwards, London.—*1st February*, 1879.
443. COMBING WOOL, &c., I. Holden, Bradford.—*4th February*, 1879.
444. GLOVE FASTENINGS, E. Atkins, Birmingham.—*4th February*, 1879.
498. BRAKE APPARATUS, C. D. Abel, London.—*7th February*, 1879.
446. SEWING MACHINES, J. H. Johnson, London.—*4th February*, 1879.
447. COLOURING MATTERS, C. Casthélaz, Manchester.—*4th February*, 1879.
457. SHEARS, C. G. Hallas, F. W. Flower, and E. Pearson, Sheffield.—*5th February*, 1879.
469. TREATING PAPER, &c., N. J. Heckmann, Loughton.—*6th February*, 1879.
530. PAPER-CUTTING MACHINES, J. H. Johnson, London.—*11th February*, 1879.
590. MOUNTING ORDNANCE, G. W. Rendel, Newcastle-on-Tyne.—*14th February*, 1879.
453. MOULDS and CORES, A. M. Clark, London.—*4th February*, 1879.
673. EXTRACTING MUCUS, &c., from SEA-WEED, T. J. Smith, London.—*19th February*, 1879.
820. GRINDING MACHINES, A. M. Clark, London.—*28th February*, 1879.

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

384. DUPLEX and MULTIPLEX TELEGRAPHS, T. A. Edison, Newark, U.S.—*2nd February*, 1875.
483. CROCHET HOOKS and HANDLES, C. Devonport, Birmingham.—*9th February*, 1875.
412. CARVING FORKS, J. C. Haddan, Brixton, and H. Smith, London.—*4th February*, 1875.
702. CUTTING, &c., STONE, J. D. Brunton, London.—*25th February*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 24th February, 1882.

4183. BRICKS, &c., R. Stone, King William-street, London.—*28th September*, 1881.
4207. DYNAMO-ELECTRIC MACHINES, C. A. Barlow, Manchester.—A communication from M. A. de Meritens.—*29th September*, 1881.
4214. TREATING SEAWEED, H. E. Newton, London.—Com. from L. de Rousseau.—*29th September*, 1881.
4225. COLLIERY CORVES, J. Trippett and F. Hallam, Sheffield.—*30th September*, 1881.
4230. CARDING CANS, H. J. Haddan, London.—Com. from Gamiche-Narjoz.—*30th September*, 1881.
4231. FEEDING-BOTTLES, H. J. Haddan, London.—Com. from F. Klingspor.—*30th September*, 1881.
4232. WATCH-WINDERS and REGULATORS, H. J. Haddan, London.—A communication from J. B. Etcheverry.—*30th September*, 1881.
4237. MIXING FLOUR, H. J. Haddan, London.—Com. from C. L. Mee.—*30th September*, 1881.
4238. PROTECTING LOCOMOTIVE ENGINES, &c., C. Colwell, Southtown.—*30th September*, 1881.
4250. SEPARATING GASES, E. P. Alexander, London.—A communication from H. Haug.—*1st October*, 1881.
4266. FURNITURE CORD or TRIMMING, L. A. Walters and A. George, London.—*1st October*, 1881.
4288. GAS ENGINES, R. Simon and F. Wertenbruch, Wilford-road, Nottingham.—*3rd October*, 1881.
4290. PRINTING FLOORCLOTH, &c., W. R. Lake, London.—Com. from C. E. Benedict.—*3rd October*, 1881.
4315. FIXED CONVERTERS, J. Lloyd, Prior's Lee Hall, near Shifnal, Shropshire.—*4th October*, 1881.
4317. BICYCLES, &c., T. Warwick, Aston, near Birmingham.—*4th October*, 1881.
4345. REMOVING COAL, &c., J. Rigg, Chester.—*6th October*, 1881.
4361. STUDS, P. F. Allen, Bloomsbury, London.—*7th October*, 1881.
4390. TRIMMING the EDGES of the SOLES of BOOTS, W. R. Lake, London.—A communication from D. C. Knowlton.—*8th October*, 1881.
4404. BESSEMER CONVERTERS, A. L. Holley, Charing-cross, London.—*10th October*, 1881.
4405. ELECTRIC LIGHT, A. M. Clark, London.—A communication from M. de Changy.—*10th October*, 1881.
4424. SECURING the COVERINGS of VEHICLES, E. Gilbert and D. Sinclair, Dundee.—*11th October*, 1881.
4514. FORGING METALS, E. Dearden, Darnall, near Sheffield.—*17th October*, 1881.
4795. KILNS, G. W. von Nawrocki, Berlin.—A communication from E. Arnold.—*2nd November*, 1881.
4796. LAVATORIES and URINALS, G. H. and S. Jennings, Stangate.—*2nd November*, 1881.
4947. ELECTRO-PLATING, F. Wirth, Germany.—A communication from A. Classen.—*11th November*, 1881.
5105. TAPS for BARRELS, &c., W. Rose, Halesowen.—*22nd November*, 1881.
5491. GRINDING, &c., WIRE CARDS, A. W. L. Reddie, Chancery-lane, London.—A communication from W. Decker.—*15th December*, 1881.
5562. SEPARATING, &c., GRAIN, W. Burley and J. H. Morgan, St. John's.—*19th December*, 1881.
5626. BLEACHING FIBRES, J. Auchinvole, Glasgow.—*23rd December*, 1881.
5650. ALUM, P. and F. M. Spence, Manchester.—*24th December*, 1881.
5697. ARTIFICIAL HUMAN MILK, P. T. J. Voltmer, Birmingham.—A communication from O. Lahrmann.—*28th December*, 1881.
5713. TREATING YARN, C. W. Lightoller, Manchester, and J. Longshaw, Preston Brook.—*29th December*, 1881.
5732. FACILITATING the TOWING of LIGHTERS, &c., W. R. Lake, London.—A communication from H. Ressel.—*30th December*, 1881.
5751. CONTROLLING RAILWAY BRAKES, W. R. Lake, London.—A communication from A. L. Duvelius, L. W. Goss, P. Higgs, F. R. Merrell, H. D. Beck, and H. Walker.—*31st December*, 1881.
20. STITCHING MACHINES, J. Day, Stafford.—*3rd January*, 1882.
26. STOWING and SEATING SHIPS' ANCHORS, S. Baxter, Hornsey-lane, London.—*3rd January*, 1882.
36. SEWING MACHINES, W. R. Lake, London.—A communication from the Rotary Shuttle Sewing Machine Company.—*3rd January*, 1882.
85. UTILISING ELECTRICITY for LIGHTING and HEATING, W. R. Lake, London.—A communication from J. S. Williams.—*6th January*, 1882.
335. VACUUM PAN APPARATUS, H. H. Lake, London.—A communication from A. R. Mackenzie and J. F. Maclaren.—*23rd January*, 1882.
479. FEED APPARATUS for STEAM BOILERS, J. Hayes, London.—A communication from E. Fromentin.—*31st January*, 1882.

Last day for filing opposition 28th February, 1 82.

4122. COMBINED KNIFE, FORK, and SPOON, L. A. Groth, London.—A communication from F. Praunegger.—*24th September*, 1881.
4123. STOPPERING BOTTLES, L. A. Groth, London.—Com. from F. Praunegger.—*24th September*, 1881.
4252. ORNAMENTING SURFACES of SHEET METAL, A. N. Hopkins, Birmingham, and G. Hatton, Kidderminster.—*1st October*, 1881.
4253. FEEDING FUEL to FURNACES, J. McMillan, Glasgow.—*1st October*, 1881.
4255. SECONDARY GALVANIC BATTERIES, A. Watt, Liverpool.—*1st October*, 1881.
4269. SEWING MACHINES, F. Cutlan, Cardiff.—*1st October*, 1881.
4275. STEAM BOILERS, J. L. Rastrick, Draper's-gardens, London.—*3rd October*, 1881.
4282. CONFECTIONERY, J. L. Collier, Rochdale.—*3rd October*, 1881.
4294. ELECTRIC LAMPS, A. G. Schaffer, Newcastle-on-Tyne.—*4th October*, 1881.
4300. PIPES, F. des Voeux, London.—A communication from M. Marx.—*4th October*, 1881.
4305. ELECTRIC LAMPS, H. J. Haddan, London.—A communication from L. Somzée.—*4th October*, 1881.
4306. FURNACES, G. Eyre, Codnor.—*4th October*, 1881.
4321. SCREW-PROPELLERS, J. Jones, Liverpool.—*5th October*, 1881.
4326. STOP VALVES, &c., J. Margerison, Preston.—*5th October*, 1881.
4331. DECORATING ARTISTIC ARTICLES, W. H. Beck, London.—A communication from H. Starcke.—*5th October*, 1881.
4351. SEWING MACHINES, H. Simon, Manchester.—A communication from F. B. Köhler.—*6th October*, 1881.
4360. SNOW, F. N. Mackay, Liverpool.—*7th October*, 1881.
4418. CALCINING METALS, R. Mackenzie, Southampton-buildings, London.—*11th October*, 1881.
4435. SMELTING ORES, J. W. Chenhal, Morriston.—*11th October*, 1881.
4449. BRUSHING the SURFACES of POLYGONAL, &c., MACHINES, F. Stansfield, Bradford.—*12th October*, 1881.
4484. SLEDGES, &c., for VEHICLES, W. B. L. de Hagulerd, Springfield.—*14th October*, 1881.
4627. SHOES for HORSES, &c., J. Bidder and M. J. Rowley, London.—*22nd October*, 1881.
4737. BEAM SCALES, &c., W. B. Avery, Birmingham.—*29th October*, 1881.
4847. PREPARING WOOL, &c., G. Little, Oldham.—*5th November*, 1881.
4854. STORING, &c., ELECTRICITY, J. B. Rogers, London.—*5th November*, 1881.
5190. SECURING HANDLES, &c., G. Harper, Lennox-road, London.—*28th November*, 1881.
5198. REGULATING ELECTRIC CURRENTS, C. H. W. Biggs and W. W. Beaumont, London.—*28th November*, 1881.
5268. TEXTILE FABRICS, C. D. Abel, London.—A communication from F. Schmalbein.—*1st December*, 1881.
5409. INDICATORS for GAS, &c., C. I. and F. Edmondson, Manchester.—*10th December*, 1881.
5504. LOCKS of FIRE-ARMS, E. Bled and E. Richoux, Paris, and J. Warnant, Liege, Belgium.—*16th December*, 1881.
5520. LOCKS of FIRE-ARMS, E. Bled and E. Richoux, Paris, and J. Warnant, Liege.—*16th December*, 1881.
5565. FLESHING, &c., SKINS, T. H. Potter and G. Rice, London.—*20th December*, 1881.
5582. TIPPING-WAGONS, H. Grafton, Chancery-lane, London.—*21st December*, 1881.
10. TUYERES of BLAST FURNACES, E. G. Brewer, London.—Com. from T. Martin.—*2nd January*, 1882.
45. ROLLER MILLS, A. V. Newton, London.—A communication from A. Mechwart.—*4th January*, 1882.
62. TREATING TIMBER, S. B. Boulton, London.—*5th January*, 1882.
84. DYNAMO-ELECTRIC MACHINES, W. R. Lake, London.—Com. from C. E. Ball.—*6th January*, 1882.
109. SODA, W. Weldon, Rede Hall, Burstow.—A communication from Dr. M. Schaffner and W. Helbig.—*9th January*, 1882.
133. CONVERTERS, J. H. Johnson, London.—Com. from W. H. Henderson.—*10th January*, 1882.
134. TREATING ANIMAL REFUSE, J. H. Johnson, London.—Com from A. J. Rinet.—*10th January*, 1882.
448. SCREW NAILS, H. H. Lake, London.—A communication from the American Screw Company (Incorporated).—*28th January*, 1882.

Patents Sealed.

(List of Letters Patent which passed the Great Seal on the 3rd February, 1882.)

2974. CASES for CARRYING FRUIT, G. A. Cochrane, Liverpool.—*7th July*, 1881.
3378. ARTIFICIAL MANURE, H. F. S. d'Esplaviz, London.—*4th August*, 1881.
3403. SUGAR, J. Duncan, Mincing-lane, London.—*5th August*, 1881.
3410. FIREPROOF DOCUMENTS, J. R. Melhé, Laurence Pountney-hill, London.—*6th August*, 1881.
3418. INDICATING DEPTH of WATER, &c., J. Dillon, Dublin.—*8th August*, 1881.
3430. PUMPING APPARATUS, A. Stierlin, Manchester.—*8th August*, 1881.
3456. PERMANENT WAY, C. Dunscombe, Liverpool.—*10th August*, 1881.
3468. SPRING SADDLE-BARS, G. Curtis, South Molton-street, London.—*10th August*, 1881.
3486. MARKING, &c., CORKS, W. R. Lake, Southampton-buildings, London.—*11th August*, 1881.
3535. CEMENT, I. C. Johnson, Mayfield House, Gravesend.—*15th August*, 1881.
3542. OIL, W. P. Thompson, High Holborn, London.—*16th August*, 1881.
3575. BLEACHING LINEN, C. D. Abel, Southampton-buildings, London.—*17th August*, 1881.
3606. METALLIC STRUCTURES, C. D. Abel, Southampton-buildings, London.—*19th August*, 1881.
3609. STRETCHERS, J. Furley, South Park, Sevenoaks. *19th August*, 1881.
3646. WET EXTRACTION of LEAD, H. J. Haddan, Kensington, London.—*22nd August*, 1881.
3655. REGULATING ELECTRIC CURRENTS, R. E. Dunston, Donhead, St. Mary, and G. Pfannkuche, Delahay-street, London.—*22nd August*, 1881.
3658. HARVESTING MACHINES, W. R. Lake, London.—*22nd August*, 1881.
3675. SORTING, &c., GRAIN, K. H. Sander, Zweinaundorf, near Leipzig.—*23rd August*, 1881.
3693. FLUID METERS, H. C. van de P. Ahrbecker and H. E. J. Hamkens, London.—*24th August*, 1881.
4042. GAS and OIL STOVES, S. Clark, Park-street, London.—*19th September*, 1881.
4101. CLEANSING BUILDINGS, &c., G. J. C. M. B. de Liebhaber, France.—*23rd September*, 1881.
4335. HARBOURS, &c., W. R. Kinipple, Westminster-chambers, London.—*5th October*, 1881.
4707. WINDOW-SASHES, J. H. Miles, Southampton.—*27th October*, 1881.
4871. DRYING, &c., FRUIT, W. H. E. Poulett, Crewkerne, and G. Hall, Droxford.—*7th November*, 1881.
4918. LAYING HOLD of SUNKEN VESSELS, J. Standfield and J. L. Clark, London.—*9th November*, 1881.
5022. COLD-AIR MACHINES, E. Hesketh, Dartford.—*16th November*, 1881.
5100. ROTARY ENGINES, J. Patten, San Francisco, U.S.—*22nd November*, 1881.
5231. MOTIVE-POWER ENGINES, J. Bell, Wishaw.—*30th November*, 1881.
5269. PURIFYING COAL GAS, J. Walker, Elmwood-place, Leeds.—*2nd December*, 1881.

(List of Patent Letters which passed the Great Seal on the 7th February, 1881.)

2749. STEAM, &c., STITCHING GEAR, A. Higginson, Liverpool.—*23rd June*, 1881.
3432. SECURING INDIA-RUBBER TIRES, W. R. Foster and T. J. Williams, Bermondsey.—*8th August*, 1881.
3447. ATTACHING HANDLES, &c., W. G. Macvitie, Sutton Coldfield, near Birmingham.—*9th August*, 1881.
3460. SAVING LIFE, J. Evans and R. Low, Dundee.—*10th August*, 1881.
3462. FINISHING, &c., WOVEN FABRICS, D. Stewart, Glasgow.—*10th August*, 1881.
3464. ELECTRIC BRAKE, S. von Sawiczeski, Paris.—*10th August*, 1881.
3465. GRATERS, J. G. Thresher, Old-street, London.—*10th August*, 1881.
3480. COMBING FIBRES, J. Heaton, Bradford.—*11th August*, 1881.
3485. GENERATING ELECTRICITY, I. L. Pulvermacher, London.—*11th August*, 1881.
3502. DIFFERENTIAL VALVE GEAR, H. W. Pendred, Manchester.—*12th August*, 1881.
3503. SPINNING, &c., J. Seed, Preston.—*12th August*, 1881.
3510. HORIZONTAL PRESSES, C. Humfrey, Hough Green, Chester.—*12th August*, 1881.
3511. PARAFFINE, &c., L. Hislop, Hough-green, Chester.—*12th August*, 1881.
3536. REFRIGERATING MACHINES, L. Sterne, D. Clerk, and J. B. Handyside, Glasgow.—*15th August*, 1881.
3540. MATCH-BOXES, R. H. Thompson, London.—*15th August*, 1881.
3572. VELOCIPEDES, G. Richards, Manchester, and J. C. Tilghman, London.—*17th August*, 1881.
3587. VELOCIPEDES, A. W. Robinson, Birmingham.—*17th August*, 1881.
3598. LOOMS, E. Smith, Houley, near Huddersfield.—*18th August*, 1881.
3670. COOLING and COMPRESSING AIR, W. R. Lake, London.—*23rd August*, 1881.
3682. MEASURING, &c., the FLOW of LIQUIDS, W. B. Healey, London.—*24th August*, 1881.
3723. KNITTED FABRICS, F. Caldwell, Loughborough, Leicester.—*26th August*, 1881.
3773. BOX for HOLDING SOAP, &c., W. R. Lake, London.—*30th August*, 1881.
4121. DRIVING BICYCLES, T. E. Heath, jun., Penarth.—*24th September*, 1881.
4229. COMPOSING, &c., TYPE, H. J. Haddan, London.—*30th September*, 1881.
4456. FURNACES, W. Black, South Shields, and T. Larkin, East Jarrow.—*13th October*, 1881.
4732. MERINO, &c., J. Kershaw, Macclesfield.—*28th October*, 1881.
4810. NON-CONDUCTING COMPOSITION, L. Masche, Hamburg.—*3rd November*, 1881.
4948. ELECTRIC LAMPS, G. G. André, Dorking.—*11th November*, 1881.
5021. SUPPOSITORIES, B. J. B. Mills, London.—*10th November*, 1881.
5084. BOTTLES, &c., J. Pattison, Newton-terrace, London.—*21st November*, 1881.
5208. STOPPERING BOTTLES, H. Mardon, Bristol.—*29th November*, 1881.
5216. HYDRAULIC MOTORS, J. E. Lardet, Brockley, and T. Donnithorne, London.—*29th November*, 1881.
5254. PICK-AXES, T. N. Robson, Newbottle.—*1st December*, 1881.
5256. LUBRICATORS, J. Davis, Great Dover-street, London.—*1st December*, 1881.

List of Specifications published during the week ending February 4th, 1881.

910, 6d.; 2474, 2d.; 2497, 6d.; 2669, 8d.; 2680, 6d.; 2723, 6d.; 2736, 4d.; 2748, 6d.; 2754, 6d.; 2769, 6d.; 2771, 2s. 2d.; 2778, 6d.; 2787, 6d.; 2793, 6d.; 2814, 6d.; 2815, 4d.; 2818, 6d.; 2831, 6d.; 2839, 6d.; 2847, 6d.; 2853, 6d.; 2861, 6d.; 2864, 6d.; 2881, 2d.; 2883, 2d.; 2834, 2d.; 2887, 2d.; 2888, 2d.; 2891, 4d.; 2893, 2d.; 2894, 2d.; 2895, 2d.; 2896, 6d.; 2899, 2d.; 2901, 8d.; 2904, 2d.; 2908, 2d.; 2912, 4d.; 2914, 4d.; 2916, 2d.; 2918, 2d.; 2921, 2d.; 2930, 2d.; 2933, 8d.; 2934, 2d.; 2936, 2d.; 2937, 2d.; 2940, 2d.; 2245, 2d.; 2946, 4d.; 2948, 2d.; 2950, 2d.; 2951, 2d.; 2952, 4d.; 2956, 2d.; 2959, 2d.; 2960, 2d.; 2964, 6d.; 2965, 2d.; 2966, 10d.; 2967, 2d.; 2971, 4d.; 2973, 2d.; 2975, 2d.; 2978, 2d.; 2980, 2d.; 2983, 2d.; 2984, 2d.; 2985, 2d.; 2987, 4d.; 2993, 8d.; 3002, 2d.; 3005, 2d.; 3012, 4d.; 3013, 6d.; 3015, 4d.; 3031, 6d.; 3083, 2d.; 4023, 6d.; 4437, 6d.; 4660, 6d.; 4779, 4d.; 4912, 6d.; 4913, 6d.; 4914, 6d.; 4988, 4d.

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

ABSTRACTS OF SPECIFICATIONS.

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

1942. ELECTRIC ARC LAMPS, *J. Brockie, Brixton.*—*4th May*, 1881. 6d.

Solenoids in the main and shunt circuit are used in a peculiar way, the shunt solenoid to release, retard, or stop the feeding train, while the main solenoid lightens or slackens the spring against which the other

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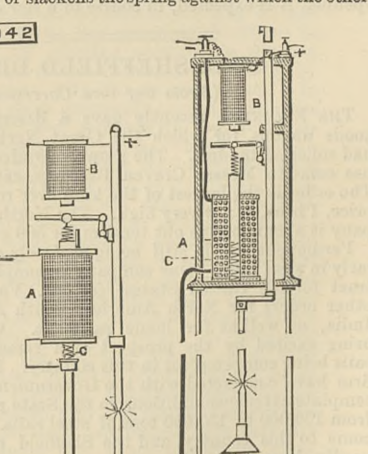
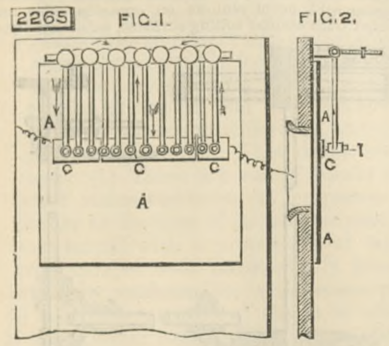


acts. In Fig. 1 A is the main, B the shunt solenoid, C a spring drawing upwards the core of A, against the action of the coil pulling it down. A modification is shown in Fig. 2 when three solenoids are used.

2265. IMPROVEMENTS IN TELEPHONE TRANSMITTING APPARATUS, *J. T. Gent and H. G. Ellery, Leicester.—24th May*, 1881. 6*d*.

Figs. 1 and 2 show the arrangement adopted. On the wood diaphragm A, which is fixed a little distance from the cover, are fastened thin plates of carbon C C,



against which rest the carbon plugs I I, as shown. The multiple contacts are claimed, and the use of flexible tubes to protect the wires.

2474. BOILERS, *A., J. T., and R. Anderton, Accrington.—7th June*, 1881.—(*Void*.) 2*d*.

This relates to the form and construction of flues for internally-fired boilers.

97. PROVISION CASES OR BOXES, &c., *W. Rollason, London.—8th June*, 1881. 6*d*.

This relates to the employment of a wire soldered round the lid of the case, the end of which wire is taken hold of by a suitable instrument for the purpose of cutting open the case.

2669. GAS RETORTS, &c., *G. Anderson, Westminster.—18th June*, 1881. 8*d*.

Two or more gas retorts are constructed from fire-bricks, side by side and parallel with one another.

2680. MONOCYCLES, *L. H. Pearce, Hammersmith.—18th June*, 1881. 6*d*.

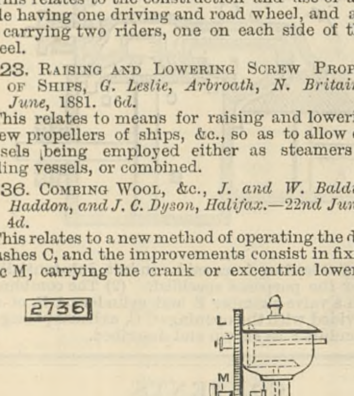
This relates to the construction and use of a velocipede having one driving and road wheel, and adapted for carrying two riders, one on each side of the said wheel.

2723. RAISING AND LOWERING SCREW PROPELLERS OF SHIPS, *G. Leslie, Arbroath, N. Britain.—21st June*, 1881. 6*d*.

This relates to means for raising and lowering the screw propellers of ships, &c., so as to allow of such vessels being employed either as steamers or as sailing vessels, or combined.

2736. COMBING WOOL, &c., *J. and W. Baldwin, R. Haddon, and J. C. Dyson, Halifax.—22nd June*, 1881. 4*d*.

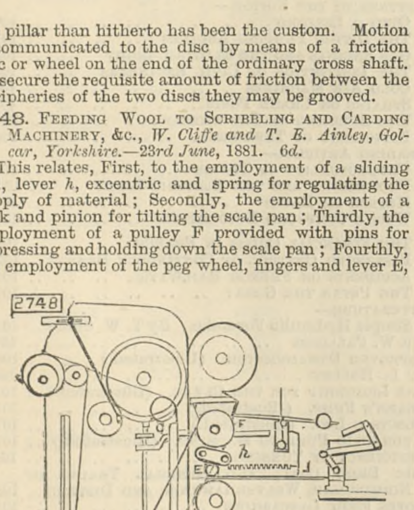
This relates to a new method of operating the dabbing brushes C, and the improvements consist in fixing the disc M, carrying the crank or excentric lower down



the pillar than hitherto has been the custom. Motion is communicated to the disc by means of a friction disc or wheel on the end of the ordinary cross shaft. To secure the requisite amount of friction between the peripheries of the two discs they may be grooved.

2748. FEEDING WOOL TO SCRIBBLING AND CARDING MACHINERY, &c., *W. Cliffe and T. E. Ainley, Golcar, Yorkshire.—23rd June*, 1881. 6*d*.

This relates, First, to the employment of a sliding rod, lever *h*, excentric and spring for regulating the supply of material; Secondly, the employment of a rack and pinion for tilting the scale pan; Thirdly, the employment of a pulley F provided with pins for depressing and holding down the scale pan; Fourthly, the employment of the peg wheel, fingers and lever E,



for releasing and elevating the scale pan; Fifthly, the combination of a hopper having a movable bottom with the scrolls and bands for raising the same at a variable speed; Sixthly, the arrangement of the door of the hopper in such manner that it may be converted into a support for the material in the upper portion whilst the lower portion is being refilled.

2754. RESERVOIR PENS, &c., *W. R. Lake, London.—23rd June*, 1881.—(*A communication from F. X. Poznánski, Paris*.) 6*d*.

This comprises a holder, in which a supply of ink is held, and separate ink receptacle, whose bottom consists of an elastic or yielding membrane or diaphragm, and from which the ink is supplied to the said holder.

2769. SLIDING TOOL HOLDER AND GUIDE, *W. R. Lake, London.—24th June*, 1881.—(*A communication from R. Dervaux-Ibled and G. N. Schœnberg, Paris*.) 6*d*.

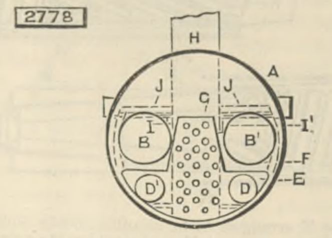
This relates to a guiding device or arrangement in which there are external angular guides and means for elastic compensation.

2771. SCREW-CUTTING, TAPPING, TURNING, AND FINISHING SCREW BOLTS, NUTS, &c., *A. M. Clark, London.—24th June*, 1881.—(*A communication from Messrs. Daville and Montelout, Paris*.) 2*s*. 2*d*.

This relates to machinery and tools for screw-cutting, tapping, and turning, and also to special arrangements for centreing and dismounting the work. The tool holders are specially arranged to hold cutters of suitable dimensions grooved longitudinally, and made either of oval, square, or flat section.

2778. STEAM GENERATORS, *W. Cooke and D. Mylchreest, Liverpool.—25th June*, 1881. 6*d*.

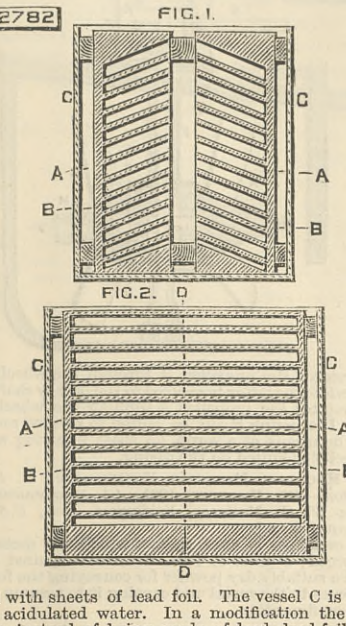
In the drawing A is the cylindrical shell, B B[1] are two internal furnaces opening into fire or flame chambers at the rear of the generator; flues or tubes D D[1] lead from the said chambers to the smoke-box E, the top F of which forms a stoking platform; G are



delivery or discharge tubes leading from the said smoke-box E to the uptake or flue H. I I[1] are dampers or valves secured to the shafts J, and free to be moved so as to open or close the passages to the uptake or flue H.

2782. SECONDARY BATTERIES, *H. E. Newton, London.—25th June*, 1881.—(*A communication from the Société Universelle d'Electricite Tommasi, Paris*.) 6*d*.

Fig. 1—a cross section of Fig. 2 in line D D—shows A A a pair of flanged plates cast with shelves B B about 5 millimetres apart, with an upward angle of 30 deg. to 40 deg. The spaces between the shelves are



fitted with sheets of lead foil. The vessel C is filled with acidulated water. In a modification the electrodes, instead of being made of lead, lead-foil, &c., are made firstly of an alloy of lead and tin, the tin being extracted by electrolysis, leaving the lead in a spongy condition.

2787. DRYING, ROASTING, HEATING, OR COOLING SUBSTANCES, *J. C. Mewburn, London.—25th June*, 1881.—(*A communication from F. Stroehmer and W. H. Eales, Dresden, Saxony*.) 6*d*.

This consists in an apparatus in which the material under treatment moves or travels downwards from one to another of a series of stages or floors within a cylinder, and falls alternately at the periphery and at the centre; of the employment of a system of pipes, through which a heating medium circulates, these pipes being arranged between the floors, which are situated at or about the middle of the cylinder, so that the main heating of the material takes place in the middle stages, while in the upper stages the material receives a preliminary heating, and in the lower stages it is cooled by imparting heat to the ascending air admitted from below.

2793. VENETIAN BLINDS, *J. L. Seymour, New Cross.—25th June*, 1881. 6*d*.

This relates to the employment of fixings which are secured to the top bar and to the bottom rail of the blind.

2814. MANUFACTURING ENVELOPES FOR BOTTLES, *W. H. Beck, London.—27th June*, 1881.—(*A communication from P. Marbœuf, Cognac, and C. Wilhelm, Argenbat, France*.)—(*Not proceeded with*.) 6*d*.

This consists partly in the folding of the straw as the sewing goes on by portions exactly corresponding to the length of the stitches of sewing.

2815. PREPARING OR COATING BAGS, &c., *A. M. Clark, London.—27th June*, 1881.—(*A communication from J. T. Tichenor, Auburn, Alabama. U.S.*) 4*d*.

This consists in applying a coating of a mixture of clay and tar on both the inner and outer surfaces of the material.

2818. PREVENTING ESCAPE OF SPARKS AND SOOT FROM CHIMNEYS, *W. R. Lake, London.—27th June*, 1881.—(*A communication from A. Petzold, Berlin*.) 6*d*.

This relates partly to the combination with cones and spiral plates or blades of a hood or case having a cover and cylinders.

2823. SECONDARY BATTERIES, *A. P. Laurie, Edinburgh.—28th June*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to the use of zinc and carbon electrodes in a solution of iodide of zinc.

2831. LAMPS, *H. J. Haddan, London.—28th June*, 1881.—(*A communication from E. S. Piper, Toronto, Canada*.) 6*d*.

This consists partly in combination with a lamp provided with a leg which is made hollow, but closed at both ends, of perforations made in the leg near to its base for the purpose of admitting cold air, with similar perforations near the top end of the leg for the purpose of permitting the air in the leg to escape into a specially formed chamber below the base of the lamp, by which the burner is supplied with fresh air, while at the same time it is protected from sudden gusts of wind.

2839. SCREW BOLTS, &c., *W. R. Lake, London.—28th June*, 1881.—(*A communication from C. H. Denison and E. F. Mead, New York, U.S.*) 6*d*.

This consists of a bolt having a screw thread and cam-shaped or excentric shank in combination with the nut and the jam nut having a cam-like or excentric bore or interior corresponding in shape with the cross section of the said shank of the bolt.

2847. COLLECTING FARES IN TRAM-CARS, &c., *W. R. Lake, London.—29th June*, 1881.—(*A communication from J. J. Greenough, Syracuse, U.S.*) 6*d*.

This consists of horizontal receptacles affixed to a passenger conveyance, and having an elongated opening or openings therein, for receiving fares at points along their whole length, and provided with a revolving or travelling belt for conveying the same to a receiver or fare box at the end of the vehicle.

2853. APPARATUS FOR STARTING AND STOPPING TRAM-CARS, *A. Piffard, Hemel Hempstead, and C. H. Gimingham, London.—29th June*, 1881. 6*d*.

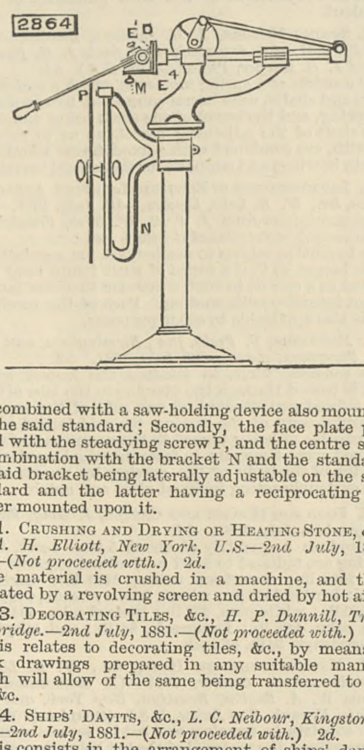
This consists of an endwise movable frame carrying two spindles (one to come in front and the other in rear of a wheel or wheels of a vehicle, so that by moving the frame endwise a roller on one or other spindle can be brought against the periphery of the wheel) in combination with a spring or springs, in such manner that the turning of one roller by being brought against the periphery of the wheel is made to extend or wind up the spring, whilst when the other roller is caused to bear against the periphery of the wheel, the spring is made to turn this roller and revolve the wheel in a direction to start the vehicle forwards.

2861. STEAM BOILERS OR GENERATORS, *F. H. F. Engel, Hamburg.—30th June*, 1881.—(*A communication from A. W. Schultze and G. Meyer, Hamburg*.) 6*d*.

This consists in the combination of a main boiler with one or more additional boilers, in such manner that the steam of the main boiler generated by direct firing is used for producing secondary steam in the additional boilers.

2864. APPARATUS FOR SHARPENING OR FILING THE TEETH OF SAWS, *F. Myers, New York.—30th June*, 1881. 6*d*.

This consists, First, of file clamping jaws hinged to lugs upon the disc E[1], which may be turned upon the disc or plate D attached to the reciprocating shaft, and is provided with the arm E[4] carrying the set screw M, these devices being mounted on a standard



and combined with a saw-holding device also mounted on the said standard; Secondly, the face plate provided with the steadying screw P, and the centre stud in combination with the bracket N and the standard, the said bracket being laterally adjustable on the said standard and the latter having a reciprocating file carrier mounted upon it.

2881. CRUSHING AND DRYING OR HEATING STONE, &c., *A. H. Elliott, New York, U.S.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

The material is crushed in a machine, and then separated by a revolving screen and dried by hot air.

2883. DECORATING TILES, &c., *H. P. Dunnill, Trowbridge.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to decorating tiles, &c., by means of chalk drawings prepared in any suitable manner which will allow of the same being transferred to the tile, &c.

2884. SHIPS' DAVITS, &c., *L. C. Neibour, Kingston.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This consists in the arrangement of ships' davits, and in the apparatus connected therewith for raising and lowering boats therefrom.

2887. SILK-DRESSING REELS OF FLOUR-DRESSING MACHINES, *J. Thornton, Worksop.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This consists in the application and use of a brush or brushes, or other suitable and soft material in connection with the silk-dressing reels of flour-dressing machines, for the purpose of clearing the silk surface of the reels.

2888. RAISING BEER, &c., *J. K. J. Foster, Bolton.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to the employment of a compressing air pump to be worked by a treadle or other suitable contrivance for the purpose of raising the beer from the cellar to the bar.

2891. EFFECTING THE SEPARATION OF SOLID BODIES FROM EACH OTHER, &c., *H. J. Smith, Glasgow.—2nd July*, 1881.—(*Not proceeded with*.) 4*d*.

The machine is constructed so that two circular or other shaped vessels provided with inlets and outlets, which may be protected by filtering apparatus, rotate together about the same axis, and whose edges, flanged and so arranged as to obtain close and perfect contact, are brought together or separated during rotation.

2893. RAILWAY CARRIAGES, *F. C. Kinnear, London.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to the employment in the end walls of the carriage of sight apertures.

2894. CLASP KNIVES AND RAZORS, *C. Carter, London.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This consists essentially of a bolt or plate fitted to be slid in one half of the handle to engage in or be released from a notched catch or stud, projecting from the inner side of the other half of the handle.

2895. TRICYCLES, &c., *G. Lowry, Salford.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to the arrangement and construction of the wheels.

2896. WHEELS FOR VEHICLES, *W. H. Carmont, Manchester.—2nd July*, 1881. 6*d*.

A weldless tire is employed, and in the periphery a recess is formed, into which an elastic material is inserted.

2899. APPARATUS FOR FACILITATING THE DISCHARGE OF LIQUIDS WITHOUT DISTURBING THE SEDIMENT, &c., *C. H. von Ullner.—2nd July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to a syphon regulator.

2901. CARD-SETTING MACHINES, *J. Haley and J. Pinder, Cleckheaton, Yorks.—2nd July*, 1881. 8*d*.

This relates to the construction and combination of apparatus for self-actingly stopping the machine when from any cause the "feed" or supply of wire from which the cards are made is interrupted, and also when the formation of the teeth is not perfected, or when the "crookers" are broken or injured, and when "maring"—that is to say, bent or imperfect—teeth are inserted in, or partly inserted in, the clothing or foundation.

2904. FURNITURE POLISH, &c., *W. Moore, Lymington.—4th July*, 1881.—(*Not proceeded with*.) 2*d*.

This consists in the combination of linseed or similar oil with methylated or like spirit.

2908. APPARATUS FOR GROWING WATER-CRESS, *G. C. Pimbury, Cheltenham.—4th July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to tanks in which water flows over a series of water-tight divisions containing sand, on the top of which the water-cress is grown.

2914. COMPOUND RESEMBLING WOOD, *C. D. Abel, London.—4th July*, 1881.—(*A communication from B. Harrass, Bohlen*.) 4*d*.

This consists mainly in the admixture of cellulose or paper material reduced to pulp with starch and flour.

2916. FASTENING FOR GLOVES, BOOTS, AND SHOES, &c., *C. D. Abel, London.—4th July*, 1881.—(*A communication from H. M. Peyser, Boston, U.S.*)—(*Not proceeded with*.) 2*d*.

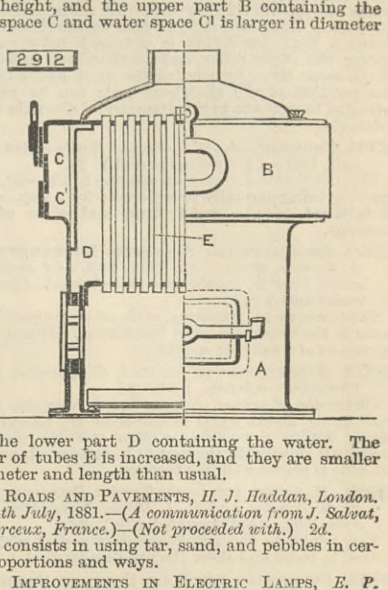
This relates to the arrangement of the hooks and the means of attaching them.

2918. HOLDERS FOR DISPLAYING COLLARS, &c., *E. Barton, Tottenham.—4th July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to an adjustable frame or ring to receive the collar, &c., and which can be fixed in position on a stand or rod by a set screw.

2912. VERTICAL STEAM BOILERS, *G. Kingdon, Devon.—4th July*, 1881. 4*d*.

The outer shell A is of large diameter in proportion to its height, and the upper part B containing the steam space C and water space C[1] is larger in diameter



than the lower part D containing the water. The number of tubes E is increased, and they are smaller in diameter and length than usual.

2921. ROADS AND PAVEMENTS, *H. J. Haddan, London.—4th July*, 1881.—(*A communication from J. Salvat, Morceux, France*.)—(*Not proceeded with*.) 2*d*.

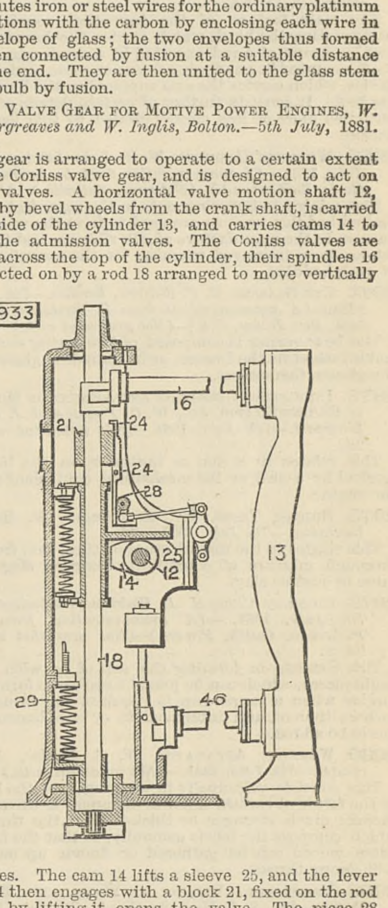
This consists in using tar, sand, and pebbles in certain proportions and ways.

2930. IMPROVEMENTS IN ELECTRIC LAMPS, *E. P. Ward.—5th July*, 1881. 2*d*.

This relates to incandescent lamps. The inventor substitutes iron or steel wires for the ordinary platinum connections with the carbon by enclosing each wire in an envelope of glass; the two envelopes thus formed are then connected by fusion at a suitable distance from the end. They are then united to the glass stem of the bulb by fusion.

2933. VALVE GEAR FOR MOTIVE POWER ENGINES, *W. Hargreaves and W. Inglis, Bolton.—5th July*, 1881. 8*d*.

The gear is arranged to operate to a certain extent like the Corliss valve gear, and is designed to act on Corliss valves. A horizontal valve motion shaft 12, driven by bevel wheels from the crank shaft, is carried at the side of the cylinder 13, and carries cams 14 to open the admission valves. The Corliss valves are placed across the top of the cylinder, their spindles 16 being acted on by a rod 18 arranged to move vertically



in guides. The cam 14 lifts a sleeve 25, and the lever piece 24 then engages with a block 21, fixed on the rod 18, and by lifting it opens the valve. The piece 28 causes the lever 24 to be disengaged from the block, and the rod 18 then falls by its own weight and the tension of spring 29. The exhaust valves 46 aré worked from the valve motion shaft by any suitable means.

2934. COMBINED ROTARY KNIFE AND FORK CLEANER, *W. Scott, Hampstead.—5th July*, 1881.—(*Not proceeded with*.) 2*d*.

This consists of two discs provided with lugs or pins on the outer faces at or near the edges for lacing wires, by which segmental pieces of leather are secured in position, in addition to being cemented to the inner surfaces of the discs. The inner surfaces of the discs are provided with concentric grooves for the reception of rubber rings, which form cushions between the discs and the leather.

2936. TRICYCLES, &c., *R. Jones, Liverpool.—5th July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates partly to making the velocipedes with three large wheels, with saddle and cranks to each.

2937. FASTENINGS FOR ALBUMS, &c., *A. J. Boult, London.—5th July*, 1881.—(*A communication from J. C. Koch, Berlin*.)—(*Not proceeded with*.) 2*d*.

This consists essentially in a clasp or bridge piece of suitable shape which fits over a stud on one of the backs of the book in the ordinary manner. The sides of the clasp slide in bearings upon or forming part of a cover or casing, which is hinged to the other "back" as usual.

2940. CHURNS, *C. Slater, Barnoldswick.—5th July*, 1881.—(*A communication from J. W. Plewes, Lynedock, Canada*.)—(*Not proceeded with*.) 2*d*.

This consists in constructing the churn with a body having curved ends; the body is mounted in an upright swinging support, to which is imparted a combined rocking and swinging motion by means of a crank or cam.

2945. APPLYING PICTURES OR DECORATIONS TO DOOR PANELS, &c., *F. D. Harding, Hampstead Heath.—5th July*, 1881.—(*Not proceeded with*.) 2*d*.

This relates to the employment of strips of metal for securing the pictures, these strips being inserted under the beading.

2946. CALORIC OR HOT AIR ENGINES, AND CARRIAGES FOR SAME, *L. Wolff, Magdeburg, Germany.—5th July*, 1881.—(*Not proceeded with*.) 4*d*.

The vehicle consists of two divisions forming separate spaces, the rear one of which serves for the passengers or goods to be conveyed, and the front one for the reception of the hot air motors. The latter is a double-acting hot air engine having a working cylinder and a closed fire-box.

2948. PRODUCING MULTIPLE COPIES OF WRITINGS, DRAWINGS, &c., *W. R. Lake, London.—5th July*, 1881.—(*A communication from H. Schmitt, Prague, Austria*.)—(*Not proceeded with*.) 2*d*.

This relates to the manufacture of gelatinous compounds.

2950. CAR AXLE LUBRICATORS, *H. J. Haddan, London.—5th July*, 1881.—(*A communication from C. G. Till and H. R. Randall*.)—(*Not proceeded with*.) 2*d*.

This relates to a car axle lubricator composed of a spiral spring adapted to rest on the bottom of the axle-box, a flexible jacket enclosing said spring on its sides and bottom, a wiper roller, a flexible sheet metal frame fastened to the spring and provided with ears to form the bearing for the axle of the wiper roller, absorbent pads secured to the flexible sheet metal frame on opposite sides of the wiper roller, and wicks depending from said pads, so that by the sheet metal frame a firm connection is obtained between the spring, the wiper roller, and the absorbent pads, and at the same time, by bending the sheet metal frame, the position of the absorbent pads can be readily adjusted to conform to the diameter of the axle to be lubricated.

2951. TROUSERS. *A. W. Adams, Southampton.—6th July, 1881.—(Not proceeded with.)* 2d.

This consists in forming an opening in the seat, such opening being normally covered over by a flap, which is fastened to the waist band and sides of the garment.

2956. SELF-ADJUSTING SURVEYING INSTRUMENTS, *E. A. Brydges, Berlin.—6th July, 1881.—(A communication from W. Hamburger, Copenhagen.)—(Not proceeded with.)* 2d.

This consists in attaching such an arrangement of parts to the tripod that the instrument adjusts itself by means of a suitable weight.

2959. MANUFACTURE OF STEEL, *J. C. Ramsden, Filey, Yorkshire.—6th July, 1881.* 2d.

Carbonate of potass and powdered vegetable charcoal in or about equal proportions are mixed and placed within a crucible or other suitable vessel or receptacle along with the iron to be converted, and the crucible is placed within a furnace.

2960. MARKERS FOR LAWN TENNIS, BILLIARDS, &c., *W. H. Douglas and E. J. Collis, Stourbridge.—6th July, 1881.—(Not proceeded with.)* 2d.

This relates to the employment of a dial which is caused to move and show the number marked.

2964. BURNISHING THE SOLE EDGES OF BOOTS AND SHOES, *P. M. Justice, London.—6th July, 1881.—(A communication from W. F. Hutchinson, Lynn, Mass., U.S.)* 6d.

The main feature of the invention consists in reciprocating the block which carries the burnishing tool by means of a rod operated by a crank pin on a shaft mounted in a swinging frame or some equivalent device, which carries the arm supporting the burnishing tool. It consists further of certain details of construction more or less closely related to this leading feature.

2965. WEAVERS' HEDDLES, *W. R. Lake, London.—6th July, 1881.—(A communication from L. Borgognon, Basle, Switzerland.)—(Not proceeded with.)* 2d.

This relates to improvements in the manufacture of plaited heddles, such as are used to form the weaving harness in the manufacture of silk ribbons, and it also relates to an improved machine for the manufacture of such heddles.

2971. EYE GLASSES, *G. F. Redfern, London.—7th July, 1881.—(A communication from F. Terstegen, Elizabeth, New Jersey, U.S.)—(Not proceeded with.)* 4d.

The bow spring is composed of two spring sections and attached to the frames, or in frameless glasses to the glasses themselves.

2973. INDICATING DIRECTION AND AMOUNT OF MOTION IN ENGINE SHAFTS, &c., *W. C. Pagan and J. Hore, Liverpool.—7th July, 1881.—(Not proceeded with.)* 2d.

This relates to a dial or indicator on the bridge worked by a cord or its mechanical equivalent from the engine.

2975. BRICKS, TILES, &c., *E. Johnson, St. Helens, Lancaster.—7th July, 1881.* 2d.

This relates to the manufacture of tiles, &c., from a thorough mixture of comminuted copper slag and mine or surface clay.

2978. CHIMNEY CAPS, *H. J. Haddan, Westminster.—7th July, 1881.—(A communication from A. Pichereau, Cailly, France.)—(Not proceeded with.)* 2d.

This consists in forming the cap of or with four angle pieces, which can be joined together to form the cap, or when a larger cap is required can form the corners thereof, and intermediate or supplementary pieces be added.

2980. WEAVING APPARATUS, *W. S. Mackie, Manchester.—7th July, 1881.—(Not proceeded with.)* 2d.

This consists principally in weaving into the body of the fabric at certain definite distances a thread or threads much stronger or thicker than the threads which compose the fabric generally, so that the fabric when woven can be gathered or drawn up on the said strong threads.

2983. PROPELLING VESSELS BY WAVE AND TIDAL POWER, &c., *S. J. Meek, Southend.—7th July, 1881.—(Not proceeded with.)* 2d.

The engine employed to drive the screw, paddle, or other propeller, or to transmit power for pumping or other purposes, is a modified arrangement of the high-pressure engine as used for steam. Compressed air is also employed as a means to obtain force on the water.

2984. FEED PUMPS, *H. F. Phillips, Hammersmith.—7th July, 1881.—(Not proceeded with.)* 2d.

This consists of an arrangement of pump in which no suction valve is used, the piston or plunger being drawn back beyond the supply inlet to allow for the inflow of water to the cylinder, the return stroke of the piston or plunger forcing the fluid past the delivery valve, and at the same time closing the inlet.

2985. WORKING CELLULOIDS OR OTHER MATERIAL FOR FIXING ARTIFICIAL TEETH, *T. B. Gibson, Hebden Bridge, Yorkshire.—7th July, 1881.—(Not proceeded with.)* 2d.

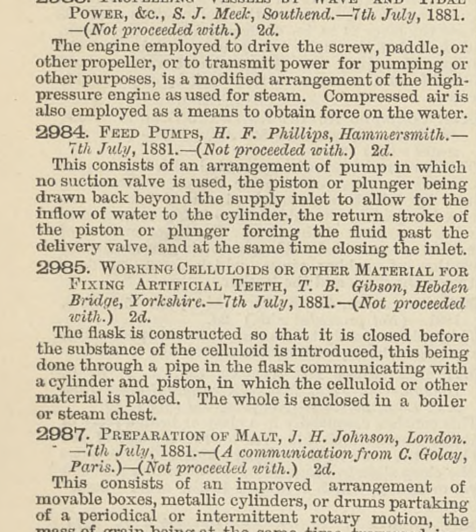
The flask is constructed so that it is closed before the substance of the celluloid is introduced, this being done through a pipe in the flask communicating with a cylinder and piston, in which the celluloid or other material is placed. The whole is enclosed in a boiler or steam chest.

2987. PREPARATION OF MALT, *J. H. Johnson, London.—7th July, 1881.—(A communication from C. Golay, Paris.)—(Not proceeded with.)* 2d.

This consists of an improved arrangement of movable boxes, metallic cylinders, or drums partaking of a periodical or intermittent rotary motion, the mass of grain being at the same time traversed in a downward direction by a current of air maintained at a suitably low temperature.

2993. BREECH-LOADING SMALL-ARMS, *S. B. Allport, Birmingham—7th July, 1881.* 8d.

This relates partly to improvements in mechanism for cocking the internal hammers of breech-loading small-arms of the kind called Lefaucheux guns—that



is to say, cocking the hammers of the said guns or unfastening the barrels for loading by means of a cocking arm turning on the same centre as the hammers, the said cocking arm being operated upon by a cam or helical shoulder made on the cylinder or cylindrical head of the locking lever. Other improvements are described.

3002. PURIFYING SMOKE, *J. Griffiths, Weobley, Hereford.—8th July, 1881.—(Not proceeded with.)* 2d.

This consists in causing the smoke to pass between a series of plates, from which water is continually dropping or flowing, or against a plate or plates, the surface of which is kept moist by water continually flowing over it, by which means the soot and other solid matter in the smoke is taken up by the water or by the wet surface of the plate or plates, and the hot air and gases pass into the atmosphere, their temperature being reduced by contact with the water.

3005. MANUFACTURE OF CHLORATE OF SODA, *J. W. Bottomley, Widnes, and R. F. S. Molesworth, Rochdale.—8th July, 1881.—(Not proceeded with.)* 2d.

This relates to means of producing at one operation chlorate of soda of a high degree of purity.

3012. COMPOUNDS FOR CASTINGS, &c., *J. J. Sachs, Sunbury.—8th July, 1881.* 4d.

This consists in the employment of sulphur and slate dust, either alone or in conjunction with coal dust, or with coal dust and plumbago, or their equivalent, or with emery or hard or siliceous powder, or with emery or hard or siliceous powder and coal dust or its equivalent, in conjunction or not with plumbago or its equivalent.

3013. SPRING MOTORS, *J. H. Johnson, London.—8th July, 1881.—(A communication from J. B. Powell and J. H. Harper, Philadelphia, U.S.)* 6d.

This consists of a spring motor, in which a series of barrels and shafts, each barrel connected to one shaft by a spring, and the barrel of one shaft being coupled to the shaft of the adjoining barrel, so as to rotate therewith, are combined with a fixed frame affording separate bearings and supports for the several barrels.

3015. IMPROVEMENTS IN ELECTRIC LIGHTING APPARATUS, &c., *W. R. Lake, London.—8th July, 1881.—(A communication from J. C. W. Greb, Frankfort, Germany.)—(Not proceeded with.)* 4d.

This invention relates to mechanism for regulating electric lamps, so that a series of such lamps may be included in a circuit in such a manner that one lamp will not interfere with another. Part of the mechanism is also applicable to other purposes.

3031. EARRINGS, *T. Perks, jun, Birmingham, and B. J. Perryman, Aston.—9th July, 1881.* 6d.

This consists, First, in jointing the looped wire which is passed through the piercing in the lobe of the ear to a fixed arm situated at one side of the top or ornamental body of the earring, the said looped wire being capable of being turned in the upper part of the said fixed arm; Secondly, in fastening the looped wire to the top of the body of the earring by means of a single or double-acting inclined plate and notch.

3083. FOOD FOR HORSES AND CATTLE, *J. Long, Reading.—14th July, 1881.* 2d.

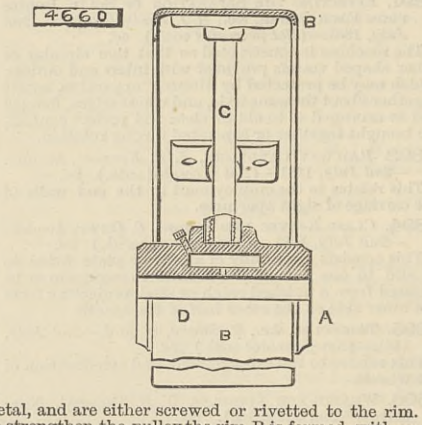
To produce a quantity of about 5 tons 4 cwt. the following are reduced to meal and mixed together:—Bran, 2688 lb.; American maize, 2400 lb.; barley, 1800 lb.; lentils, 1466 lb.; wheat, 960 lb.; beans, 640 lb.; oats, 360 lb.; white peas, 252 lb.; linseed cake, 504 lb.; cotton cake, 446 lb.; fenugreek, 84 lb.; and allspice and carraways, 56 lb. of each.

4437. MANUFACTURE OF HATS, &c., *W. R. Lake, London.—11th October, 1881.—(A communication from W. A. Baglin, Brooklyn, New York, and G. Yule, Newark, New Jersey, U.S.)—(Complete.)* 6d.

This consists in forming the bat by several successive operations, the material of the bat being deposited upon different parts of the usual forming cone at different times in figures of any shape determined by the arrangement of the perforations in the cone.

4660. BELT PULLEYS, *G. Pitt, Sutton.—25th October, 1881.—(A communication from P. Medart, Missouri, U.S.)—(Complete.)* 6d.

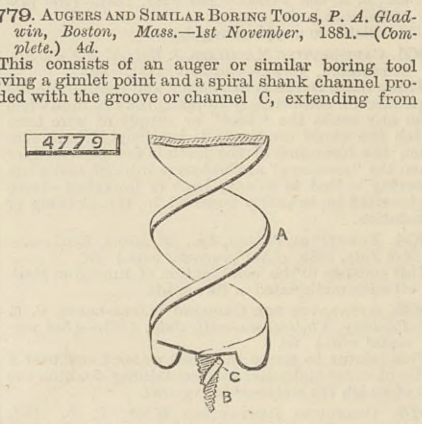
This relates to belt pulleys composed of a separate spider or centre and an independent wrought metal rim, and the first part consists of a cast iron hub A with screw-threaded sockets, and an annular oil chamber communicating with the bearing by radial openings, and also with spoke socket opening. The arms C are preferably of wrought metal tubing, the openings of which communicate with oil chamber, and form an additional reservoir. The bracket lugs to which the rim is secured are formed of cast or wrought



metal, and are either screwed or rivetted to the rim. To strengthen the pulley the rim B is formed with an internal flange at each edge. The invention further relates to means for accurately balancing the pulley, joining the ends of the rim, and also in the machinery for producing the different parts and accurately fitting them together.

4779. AUGERS AND SIMILAR BORING TOOLS, *P. A. Gladwin, Boston, Mass.—1st November, 1881.—(Complete.)* 4d.

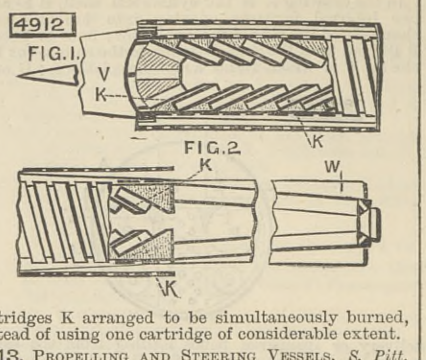
This consists of an auger or similar boring tool having a gimlet point and a spiral shank channel provided with the groove or channel C, extending from



the lower end of the shank channel downward across the thread of the screw B, and following the general direction of said shank channel toward the gimlet point of said screw B.

4912. TORPEDOES, *S. Pitt, Sutton.—9th November, 1881.—(A communication from W. H. Mallory, Bridgeport, Con., U.S.)—(Complete.)* 6d.

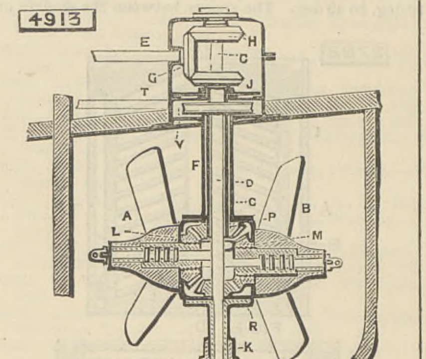
Fig. 1 represents a view partly in section and partly in elevation of the forward half of the torpedo, and Fig. 2 a similar view of the stern end of the torpedo. The stern end is provided with wings or fins W for the purpose of turning the torpedo upon its axis as it advances through the water. The forward chamber V may be charged with any suitable explosive to be fired in any well-known way. The powder which is to propel the torpedo is arranged in a number of small



cartridges K arranged to be simultaneously burned, instead of using one cartridge of considerable extent.

4913. PROPELLING AND STEERING VESSELS, *S. Pitt, Sutton.—19th November, 1881.—(A communication from W. H. Mallory, Bridgeport, Conn., U.S.)—(Complete.)* 6d.

The object is to control the vessel both as to movement and direction by its propeller wheel or wheels, and it consists in the employment of two propeller wheels A and B mounted opposite to each other on the same casing F, which rest in a socket K, and may be revolved round its axis. The shaft E operates the mitre wheels H and J, the former secured to shaft D,



which rotates the propeller B through the wheels R and M, while the latter is secured to the hollow shaft C, which rotates the propeller A through the wheels P and L. The casing F can be caused to revolve round its axis by means of a worm on shaft T gearing with the wheel V mounted on the casing.

4914. MOULDED METALLIC BODIES, &c., *S. Pitt, Sutton.—9th November, 1881.—(A communication from W. H. Malloney, Bridgeport, Con., U.S.)—(Complete.)* 6d.

A die or shaper is used, against which the metal is to be forced; a press to force the metal against the die, and a suitably dry powder for conveying the force of the press to the metal and causing it to assume the desired configuration.

4988. PURING HIDES AND SKINS, &c., *S. Pitt, Sutton.—15th November, 1881.—(A communication from W. Maynard, New York, U.S.) (Complete.)* 4d.

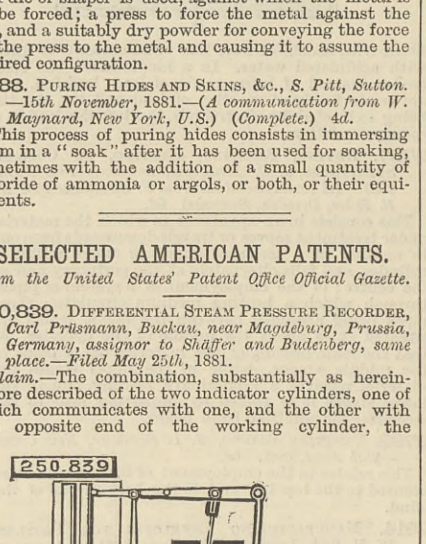
This process of puring hides consists in immersing them in a "soak" after it has been used for soaking, sometimes with the addition of a small quantity of chloride of ammonia or argols, or both, or their equivalents.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

250,839. DIFFERENTIAL STEAM PRESSURE RECORDER, *Carl Prüsmann, Buckau, near Magdeburg, Prussia, Germany, assignor to Shaffer and Budenberg, same place.—Filed May 25th, 1881.*

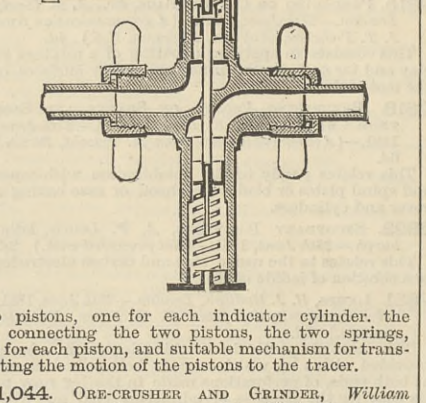
Claim.—The combination, substantially as hereinbefore described of the two indicator cylinders, one of which communicates with one, and the other with the opposite end of the working cylinder, the



two pistons, one for each indicator cylinder, the rod connecting the two pistons, the two springs, one for each piston, and suitable mechanism for transmitting the motion of the pistons to the tracer.

251,044. ORE-CRUSHER AND GRINDER, *William Gutenberger, Sacramento, Cal.—Filed March 10th, 1880.*

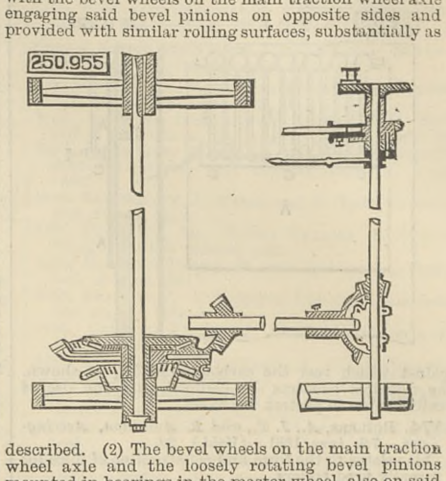
Claim.—In an ore-crusher having a loose stem and crushing rolls journalled thereon, a driving wheel keyed to the stem and formed with a concentric



pulley flange J, forming a weight receptacle, whereby the pressure of the wheel can be varied, as set forth.

250,955. GEAR FOR TRACTION ENGINES, *Ferris Ogden, Mansfield, Ohio, assignor to the Aultman and Taylor Company, same place.—Filed January 19th, 1881.*

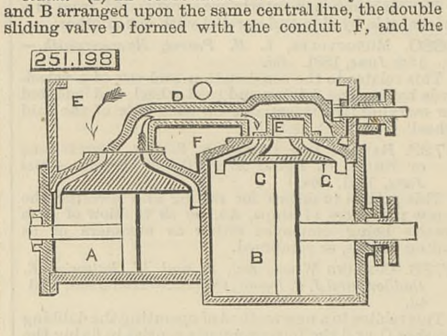
Claim.—(1) In a traction engine, the master bevel wheel carrying the freely rotating bevel pinions provided with the plane rolling surfaces, in combination with the bevel wheels on the main traction wheel axle engaging said bevel pinions on opposite sides and provided with similar rolling surfaces, substantially as



described. (2) The bevel wheels on the main traction wheel axle and the loosely rotating bevel pinions mounted in bearings in the master wheel, also on said axle, said bevel wheels being provided with rolling surfaces, as described, in combination with the adjustable collar for setting and holding the master wheel and its pinions in the required working relation to the bevel wheels, substantially as described.

251,198. COMPOUND ENGINE, *Michael Elsesser, Brooklyn.—Filed May 26th, 1881.*

Claim.—(1) In combination with the cylinders A and B arranged upon the same central line, the double sliding valve D formed with the conduit F, and the



openings C C leading from said conduit, substantially as and for the purposes specified. (2) The combination, with a valve-chamber E and cylinders A B, of a valve provided with the openings C C, exhaust passage E, and conduit F as shown and described.

CONTENTS.

THE ENGINEER, February 10th, 1882.