THE EFFICIENCY OF FANS.

Some months ago we illustrated and described a fan invented by the Rev. G. M. Capell, of Passenham Rectory, Stoney Stratford. We spoke in very favourable terms of the fan, and we have heard nothing since concerning it to induce us to alter our opinion. On the 3rd of September Mr. Capell read a paper on his fan before the Institute of Mining Engineers, at Dudley. He described various experiments which he had made, and from which he drew the following deductions:—(1) That with an inlet five-ninths the diameter of the fan, he got an inlet air speed nearly equal to the blade-tip speed, against half, or less than half, in fans of other construction. (2) That the average water gauge of the open fan was superior to the recorded gauges of the Guibal type of fan, and far above that of any open running fan of which he had been able to take or obtain the tests. (3) That the air speed at the inlet of the new fan was about double that of any inlet speed he had yet known, in proportion to blade-tip speed. As was to be expected, these statements were criticised, and particular inquiries were made as to the power expended in driving the fan. Mr. Capell promised to have a power test made, and this test was actually made, and on Monday week there was another meeting of the South Staffordshire Mining Engineers held at Dudley, when the results of the trial were brought forward and discussed. It was stated that the power exhibited by the fan was as nearly as possible twice that of the engine. Mr. Alexander Smith said that it appeared that Mr. Capell was creating power, and as he did not quite see how this could be, he suggested that a public trial of the fan should be made at a colliery. The meeting finally broke up without being able to come to any conclusion. Those present seemed to regard the figures obtained as something "no fellow could understand," and all that could be suggested was that the water gauge was wrong. By this time, no doubt, the members of the South Staffordshire Institute having had time to think the matter over have found where the mistake in Mr. Capell's calculations resides. Mr. Capell makes, we believe, no pretence to scientific training, and his fan is the result of no mechanical investigations. It was therefore likely enough that he should make an erroneous calculation; but it is not to the credit of the South Staffordshire Engineers that they should allow his mistake to pass uncorrected on the spot. As they have not corrected it, we may be excused if we explain how the power spent by a fan is to be calculated, for the benefit of all whom it may concern.

The work done by a fan consists in imparting to a certain weight of air previously at rest, motion at some velocity. A paddle-wheel does for water what a fan does for air; it puts a weight of it in motion. The fact that air is an elastic fluid while water is an inelastic liquid, in no way affects the problem, save in the sense that these respective characteristics modify the velocity under given conditions. Thus air will flow more readily than water will through crooked or tortuous passages. In order to ascertain what is the net work done by a fan, we must ascertain the weight of air and the velocity of it discharged from the fan in a minute or an hour, or other suitable interval; with these figures in our possession the rest is easy. To show this we give an example, and we take Mr. Capell's figures, as stated in the paper read by him at Dudley; but it must be understood that we do not undertake to say whether his figures are right or wrong. Into a fan having an inlet orifice of 19¾in. diameter air rushed at the rate of 4280ft. per minute; we may take it that the exit velocity was the same. These figures are sufficient for our purpose. A circle 19¾in. diameter has an area of 306·35 square inches, or 2·128 square feet, and 2·128 × 4280 = 9108 cubic feet per minute, omitting fractions. We do not know what was the temperature of the air when the experiment with which we are dealing was made, but we shall not be far wrong if we assume that 13 cubic feet weighed a pound. Now $\frac{9108}{13} = 700$ in round numbers; that is to say, Mr. Capell's fan delivered air at the rate of 700 lb. per minute. The work stored in this air could not be greater than the power expended in putting the air in motion. Allowance must also be made for friction and waste, consequently the power expended by the engine must be greater than that found in the air. The power in the air is found by the well-known formula $\frac{M v^2}{2g}$. Here we have M = 11·66 lb., v = 71·3ft., and $2g$ is of course 64·4. Then $\frac{11{\cdot}66 \times 5083}{64{\cdot}4} = 920{\cdot}3$ foot-pounds per second, or 920·3 × 60 = 55,218 foot-pounds per minute, or about 1⅔-horse power. We believe that the engine indicated about 2⅔-horse power, and this is what we should anticipate, allowance being made for engine and belt friction and the waste of power expended in churning the air in the fan, and in driving it over the comparatively rough metal surfaces.

We do not know in what way Mr. Capell has made his calculations, but we fancy he has taken the pressure of the air as deduced from the water gauge, multiplied it by the area and by the velocity. The head is not stated for the experiment we have given, but it seems likely that it was under 4in.; let us call it ⅙lb. per square inch. This is equivalent to a total pressure over an area 19¾in. in diameter, of 51 lb. in round numbers; and this multiplied by 4280ft., the speed at which the air entered the fan, and divided by 33,000 = 6·5-horse power very nearly. If the engine indicated something like 3-horse power, we have here the foundation for the statement that the power got out of the fan was double that exerted by the engine. At first sight it may appear that this is the proper way to calculate. It will be urged that we have here the equivalent of a pressure of 50 lb. moving at the rate of 4280ft. per minute. This is true, but it is only true in a sense, and it does not apply in this case. In calculating the power of a water wheel, no one thinks of multiplying the velocity of the water by the pressure due to the head, and by the sectional area of the feed pipe. The estimate is made in terms of the quantity of water and its height, or the weight of water and its velocity; and what holds good of water holds good of air. The water gauge shows a certain vacuum or pressure, but it does not at all follow that this pressure is the equivalent of the work done. If Mr. Capell will run his fan at various speeds, he will soon find that the relations which exist between the delivery of air, the height of the water gauge, and the power expended by the engine, will vary so much that he will get the most extraordinary results on his system of calculation. The power given out by the fan may appear, indeed, to be less and less the faster it is driven, because the water gauge does not rise at the same rate as the fan speed increases. Again, if he will contract the inlet area, other things remaining the same, he will find his gauge rise, while the air entering is reduced in volume. It is quite beyond our purpose to go into an explanation of the reasons why fan power should be calculated as we have shown. We must refer our readers who wish to pursue the subject further to any good work on Dynamics. Those who do not will, perhaps, rest content with an assurance that the rules we have given are correct; and they will be the more likely to do this seeing that to calculate the efficiency of a fan in any other way leads up to an absurdity. We have, as we have said, little doubt that by this time both Mr. Capell and the engineers of South Staffordshire have found all this out; but so little seems to be understood about the performance of fans that no harm can, we think, be done by this explanation, and the warning which we have given.

GIFFARD'S INJECTOR.

By James Lyon, B.A., Demonstrator of Mechanics in the University of Cambridge.

The following short paper is intended to put the formulæ connected with Giffard's injector into a simple and easily worked shape suitable for practical men :—

Let a be the area of steam nozzle in inches.
a' be the area of delivery valve in inches.
p = pressure of steam in pounds per inch.
h = height of a column of steam at density corresponding to pressure p which would give that pressure (regarded merely as a fluid).

Then v = velocity of issuing steam in feet per second = $\sqrt{2gh}$.

Let the density of water be unity, and suppose the density of the steam to be $\frac{1}{n}$th that of water, the mass of a cubic inch of water being m, then the mass of steam passing through the steam nozzle per second is—

$$12\, v\, a \frac{m}{n} = 12\, a \frac{m}{n} \sqrt{2gh}. \quad \ldots \quad \text{(I.)}$$

Hence if the feed just enters the boiler and comes immediately to rest, *i.e.*, it comes up to the foot valve with just sufficient momentum to open it and enter; the momentum destroyed per second is—

$$12\, a \frac{m}{n} \sqrt{2gh} \,.\, \sqrt{2gh} = 12\, a \frac{m}{n} 2gh. \quad \ldots \quad \text{(II.)}$$

This momentum is therefore destroyed in one second by the pressure p acting on an area a'. We will suppose that the steam after taking up the feed-water becomes perfectly condensed, and that V is its velocity just before opening the delivery valve. Then from the well-known equation $m v = \mathrm{F} t$, we have $12\, \mathrm{V}\, a'\, m\, \mathrm{V} = p a' g$; (III.) ($t$ being 1)

$$\therefore \text{ the minimum value of V is } \sqrt{\frac{pg}{12m}}.$$

Next, let m' be the mass of water taken up per second. Then, since the momentum of the condensed steam and water together must be same as that of steam before taking up water, we have—

$$\left(12\, a \frac{m}{n} \sqrt{2gh} + m'\right) \mathrm{V} = 12 \frac{m}{n} a\, 2gh \quad \text{(IV.)}$$

The equation of continuity is—

$$12\, \mathrm{V}\, a'\, m = 12 \frac{m}{n} a \sqrt{2gh} + m' \quad \ldots \quad \text{(V.)}$$

$$\therefore \text{ IV. becomes } \left(12 \frac{m}{n} a \sqrt{2gh} + m'\right) \sqrt{\frac{pg}{12m}} = 12 \frac{m}{n} a\, 2gh.$$

$$\mathrm{V} \text{ becomes } 12\, a'\, m \sqrt{\frac{pg}{12m}} = 12 \frac{m}{n} a \sqrt{2gh} + m.'$$

These two last equations reduce to—

$$\sqrt{\frac{pg}{12m}} = \frac{a}{a'}\, n \sqrt{\frac{2gh}{\frac{pg}{12m}}}$$

or

$$\frac{pg}{12m} = \frac{a}{a} \frac{2gh}{n}$$

Thus a' is known in terms of known quantity, and IV. gives m' in terms of m. Of course the quantity found for m' is a superior limit since friction is altogether neglected.

Sewerage of Wolverhampton.—Wolverhampton will have soon to undertake additional sewerage work, which will entail a very heavy expenditure. The greater portion of the borough is deep sewered, and the sewage flows by gravitation to the Barnhurst Farm, where it is disposed of by broad irrigation. The area of the land irrigated compels the use of one acre to purify the sewage from 347 persons instead of from eighty, and the total of the population in the sewered area is 52,000. The purification is consequently incomplete. Mr. Edward Pritchard, C.E., of Birmingham and Westminster, has been called in, and he recommends the adoption of the intermittent filtration system on a lower portion of the farm, and a complete rearrangement of the whole of the drainage, together with the preparation of 150 acres for purification. The unsewered portion of the borough is 782 acres in extent. For that he recommends a separate system, which shall take the sewage to land near to Pool Hall, Compton, in quite another direction from the existing outfall. Independently of land in each case, Mr. Pritchard estimates £22,500 as the cost of reconstruction, and the like as to the existing system, and £21,600 as the cost of the new or second system—the last-named sum to include £8000 for the construction of outfall works.

THE CHICAGO RAILWAY EXPOSITION.

No. VII.

The exhibit of locomotives was very complete, though it is to be regretted that the modern English locomotive was represented only by a few photographs contributed by the Midland, London and North-Western, Brighton, and Great Southern and Western Railways. The principal British exhibit was the well-known engine "Locomotion No. 1," which was the first engine to run on the first public railway, and was exhibited by the North-Eastern Railway Company, which for many years past has preserved it on a pedestal in front of Darlington station. Visitors to the exhibition appeared to regard it as the most interesting relic in a large and excellent collection of railway appliances of the past.

Several old American engines were also exhibited, the Chicago and North-Western Railway Company contributing the "Pioneer," which is believed to be the first engine that ran west of Chicago, though that mere fact does not imply any great degree of antiquity, as this first trip only took place on October 25th, 1848. The engine was, however, built by Baldwin in 1836, and had been previously used on the Utica and Schenectady line in New York State. The boiler, like those built by Bury in this country, has a hemispherical-topped fire-box. The bar frame is outside and the crank pin is fixed to the inner face of the driving-wheel boss, a surviving example of Baldwin's half crank. The excentrics are on the outer ends of the axle driving the gab end valve motion. The single pair of driving wheels is behind the circular fire-box, and the front end of the engine is carried on a four-wheeled bogie. The engine forms a curious link between the past and the present of American locomotive history, possessing many of the distinctive features of the modern American engine, such as the rocking shaft working a valve above the cylinders, bar frame, wooden cab, four-wheel bogie, &c., though possibly these features have been added at different times during its career of forty-nine years.

The Baltimore and Ohio Railroad Company exhibited a veteran engine, The Arabian, which was built in 1834. A few similar engines are still in regular use on that line, their short wheel base, 4ft., rendering them useful for shunting in certain yards. The cylinders are vertical, and the piston-rods are attached to two grasshopper beams, to the outer ends of which the connecting rods are coupled, driving a crank shaft which is geared to another shaft coupled to the four wheels of the engine. The boiler is vertical, and carries the fulcrum for the grasshopper beam. This engine has since been exhibited at Pittsburg, Pa., where it was destroyed in a serious fire.

Nova Scotia contributed an old engine and its driver, both having been at work from 1838 to 1882. The John Bull, built in England in 1831 for the Camden and Amboy Railway—now part of the New Jersey division of the Pennsylvania—was also exhibited, and just previous to the close of the Exposition the original "Puffing Billy" arrived from Newcastle-on-Tyne. The veteran Horatio Allen delivered a very interesting address in the Exposition building on his connection with the first introduction of railways into the United States. He stated that in 1827, while engineer to the Delaware and Hudson Canal Company, hearing of the success of the Stockton and Darlington Railway, he resigned his post and went to England to carefully investigate the question, and if necessary purchase rails and locomotives for a projected railway in the States. Mr. Allen met George Stephenson and Rastrick, the former advocated tubular boilers, which were then untried, and the latter flues accessible to a man for cleaning or repair. Finally two engines were ordered, one from each maker, in April, 1828, and Rastrick's engine, the Stourbridge Lion, was set to work in 1829. The boiler of this earliest locomotive in the New World was exhibited at the Exposition, though in a somewhat altered form. Mr. Allen claimed that he was the first to order a multitubular locomotive boiler from George Stephenson.

The Rhode Island Locomotive Works, (then under the management of Mr. J. A. Durgin) exhibited a fine four-coupled freight engine, built for the Chicago, Milwaukee, and St. Paul Railroad. This engine was an excellent example of modern American practice, the light and almost flimsy construction usual a few years ago having given place to larger and heavier forms, until the American engine weighs as much as an English engine of the same sized cylinders and wheels. The crank pin of this engine measures 4½in. diameter by 4in. in length, and the other bearings are in proportion. The coupling rods are fitted with strap ends, which are still generally liked in America. Were bushes used, and the coupling pins made as large as those in use here, straps would soon go into disfavour; but with the small pins in use the bushes soon wear slack, and some means of adjusting the wear being necessary, a strap secured with two or three bolts and a cotter to tighten the brass is used, adding much to the breakage of coupling rods and fracture of crank pins. American drivers are expected to look after their engines themselves and execute or superintend small repairs, and in this respect are superior to our men, who can seldom be trusted to take up wear in any direction. The nature of the duty of drivers in the two countries differs materially—an English driver is chiefly occupied with looking after his distant signals, seeing that his firemen wastes no coal, and putting on the feed whenever his engine threatens to blow off. In America there are few signals of any kind, and none that can be called distant, while nearly every engine is still fitted with an easing valve to enable the safety valve spring to be slackened and steam blown off—that is, wasted, when standing; while, as a general rule, very little attention is paid to the quantity of coal burnt. The enormous natural resources of America and the boundless supply of nearly every raw material induce a lavish and reckless waste, which is especially noticeable in timber and coal, but which extends to every article, and is a marked characteristic of the American people.

The boiler fittings of this engine are arranged in a way that is becoming general in America. A brass casting having one opening to the boiler carries the pressure gauge

cock, injector steam cock, lubricator steam cocks, and other steam cocks necessary for the working of the engine. Any of these cocks can be removed for repair while the engine is under steam, as the opening into the boiler can be closed by a screw-down valve. The engine is fitted with one Seller's injector and one pump. The crosshead, slide blocks, and crosshead pin form a solid steel casting fitted with phosphor bronze rubbing pieces or liners, lugs on which fit into milled grooves in the crosshead. This method has become a common practice, as the old form of cast iron solid crosshead is apt to break when applied to the large cylinders now used. Four slide bars are used, placed above the centre line of the piston-rod, which is 2¾in. diameter. The weigh bar shaft brackets are of cast iron, and are in one piece, and not adjustable. The weigh shaft is balanced by means of a coiled spring. Two $\frac{7}{8}$in. plate cross frames are secured by angle irons to the boiler barrel between the driving axle and smoke-box. The boiler and fire-box throughout are made of Otis steel, and the general dimensions of the engine are as follows :—

Cylinders	18in. by 24in.
Driving wheels, diameter	5ft. 3in.
Tractive force per lb. average pressure in cylinders	123·5 lb.
Diameter boiler inside smallest ring	4ft. 4in.
Fire-box, length inside	6ft.
Fire-box, width inside	2ft. 9in.
Number of tubes	200
External diameter of ditto	2in.
Length between tube plates	11ft. 11in.
Heating surface, tubes	1240 sq. ft.
Heating surface, fire-box	105 sq. ft.
Total	1345 sq. ft.
Grate area	16·5 sq. ft.
Total wheel base	23ft. 4in.
Ditto between coupled wheels	8ft. 6in.
Diameter driving axle, wheel seat and journal	7½in.
Weight in working order	40 tons 1 cwt.
Tender tank holds	2500 gallons.
Fire-box, length inside	6ft. 1in.
215 tubes, diameter and length	2in. and 11ft. 7in.
Rigid wheel base	15ft. 9in.
Total wheel base	23ft. 3in.
Weight in working order	98,400 lb., or 43 tons 18 cwt.
Tender tank holds	2900 galls.

Engine truck wheels—paper :—

	dia.	length.
The main crank pin measures	4½in.	by 4½in.
The small end pin measures	3in.	by 3in.
The coupling rod pins L. and T.	4in.	by 2⅝in.

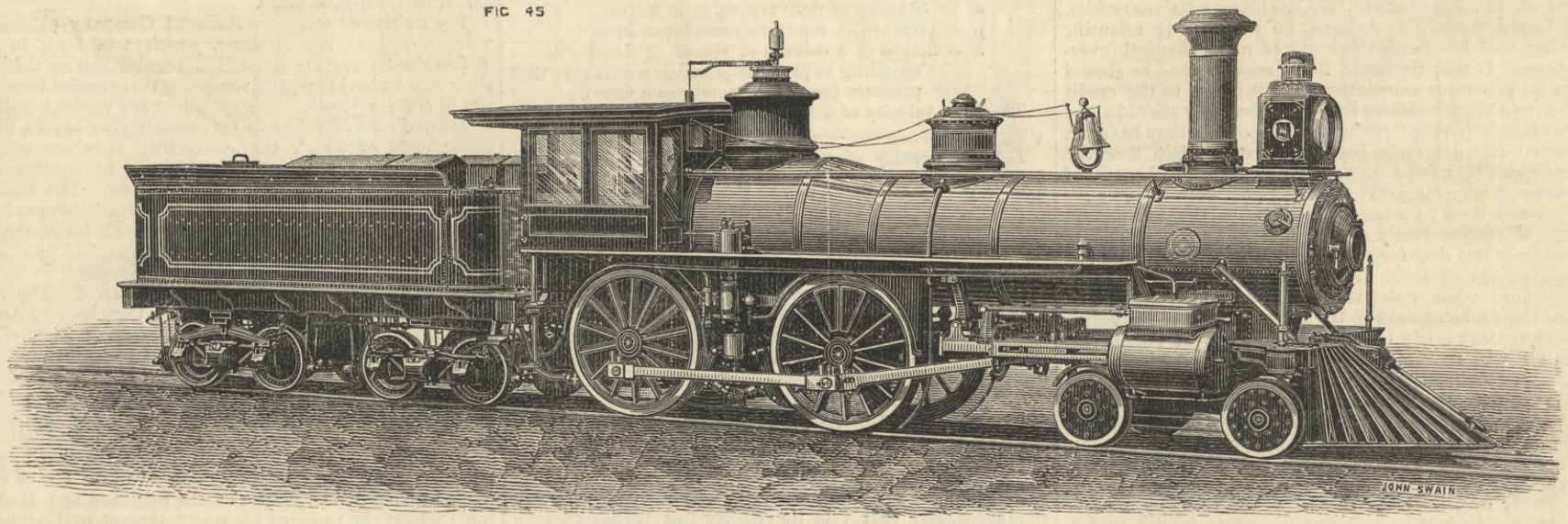
The tires are 3in. thick, a size very usual in the States, though on some lines a standard thickness of 4in. is adopted. The engine, though intended for goods traffic, is fitted with a Westinghouse brake, and can therefore work a passenger train should the necessity arise. The feed pipes are made of wrought iron, a common practice in the States, as the quality is so good that copper pipes are in many instances no better suited for the work than the cheaper material.

The same firm intended to exhibit a fine specimen of a modern American express engine, but the railway on which it has been running for some months was unable to lend it for exhibition owing to an increase in traffic, which kept the whole rolling stock fully employed.

The engine in question is fitted with Allan's paper car wheels under the bogie or truck, which as usual carries the leading end of the engine. The use of these wheels under passenger engines and tenders is spreading, as the uncertainty of the ordinary cast iron wheel renders it unsafe at a high speed, and its rigidity has a tendency to crystallise and ultimately fracture axles. There can be no doubt that the chilled wheel will gradually be superseded by a more expensive but safe, elastic, and durable wheel. The engine has four coupled wheels 6ft. 2in. diameter, with 18in. by 24in. cylinders, and is now running express trains between Providence and New London, part of a singularly neat indicators show at a glance the condition, as regards repair, of every engine on the road, with the running shed where they are stationed, and the nature of the traffic they were built for, and are engaged in respectively; while an elaborate set of books fully record the age and history of each engine and the mileage and condition of its principal parts. In fact, the conditions of American railways require the heaviest possible train to be drawn the greatest possible distance by the lightest possible locomotive, and this can only be done by overworking the locomotive, which, of course, entails an extravagant consumption of fuel, and corresponding wear and tear of engine.

As we have already mentioned, the Brooks Locomotive Works, of Dunkirk, New York, exhibited no less than seven remarkably fine and well-finished locomotives, probably the finest collection of engines built by one firm ever exhibited. We illustrate one of these engines by Figs. 45 to 49, and subjoin a specification. It will be noticed from Figs. 45 and 46 that the smoke-box is extended, and that a diagonal baffle plate intercepts the direct passage of the cinders to the chimney. A wire netting is placed in the smoke-box, and arrests any sparks that have passed under the baffle plate and have not lodged in the lower front corner of the smoke-box, which, being a sort of dead space, gradually fills with cinders while the engine is running The smoke-box is emptied by means of a small pipe—not shown in the drawings—which conducts a jet of steam to the hopper at the bottom of the smoke-box and blows the ashes out. A hand-hole, as shown, is provided in the upper part of the smoke-box for cleaning the wire netting, &c. This "extended smoke arch," as it is termed in America, has come into extensive use within the last two years, and is said to be the best method hitherto found of dealing with sparks. The engine is fitted with Newth's ash-pan, which was described on p. 146 in our issue of August 10th.

FIG 45

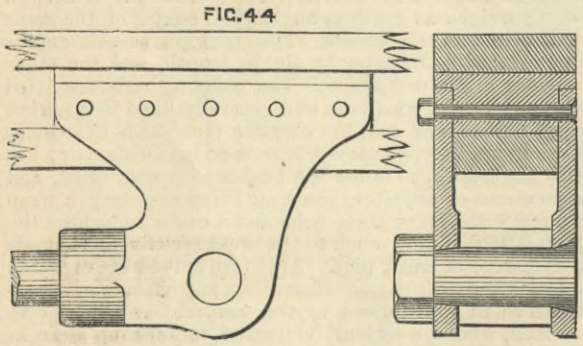


PASSENGER ENGINE, CHICAGO EXHIBITION.

The main frame between the cylinders and driving axle is composed of one bar measuring 3½in. wide by 4½in. deep. Two bars, one above the other, are used between the driving and trailing axles, the upper being 3½in. by 3½in., and the lower 3½in. wide by 3in. deep. The excentrics are not keyed to the axle, but are held in place by set screws and bolted together side by side, and are said to give no trouble from shifting.

The Rhode Island Locomotive Works also exhibited a fine Mogul engine, built for the New York and New England Railroad—a new line, which is worked in connection with the Pennsylvania Railroad, and forms a convenient route from Philadelphia and Washington to Boston without passing through the city of New York. The crosshead—a cross section of which is shown by Fig. 44—is so arranged that the upper of the two slide-bars is wider than the lower bar, and thus the greatest surface is obtained where

FIG.44



it is most wanted. The rubbing piece is of cast iron, and is gripped by countersunk headed bolts between the jaws of the wrought iron crosshead. It forms a good crosshead for a Mogul engine where the width is limited, as the leading coupling-rod pin has to be cleared. The cab is, as usual, made very comfortable for the men. Padded arm-rests outside the window sills, and padded backs and seats, give them the equivalent of easy chairs. It is usual for the driver to sit down comfortably when running; and certainly the rest and comfort thus obtained should and does preserve his faculties of sight and hearing from fatigue. The comparative absence of signals and fences obliges a more constant watchfulness than at home, where the distant signal once sighted, all is often taken for granted until the next distant signal may be expected.

The dimensions of the engine are as follows :—

Cylinders	18in. by 24in.
Diameter of driving wheels	4ft. 9in.
Diameter of boiler (steel, wagon top)	4ft. 6in.

route between New York and Boston. The following particulars of its performance are interesting. The usual train comprises eight cars weighing as under :—

	lb.
4 Drawing room cars, 60,000 lb. each	240,000
2 Ordinary passenger cars, 57,000 lb. each	114,000
1 Smoking car, 48,000 lb.	48,000
1 Baggage car, 50,000 lb.	50,000
Total	452,000
Weight of the engine	80,000
Weight of the tender	48,000
Grand total	580,000 or 259 tons.

The regular running time is sixty-four miles in 1h. 25m. without any intermediate stoppage, and in 1h. 37m. with two stoppages; but this distance has been done in 1h. 15m., which is very fast, and would be considered an excellent performance on any English railroad. At the time this run was made the track was in bad condition owing to a thaw. The consumption of coal, however, is something calculated to astound those used to English practice. For the trip of 128 miles, from New London to Providence and back, there are used 10 tubs of coal, each tub containing 800 lb., making a consumption of 62·5 lb. of coal per mile. This performance may be compared with that of the single-driving wheel express engines designed by Mr. Bromley for the Great Eastern Railway. They took a train of seventeen to twenty coaches, weighing about 180 to 200 tons, in 1h. 35m. from Liverpool-street to Ipswich. Deducting the distance and time between Liverpool-street and Forest-gate, where the speed is restricted, owing to the numerous signals and junctions, the remaining distance, about sixty-three miles, is run in 1h. 20m., the worst gradients ranging from 1 in 100 to 1 in 84. The consumption of coal would be about half that of the American engine; but the English engine would be taxed to her utmost capacity with such a load, and could not possibly make up time to the extent of ten minutes. In America economy of fuel is not regarded as a primary object, though coal is, on the whole, more expensive than in England. If the trains can be run regularly in any weather, the coal bill is cheerfully paid, and on one well-known line no effort is made to ascertain, much less check the consumption of coal, costing 4 dols. 50 cents per American ton, or £1 1s. 1d. per ton of 2240 lb., which is probably a higher average price than is paid by any important railway company in Great Britain. This indifference to the consumption of coal certainly does not arise from a general looseness and carelessness in collecting and collating figures and statistics. On the contrary, in the offices of the chief locomotive superintendents of this and many other lines, there are few main line passenger engines in Great Britain that equal this engine in tractive power, though the weight on the driving wheels is very moderate. This is partly due to the steel fire-box, the plates of which are thinner than is possible with copper, and the difference in the specific gravity of the metals. The shell of this fire-box weighs 1730 lb., whilst a copper box of the same size would weigh about 2950 lb., a difference of 11 cwt. The running board, a plank supported on brackets on the boiler, weighs considerably less than the lightest English foot-plating and outside frame; and the remaining difference in weight is mostly accounted for by the lighter hornblocks and main frame. The centre line of the main frames and journals coinciding, the hornblocks do not require to be strongly bolted to the frames to resist the side strain, and in fact are simply wearing pieces of channel section butting against the vertical face of the bar frame. A bar measuring 3½in. or 4in. square can better resist compression than a plain plate 20in. to 24in. deep and only 1in. thick, though the latter frame is nearly double the weight. Thus the lightness of the American engines is due more to their peculiar mode of construction than to weak scantling or small bearing surfaces. On the other hand, it must not be forgotten that plate framed engines can be made lighter than American framed engines if desirable. For example, the Gladstone is a more powerful engine than this, but it weighs only 19 cwt. more.

Specification of a Passenger Locomotive, 18in. by 24in. cylinders.

Type.—American pattern (four-coupled, bogie under leading end.)
Gauge.—4ft. 8½in.
Cylinders.—18in. dia., 24in. stroke.
Driving tires.—Flanged, 61in. inside dia. and 67in. outside dia., 5½in. wide, 3in. thick, made by Midvale Steel Company.
Boiler.—Wagon top style; made of Otis homogeneous cast steel; diameter at smoke-box end 52in.; extension front end; thickness of plates, $\frac{7}{16}$in.; tube sheet, ½in.
Fire-box.—Made of Otis homogeneous cast steel; 72in. long, 34in. wide at grate, 46in. wide at crown sheet, 66in. high; thickness of plates, side and door sheets, $\frac{7}{16}$in.; crown sheet, $\frac{5}{8}$in.; tube sheet, ½in.; water spaces, 3in. sides and back; 4in. front.
Tubes.—Lap welded iron, 197 in number, 2in. outside dia., 11ft. 9in. long; set with copper thimbles at fire-box ends.
Smoke stack.—Straight pattern; outside plates made of Otis steel.
Axles, driving.—Hammered iron; journals, 7½in. dia., 8in. long.
Axles, bogie.—Hammered iron; journals, 4⅝in. dia., 10in. long.
Axles, tender.—Hammered iron; journals, 3⅝in. dia., 7in. long.
Wheels, bogie.—30in. dia. on tread, Allen paper wheel.
Wheels, tender.—Chilled cast iron, 33in. dia. on tread, Master Car Builder's Standard.
Crossheads.—Cast steel, with phosphor bronze rubbing pieces.
Crank pins.—Made of Otis steel; main bearings, 4½in. dia., 4½in. long; side rod bearing, 3½in. dia., 3½in. long.
Slide bars.—Hammered iron, case-hardened.
Links.—Hammered iron, case-hardened, forged solid.
Feed-water.—Two No. 9 Friedman non-lifting injectors.
Piston glands.—Dunbar's patent soft metal split cones.

PASSENGER LOCOMOTIVE, CHICAGO EXHIBITION.

BROOK'S LOCOMOTIVE WORKS CO., NEW YORK, ENGINEERS.

Fig. 46.

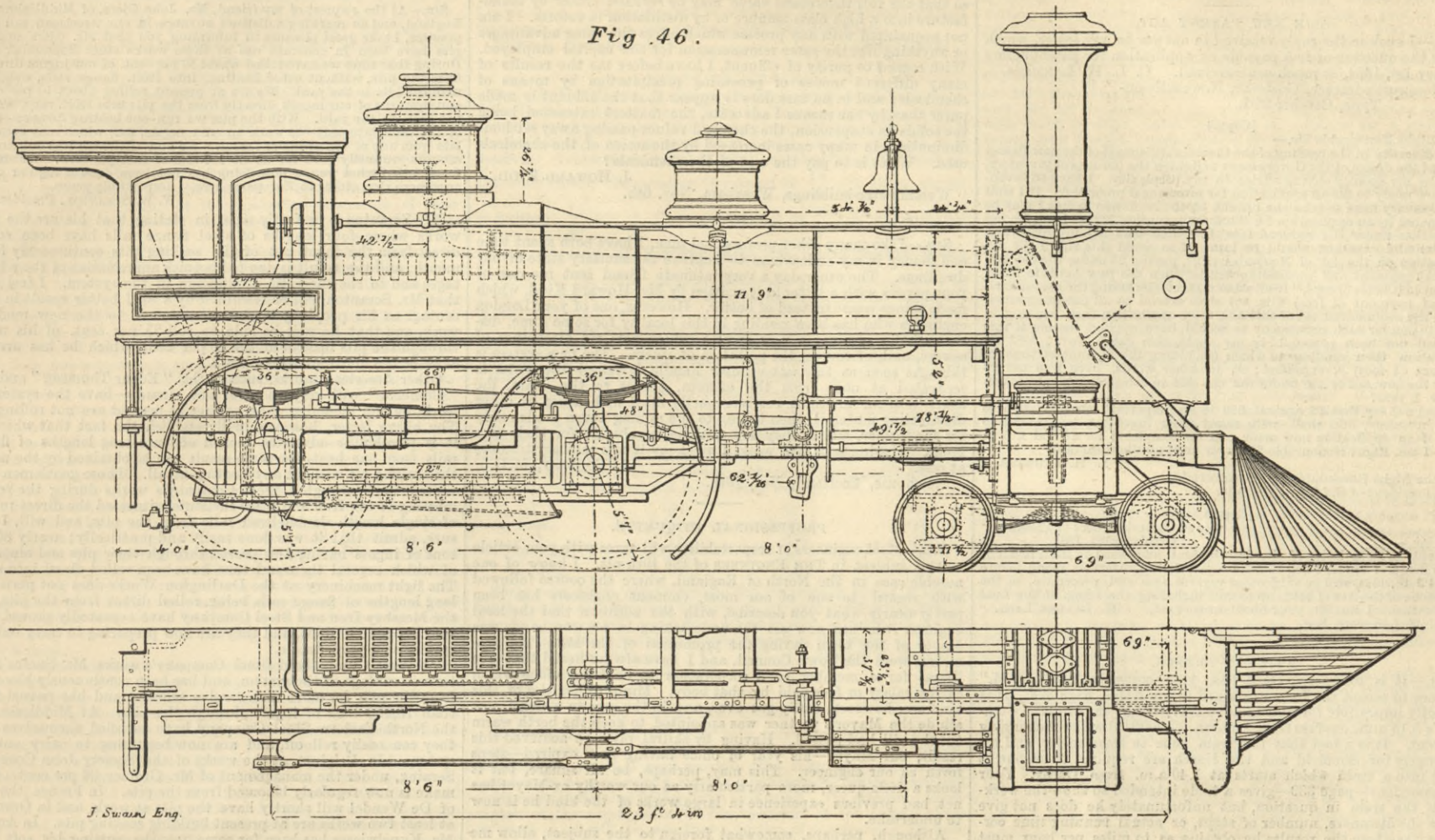


Fig 47.

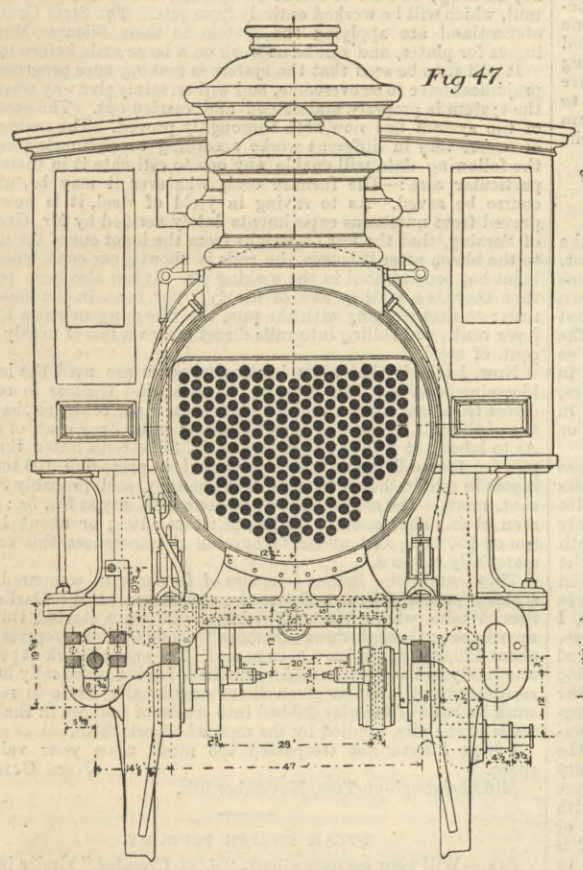


Fig 48.

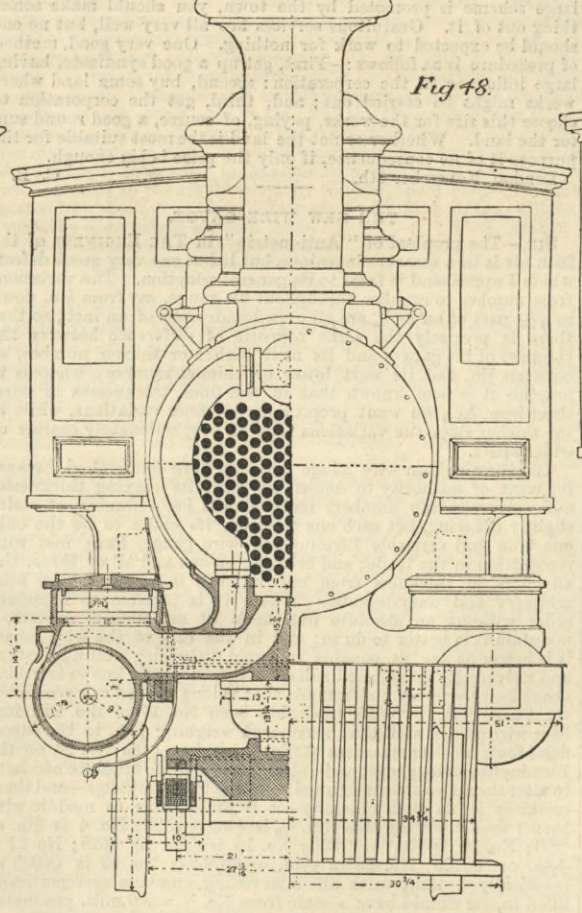
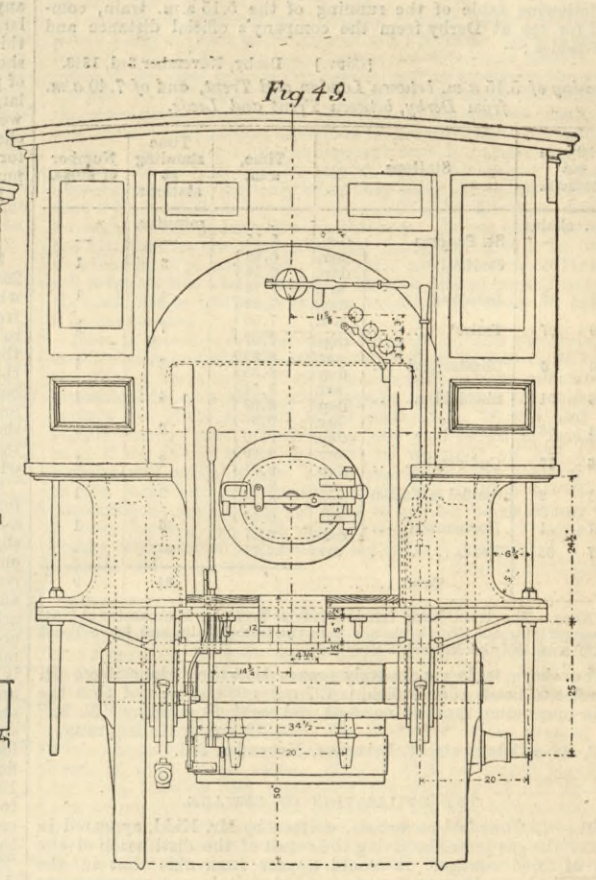


Fig 49.



Steam gauge.—6¾in. dial; made by Ashcroft Manufacturing Company, New York.

Headlight.—23in.; made by Kelly Lamp Company, Rochester, New York.

Safety valves.—One 2½in. Crosby direct-acting lock-up, and one flat valve with lever and scale in cab.

Springs, engine.—Made of carefully selected crucible cast steel by A. French and Co., Pittsburg, Pa.

Tender.—Eight-wheeled, forward truck centre bearing, rear truck centre and side bearing; frame of oak, well braced; outside sills bound with iron.

Tank.—Capacity, 2400 gallons water; top and bottom plates, No. 5 B.W.G.; sides, No. 6 B.W.G. iron, with angle iron corners, well braced.

Wheel base.—Driving wheels, 8ft. 6in.; engine wheels, 23ft. 4in.; engine and tender, 43ft. 8in.

Brakes.—Westinghouse automatic on driving wheels and tender; hand brakes on both tender trucks.

Grate.—Area, 16·9 square feet.

Ash-pan.—Newth's patent drop bottom.

Heating surface.—Fire-box, 112·42 square feet; tubes, 1207·66 square feet; total heating surface in boiler, 1320·08 square feet.

Weights.—Weight of engine empty, 33 tons 14 cwt.; weight of engine in working order, 37 tons 15 cwt.; weight on drivers in working order, 24 tons 2 cwt.; weight on engine truck in working order, 13 tons 13 cwt.

Tonnage.—This engine will haul in addition to the weight of engine and tender, the track being in good condition and comparatively free from curves, on a level, 1312 tons (2240 lb.); on 1 in 264, 623 tons; on 1 in 132, 393 tons; on 1 in 88, 278 tons; on 1 in 66, 209 tons; on 1 in 53, 163 tons.

LIVERPOOL ENGINEERING SOCIETY.—The thirteenth meeting of the session was held on Wednesday, the 7th of November, at the Royal Institution, Colquitt-street, Mr. H. Bramall, president, in the chair, when a paper, entitled "The Proposed Lancashire Plateway," was read by Mr. A. Holt, M.I.C.E. The author commenced by stating that while the project was at present in embryo, it would be impossible to avoid mixing commercial matter with engineering, as the latter was dependent on the requirements of the former. "Necessity was the mother of invention," and the pressing personal necessity of cheaper conveyance drove him to devise this scheme in order to obtain something approaching natural carriage rates for export goods to China. The course of thought that led him to suggest the plateway system—for which he claimed no invention, but only adaptation—was as follows: Analysis of the present carrier's rates soon showed that nearly half the whole were for other services than carriage, and which were not asked for by the traders, broadly known by the name of "terminals," and mainly consisting of loading and discharging, and station expenses. This led him to endeavour to devise a system which would avoid these. This was evidently attained by the plateway, the underlying principle of which is that the same vehicle should be suitable for being drawn on ordinary roads or along metals. Thus all loading and discharging were avoided, and the stations were reduced to mere open yards for coupling lorries into trains. The steam traction when on the metals would be done by ordinary locomotives, arranged with small wheels for slow draught—say ten miles an hour. Another leading distinctive feature of the plateway is that, though the speed would be slow, the delivery would be quick, owing to no delay being necessary to keep the line free for passenger trains, the conveyance of goods alone being contemplated. There is, Mr. Holt alleged, no constructive difficulty in drawing a wagon on metals. Its strength and durability are more severely tested at present on the rough roads. The metals would, in principle, be simply an ordinary railway tire-bar straightened, and the tire simply a rail bent into a circle. These alterations, Mr. Holt contended, should make no difference in the conditions of draught, which when on the metals should be fully as easy and safe as a railway, and when on the roads identical with the ordinary street lorry. He handed round copies of a pamphlet, giving woodcuts of the vehicle under horse as well as under steam traction, and containing sundry other illustrations of the system, and some calculations of its cost, profit, and general advantages to trade. Mr. Holt contended that by the avoidance of unnecessary expense, so cheaply might the system be worked that calculations showed that a good profit might be realised at a rate of one penny per ton per mile, plus a ninepence terminal, for full loads of undamageable goods, or general goods on which claims for damage were agreed to be foregone, throughout all Lancashire. He explained the circumstances of the abortive Bill of 1882, and also laid before the meeting the plans on which the project would be placed before the public as soon as that impossible "Will o' the Wisp" was settled. The list of assistant promoters was probably the best that ever joined for one object in Liverpool. To them he hoped to add concurrent support from Manchester and the manufacturing districts; and so supported, he anticipated being able to carry a Bill through Parliament despite the opposition of the present carriers. He also believed in being able to convince investors that the project would be profitable; and animated by a firm belief that, in the present state of engineering science, the plateway system is far the best for a district like Lancashire, where the trade is large and the distance is short, he proposed to persevere when circumstances were fitting.

LETTERS TO THE EDITOR.

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

THE NEW PATENT ACT.

SIR,—I enclose the reply received in answer to my letter, which settles the question of fees payable on application for patent before January 1st, 1884, so much controverted. C. L. H. LAMMERS.

2, Roseworth-terrace, Gosforth, Newcastle-on-Tyne, October 28th.

[Copy.]

Right Honourable Sir,—

The diversity in the reading of the 45 section (Clause 3) of the new Patent Act, and the desire of the Government to lighten the burdens of inventors, must be my apology asking advice in my perplexity. I have an invention now ready to file an application for provisional protection. If I wait until January next to take the benefit of the reduction in fees I may be anticipated by an application for the same invention before I can file my application under the reduced fees, in which case my invention and experimental expenses would be lost. If to avoid this risk I file my application on the 1st of November next, paying £5 under the old Act, the next payment and proceeding will be when the new Act is in force. Section 45 (Clause 3) says, "In all other respects (including the amount and time of payment of fees) this Act shall extend to all patents granted before the commencement of this Act, or on application then pending in substitution for such enactment as would have applied thereto if this Act had not been passed." Is my application dated Nov. 1, 1883, an application then pending to which (including the amount of time of payment of fees) is extended; or, in other words, have I to pay £3 under the new Act or £20 under the old Act to complete my application of Nov. 1, 1883?

I need not say that £3 against £20 is an important consideration to most inventors, and shall, with many other inventors, be grateful to know if an application now made can be completed for £8 and £25 in fees.—I am, Right Honourable Sir, your most obedient servant,

C. L. H. LAMMERS.

To the Right Honourable Mr. Chamberlain,
President of the Board of Trade.

[Copy.]

Office of Commissioners of Patents,
Sir,— October 26th, 1883.

In reply to your letter of the 20th instsnt, addressed to the President of the Board of Trade, I beg to inform you that applications made before the 1st Jan., 1884, will be subject, as regards fees and procedure, to the provisions of the Act of 1852, up to and including the filing of the final specification.—I am, Sir, your obedient servant, H. READER LACK.

C. L. H. Lammers, Esq.

RAILWAY SPEEDS.

SIR,—It is to be regretted that your correspondent "M. M." declines to accept the facts contained in my letter, page 323. It is perfectly impossible for him to have travelled by the Midland Company's 5.15 a.m. express from London to Sheffield without changing at Trent. It is a fact that the train runs to Manchester, and all passengers for Sheffield and the North are required to change at Trent into a train which starts at 7.40 a.m. from Derby. Your correspondent—page 339—gives a table intended to show the working of the train in question, but unfortunately he does not give either the distances, number of stops, or actual running time correctly, therefore the results he obtains as to miles per hour must be incorrect. As he declines to accept my statement, I forward the following table of the running of the 5.15 a.m. train, compiled for me at Derby from the company's official distance and time-tables :—

[COPY.] Derby, November 3rd, 1883.

Running of 5.15 a.m. between London and Trent, and of 7.40 a.m. from Derby, between Trent and Leeds.

Distance *viâ* Sheffield.		Stations.		Time, a.m.	Time standing at stations.	Number of stops.
miles.	chains.				minutes.	
—	—	St. Pancras ..	dep.	5.15	—	—
49	65	Bedford	arr.	6.15	3	1
			dep.	6.18		
99	9	Leicester	arr.	7.18	4	1
			dep.	7.22		
119	67	Trent*	arr.	7.50	7	1
			dep.	7.57		
146	6	Chesterfield ..	arr.	8.32	3	1
			dep.	8.35		
158	31	Sheffield	arr.	8.54	4	1
			dep.	8.58		
163	68	Masbro	arr.	9.8	2	1
			dep.	9.10		
176	77	Cudworth	arr.	9.29	2	1
			dep.	9.31		
183	2	Sandal & Walton	arr.	9.41	3	1
			dep.	9.44		
187	1	Normanton ..	arr.	9.51	6	1
			dep.	9.57		
197	68	Leeds	arr.	10.15	—	—
		Total			34	9

* NOTE.—The train from London leaves Trent for Manchester at 7.54. Passengers for the North change into the Derby train, and leave Trent at 7.57 a.m., *viâ* the Newark Valley line.

The above table conclusively proves that the distance from St. Pancras to Leeds *viâ* Sheffield is 197 miles 68 chains, and that the train in question makes nine stops, not eight, as given by "M. M."

CLEMENT E. STRETTON.

40, Saxe-Coburg-street, Leicester, November 3rd.

THE UTILISATION OF SEWAGE.

SIR,—In June last an article, written by Mr. Kidd, appeared in one of the gas journals, giving the result of the distillation of one ton of dried sewage. It would appear from this that in the economical treatment of sewage sludge it is not necessary to evaporate by heat more than one-third of its weight of moisture, and as 5000 cubic feet of gas are generated by its distillation, about every 750 cubic feet of which, when applied to properly constructed boilers, would evaporate one ton of water, a large amount of steam would be raised and used for drying purposes, to save further cost of fuel.

I have not had an opportunity of seeing sludge dried by such process, but I have obtained a small quantity of ammoniacal liquor from the distillation of a lime-treated sewage, and had it analysed; the result shows 2·93 per cent. of ammonia, equivalent to ammoniacal sulphate 11·4. Considering the large amount of ammoniacal liquor, besides other valuable residual products yielded, such a process applied to the treatment of sewage deposits would be far less costly than the purchase of chemicals, and after expense incurred in getting rid of such filthy materials.

J. C. CHAPMAN, Assoc. M. Inst. C.E.

70, Chancery-lane.
November 10th.

SIR,—I venture to think that M. Rodolph de Salis has not read my letter very carefully. If he will re-peruse it he will find that I am quite aware that certain manurial values pass away in solution with the effluent water; and I state that although numerous plans have from time to time been tried to extract these values, not one, so far as I am able to obtain evidence, has been successful. I suggest that if chemicals are used it would be more economical to apply them to the effluent than to the incoming sewage, but by far the best plan is to use a clarified effluent obtained by natural subsidence for irrigation. As to the value of the "resulting sludge," M. Rodolph de Salis is I think in error. The analysis of sewage sludge dried by my process shows that it contains over 2 per cent. of ammonia, 2¼ per cent. of phosphate of lime, and 2½ per cent. of alkaline salts. As a manure, although in this state it is not worth a farmer's attention, it possesses a far greater value than the cost of obtaining it. All the values are therefore not held in solution. I am perfectly aware that the sludge is in many cases dug into the ground, and it is against this wilful waste and extravagance that I protest. Thousands of tons of sewage sludge may be obtained and brought into a fit state for commercial utilisation at little cost, so that the full theoretical value may be realised either by manufacture into a high class manure or by distillation in retorts. I am not acquainted with any process which offers the same advantages or anything like the same remuneration for the capital employed. With regard to purity of effluent, I have before me the results of many different modes of procuring precipitation by means of chemicals; and in no case does it appear that the effluent is made purer than by the means I advocate, the matters extracted being the solids in suspension, the chemical values passing away without diminution, in many cases increased by the action of the chemicals used. What is to pay the cost of the chemicals?

J. HOWARD KIDD.

Westminster-buildings, Wrexham, Nov. 6th.

SIR,—Like many other professional men, I have both spent time and money in my endeavours to improve the sanitary state of our dwellings. The other day a very intimate friend sent me one of your papers with a letter in it written by Mr. Howard Kidd, which made things worse instead of better. However, one of your London engineers who has been residing in this locality for some time, discovered this summer a new system which gets rid altogether of sewers, and, of course, the pollution of rivers. The new system is this: As soon as the water-closet handle is raised the water is separated at once from the excreta, passes to the drain, the other into an air-tight receiver partly filled with ashes or other disinfecting material, then taking to the mixing house made ready for the former, which they say will be invaluable for their clay lands. Having seen it at work, I must say it sets sanitary troubles at rest. J. FORREST, M.D.

Newhouse, Scotland, Nov. 13th.

PROFESSIONAL ETIQUETTE.

SIR,—Most engineers of respectability will agree with your article on this subject in THE ENGINEER of the 19th ult. I know of one notable case in the North of England, where the course followed with regard to one of our most eminent engineers has been pretty nearly what you describe, with the addition that the local engineer who has now got the undertaking in his own hands was Mayor of the town during the promotion of the bill. The promoters were the Town Council, and I have always heard that it is illegal for a member of a corporation to hold any office which carries salary or fees paid by that body. Minor difficulties of this kind are, however, easily got over, and in the case to which I now allude the Mayor's partner was appointed to keep the berth warm till the bill had passed. Having by skilful pilotage achieved this result, our Mayor—his year of office having now expired—steps forth as our engineer. This may, perhaps, be all square, but it looks a little queer, more particularly as our worthy ex-Mayor has not had previous experience in large works of the kind he is now to undertake.

Although, perhaps, somewhat foreign to the subject, allow me to give a word of advice to Town Councillors—if, indeed, there are any anywhere who have not already learnt the lesson. If any large scheme is promoted by the town, you should make something out of it. Gratuitous services are all very well, but no one should be expected to work for nothing. One very good method of procedure is as follows:—First, get up a good syndicate, having large influence in the corporation: second, buy some land where works might be carried out; and, third, get the corporation to choose this site for the works, paying, of course, a good round sum for the land. Whether or not the land is the most suitable for the purpose is of no consequence, if only the price is big enough.

London, November 6th. C. E.

THE NEW WIRE GAUGE.

SIR,—The proposal of "Anti-metric" in THE ENGINEER of the 26th ult is in a measure ingenious, but it has one very great defect, which I apprehend is fatal to its general adoption. The variations from number to number throughout his gauge, say from ½in. down to $\frac{1}{100}$ part of an inch, are all even hundredths of an inch, so that there is precisely the same measure of difference between the thinnest of his gauges and its next higher or thicker number, as between ½in. and its next lower or thinner number; whereas in practice it is well known that in the finer thicknesses of wire, sheet iron, &c., we want proportionately finer variations, while in the thicker sizes the variations may be proportionately coarser or wider apart.

The Birmingham wire gauge has long been condemned, because for want of authority to determine what its varying thicknesses and corresponding numbers really should be, a number of scales slightly differing, but each one asserting its claim to be the only one true and veritable Birmingham wire gauge, have met with recognition in the trade; and because, in one and all of these, the advances in thickness from one number to another have been arbitrary and unsystematic. Where it is possible to introduce order without an absolute overthrow of established custom, I maintain it is better to do so; and in the case of the wire gauge, it is better as far as possible to avoid disturbing well understood and universally established rules. Everybody who knows anything about iron perfectly understands that as long as men can remember sheet iron $\frac{1}{16}$in., or ·0625, thick, has been No. 16 on the Birmingham wire gauge, and that sheet iron weighing 1 lb. to the superficial foot, or that measures ·025in. thick, has been No. 24 on the Birmingham wire gauge, and unless there is some absolute necessity to alter these two old-established points on the wire gauge—and there certainly is no such necessity—it is undesirable to meddle with them; and if we say that No. $\frac{3}{0}$ is ½in. or ·500; No. 4 is ¼in. or ·250; No. 10 is ⅛in. or ·1250; No. 16 is $\frac{1}{16}$in. or ·0625; No 22 is $\frac{1}{32}$in. or ·03125; No. 28 is $\frac{1}{64}$in. or ·015625; No. 52 is ·00095 or practically 1 mil.; with all intervening numbers systematically filled in, we should have a scale from No. $\frac{3}{0}$=500 mils. graduated in thickness, by attenuations that are practically the same in degree or percentage one from another, right through to No. 52, which is practically 1 mil. Thus, there would be the same proportionate measure of difference between the finer sizes as between the larger sizes. And the same arrangement would be suitable for not only sheet iron, but wire, copper, brass, zinc, &c., for which reason I would recommend that it be no longer called a B.W.G., but "the English Imperial Standard Metal Gauge," and in short "the Metal Gauge," or "M.G."

The sooner we have decimal divisions made customary for reckoning in weights, measures, and coinage the better, but by all means let us preserve the pound-weight, the yard measure, and the gold sovereign as units. Some writers may recommend the metric system pure and simple, but I cannot see why the French metre of 3ft. 3⅜in. should be any better than the yard of 3ft. for a unit of measurement, and it would be exceedingly undignified for the greatest commercial country in the world to cast off its ancient and time-approved bases of comparison for the sake of adopting other bases no better in themselves, because they prevail in neighbouring countries. I cannot think that anyone would seriously advocate such a radical change as that, but allusions to the French metre, litre, gramme, &c., that have appeared in print in arguments favouring the decimal system might by some be taken as urging that they should become likewise bases of comparison in this country. WILLIAM HATTON.

Bilston, 5th November.

GJERS' SOAKING PITS.

SIR,—As probably many of your readers take an interest in the economical manufacture of steel, I beg leave to draw your attention to the following letter, written Mr. W. W. Scranton, president of the Scranton Steelworks, United States, which appeared in the *Engineering and Mining Journal* of New York, published on the 29th of September last, as follows:—

THE GJERS' SOAKING PIT AT THE WORKS OF THE SCRANTON STEEL COMPANY.
(*Editor Engineering and Mining Journal*)

SIR,—At the request of my friend, Mr. John Gjers, of Middlesbrough, England, and as marking a distinct advance in our American rail mill practice, I take great pleasure in informing you that Mr. Gjers' soaking pits have been in constant use at these works since September 3rd. During that time we have rolled about 80 per cent. of our ingots directly from the pits, without other heating, into 120ft. flange rails, weighing mainly 67 lb. to the yard. We are at present rolling about 85 per cent. and upwards of our ingots directly from the pits into 120ft. rails, weighing 70 lb. to the yard. With the pits we run one heating furnace—most of the time days only—to work up cold ingots, &c., which may accumulate from any of the ordinary causes. We find that with four-rail ingots six pits are easily good for about 150 tons of rails per turn. We are informed that what we are now doing has not been done as regular work anywhere else, either in Europe or here.—Respectfully yours,

W. W. SCRANTON, President.

Mr. Scranton is perfectly right in stating that his are the first works where four lengths of steel flange rails have been rolled direct from the ingot out of the soaking pits continuously for a month, and the result is due to his quick appreciation of the advantages and to the energetic application of the system. I feel sure that Mr. Scranton will be rewarded by a still better result in percentage as his people get more accustomed to the new mode of work, and that he will be able to roll 95 per cent. of his make through the pits instead of the 85 per cent. which he has arrived at after the first four weeks' work.

Other American works, such as the "Edgar Thomson" and the "Cambria" will very soon—if not already—have the system at work, but for blooming only, as they at present are not rolling off. The above letter, however, will establish the fact that wherever it is possible or advisable to roll off into long lengths of flange rails from one heat, the same result can be obtained by the use of the soaking pit without any heating at all. Those gentlemen who visited the Darlington Steel Company's works during the recent meeting of the Iron and Steel Institute witnessed the direct rolling of single length double-head rails from the pits, and will, I feel sure, admit that it was done easily and practically; nearly 80,000 tons of ingots having now passed through their pits and bloomed, of which several thousand tons have been rolled direct into rails. The light machinery at the Darlington Works does not permit of long lengths of flange rails being rolled direct from the pits, but the Mossbay Iron and Steel Company have repeatedly proved that they are able to do it, and they are now preparing to carry out the system on a proper scale.

At West Cumberland Steel Company's works, Mr. Snelus early took advantage of the system, and has been continuously blooming from the pits for more than twelve months, and has passed more than 75,000 tons of ingots through the pits. At Middlesbrough the North-Eastern Steel Company have satisfied themselves that they can easily roll off, and are now beginning to carry out the system. In Belgium, at the works of the Society John Cockerill, Seraing, under the management of Mr. Greiner, 96 per cent. of the make is now regularly bloomed from the pits. In France the firm of De Wendel will shortly have the pits at work, and in Germany at least two works are at present building soaking pits. In Austria Mr. Kupelwieser has been for some months putting his soft steel ingots for plates through the pits—rolled them into slabs without any heating; and he is about completing and starting a new rail mill, which will be worked entirely from pits. The Steel Company of Scotland are applying the system to their Siemens-Martin's ingots for plates, and will be at work on a large scale before long.

It will thus be seen that the system is making sure progress, but prejudices have to be overcome, and will certainly give way wherever the system is properly understood and carried out. The economy of the system has now been thoroughly proved. The saving will of course vary in different works according to circumstances, but the following data will enable any one to estimate it in their own particular case:—The furnace coal, whatever it may be, will of course be saved. As to saving in yield of steel, it is now well proved from numerous experiments lately verified by Mr. Greiner, of Seraing, that the loss of weight from the ingot out of the mould to the bloom after it leaves the rolls is about ½ per cent. when the ingot has been treated in the soaking pit. It has also been proved that there is a further loss of nearly ½ per cent. in the finishing rolls; so that working with the pits, the blooming means a loss of ½ per cent., and rolling into rails direct means a loss of nearly 1 per cent. of steel.

Now, I take it that when heating furnaces are used the loss in blooming is seldom less than 2½ per cent., and the loss in rolling direct from one heat not much less than 3 per cent., so that the use of the pits means a saving of something like 2 per cent. of steel. As to labour, it will be noticed from Mr. Scranton's letter that six pits for four rail ingots are quite equal to preparing 150 tons of ingots in twelve hours to work this quantity, and probably 30 per cent. more. The men required are—one man, say at 5s., 5s.; three men at 4s., 12s.; one boy at 2s., 2s.; total, 19s.; or about 1½ per ton on 150 tons, and under favourable circumstances this can be materially reduced.

Then comes the items of repairs of furnaces as compared with soaking pits, and I can point to the experience at the Darlington Steel Works, where a set of eighteen pits were started thirteen months ago; through these pits more than 60,000 tons, representing about 120,000 ingots, have been passed. They are at work at present and likely to last for a considerable time, having practically had no repairs, except what is given them occasionally while in regular work by balls of fire-clay dabbed into cracks or hollows in the brick walls of the pits, applied by the men who work them.

I hope I have not trespassed too much upon your valuable space. JOHN GJERS.

Middlesbrough-on-Tees, November 6th.

STEAM ENGINE ECONOMY.

SIR,—Will your correspondent, "J. B. Crossley," kindly inform me with reference to the trial you published in THE ENGINEER of the 19th October (1) whether the coal was weighed, and if so, was steam got up to working pressure, and the fires drawn, the coal so used not being taken into account? (2) Was the water used for boilers properly measured, and how? Were the water level and the pressure in the boilers the same at the end as at the beginning of the trial? I understand that the coal comes to the Old Steam Mills by boat, and is shovelled into the fire-hole direct, so that it is not weighed. I am told that a boat load is generally in this district understood to mean about 32 tons, sometimes more sometimes less; but the mill owner is only supposed to pay for the 32 tons, when really it may be 33 or 34 tons. In this way no accurate calculations can be made, but I have diagrams taken from these engines day after day until a boat load was burnt under these conditions, which show consumption of coals to be 2·65 lb. per indicated horse-power per hour, the engines indicating on an average for four of these days 275·9 indicated horse-power. But it is obvious that these calculations cannot be quite right under the circumstances.

Does Mr. Crossley mean that the actual amount used is as stated 2·016 lb., or is Messrs. Rayner only supposed to pay for this amount? Mr. Crossley has perhaps noticed that 532 ÷ 249 = 2·136, and not 2·016 as stated. W. T. M.

Rhodes, Middleton, Lancashire,
November 6th.

DESIGNS, SPECIFICATIONS, AND INSPECTION OF IRONWORK.

SIR,—I have not much time to spare for letter writing. Still I must thank Mr. Webster for his apology contained in his last letter. As to the sketch of my angle iron joint cover in your impression, it is quite correct, and Mr. Dornton's sketch is the same as mine. I will try and make clear to Mr. Webster about tensile or lateral strains. Where a joint occurs in tension members, obviously a joint cover is needed; while if Mr. Webster will sub-

stitute "bending" or "buckling" for lateral, possibly he will understand me.

Mr. Webster is amused at what he calls my burst of virtuous indignation about doubting respectable firms. He says he has always found it necessary to inspect each delivery. Am I to understand him to mean that he simply had to look over the plates for cracks, laminations, or other defects of that sort? or does he mean that he had to test samples? If he means the former, then I must refer him to my last letter. If the latter, then it would be interesting if Mr. Webster would kindly tell us how often he has had to reject deliveries succeeding the first accepted lot? I hope he will give us some idea of this. Let him, without supplying names, state the particulars of any one contract he has superintended, the number of individual deliveries of iron, and the number of those again he has had to reject. I think Mr. Webster is less than just to the business capacity of millowners if he thinks that they allow iron to be sent out simply at the unchecked discretion of their employés, taking no personal cognisance of its quality before it is delivered.

Mr. Webster asks, "Why have inspectors at all?" Surely he must be aware that an inspector has many responsible duties besides the one of testing the quality of the iron—duties that involve no suspicion of the honesty of the contractor.

I am sorry Mr. Webster should think I wanted, or intended, to make capital out of his clerical error about cinder being pressed into the roll. I only corrected the error for him. He reminds me that it is not necessary to spoil a large plate by cutting a sample from it. Will he be so kind as to describe how the quality of the plate is to be determined? The iron is always delivered nearly finished size, allowance for planing only being left. The engineer may certainly go to the mill, see the plate rolled and trimmed, and obtain test pieces from the trimmings; but some millowners object to this, fearing that the iron in the trimming may be, from some cause or other, inferior to the plate itself, and decline to accept such test. Under these circumstances, what would Mr. Webster do? The thing has happened to myself. Mr. Webster maintains that my test of hammering down and bending the corner of a plate would be perfectly useless. Has he never seen it stipulated in specifications that the iron shall bear cold bending to an angle of a certain number of degrees without cracking? I can assure him I have in my possession specifications with such a condition; and the clause, too, is badly, very badly, framed, and contractors have made complaint to me of it; for it says not a word about the radius of the bend, nor whether the bending is to be done by a hammer or by a press.

Mr. Webster does not like my quoting the practice of foreign workshops very well. I may tell him I superintended the making of an iron bridge some three years ago, containing about 260 tons of iron, and the plates were all done in the way Mr. Webster thinks so expensive, and it was done by a very eminent English firm, so I do not need to hurt Mr. Webster's patriotism in the least. He says that for drawing plates together a long taper-ended spanner should be sufficient. It does well enough in small, light work; but let him try and adjust, say, five ¾in. plates, 14ft. long and 3ft. 6in. wide, laid one on another, forming part of the main flange, and he will quickly find he will need something more powerful. Mr. Webster says:—"Then Mr. Pendred does not approve of drifting. I quite thought he said it was absurd to forbid it." Once more I am compelled to correct his logic. Cannot he see that there are many methods of work of which we may not approve, but which common sense—that best of all engineers, as Vauban said—tells us we must make use of, because we have no better, and which, therefore, it is absurd to forbid? I will put a fair and reasonable proposition to Mr. Webster—will he write out the general particulars of any iron structure he is personally cognisant of containing, shall I say, 200, or even 100 tons of iron, that was made and finished from beginning to end absolutely without the use of a single drift? I am sure, if he will, such a document will be matter of general professional interest.

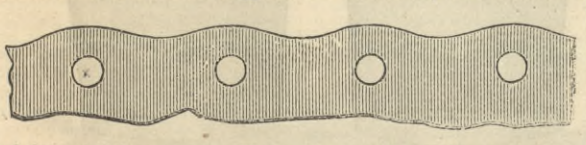
Lastly, I observe that Mr. Webster virtually withdraws the remarks about heating rivets throughout contained in his first letter, for he now says he is well aware the holes have to be much larger than the rivets. He takes exception, however, to what I said about $\frac{1}{16}$ of an inch. In a letter it is difficult to go into minutæ. I had in my mind $\frac{5}{8}$, $\frac{3}{4}$, and $\frac{7}{8}$ rivets, these being the sizes in most common use. Less, of course, will do for smaller rivets. As to the squeezing or bulging of rivet shanks between the plates, I must only ask Mr. Webster to read my last letter again. He kindly has taken the trouble of trying a practical experiment for mine and Mr. Dornton's behoof. For myself I thank him very much, he does not clearly describe the experiment. Had the thin packing a hole same size as plate holes? or was it larger so as to leave a circular recess? I presume the latter. Well in that case the experiment is useless, and teaches us nothing we did not anticipate before, or, at least, I will speak for myself. What is the use of trying an experiment of this sort under conditions never present in actual every-day practice? Of course Mr. Webster's rivet obeyed the great natural law, and its parts followed the line of least resistance. Will he kindly repeat his experiment exactly as before without the packings, and leaving all his conditions as much as possible those of every-day work, and tell us the result? I may tell Mr. Webster that some years ago I was shown two $\frac{5}{8}$ plates rivetted together by a Tweddell machine and planed down, removing half the seam, and not the least trace of bulging between the plates existed. There were, I think, four $\frac{5}{8}$ rivets in it.

HAMILTON W. PENDRED.

November 10th.

SIR,—Before the discussion raised by Mr. Webster is allowed to drop, I think it would be to the advantage of many of your readers that something should be said concerning machine rivetting. For myself, I may state that a somewhat extended experience in all classes of work leads me to state that while nothing can equal the hydraulic rivetter, as made by Messrs. Fielding and Platt, for coarse, heavy bridge work, where three or more thicknesses of plates are to be rivetted up, machine rivetting is quite unsuitable for all but heavy boiler work, the most of which really cannot be closed by hand.

The hydraulic rivetter is never used in the best locomotive boilers, nor, indeed, in any first-class boiler works, but it is the mainstay of slop boiler makers, and an examination of most machine rivetted boilers will show that the edges of the plates assume the form shown exaggerated in the sketch, while cracks are



of frequent occurrence. These are caused by the rivet being expanded so much in shutting up that it tends to burst the plate, and sometimes does burst it.

It may be said that with care this cannot happen, but it does happen. I saw it happen, in boiler works not 100 miles from London, very recently. I was inspecting a totally different job in the works, and having nothing particular to do for the moment, I stopped to see a horizontal seam rivetted up in a large vertical boiler. Two holes were split before my eyes in five minutes, and I subsequently found the edges of the plates as I have shown. It was no affair of mine, but I called the foreman's attention to it afterwards. "Well," he said, "the men put on too much pressure; it is all contract work, and it saves caulking." This is only one instance I could name out of many, for Mr. Webster may say such things are not done, just as he said bridges could be put up without a drift, and that angle irons were never used as covers.

Concerning big marine boilers again, it seems that hydraulic rivetters do not put on pressure enough, for it is the universal practice in the North to caulk all round the rivet heads inside such work. A great deal of advantage might be gained, I think, by a full discussion of the whole subject of rivetting, hand and machine—I mean from a practical point of view—as to the results obtained from each as regards cost, and strength, and durability.

Millwall, November 12th.

SNAP HEAD.

CONTINUOUS GIRDERS.

SIR,—In Mr. Max am Ende's article appearing in your last issue on "Continuous Girders," Example 3 is specially interesting. An error occurs in working it out which may prevent those who notice it forming as high an estimate of the value of the example as it deserves. I therefore write to point out that this error does not affect the result. In equation 10 instead of $\frac{14}{49}\ d^1{}_b$ there should be written $\frac{14}{49}\ (d_b + d^1{}_b)$, and instead of $\frac{15}{49}\ d_a$ there should appear $\frac{15}{49}(d_a + d^1{}_a)$. The same slip occurs in the second equation in the third column, where $d^1{}_b$ should be replaced by $d_b + d^1{}_b$, this being again twice repeated lower down. Similarly in the next integration we should have $d_a + d^1{}_a$ in place of d_a. But these are probably clerical errors because they cancel each other, and the resulting equations, (12) and (13) are correct.

It may be useful to gather the results obtained in examples 3 and 5 together. Three different pairs of values for the forces P and Q are obtained for three corresponding pairs of values for the deflections d_p and d_q at the points P and Q. The results are the following, where I have expressed the deflections as fractions of an inch so that they may be more readily imagined, and where I have calculated P and Q for the last case from Mr. Max am Ende's equation with the signs of the factors of e changed, which again have been put in wrongly without the result being wrong:—

P	Q	d_p	d_q
tons.	tons.	inch.	inch.
— 1	+ 11	·024	·008
+ 7·56	+ 3·52	0	0
+ 0·22	+ 9·39	·028	0

Such very large differences in the supporting forces P and Q being due to such minute differences of level in the supports at P and Q, it may well be doubted whether such calculations can be usefully or safely applied to practical work of this class.

Mason Science College, Birmingham, November 10th.

ROBERT H. SMITH.

THE GLADSTONE.

SIR,—While concurring with your correspondent "I. D. R," that the ports of the Glasgow and South-Western engine are considerably throttled, I may mention that there are other engines running in a very nearly similar predicament, which have not shown any particular failing from this cause. On reference to my sketch of the arrangement of the cylinders of the engine above referred to, it will be seen that a portion of the framing has been cut away to admit the flange of the cylinder and its cover, giving more room than would otherwise be obtained, and thus bringing the cylinders in close proximity to the framing. However advantageous this may be for securing increased room for ports and valves—the exhaust ports of this engine being 3¼in. wide and 1ft. 4in. long, as compared with 2in. wide and 1ft. 3in. long in the Gladstone—it must act most unbeneficially on the bearings and crank webs. In the Glasgow and South-Western engine, the length of bearing of the crank axle is 7in., and the thickness of the web of the bearing side of the crank is not more than 4in., the corresponding dimensions in the Gladstone being 8⅝in. and 5in. respectively. All who are concerned in locomotive matters will look forward with interest to the results given by the new South-Eastern engine, stated by "F. M." as being constructed with 19in. inside cylinders with the slide valves between them.

F. A. FIELD.

28, Southampton-buildings, London, November 10th.

SIR,—Referring to the correspondence under this title, out of which has arisen the discussion as to the difficulty of getting a little larger cylinders between the frames of a locomotive than is the common practice when the valve chests are between the cylinders, this difficulty does exist, coupled with the excessive crowding of all the parts; but in the case in point, the "Gladstone," the valve chests are below, and even larger cylinders might have been employed if it had been thought desirable. Thus the difficulty and the crowding of parts and cramping of surfaces disappear when the valve chests are placed either above or below. As a case in point, Mr. Johnson, of the Midland, is now building some large engines for his fast and heavy traffic, which has to be worked over very heavy gradients. These engines have 19in. cylinders, with 26in. stroke. The bearings of driving axle are 9in. long, and the crank webs are 4½in. thick. The valve chests are on the top, and the valves are worked by my valve gear, which allows of this disposition of the parts. On this system even 21in. or 22in. cylinders may be got in, retaining the 9in. bearing and 4½in. crank webs. Cylinders of this size are being used by our American neighbours for outside arrangements, and I know of at least one locomotive superintendent who is preparing to adopt 20in. for inside cylinder goods engines; and if traffics and speeds are to go on increasing as they have done of late years, we shall have to come to these dimensions shortly.

DAVID JOY.

8, Victoria-chambers, Westminster, November 13th.

SIR,—Referring to a letter in your last issue signed "F. M.," in which it is stated that Mr. P. Stirling built engines in 1871 with cylinders cast in one, I wish to remind "F. M." that Mr. William Stroudley made engines with cylinders cast in one piece as early as 1870.

A. W. L. PARKHOUSE.

Brighton, November 14th.

DEPRECIATION IN FACTORIES.

SIR,—If your correspondent "Z." had stated what he means by "alterations and repairs" it would be easier to reply to his query. If "Z." has an extensive establishment employing many machine tools, and his trade be of a diversified character, it is probable that his "alterations" of plant frequently involve considerable outlay to adapt different machines to the varying nature of his trade. If this be so, and the said "alterations" add to the value of the machinery, they have as much right to be charged to machinery account as additional or new machines have. If by "alteration" "Z." means simply repairs, I think his former plan of charging this item to profit and loss the safer and wiser plan of the two. Repairs and maintenance should go together, and if these are fairly well kept up, the rate of depreciation may and ought to be a low one.

With all due respect to your able correspondent Mr. Matheson, I doubt greatly whether in these times of close cutting, low prices, and bad trade, there are many engineering firms who can afford to allow such high rates of depreciation as are mentioned by him. It is doubtless a wise plan to be on the safe side by making all such deductions which form part of establishment charges sufficiently large, and provided you can get plenty of work, all is easy sailing; but, Sir, there are not a few firms who are so heavily burdened by these establishment charges, of which repairs, maintenance, and depreciation form a big item, that when they tender for work they are hopelessly out of the running. There is also much to be said for the practice advocated by Mr. Matheson of periodically revising these depreciation rates. That depreciation occurs all know, and equally that it must be provided against, but to commence writing off heavy percentages during the first year or two of a firm's life, simply because it is a fact that after being worked machines are second-hand, and therefore if thrown upon the market would be found to have depreciated immensely, would be an act of folly, and no young firm in general trade could stand against such writing off. Neither, I submit, is such excessive writing off necessary or just. It generally takes a year or so to get a new engineering establishment into smooth working, and the various loose parts, or tools, adapted to the large machines, and the large machines themselves to get into working trim. All this time money is being spent in perfecting the plant, and yet we are told that we must allow a heavier rate of depreciation. And now, Sir, for the result. I have known firms who, having started with much prestige, have been able to continue for a good few years, even though overburdened by these heavy charges, then finding their trade slipping from their grasp, their tenders all hopelessly high, have gone through their costs again and found they had written off for depreciation so largely that their plant and machinery stood in their books at a trifle above scrap price, although splendidly kept and practically as good as ever. Then comes the revision of prices, and they are able to tender on terms of equality with other firms; but alas! prestige has not done everything for them. Their high prices became so well known that their customers went elsewhere, and they had to look to other fields for trade.

I think, Sir, the query put by "Z." about hits the nail. If engineering firms will properly repair and maintain their machinery and plant, charging such repairs and maintenance to profit and loss, the rate of depreciation may and ought to be a low one. It is a source of great satisfaction to many I know to see this question taken up so ably in your paper. It is such a vital point to all manufacturing mechanical engineers, that I trust you will accept this reason as my apology for so lengthy a communication.

M. I. M. E.

London, November 12th.

SIR,—In common with, no doubt, many others, I have read with great interest what Mr. Matheson has said on this subject in your pages, and I think I may add that you have never done your readers better service than by opening this most important subject—never before, I think, handled in print, for discussion. It affects us all as closely as possible; whether we make a profit or find our way to the Bankruptcy Court depends on the way we estimate wear and tear. I would much like to have the views of men who have large experience in the sales of plant, such as Messrs. Wheatley Kirk, Price, and Goulty, or Messrs. Fuller and Horsey, on the deductions that ought to be made for depreciation.

I think Mr. Matheson is in some respects quite too cautious. If we pursued his system fully we should soon have the price of our tools standing at about that of old iron. For example, I bought a steam engine the other day, new; it cost me £300. If I were to work this engine for six months and then sell it I suppose I could not get £100 for it; am I therefore to credit myself in my books with only £100? I say no. I do not want to sell the engine any more than I want to sell my watch, or my books, or the furniture of my house. I hope it will wear itself out in my service, and I can see no sense or reason why I should charge myself with a depreciation of £200 on its account. This seems to me to be the weak point in Mr. Matheson's reasoning. He attaches a saleable value to what is not for sale.

I once knew a farmer who charged himself in his books with a pound a day for each pair of horses and a plough. He also charged himself with £3 10s. per ton of straw converted into manure. He pursued the same process throughout, and he always at the end of the year had a balance against himself in his books, but somehow there was always a balance in his favour at his bankers. He lived in good style, kept a modest brougham for his wife, and entertained his friends. He never could understand how it happened. I have pointed out to him that he had no right to charge £1 a day for horses and plough, but only what they cost. His reply always was that if he hired them out he could get £1 a day for them, and that he ought to charge himself with this sum. It was quite useless to tell him that no one wanted to hire them, and that if he did his own land must go unworked. The same with the straw. He could sell it for £3 10s. a ton; therefore he must charge himself so much. He could not be got to see that he must not sell straw off his land if he kept cattle.

Now, it seems to me that many firms go on this principle, and credit themselves with the selling value of things they could not for the life of them sell. The proper principle is to estimate the probable life of a thing with repairs, and write off enough to replace it. Thus, a steam boiler costs £200; it will last with repairs twenty years. Then £10 a year put by would replace it, even if we do not count interest; so we write off £10 a year. Repairs will probably cost £10 a year more, but I charge them in the profit and loss account, which has nothing to do with depreciation; and as I do not mean to sell my boiler at any time, I never trouble my head with its selling value. I think I am right; will some of your readers say what they think?

Leeds, November 12th.

LONG ESTABLISHED.

SAND BLASTING FILES.

SIR,—In your description of our process in last week's ENGINEER there are two or three points which require, we think, further explanation in order that the matter may not be misunderstood. (1) Our charge of 5 per cent. for sand blasting new files is calculated upon the Sheffield file list prices, not upon their actual value. The average discount for new files at the present time being about 50 per cent., our charge would be something like 10 per cent. of their actual value. (2) The £500 per month mentioned for sand blasting files represents the capacity of our four file sharpening apparatus, but at present we are able to work only two of them because of insufficient boiler power. The amount received for sharpening when using £10 per month of coals is, therefore, only half of the above sum—viz., £250. From this it will be seen that the actual value of new files sharpened with the above amount of coals is £2500. Adding to this the amount sharpened at the two other works where the process is used, we find that between £3000 and £4000 worth of sand blasted files are sent out of Sheffield per month, and the demand is rapidly increasing.

J. E. MATHEWSON.

Bellefield Works, Sheffield, November 12th.

Tilghman's Patent Sand Blast Company, Limited.

CATECHU AS A DISINCRUSTANT.

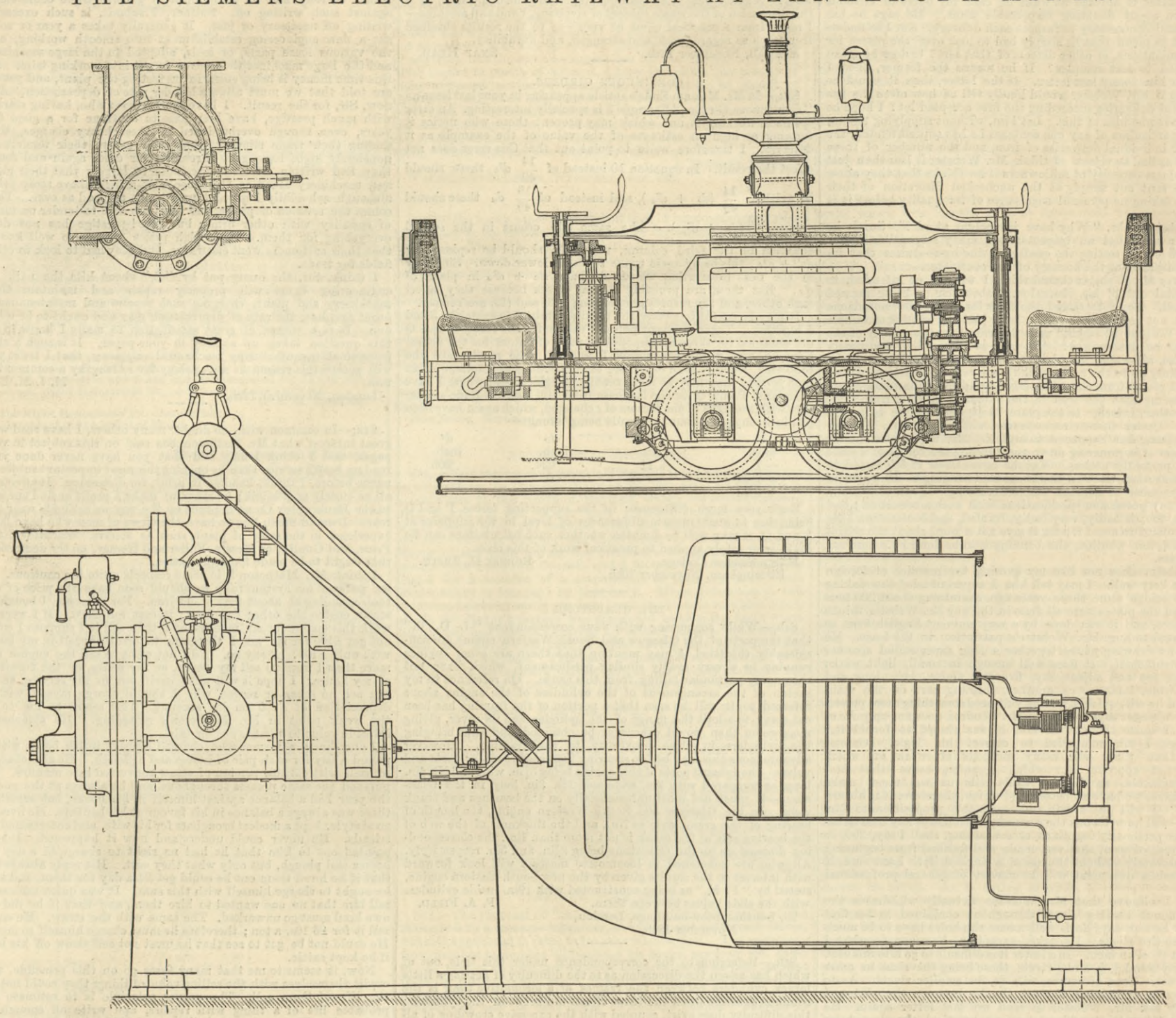
SIR,—I note a letter signed "W. R. Muir" in your issue of the 2nd, stating that the use of catechu to prevent scale in steam boilers is patented by the Disincrustant Marsellaise Company. If the company referred to claims the right of using it in a special manner, it would be well to explain, as catechu has been used for the purpose above indicated for many years, and there is hence nothing to prevent parties using it in steam boilers. I know of it being so used early in 1860, or nearly twenty-four years ago. Probably many of your readers can state similar facts.

November 14th.

CATECHU.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—William J. J. Spry, chief engineer, additional, to the Victoria and Albert, for service in the Alberta, vice Carlisle; Robert Anderson, chief engineer, additional, to the Indus, vice Elgar. Mr. C. Colson, who has been assistant civil engineer at Portsmouth since November, 1874, and who had previously, as clerk of works, had practical charge of the construction of the new docks and basins in the extension works, has been appointed superintending civil engineer at Malta, where it is intended to build a deep dock and new military barracks. He will be succeeded at Portsmouth by Mr. E. Aslat, clerk of the works at Sheerness.

THE SIEMENS ELECTRIC RAILWAY AT ZANKERODA MINES.

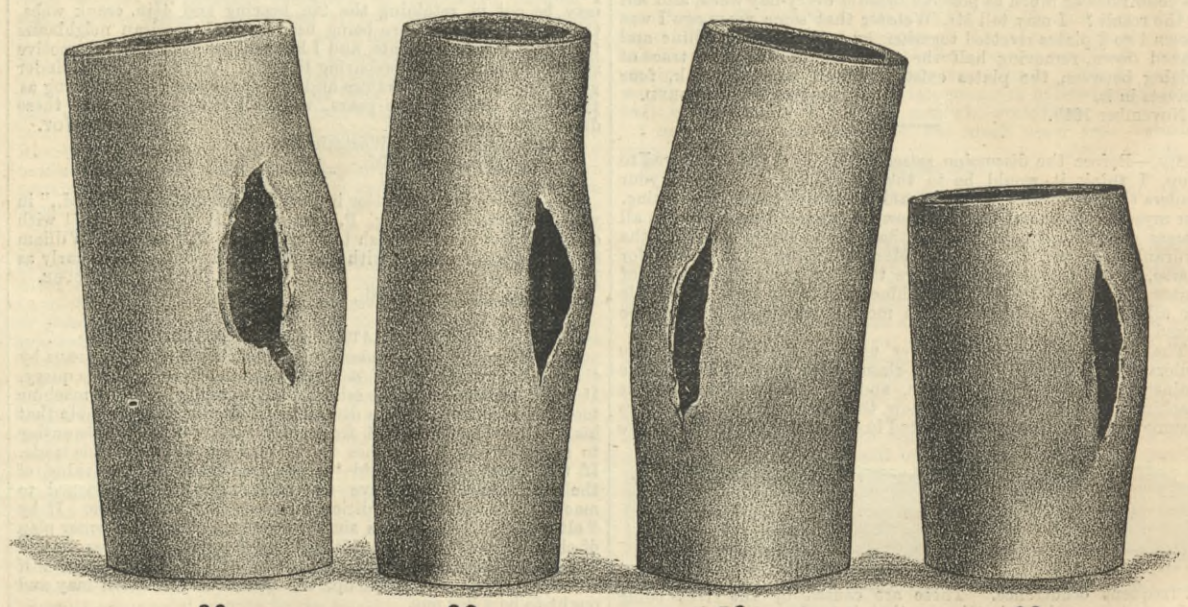


The original electric railway laid down by Messrs. Siemens and Halske at Berlin seems likely to be the parent of many others. One of the most recent is the underground electric line laid down by the firm in the mines of Zankeroda in Saxony. An account of this railway has appeared in *Glaser's Annalen*, together with drawings of the engine, which we are able to reproduce. They are derived from a paper by Herr Fischer, read on the 19th December, 1882, before the Electro-Technical Union of Germany. The line in question is 700 metres long—770 yards—and has two lines of way. It lies 270 metres—300 yards—below the surface of the ground. It is worked by an electric locomotive, hauling ten wagons at a speed of 12 kilometres, or 7½ miles per hour. The total weight drawn is 8 tons. The gauge is a narrow one, so that the locomotive can be made of small dimensions. Its total length between the buffer heads is 2·43 metres; its height 1·04 metre; breadth ·8 metre; diameter of wheels, ·34 metre. From the rail head to the centre of the buffers is a height of ·675 metre; and the total weight is only 1550 kilogrammes, or say 3400 lb. We give a longitudinal section through the locomotive. It will be seen that there is a seat at each end for the driver, so that he can always look forwards, whichever way the engine may be running. The arrangements for connection with the electric current are very simple. The current is generated by a dynamo machine fixed outside the mine, and run by a small rotary steam engine shown in section and elevation, at a speed of 900 revolutions per minute. The current passes through a cable down the shaft to a T-iron fixed to the side of the heading. On this T-iron slide contact pieces, which are connected with the electric engine by leading wires. The driver by turning a handle can move his engine backwards or forwards at will. The whole arrangement has worked extremely well, and it is stated that the locomotive, if so arranged, could easily do double its present work; in other words, could haul 15 to 16 tons of train load at a speed of seven miles an hour. The arrangements for the dynamo machine on the engine, and its connection to the wheels, are much the same as those used in Sir William Siemens' electric railway now working near the Giant's Causeway.

THE STRENGTH OF LEAD PIPES.

The accompanying engravings represent the fractures of several lead pipes tested to destruction by a German firm of manufacturers, from whom the Pintsch's Lighting Company obtain the lead pipes used in the installations of compressed oil gas apparatus, by which a number of the railway companies of this, among other countries, supply their railway carriages with oil gas. After trying the lead pipes of several English makers, the Pintsch Company was forced back upon the German makers for lead pipes which would, for any length of time, stand the high pressure—90 lb. to 105 lb.—at which the gas is distributed for charging the carriage receivers. The makers of these pipes assert that they use only pure lead, but we are inclined to think that the figures representing the bursting pressure indicate the use of an alloy. The numbers placed below the several pieces of pipe shown in the engraving give the numbers of atmospheres at which the bursting took place, except in the case of that marked 73, which should be 75. The external and internal diameters of these pipes are respectively 1·5625in. and 1·125in.; 1·3125 and ·9375in; 1·4375 and 1·0625in.; 1·375 and ·9375in.

Calculated by the formula $S = \frac{p}{\text{hyp. log. } R}$, in which R = ratio of external to internal diameters, p = pressure in pounds per square inch, S = stress in pounds per square inch of the material of the pipe, the bursting pressures give a stress S = respectively 3720 lb. = 1·66 ton; 2679 lb. = 1·19 ton = 3750 lb. = 1·67 ton and 2460 lb. = 1·1 ton, or an average of 1·405 ton per square inch of section of the lead.

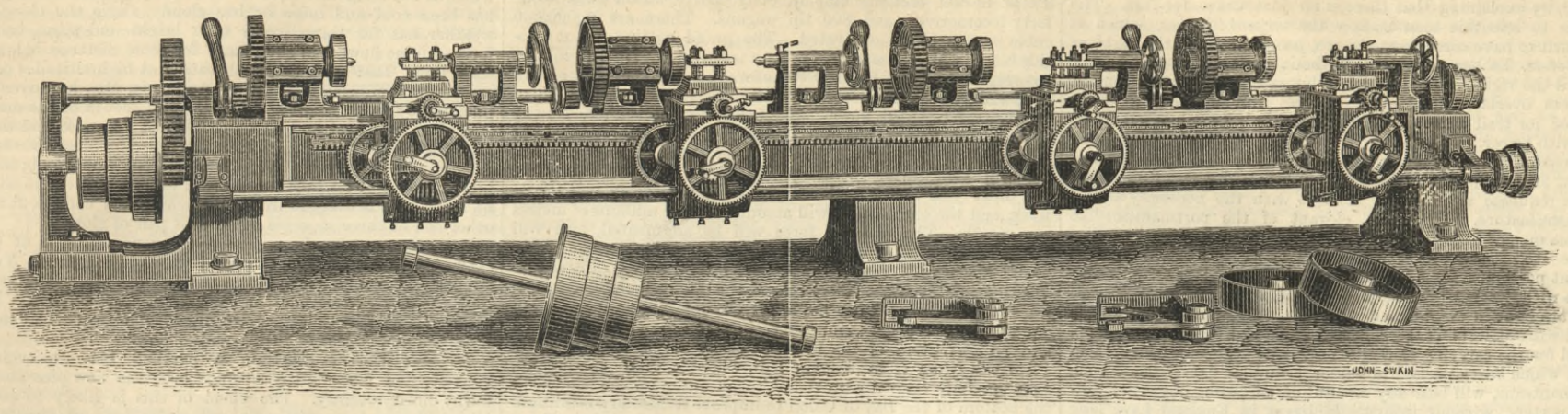


M. Jardine found that a lead pipe 1·5in. diameter and 0·20in. in thickness sustained a pressure of 1000ft. of water, or 29·5 atmospheres, without alteration of form. Under 1200ft. of water or 35 atmospheres it began to enlarge, and it burst under 1400ft. of water or 40 atmospheres, having swollen to a diameter of 1·75in. A 2in. pipe 0·20in. thick sustained a pressure of 800ft. of water or 23·5 atmospheres with scarcely any enlargement; but it burst under 1000ft. or 29 atmospheres. From these results, as given by Mr. D. K. Clark, it appears that the resistance of lead to a tensile stress is equal to 15 cwt. per square inch of sectional area, and that its ultimate strength is equal to 1 ton per square inch. We are not told how long a time these pipes were subject to the lower stresses mentioned; but there is little doubt that under long-continued stress enlargement would take place at lower pressures than those which equal a stress of 15 cwt. per square inch of the material, so the ratio R would gradually decrease, S consequently become greater and p less. The stress necessary to burst the pipes we have illustrated was no doubt brought to bear without much reference to the time occupied, and under the circumstances the bursting pressure might be somewhat high and would also be somewhat irregular, which probably explains the difference in the figures above given. These give a mean breaking stress of 28 cwt.; but it is not very likely that the same material in other form than that of a pipe would withstand so high a pressure, because at a slightly weak place extension commences, and though fracture is thus localised, the material is not supported by that around it.

It will be observed from the forms of the fractures, which are clearly shown in our engravings, that they are those which are usually seen in lead pipes in vertical or approaching vertical position, and are burst by frost in winter. These, as well as other fractures, are usually attributed to the expansion of water

MULTIPLE LATHE.

MESSRS. WILKINSON AND LISTER, KEIGHLEY, ENGINEERS.



n freezing; but a little reflection will show that as this expansion takes place as the water solidifies, the fracture produced by it alone would be in the form of a long crack only wide enough to permit of the slight expansion which takes place between 39 deg. and 32 deg. Fah.

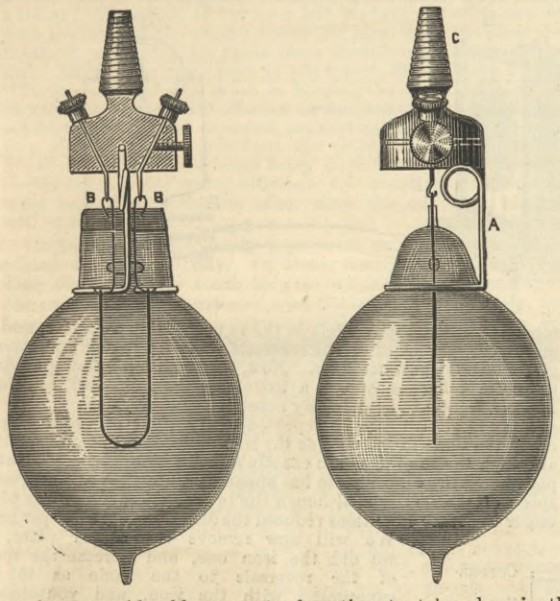
When lead pipes are burst during frost, the fracture being more or less wide, short, and localised at a considerable swelling, the bursting is not always directly due to the freezing and consequent expansion of water and solidification. In freezing, water gives up a large quantity of its contained air, and this rises to the upper parts of a pipe, or to any part where it gets caught, as in the upper part of a bend. As the water in the pipe falls from 39 deg. to 32 deg. Fah., or from 4 deg. Cent. to zero Cent., its volume increases from 1 to 1·000122, and this, acting on the imprisoned air, compresses a highly elastic medium, which remains under pressure even after the water has become solid. By this means the pipe is swollen and thinned where the air is imprisoned, and by a repetition of the process a burst takes place, which is assisted by the expansion of the air when the thawing sets in, the expansion of air per degree being 0·00217, which is so much greater, as above seen, than that of water.

MULTIPLE LATHE.

THE engraving above illustrates a novel type of lathe made by Messrs. Wilkinson and Lister, Keighley, for Messrs. Manlove, Alliott, Fryer, and Co., of Nottingham and London. The lathe is specially designed for turning rolls, pulleys, studs, &c., and will turn four articles at the same time 11in. diameter and 14in. long, or one or more pairs of heads can be quickly removed to suit longer articles. Each tool is self-acting for slide and surfacing, and each set can be worked entirely independent of the others. It is very rigid, with quick traverse. It will be seen that this is a labour-saving tool, and likely to be extremely useful to general engineers and machine makers.

HIGGS' SUSPENSION FOR INCANDESCENT LAMPS.

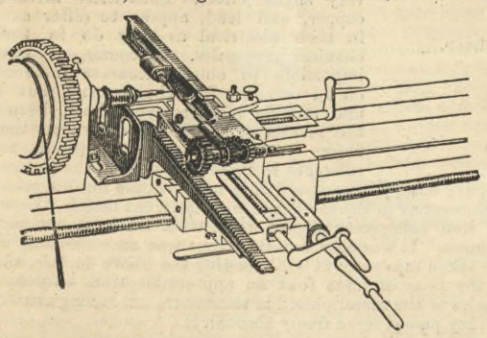
THE accompanying engraving requires no description. It explains itself, and shows a very neat suspension for incandescent electric lamps, designed by Mr. Paget Higgs. The arrangement



permits a considerable amount of motion to take place in the lamp, and is free from the objection to the ordinary Swan suspension, because the lamp cannot become unhooked.

MACHINE FOR CUTTING HELICAL GROOVES IN TWIST DRILLS.

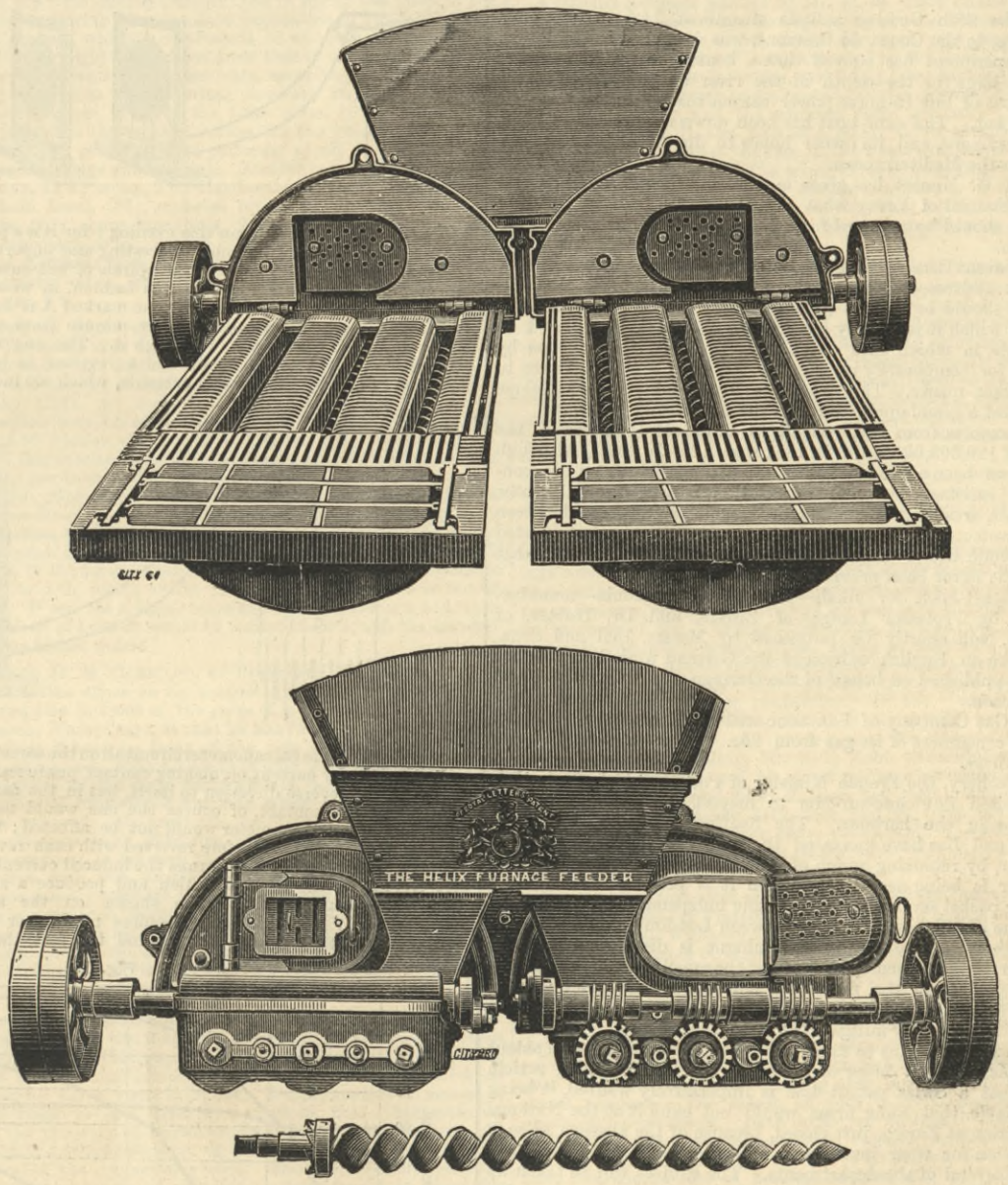
THE new apparatus illustrated by the engraving below serves to cut twist drills, both right and left-handed, for helical drills,



reamers, taps, and similar objects, and may be used on any ordinary lathe without altering it. It is made by the Britannia Machine Company, Colchester, and its construction will be readily gathered from the engraving. The object to be grooved, after being centred, has the centre made triangular by means of a triangular punch. It is then fixed, the triangular holder forming a guide as well as driver. Helical grooves, either right or left-hand, may be made with it, as well as straight grooves. It is stated that a 4in. groove on a 1in. drill may be obtained in five minutes, and the same on a ½in. drill in two or three minutes. The triangular driver serves as divider for three grooves, and two, four, or six grooves are obtained by means of the dividing plate.

THE HELIX FURNACE FEEDER.

MESSRS. HAWKSLEY, WILD, AND CO., of Brightside Boiler Works, have been quietly pushing for some time the furnace which we illustrate below. Experience has been acquired with it, and we understand that the apparatus may now be considered fully efficient and satisfactory as a smoke preventer. The accompanying engraving will make its construction quite intelligible. Instead of the furnace floor consisting entirely of fire-bars, some are omitted, and in their stead one or more long troughs are placed and connected with openings along taper



tubes placed beneath the fire-bars. The wide ends of these tubes continue under the dead plate, and join a feed trough or hopper box which crosses the front of the furnace.

Passing through the feed trough, and nearly filling the taper tubes, long auger-like screws are placed, and receive a continuous motion from worm wheels and worms carried on a shaft running in front of the furnace. A large hopper supplies the coal to the feed trough, and the screws carry it into and along the taper tubes and lift it up through the openings before described into the fire, in proper proportions throughout the length of the furnace. The hopper is placed in the centre. The feed trough runs right and left, and allows room for a full sized door, which is very convenient for inspecting the fire at any time, and for banking up, or for firing by hand in case of need. It will be seen from this description that all the new coal has to pass up through the fire; no gases can therefore escape without being thoroughly heated, and as a result there is, it is claimed, always a clear hot fire, no smoke, and great economy of fuel.

Messrs. Williamson and Sons, of Lancaster, have sixteen boilers fitted; Messrs. Lister and Co., of Bradford, have fourteen fitted, among many others, and they express much satisfaction with the working of the Helix feeder.

FOREIGN NOTES.

IN consequence of it having become evident that the exhibition building at Nice could not be completed at the appointed time, December 1st, under normal conditions, the work is being pushed on by night, by the aid of the electric light, that all may be finished in time. The demand for space at the exhibition seems likely to exceed that available.

The little town of Vevey is to have the benefit of the electric light, in consequence of the large supply of water motive power in Switzerland. On the 29th October the Communal Council of Vevey considered the agreement proposed between the Commune and Messrs. Mueron and Cuénod, of Geneva, authorising the latter, for the term of twenty-five years, to run their wires over and under the public roads and lands, for the purpose of distributing electric light and motive power. The Commune, under the agreement, will be held free from all individual claims which may crop up in the carrying out of the plans. In addition, the concessionaires agree to use electricity of moderate tension only, to mitigate sources of danger. M. de Meuron has informed the Council that a certain amount of danger attends the use of electricity, but that such is the case also with the use of steam and gas. The Council unanimously ratified the agreement, so Vevey will be lighted by electricity.

A singular railway accident occurred a few days ago at Ebikon station, near Lucerne. A woman fell between the rails in such a way that her feet nearly touched one rail, and her head the other. The wheels of an approaching train pulled off her chignon and ironed it flat. She was unhurt.

Swiss engineers are required to some extent in Greece for road-making, and for other purposes requiring scientific ability. The Grecian inspector of public works, Mr. Phlassis, is in Switzerland for the purpose of engaging fifteen or twenty engineers for the foregoing purposes.

Now that the electric light is appearing in the small towns and villages on the Swiss lakes, the "*serpent du lac*" is arising from his sleep of ages—according to the Swiss newspapers—in the dead season, and doubtless with the intention of inspecting it. The

present abode of the lake serpent is at Coudrée, at a point where the Lake of Geneva is bordered by a pine forest, and the poor gamekeeper who has seen it is *encore tout tremblant*. But the *Journal de Geneve* does what it can to allay the excitement it has raised, by explaining that there is no just cause for fear. The puzzle to scientific men is, how the *serpent du lac*, which is assumed to have come from the sea, passed through the turbines of Messrs. Escher and Wyss without maceration, and how it eluded the vigilance of the custom-house officers on the frontier. It goes overland sometimes, and an unfortunate dog which scented its trail a foot wide was transfixed, its hair standing on end with terror.

Ornamental basket making is an industry in which England cannot at present compete with France or Switzerland, for want of the requisite art taste, if not also with the necessary ability to manufacture. The most elegant of the portmanteau-like baskets on sale in London in shops near Covent Garden and elsewhere are imported from France. The Swiss sometimes make elegant portmanteaus of basket work, as perfect in form as any made with leather. The value of these portmanteaus is that they are light in weight, and that the "spring" in them, combined with powers of resistance to pressure also, makes them useful for the carrying of fragile articles, such as those made of glass, which when packed in hay or crumpled paper inside such portmanteaus, will bear any amount of throwing about by railway porters, without injury. Milliners in England have long recognised the value of baskets for the carrying of their fragile goods, without importing unnecessary weight. The result is that some experiments are being made in Switzerland on the cultivation of osiers, and the first results seem so likely to be profitable, that one of the Communes is considering whether it shall not devote some public land to their growth. In competition with some other continental goods, England practically suffers owing to the diffusion of art taste being less general than abroad, consequently the encouragement given to art of late by South Kensington is not without its aspects of commercial advantage. Why should not common railway bridges be as handsome as some of them are on the Dulwich estate, instead of too often resembling iron coffins on the top of rectangular brick towers? "A thing of beauty is a joy for ever."

The silk trade of the South of Europe has been in a terribly low state all this year, and is at root the chief cause of the late disturbances at Lyons. The trade journals devoted to the industry are full of complaints about the position, and by their remarks convey the idea that they are hoping against hope as to the future. On the southern side of the Alps and to the north of Milan, the raising of silkworms is an important branch of trade.

On the 25th October a little steamboat 14·5 metres long, belonging to the Count de Bremont, was launched in the Rhine. This experiment has proved that a boat drawing 1·5 metre of water is large for the depth of the river at places, and that a steamboat of but 15-horse power cannot make headway against the current. The same boat has been down much of the Rhone, as far as Lyons, and its owner hopes to do the rest of the distance to the Mediterranean.

Mons. G. Montet has given notice that he will ask the Communal Council of Vevey what position it will take up if a subvention should be required from it towards the tunnelling of the Simplon.

To prevent the opening of letters by persons to whom they are not addressed, some French newspapers suggest that the address should be written on the opposite side of the envelope to that on which it is usually placed, and the stamp also placed on that side, in which case any tampering with the envelope by devices for temporarily moistening the gum are almost sure to leave their marks. The otherwise blank side of the envelope will afford a grand opportunity to the advertising fraternity.

The exports from Switzerland to France in 1882 were of the value of 120,363,000f., and in 1881 were 125,470,000f. Although there has been a general falling off, the special items are considered satisfactory. The diminution occurs chiefly in raw materials, articles of food, and cattle, whilst the increase has been in manufactured goods. Last year Switzerland exported 57,873,000f. worth of manufactured goods to France, and that value has never been previously reached.

A pocket-book for alkali—potash and ammonia—manufacturers, by Professor Lunge, of Zürich, and Dr. Hurter, of Widnes, will shortly be published by Messrs. Bell and Sons. It will be an English edition of the German work by Professor Lunge, published on behalf of the German Alkali Manufacturers' Association.

The Gas Company of Lausanne will in December reduce the cost to consumers of its gas from 35c. to 30c.—about 2½d.—per cubic metre.

M. Cochery, the French Minister of Posts and Telegraphs, has just visited Boulogne-sur-Mer to inspect the improvements in progress in the harbour. The floating machines of Messrs. Volker and Bas have increased the depth of water outside the harbour, by removing much of the sand, and the inside of the harbour is being deepened. When it is possible to establish a regular packet service with Boulogne independently of the tides, the time of the postal service between London and Paris can be diminished. The drainage of Boulogne is discharged into the harbour, so that when the tide is out the smell is often intolerable, and travellers in the numerous hotels alongside the quay feel the effects of the nuisance. Increasing the depth of water in the harbour may mitigate the evil.

Switzerland begins to find it disadvantageous to have no patent law. *Le National Suisse* of November 4th in its leading article says that a Swiss patent law is imperatively wanted, it being undeniable that some firms would not exhibit at the National Exhibition at Zurich, just closed, because of the absence of such protection for their inventions, and that this impediment was felt in several of the departments. The subject will be taken up by the Federal Government in the coming session, and the Neuchatel deputies will advocate the enactment of a law for the protection of inventions. The same journal considers that nothing further in the way of legal protection is necessary for the encouragement of Swiss industries.

The exportations of Switzerland to the United States during the month of October last were:—Watches, clocks, and chronometers, 1,053,527·85 francs; musical boxes, 13,774·05 francs; miscellaneous, absinthe, eau de cerises, chocolate, &c., 12,150 francs; total, 1,079,451·90 francs.

In relation to the congress just held at Rome, for the recognition of one meridian and one universal time, the Government of Switzerland has given instructions to its delegate, Mr. Hirsch, director of the observatory at Neuchatel, to agree to the adoption of the meridian of Greenwich as recommended by the conference. The Swiss Government will, therefore, be among the first to agree to the recommendations of the congress. Whether some of the great Powers, more especially the United States, will do so is problematical at present.

Galignani, of November 10th, publishes the following, dated Panama, October 26th:—"The progress of the work on the Panama Canal is shown by the following statement: The total length of the canal is 74 kilometres from the Atlantic to its mouth in the Pacific, at the Naos and Flamenco. It is divided into twelve sections, the most important of which are those of Colon, Gorgona, Obispo, Emperador, Culebra, and Paraiso. These united sections employ daily thirty steam excavators, forty locomotives, and 800 tip wagons. There are 90,000,000 cubic metres to be excavated. The grand cutting, about two-thirds of which has already been excavated, is the cutting between Obispo and Paraiso. The force employed upon the work is upwards of 10,000 men, and the excavation up to the 15th of October amounted to more than 2,500,000 cubic metres. During these latter months of the bad season the excavations have amounted to about 350,000 metres per month. This figure will be quintupled during the fine season which begins in December, and next year mostly all the necessary machinery will be at work, and the excavations will amount to four millions of metres per month. The working force will be augmented, and will form a total of 15,000 men. At Colon the port works are nearly complete. The Terra Plein, with the breakwater, destined to lessen the effect of the heavy seas at the entrance of the canal, is finished. An entire town has appeared there, with a collection of workshops, warehouses, and connecting railways for the reception and redistribution of the material. The earth for the Terra Plein was taken from Monkey Hill, where a great cutting has been specially opened with the object of filling up the lagoons at the bottom of the Bay of Colon to improve its sanitary condition. This cutting at Monkey Hill will itself be enlarged into Terra Plein, and will become an annexe for stores, workshops, warehouses, &c. The port of Colon is dredged continually by three machines, producing together daily from 6000 to 7000 metres."

A phenomenon has been witnessed in the Alps this autumn which is not altogether rare. Whilst the weather on the plains has been cold and more or less cloudy, above the clouds the weather has for three weeks been bright and warm, bringing forth Alpine flowers in abundance for some distance below the snow line. Last week this fine weather at high altitudes ceased.

Deacon Wellbeloved Potts, of Ambrosia, Mo., has invented a pneumatic machine for killing rats. The mouth of the machine is applied to the rat hole, the exhaust set to work, and the rat thinking he has forgotten to close his bed-room door rises to stop the draught. The force of the blast causes him to dig his feet into the sides of his hole and to yell for the police, but all is of no avail. He is dragged into the machine and comes out at the other end as three sausages and a neat pair of gloves.

Some manœuvres have just been gone through at Gaeta between a fleet of Italian torpedo boats and ironclads. Two of the torpedo boats managed to reach the ironclads, notwithstanding a vigilant outlook and the use of the electric light. When racing the torpedo boats proved to be the fastest. The torpedo boats are now in Spezia.

A great deal of litigation is pending between engineers, bankers, and insurance companies over the new pier at Nice, burnt down recently. The effect of this is likely to be that Nice will have to go without a promenade for some time yet.

VOLTA-ELECTRIC INDUCTION.*

By Willoughby Smith, Pres. Soc. Tel. Eng.

In my presidential address which I had the pleasure of reading before this Society at our first meeting this year, I called attention, somewhat hurriedly, to the results of a few of my experiments on induction, and at the same time expressed a hope that at a future date I might be able to bring them more prominently before you. That date has now arrived, and my endeavour this evening will be to demonstrate to you by actual experiment some of what I consider the most important results obtained. Soon after the discovery by Oersted, Faraday, with the care and ability manifest in all his experiments, showed that when an intermittent current of electricity is passing along a wire it induces a current in any wire forming a complete circuit and placed parallel to it, and that if the two wires were made into two helices and placed parallel to each other the effect was more marked. This Faraday designated "Volta-electric induction," and it is with this kind of induction I wish to engage your attention this evening; for it is a phenomenon which presents some of the most interesting and important facts in electrical science. Here are two flat spirals of silk-covered copper wire suspended separately, spider-web fashion, in wooden frames marked respectively A and B. The one marked A is so connected that reversals at any desired speed per minute from a battery of one or more cells can be passed through it. The one marked B is so connected to the galvanometer and a reverser as to show the deflection caused by the induced currents, which are momentary in duration, and in the galvanometer circuit all on the same side of zero, for as the battery current on making contact produces an induced current in the reverse direction to itself, but in the same direction on breaking the contact, of course the one would neutralise the other, and the galvanometer would not be affected; the galvanometer connections are therefore reversed with each reversal of the battery current, and by that means the induced currents are, as you perceive, all in the same direction and produce a steady deflection. The connections are as shown on the sheet before you marked 1, which I think requires no further explanation. Before proceeding please to bear in mind the fact, that the inductive effects vary inversely as the square of the distance between the two spirals, when parallel to each other; and that the induced current in B is proportional to the number of reversals of the battery current passing through spiral A, and also to the strength of the current so passing. Faraday's fertile imagination would naturally suggest the question, "Is this lateral action, which we call magnetism, extended to a distance by the action of intermediate particles?" If so, then it is reasonable to expect that all substances would not be affected in the same way, and therefore different results would be obtained if different media were interposed between the inductor and what I will merely call for distinction the inductometer. With a view to proving this experimentally, Faraday constructed three flat helices and placed them parallel to each other a convenient distance apart. The middle helix was so arranged that a voltaic current could be sent through it at pleasure. A differential galvanometer was connected with the other helices in such a manner that when a voltaic current was sent through the middle helix its inductive action on the lateral helices should cause currents in them, having contrary directions in the coils of the galvanometer. This was a very prettily arranged electric balance, and by placing plates of different substances between the inductor and one of the inductometers Faraday expected to see the balance destroyed to an extent which would be indicated by the deflection of the needle of the galvanometer. To his surprise he found it made not the least difference whether the intervening space was occupied by such insulating bodies as air, sulphur, and shellac; or such conducting bodies as copper and the other non-magnetic metals. These results however did not satisfy him, as he was convinced that the interposition of the non-magnetic metals, especially of copper, did have an effect, but that his apparatus was not suitable for making it visible. It is to be regretted that so sound a reasoner and so careful an experimenter had not the great advantage of the assistance of such suitable instruments for this class of research as the mirror galvanometer and the telephone. But although he could not practically demonstrate the effects which by him could be so clearly seen, it redounds to his credit that as the improvement in instruments for this kind of research has advanced, the results he sought for have been found in the direction in which he predicted. A and B will now be placed a definite distance apart, and comparatively slow reversals from ten Leclanché cells sent through spiral A; you will observe the amount of the induced current in B, as shown on the scale of the galvanometer in circuit with that spiral. Now midway between the two spirals will be placed a plate of iron, as shown in Plate 2, and at once you observe the deflection of the galvanometer is reduced by less than one-half, showing clearly that the presence of the iron plate is in some way influencing the previous effects. The iron will now be removed, but the spirals left in the same position as before, and by increasing the speed of the reversals you see a higher deflection is given on the galvanometer. Now, on again interposing the iron plate the deflection falls to a little less than one-half, as before. I wish this fact to be carefully noted.

Fig. 1

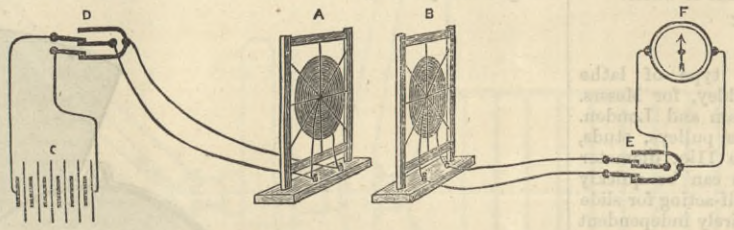
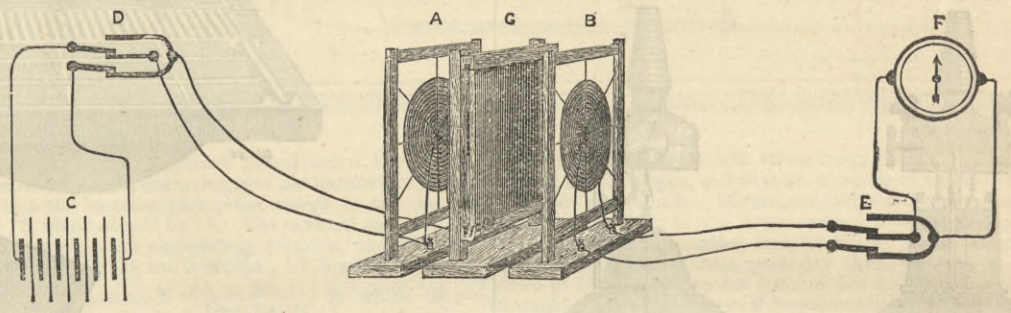
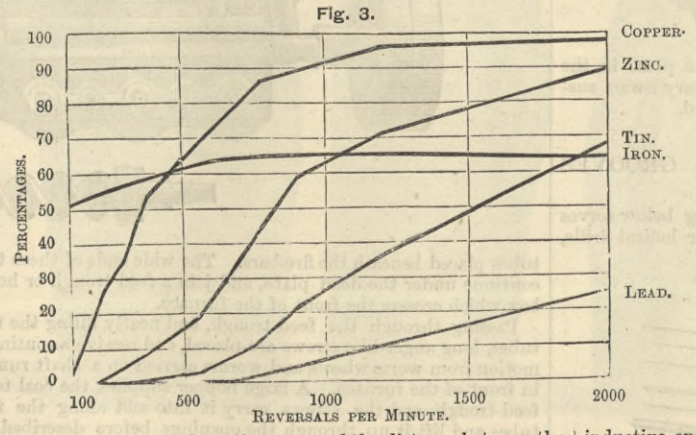


Fig. 2



The experiment will be repeated with a plate of copper of precisely the same dimensions as the iron plate, and you observe that although the conditions are exactly alike in both cases, the interposition of the copper plate has apparently no effect at the present speed of the reversals, although the interposition of the iron plate under the same conditions reduced the deflection about 50 per cent. We will now remove the copper plate, as we did the iron one, and increase the speed of the reversals to the same as in the experiment with the iron, and you observe the deflection on the galvanometer is about the same as it was on that occasion. Now by replacing the copper plate to its former position you will note how rapidly the deflection falls. We will now repeat the experiment with a plate of lead, and you will see that like the copper it is unaffected at the low speed, but there the resemblance ceases, for at the high speed it has but very slight effect. Thus these metals, iron, copper, and lead, appear to differ as widely in their electrical as they do in their mechanical properties. Of course, it would be impossible to obtain accurate measurements on an occasion like the present, but careful and reliable measurements have been made, the results of which are shown on the sheet before you marked 3. It will be seen by reference to these results that the percentage of inductive energy intercepted does not increase for different speeds of the reverser in the same rate with different metals, the increase with iron being very slight, while with tin it is comparatively enormous. It was observed that time was an important element to be taken into account while testing the above metals, that is to say, the lines of force took an appreciable time to polarise the particles of the metal placed in their path, but having accomplished this they passed more freely through it.

Fig. 3.



(*To be continued.*)

* A paper read at the Society of Telegraph Engineers and Electricians, November 8th, 1883.

The autumn congress and sanitary exhibition of the Sanitary Institute of Great Britain will be held in Dublin in the year 1884.

RAILWAY MATTERS.

THERE were only nine accidents to trains in 1882 in the United Kingdom by which passengers were killed.

THE Great North of Scotland Railway Company has decided next session to construct three new lines, connecting Deeside, Invernesss, and the Highlands generally.

THE lowest tender received by the South Australian Government for the construction of the first section of the railway line to the Victorian Border amounted to £285,508. They have decided to re-advertise it.

THE Board of Trade has now issued its certificate formally passing and granting the opening of the Whitby and Loftus Railway. On Monday next passenger and mineral traffic will be worked. The new line will open up a district which hitherto has been comparatively unknown to the general traveller, and it runs through some of the most lovely and romantic scenery to be met with in any part of England. Nearly all the way an uninterrupted view of the magnificent coast scenery is obtained.

A *Times* Brighton correspondent telegraphs:—"It is stated on good authority, that in consequence of difficulty having been experienced in raising the requisite deposit money, no steps will be taken this year to obtain Parliamentary powers for the construction of the London and Southern Railway. This line, it will be remembered, was intended to run from Shoreham and Brighton to Eastbourne and London, being an extension of the scheme brought before Parliament last year, which met with failure. It then terminated at Eastbourne."

THE outgoing of emigrants for settlement, whether in the south or the north of South Australia, has been speedily followed by well-made roads or railways leading to the most important centres of population. That South Australia has been fairly keeping pace with settlement in the construction of roads and railways may be seen, says the *Colonies and India*, from the extent of both which were open for traffic at the end of 1882. Of main roads there were open at that date 3374 miles, of which, in round numbers, 1776 miles were metalled and completed, not taking into consideration those lines under the control of corporations and district councils. Of railways and tramways there were open 945 miles, all but 62½ miles of which were worked by steam power. It can scarcely be said that 945 miles of railway and 1766 miles of well constructed macadamised roads show a bad record for so young a colony.

A CORRESPONDENT calls attention to a curious fact recorded in a table printed at page 592 of the *Railway News* of 20th ult. The item "general charges" varies between 1·9 per cent. and 3·1 per cent. of the receipts of the larger railway companies, the mean being 2·3 per cent., whereas on the South-Eastern they amount to, as near as possible, double that rate, viz., 4·2 per cent. These charges consist of director's remuneration, salaries of officers and the headquarters' staff, generally; in other words, the cost of the "management," about which so much has been written lately. The total amount, as taken from the last half-yearly reports, are £38,000 for the South-Eastern, £15,000 for the Chatham, and £19,000 for the Brighton. The South-Eastern, therefore, pays considerably more for their "management" than the Chatham and Brighton companies put together. The administration of the Brighton Railway is furnished at exactly one-half the cost of the South-Eastern, and yet gives perfect satisfaction; while in the case of the South-Eastern, the recent voluminous correspondence in the *Times* affords a striking commentary on the management of the line. The fact should be noted by South-Eastern shareholders.

A REPORT to the Board of Trade on the accident which occured on the 11th ult., at Waterloo Colliery junction, near Leeds, on the North-Eastern Railway, affords another illustration of the great importance of automatic action in brakes. In this case, as the 12.42 p m. express train from Hull to Leeds, consisting of engine and tender, two horse-boxes, one brake-van, one third-class, one composite, one third-class, one composite, and one third-class carriage, and rear brake-van, all fitted with Westinghouse brake, was passing Waterloo Colliery junction at 2.2 p.m., running at considerable speed, it was turned though the facing-points on to the independent line or up goods loop, and left the rails at or near a second set of facing-points leading from the independent line to a siding. The whole of the train left the rails and came to a stand with the front of the engine about 160 yards from the place where it ran off, and about 235 yards from the facing-points on the main line. In the concluding part of the report, Major Marindin says: "To the action of this brake in keeping the train extended must be attributed the entire absence of any telescoping, which might otherwise have been expected, considering that the engine came to a stand only 160 yards from the point where it left the rails. Moreover, owing to the brake being an automatic one, it remained on throughout the train, although the couplings in two places were parted." No brakes other than the one here concerned will do this.

UP to January 1st, 1881, there were only 5412 miles of completed railways in Italy. Of these, nearly half were in North Italy, in a territory containing about 8,000,000 inhabitants, while the remainder were scattered over Central and South Italy, over a much larger territory, containing 20,000,000 inhabitants. When all the contemplated roads are complete, there will still be less than 10,000 miles of railroads in Italy for a population of 29,000,000, and an area of 114,377 miles; a smaller proportion than any other country of Central or Western Europe, except Spain and Portugal. Compared with other countries, the cost of construction in Italy is exceedingly heavy; the average being about £23,000 per mile, and the estimated cost of some of the projected lines amounts to nearly £32,000 per mile; and the longest line of all, that between Eboli and Reggio, opposite Messina, about 323 miles, will cost to construct £8,000,000, or over £24,000 per mile. This excessive cost is owing, in a great measure, to the difficult mountainous character of a large portion of the country, and partly by the great solidity of the roads built, and in part because they are built at public expense and not by private enterprise. The capital for building railway lines in Italy is obtained by a Government guarantee of bonds at 5 to 6 per cent., so that as the net average profit of the lines amounts to only about 2 per cent., the remaining 3 to 4 per cent. has to be paid out of the Treasury.

THE *Railroad Gazette* monthly record of train accidents gives the following:—There were 78 collisions, in which 21 persons were killed and 125 injured; 73 derailments, in which 22 persons were killed and 56 injured, and 7 other accidents, by which 1 person was killed and 2 hurt. This is a total of 158 accidents in which 44 persons were killed and 183 hurt. Of the persons killed in the collisions 12 were railroad employés and 9 were passengers or others riding in the cars; of the injured 79 were employés and 46 passengers. Twenty of the killed in the derailments and 42 of the injured were employés, as were the two persons injured in the other accidents. As compared with August, 1882, there was an increase of 5 accidents, of 10 in the number killed, and 47 in that of injured. These accidents may be classed as to their nature and causes as follows:—Collisions: Rear, 45; butting, 28; crossing, 5; total, 78. Derailments: Broken rail, 2; broken switch rod, 1; broken bridge, 2; spreading of rails, 11; broken wheel, 1; broken axle, 4; broken truck, 1; accidental obstruction, 6; cattle, 7; land-slide, 1; misplaced switch, 10; running off end of siding, 1; bridged removed to be replaced, 1; flying switch, 1; purposely misplaced switch, 1; malicious obstruction, 1; unexplained, 22; total, 73. Other accidents: Broken connecting rod, 1; cylinder head blown out, 3; broken axle not causing derailment, 1; broken wheel not causing derailment, 1; car burned while running, 1; total, 7. Grand total, 158. Nine collisions were caused by trains breaking in two; 7 by mistakes in orders or failure to obey them; 6 by misplaced switches; 3 by carelessness in running at too high speed; 2 by runaway engines; 2 by runaways maliciously caused; 1 by cars carelessly left on the main track, and 1 by carelessness in leaving cars on a siding too near the main track. The whole of the unexplained accidents relate to derailments.

NOTES AND MEMORANDA.

THE returns of the census taken on January 1st, 1883, which have just been published, show that the Empire of Japan contained a population of 36,700,100, made up of 18,598,998 males and 18,121,000 females.

HERR A. OBERBECK publishes in the *Ann. der Phys. u. Chem.* investigations on phases of electric vibrations, which lead to the following law:—If electric waves, which are synchronous, but have different phases, flow through the fixed and the movable coil of an electro dynamometer, the deviation of the movable coil is proportional to the product of the maximum intensity and the cosine of the difference of phase.

ACCORDING to the *Chron. Industr.*, M. G. Meyer has submitted to the Société d'Encouragement specimens of incombustible paper and cardboard. The base of the paper is asbestos; but it was necessary also to invent inks which should be both indelible and incombustible, and which could be employed in writing, printing, lithographing, &c. One of his lithographs when placed between two layers of melted glass resisted the action of heat. The *Journal of the Franklin Institute* says it remained uninjured, and preserved all its sharpness.

IT has been asked why something has not been done with the form of regulator battery for compound parallel incandescent work, which was shown by Mr. Henry Edmunds, in conjunction with the Swan lighting, at the Paris Electric Light Exhibition in 1881, and which enabled him to show the jurors how he could turn out any number of lamps in parallel from maximum to zero without affecting the other lamps in the neighbouring series in any way. His device was simply a number of lead pyramidal cone trays, very easily formed out of sheet lead, without seam or joint, separated by pieces of wood, and placed one above the other. Each inverted cone-shaped tray was filled with acidulated water, and the terminals were simply attached to the top and bottom tray, or inverted pyramidal cone element.

AT the meeting of the Chemical Society on the 1st inst. a paper was read, "On the Chemistry of Lacquer"—Part I.—a communication from the Chemical Society of Tokio, by H. Yoshida. Japanese Lacquer—Urushi—is the milky secretion of *Rhus Vernicifera*. The tree is from 9ft. to 12ft., and resembles the ordinary wax tree. Two varieties of Urushi exist—Ki Urushi and Seshime Urushi. The Ki Urushi, or raw lacquer, is the best, being the natural juice which exudes from cuts in the stem, the Seshime Urushi being prepared by soaking branches and twigs for some months in water. The Urushi is usually coloured with lampblack, vermilion, indigo, &c. The pure Urushi is a thick greyish fluid having a characteristic sweetish odour—sp. gr. 1·0020 deg. at 20 deg. Cent. When exposed to moist air at 20 deg. in thin layers it rapidly darkens in colour, and dries up to a lustrous translucent varnish.

DURING the week ending October 20th in thirty-two cities of the United States, having an aggregate population of 7,305,300, there died 2722 persons, which is equivalent to an annual death rate of 19·4 per 1000, a slight diminution from that of the preceding week. In the North Atlantic cities the rate, according to the statistics officially published in the American *Sanitary Engineer*, was 19·9; in the Eastern cities, 20·1; in the Lake cities, 16·2; in the River cities, 19·0; and in the Southern cities, for the whites 16·9, and for the coloured 31·9 per 1000; 35·6 per cent. of all the deaths were of children under five years of age. Accidents caused 3·7 per cent.; consumption, 14·6; croup, 2·6; diarrhœal diseases, 4·7; diphtheria, 4·4; typhoid fever, 3·6; malarial fever, 2·1; scarlet fever, 2·1; pneumonia, 5·5; acute bronchitis, 2·4; measles, 0·3; small-pox, 0·3; and whooping cough, 0·6 per cent. of all deaths. The highest percentage of deaths from consumption, viz., 17·5, occurred in the North Atlantic cities, the highest percentage from diarrhœal diseases, viz., 6·2.

SPEAKING of steel ropes as transmitters of power, Professor Osborne Reynolds says these have a great advantage over shafts, for the stress on the section will be uniform, the velocity will be uniform, and may be at least ten to fifteen times as great as with shafts—say 100ft. per second; the rope is carried on friction pulleys, which may be at distances 500ft. or 600ft., so that the co-efficient of friction will not be more than ·015, instead of ·04. Taking all this into account, and turning to actual results, the work transmitted per inch would be 1,500,000 foot-pounds per second; so that a ⅜in. rope is all that is necessary to transmit 1000-horse power in one direction; this would make the loss per mile only $\frac{1}{10}$th. But in practice, rope has to be worked backwards and forwards, and the tension in the backward portion of the rope must be half the tension in the forward portion. This reduces the performance from $\frac{1}{10}$th to $\frac{1}{20}$th, which would cause half the work to be lost in ten miles. If we use a bigger rope and run at a lower speed, then the co-efficient of friction would be reduced to 0·1, and the distance extended to fifteen miles.

PROFESSOR H. S. CARHART, of Evanston, Ill., has made some researches on the effect on the magnetic field on the rotation of a pierced iron disc in front of the poles of a magnet. The result of this research, *Nature* says, is that he has found that an iron screen with a hole in it held in front of the pole of a magnet acts magnetically, as a screen with a hole in it held near a light acts optically, the shape of the hole being clearly defined; thus showing the difference of intensity of the field when the iron is there and when it is removed. He has made use of this property by placing a small coil capable of inductive action opposite each pole of a horseshoe magnet; in between the coils and the magnet he rotated a disc of iron with two concentric circles of holes ¼in. diameter, which came exactly opposite the two poles of the magnet. The inner circle contained thirty-two holes, and the outer contained sixty-four. The two induction bobbins he had connected up with a telephone. When the disc was rotated, he distinctly heard two musical notes produced which were an octave apart. The name given to this instrument is the magnetophone.

AT the British Association meeting a paper by Prof. J. A. Ewing was read, on the magnetic susceptibility and retentiveness of iron and steel. This paper was a preliminary notice of some results of an extended investigation which the author had been conducting for three years in Japan. Experiments with annealed rods and rings of soft iron wire showed that that material possesses the property of retentiveness in a very high degree. As much as 90 and even 93 per cent. of the induced magnetism survived the removal of the magnetising force. The extraordinary spectacle was presented of pieces of soft iron entirely free from magnetic influence, nevertheless holding an amount of magnetism, per unit of volume, greatly exceeding what is ever held by permanent magnets of the best tempered steel. The magnetic character of the iron in this condition was, however, highly unstable. The application of a reverse magnetising force quickly caused demagnetisation, and the slightest mechanical disturbance had a similar effect. Gentle tapping removed the residual magnetism completely. Variations of temperature reduced it greatly, and so did any application of stress. On the other hand, the magnetism disappeared only very slowly, if at all, with the mere lapse of time. The residual magnetism in hardened iron and steel was much less than in soft annealed iron. The maximum ratio of intensity of magnetism to magnetising force during the magnetisation of soft iron was generally 200 or 300, and could be raised to the enormous figure of 1590 by tapping the iron while the magnetising force was being gradually applied. A number of absolute measurements were made of the energy expended in carrying iron and steel through cyclic changes of magnetisation; and the effects of stress on magnetic susceptibility and on existing magnetism were examined at great length. The whole subject was much complicated by the presence of the action which, in previous papers, the writer had named *Hysteresis*, the study of which, in reference both to magnetism and to thermoelectric quality, had formed a large part of his work.

MISCELLANEA.

A MONTHLY Index to the Copyright Registers at Stationers' Hall now appears in "Bookseller." The index is arranged under the titles or subjects of the works entered, so that a glance will suffice to ascertain whether a particular title has been entered.

CARE is taken of the health of the inhabitants of Zurich, the Municipal Council having just decided that new houses, which in Zurich are substantially built of white stone, must not be inhabited until four months after their completion, in order to avoid the danger from damp. The time just mentioned may be altered within certain limits, according to the state of the weather.

THE American *Mechanical Engineer* makes a special note of our quoting from it and acknowledging the *American Engineer*. But the first-named takes a note from us on a method of getting at the speed a train is running, and does not even credit it to a contemporary of a similar or any other name. American fair play does not always appear on the surface, but the *Mechanical Engineer* does not often make this mistake.

THE *Continental Times* says that a gas engine of 4-horse power will work the organ for Riga Cathedral. This organ has been built at Ludswigsburg, and is probably the largest one ever constructed. It contains 7000 pipes, 124 stops, and pedals proportionately numerous. It is 20 metres high, 11 broad, and 10 deep. The largest wooden pipe is 10 metres high, its cubical contents 70·6 cubic feet. The smallest pipe is about ½in. high, and is attached to the largest one. A very complete "swell" arrangement allows genius to express itself with delicacy and effect on this huge piece of mechanism.

UNTIL five years ago the Midland Counties ironworkers were amalgamated with the North of England Association, but they then seceded in consequence of the resolution in favour of the centralisation of the funds of the lodges at Darlington. By the dissolution the local lodges lost the funds which had been centralised. There was a unanimous feeling in favour of the establishment of the union, and a committee is to be appointed to draft a code of rules. The ironworkers of South Yorkshire are entirely ruled, as to wages and hours of working, by the South Staffordshire regulations.

AT a meeting of the Darlaston Local Board on the 7th inst., a scheme which Mr. E. Pritchard, C.E., had prepared for the sewerage of the district and purification of the sewage, was adopted, and ordered to be forwarded to the Local Government Board for approval. The scheme included the complete sewerage of the town upon the partial separate system; the conveyance of the sewage to outfall works, there, in tanks, by precipitation and quiescence, to be clarified and partially purified, and aftewards to be filtered through a small area of land, and poured into the Tame, in the parish of Walsall. The total cost of the scheme, exclusive of purchase of land and compensation, was estimated at £18,555.

A REPORT has been written by Mr. D. K. Clark on the action of the Lancaster steam trap, the speciality of which consists in the loose disc valve at the orifice of the discharge pipe in connection with a quick thread screw motion worked by the float. This valve, he says, is frictionless in action, and being loose cannot stick to its seat. It is very prompt in its movements for opening and closing the discharge pipe, and the working parts are very simple and easily examined. It also acts as a safety valve, as any excessive pressure exerted against the face of the loose disc valve would, by virtue of the quickness of the screw thread, force it open. At the recent Engineering and Metal Trades Exhibition, in the trial of fossil meal, three were used, one of the traps being used to drain the dirty water collected by the steam filtering apparatus attached to the steam supply pipes.

A SERIES of regulations has been issued by the Prussian Ministry of Public Works with regard to periodical inspections of iron bridges used as thoroughfares. In addition to careful examination of the masonry, an investigation of the condition of the rivets is specially ordered with a view of discovering whether any have become loose at places where the greatest strength is required. The separate parts of the constructions are also to be examined with respect to fissures at the rivet holes, bending, want of paint, and appearances of rust. If a more detailed examination by aid of measurements is deemed necessary, these investigations are to be carried out in such a way as to define, amongst other points, the extent of the elastic flexure when vehicles are passing over the bridge. If there is any doubt as to whether the work is free from defects, it is ordered for burden tests to be applied, in order to render any faults apparent.

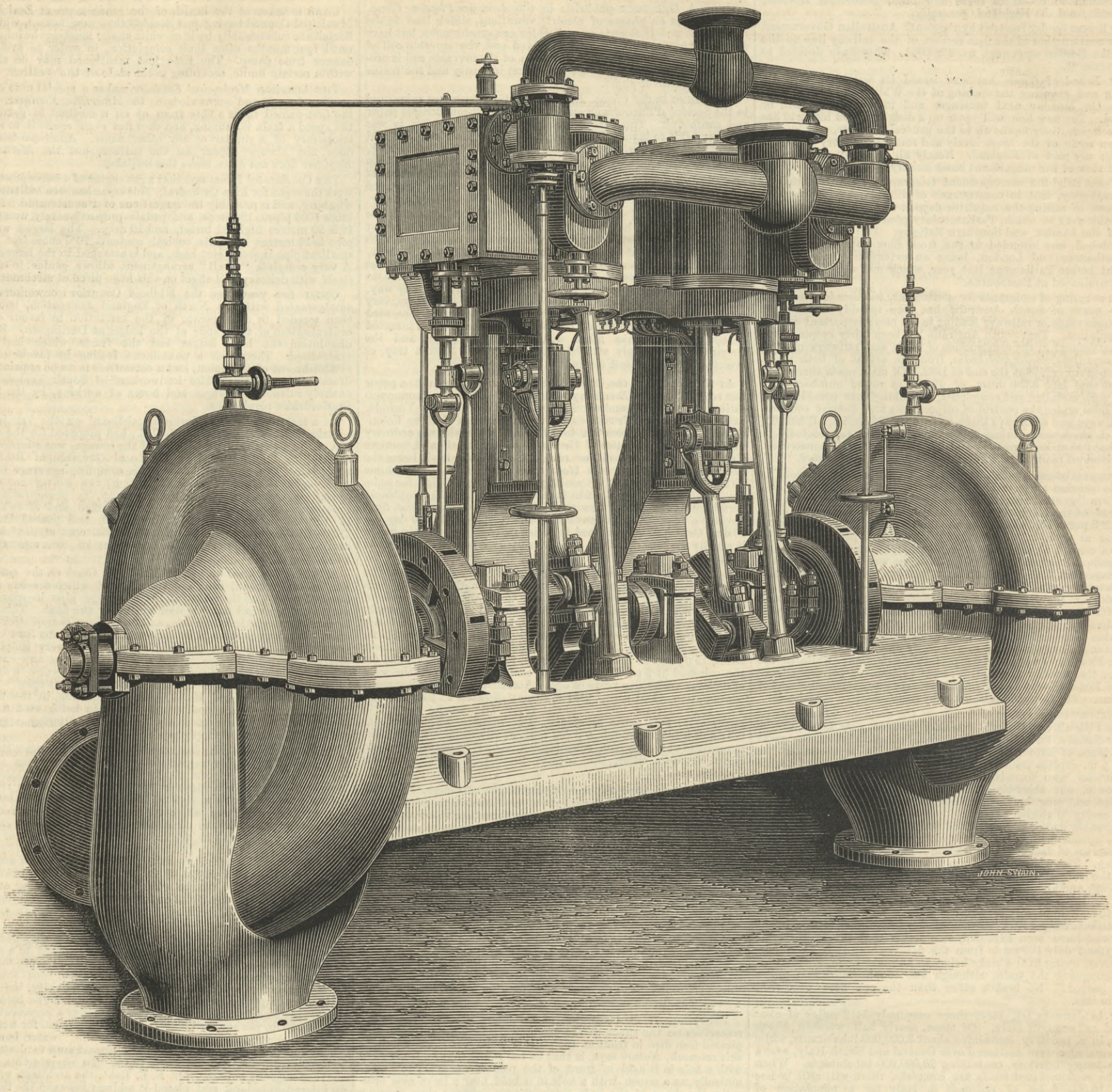
THE extraordinary height of many of the New York office buildings and apartment houses is such that water forced to a tank at or near the roof and distributed downward, has a pressure too great for ordinary plumbing fixtures and for lead pipe of usual thickness. In the case of the "Tribune" Building in that city, the height water is pumped is about 170ft., which to distribute back again would visit on a fixture in the basement or cellar a pressure of from 70 lb. to 75 lb. per square inch—in itself is too much for fixtures—but that, when taken in connection with the "water hammer," which will be likely to occur, would be almost sure to destroy the strongest made fittings, and burst pipes. To obviate this, in the above-mentioned building, Mr. E. E. Raht, the architect, provided an intermediate tank and placed it midway between the floors on which water-closet and bowl fixtures are used. The cisterns for the water-closets on the fifth floor and all fixtures above them taking water from the upper house tanks, while the wash bowls on the same floor and all fixtures below them take their supply from the intermediate tank.

ON the 3rd inst. the paddle steamer Violet, built by Messrs. Allsup and Sons, of Preston, was launched. She has been built to the order of the Wallasey Local Board, from the designs and under the superintendence of Messrs. Flannery and Faweus, of Liverpool, and is intended for the passenger traffic between New Brighton, Seacombe, and Liverpool. This vessel is to be classed 100 A 1 at Lloyd's, and will have a Board of Trade certificate for 1000 passengers. Her dimensions are: Length, 150ft.; breadth, 26ft.; and depth of hold, 10ft. 6in. She is divided into twelve water-tight compartments, and is fitted with steam and hand combined steering gear, steam starting and reversing gear, and patent direct-acting steam windlass. The saloon on deck is 110ft., and has spacious promenade deck above. Both decks are of teak. The Violet has feathering floats, diagonal oscillating engines, with two cylinders, each 38in. diameter and 5ft. stroke. The boilers, two in number, have 2400 square feet of heating surface, and are constructed to Board of Trade rules for a working pressure of 45 lb. With this machinery the vessel will have adequate power to obtain a speed, it is estimated, of twelve knots per hour.

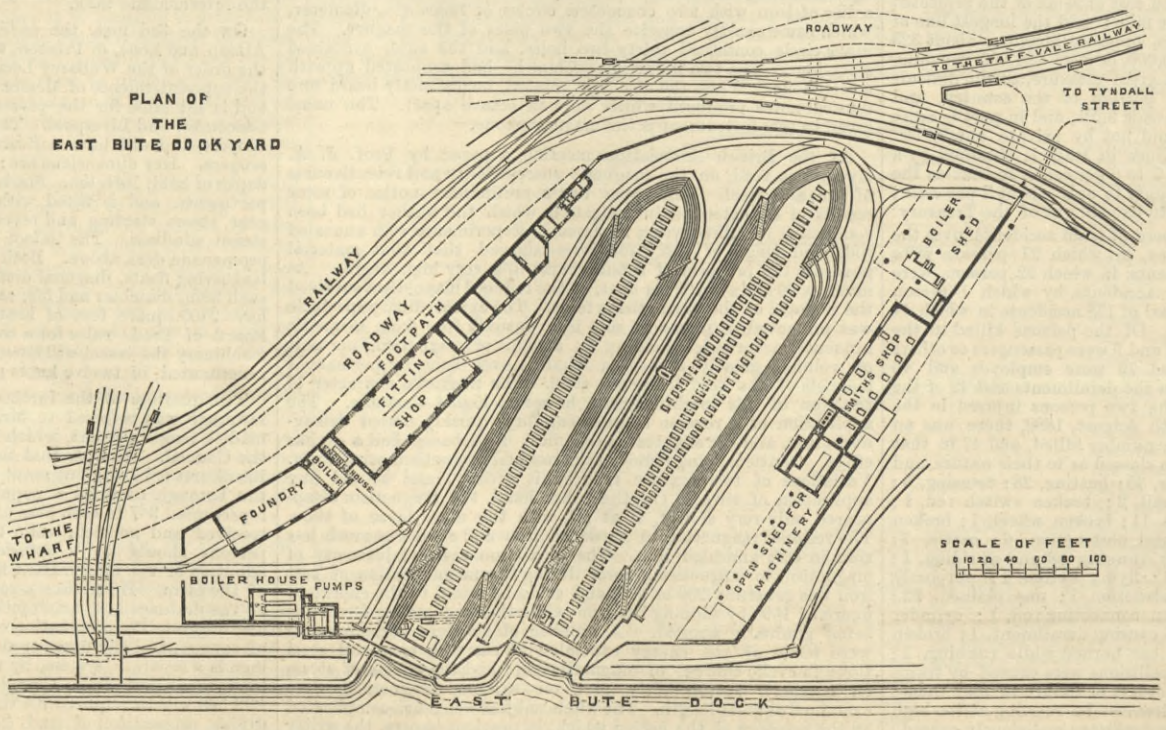
THE question of the further extension of the Wolverhampton sewerage was referred to Mr. Edward Pritchard, C.E., who has made a lengthy report, which is now under the consideration of the Council. He finds that the purification of the sewage at the Barnhurst is having but scant attention. The sewered portion of the borough contains a population of 52,000 inhabitants, which represented 347 to each acre of land from which sewage had to be received and purified, while under existing circumstances eighty persons should be a sufficient number. He recommends the adoption of the intermittent filtration system on a lower portion of the farm. He advises a complete re-arrangement of the whole of the drainage and construction of the main outfall drain. He also suggests the preparation of 150 acres of land for purification of sewage, and the unsewered 782 acres of the borough, he recommends a separate system, by which the sewage can be taken to land near Pool Hall, Compton. Mr. Pritchard estimates that £22,500 will be required for the extensions and re-constructions of drains, preparation of land, &c., at the Barnhurst, while the separate system for the unsewered portion of the borough he calculated would cost £21,600, including £8000 for the construction of outfall works, exclusive of land.

CENTRIFUGAL PUMPS AND ENGINES, BUTE DOCKS, CARDIFF.

MESSRS. W, H. ALLEN AND CO., LAMBETH, ENGINEERS.



THE extraordinary rapid growth of trade at Cardiff during the last few years has necessitated a development at that town of everything connected with the docks, and railways in conjunction therewith, more particularly in reference to the acreage of the floating docks, to make room for the immense quantity of shipping coming into the port, and also for the necessary repairs. The Marquis of Bute, to whom the docks principally belong, is now spending about half a million sterling in developing the floating docks, and private firms have also greatly increased the local accommodation. Amongst some of the most important private undertakings which have been recently completed are the new graving docks in connection with Messrs. Hill's Dry Dock and Engineering Company, Limited. These docks lie at the north end of the East Bute Docks. One of these docks has been in operation for some time past, but the extension of business has compelled the company to construct a new dry dock alongside its old one. This dock is 400ft. long, 45ft. wide, and 22ft. deep, and is capable of taking in nearly every class of vessel that comes to Cardiff. A plan of these graving docks, together with the convenient arrangement of buildings around the same, including the foundry and fitting shop for repairing the engines of steamers, we give above. This dock, containing 2½ million gallons of water, has to be pumped out direct into the main floating basin, there being no tide whatever of which to take advantage. The dock being 22ft. deep, the water has to be pumped against this head. The work is accomplished by two sets of fine centrifugal pumping engines, manufactured by Messrs. W. H. Allen and Co., of York-street Works, Lambeth. An engraving of these pumping engines are given above. The centrifugal pumps have suction and delivery pipes, 18in. diameter, and are driven by two inverted engines, having cylinders 15in. diameter and 12in. stroke. The crank shaft is 4¼ diameter, with bearings 7½in. long, and the engines are fitted with all the latest improvements, including variable expansion valves, and patent ejectors by which the pumps are charged when the water is at the bottom of the dock in the space of a couple of minutes. Either engine can work either pump—very essential to dock pumping machinery. The engines are supplied with steam by two boilers, each 6ft. diameter by 22ft. long, with two flues 2ft. 6in. diameter, which provide ample steam at 70 lb. pressure, with easy firing. By the terms of the contract the engines were contracted to discharge 12,000 gallons of water per minute, and to clear the dock in three hours. At the trial which took place at the opening of the dock on the 19th September last, the pumps discharged a volume of 18,000 gallons per minute, and the dock was emptied in two hours. In the amount of fuel used, the engines proved themselves very economical, about 15 cwt. of coal only being required —inclusive of lighting fires— during the whole operation. By means of a large culvert from the east dock under the new west dock, either graving dock can be pumped out by the same engines. The whole arrangement of this machinery, both in detail of construction and manufacture, as well as the docks themselves, is most complete and perfect in every way.



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TO CORRESPONDENTS.

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

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

H. and T. (Carlisle).—*We cannot. Try Scotland.*

M. C. E.—*We know no dictionary better than Tolhausen's, which you say you have got.*

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A. J. C.—*Water pipes are burst by the expansion of water in freezing. When a thaw takes place the water runs out through the cracks.*

J. B. (Kidderminster).—*The best elementary book on the steam engine you can have is that published in Weale's Series by Messrs. Crosby Lockwood and Co., London.*

W. B. (Stepney).—*The Westinghouse brake in all its modifications has been fully described in* The Engineer. *You can no doubt obtain particulars in a compact form by applying to the Company, Canal-road Works, King's Cross.*

J. W. P.—*There is no book dealing specially with the construction of gasholders. You will get a good deal of information from Richard's book "On Gas Manufacture," and more from the "Proceedings" of the Institution of Civil Engineers.*

H. M. R.—*Tug boats from northern ports, such as Newcastle and Liverpool, are always fitted with disconnecting gear, so that one paddle can turn ahead and the other astern. There are no boats of the kind running between London Bridge and Chelsea.*

H. Von E. (Rostoff-on-the-Don).—*Percy's "Metallurgy of Iron" will supply the information you require. Tin-plates are made by rolling very tough charcoal or coke iron into thin sheets, the surfaces of which are cleaned by pickling in dilute sulphuric acid. The plates are then washed and dipped in baths of melted tin kept from oxidising by melted tallow floating on the top.*

PURIFYING OLIVE OIL.

(To the Editor of The Engineer.)

Sir,—Will any of your readers kindly say where oil purifying apparatus can be had? H. P.

Lisbon, November 8th.

THOMSON'S GOVERNOR.

(To the Editor of The Engineer.)

Sir,—Can any reader kindly tell me where I can obtain information concerning the governor and expansion valve exhibited at Philadelphia, I believe, two or three years ago by a Mr. Thomson? R. T. C.

Stockton-on-Tees, October 30th.

PLATING SHIPS.

(To the Editor of The Engineer.)

Sir,—Will some of your numerous readers be kind enough to state when a ship is considered to be in frame, and also when plated? In the first case ought her beams to be up, and in the latter case ought the plates to be rivetted? Wm. C.

Dundee, November 12th.

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

MEETINGS NEXT WEEK.

The Institution of Civil Engineers.—Tuesday, Nov. 20th, at 8 p.m.: Ordinary meeting. Paper to be read with a view to discussion, "The Adoption of Standard Forms of Test-Pieces for Bars and Plates," by Mr. W. Hackney, B.Sc., Assoc. M. Inst. C.E.

Society of Telegraph Engineers and Electricians.—Thursday, Nov. 22nd, at 8 p.m., the following papers will be read:—"Submarine Telegraph Cables; their Decay and Renewal," by Messrs. S. Trott and F. A. Hamilton, Associates. "Trott and Kingsford's Automatic Grapnel for Submarine Cables and Torpedo Lines," by Mr. H. Kingsford, Associate.

Royal Meteorological Society.—Wednesday, Nov. 21st at 7 p.m., the following papers will be read:—"Report on Temperatures in Different Patterns of Stevenson Screens," by Mr. Edward Mawley, F.R.Met. Soc., F.R.H.S. "On the Storm which Crossed the British Islands between September 1st and 3rd, 1883, and its Track over the North Atlantic," by Mr. Charles Harding, F.R.Met. Soc. "On the Influence of the Moon on the Height of the Barometer within the Tropics," by Mr. Robert Lawson, Inspector-General of Hospitals. "The Ice Storm of July 3rd, 1883, in North Lincolnshire," by Mr. John Cordeaux.

THE ENGINEER.

NOVEMBER 16, 1883.

INSIDE CYLINDER LOCOMOTIVES.

What we have said concerning the London, Brighton, and South Coast Railway Company's fine engine, the Gladstone, has set on foot an interesting discussion concerning the size of cylinders that can be got between frames. We stated, it will be remembered, that 17¼in. is the largest diameter that can be got in while the valve chests are retained between the cylinders. To this statement a correspondent took exception, and showed that cylinders 18¼in. diameter were being put between the frames of some new engines for the Glasgow and South-Western Railway. This fact, however, in no way affects what we have said. No one, we fancy, supposes that we wished it to be understood that even 19in. cylinders could not be put into an inside cylinder engine with the valve chests between them. What we intended to convey, and what we now repeat, is that in a properly designed engine, cylinders 17¼in. diameter are the very largest that can be used in the way stated. We know that attempts are made to get the necessary space for the valves by cutting holes in the frames to let the cylinders come further apart. To this there are objections, but they are not of much moment; but there is more to be thought of than the cylinders. An engine with cylinders 19in. or so in diameter must be very powerful, and ought to have crank axle bearings 9in. long; but these cannot possibly be used under the conditions stated unless the outside crank webs are not more than 3½in. thick, or thereabouts. In the Gladstone the crank webs are 5in. thick. Three and a-half inches is too little for the crank web of a very big locomotive, and the adoption of such a dimension appears to us to be rash, and is certainly not justified by the results obtained; in fact, it is, to speak plainly, bad designing. If there was no way out of the difficulty, then we might pity the engineer who was driven to adopt such an expedient; but with the example set by Mr. Joy on the one hand, and Mr. Stroudley on the other, there need be no difficulty at all about the matter. Mr. Johnson is building now the most powerful passenger engines ever turned out. They are intended to work trains of eighteen and nineteen coaches over the hills between Manchester and Sheffield. They will have 19in. cylinders, 26in. stroke, and four-coupled 6ft. wheels. The valves will be above the cylinders, and driven by Mr. Joy's valve gear. On the Great Eastern Railway Mr. Massey Bromley built some engines on modified American patterns, with the valves on top of the cylinders, and driven by a countershaft. These engines perform very well. On the London and North-Western Railway there are scores of engines with the slide-valve faces representing the two sides of a V, one for each cylinder. The approximately horizontal plane cutting the valve gear is inclined from the crank-shaft upwards, while the plane cutting the cylinder-centres and crank-shaft is level. This is a compromise between the other two arrangements, and it has given satisfaction.

We have said nothing as yet of the great objection to crowding valves between cylinders. This is the throttling of the exhaust. It is simply impossible to overrate the value of free exhaust, and for very high speeds we believe that negative lap on the slide valve might be adopted with advantage. Who can look at the engraving of the cylinders of Mr. Stirling's engine on page 337 without seeing that exhaust is frightfully throttled? It is little good to make the exhaust port wide if the steam ports are small, and the bridge in the slide valve even smaller. At slow speeds this question need hardly be considered, but at high speeds it is one of the most important that can be handled. Mr. D. K. Clark did good service when he insisted many years ago on the value of free exhaust, and pointed out that outside cylinders must have more back pressure than inside cylinders, because they worked with wetter steam, which is sluggish in its movements. If our readers will turn to page 317 and 318 in our impression for October 26th, they will find much to interest them. Let us take, for example, the sixth diagram, at the top of the page. The cut-off varied from 17 to 50 per cent. The speed was very nearly constant, 50 to 51 miles per hour. We see that the back pressure is enormously augmented at the 50 per cent. cut-off as compared with all the other diagrams drawn on this card, save that at 17 per cent., in which compression plays an important part, which must not be confounded with back pressure. Compression is due to the closing of the port; back pressure is due to more steam having to get out while the exhaust port is open than it can conveniently pass. There are two very suggestive diagrams a little lower down on page 317, side by side. In the first, the cut-off takes place at 58 per cent. The speed is 56 miles per hour; the average pressure, 53·7 lb.; the horse-power 1040. The next diagram shows a cut-off at 62 per cent., an average pressure of 59·2 lb. and 933·6-horse power. The average back-pressure in the first case is about 10 lb. per square inch; in the second it is over 14 lb., or, say, 4 lb. in excess. The eighth diagram is a still more striking example of the fact that as the quantity of steam admitted to the cylinder increases so does the back-pressure. Here we have 62 per cent. admission, and 60 miles an hour. The back-pressure has risen to nearly 15 lb. on the square inch, and this, be it remembered, with an enormous exhaust area so direct that standing under a pair of cylinders in place, but without the valve or valve chest cover, we can see up the chimney through the exhaust port and blast pipe. At 60 miles an hour the back-pressure represents a great deal of work—nearly one-fourth of the whole power expended. If it did not exist, instead of indicating 951-horse power, the engine would have indicated over 1100. An admirable case in point is supplied by the Trent brake trials. Each engine, it will be remembered, had a level run of three miles, during which to get up speed for the trial ground; not one of the powerful engines used could manage to get over the staked portion of the course at 60 miles an hour. The drivers all made the same mistake; while running the three miles they kept the engines notched up to save steam. On the course they reduced the ratio of expansion, choking the exhaust as a result, running up the back pressure, and actually reducing the speed of the train. If our readers will bear in mind that at sixty miles an hour a cylinder has to be emptied in, say, the 0·25 of one second, during little more than half which time the exhaust port is full open, the importance of providing plenty of space for the steam to get away will be understood. For very fast running engines, indeed, of all kinds, it seems that it might be worth while to make the exhaust port begin to open almost at the same moment that the admission port is closed.

We believe that many of our readers can if they please supply in our correspondence columns a great deal of very valuable and useful information on the results obtained with various types of inside cylinder engines. A comparison between their performance and that of outside cylinders, such as those on the Great Northern, Great Eastern, and South-Western, would be very interesting and instructive, and would not be difficult to prepare. We have only to add that we shall gladly open our columns to well authenticated comments on the subject.

UNIFORMITY OF ROTATION IN ELECTRIC LIGHTING ENGINES.

The satisfactory performance of any electric lighting installation depends a good deal on the uniformity in the speed of rotation of the armatures of the dynamo machines and therefore on that of the engine by which they are driven. Few installations have yet been put to work without the display of some differences of opinion between the electricians and the makers of the engines as to the apportionment of the blame for the photometric and other irregularities, of the arc lamps more especially. The electrician says the engine runs too fast or too slow, or both, though not, perhaps, at the same time. He has this advantage over the maker of the engine, that the terms he uses in making his complaint as to the engines are old and generally well known and understood. The engine maker must accept or reject the statements; but if he asserts the regularity of the speed of his engine, he is soon floored by the electrician, who has other weapons to fight with, which the engine maker cannot use at all. The electrician points to his incandescent lamps, propounds conundrums about volts, and to his arc lamps, and talks of ampères; and the engineer gives it up, convinced against his will. We do not pretend to say that the engines are not occasionally at fault; sometimes they are, and even if it is only sometimes, then it is time for the engineers to look to the cause. Dynamo-electric machines may, for the purpose of argument, be said to run at an average speed of 1000 revolutions per minute. If the engine driving them runs at, say, 100 per minute, then one revolution per minute makes a difference of ten revolutions per minute in the machine, which would not often be of any importance; but three or four revolutions difference in the engine makes from thirty to forty revolutions difference in the machine, and then the electrician gets cross. With the object of getting over this difficulty engine builders have gone to all sorts of trouble in making automatic variable cut-off gear, sensitive governors, compound engines, and complications. These have not always done much towards keeping the electricians in good humour, for, with all the refinements, speed varies, or if it does not the lamps do, which is all the same, and being there to do the work, the engine must receive the blame. Conspicuous illustrations of this were afforded at the Fisheries Exhibition. The makers of arc lamps, in which regularity of working could only be obtained with carbons absolutely homogeneous, equal in resistance, and perfectly pure, and with engine and machine innocent of any assignable irregularities of any kind whatever, complained that the flickering uniformity of the arc in their lamps was due to the engine. The engine makers were, of course, obliged to believe this; but we hear that, to this moment, it is a puzzle to them that some other sorts of arc lamps, which did not require the above supernatural perfections, worked with remarkable steadiness, though fed by currents from machines driven by the same engine. But some electrical matters are puzzling.

High speed engines have in one respect the advantage over the slower running engines, namely, that two or three revolutions more or less in their speed will not be felt so much on the dynamo machine because the speeds more nearly approach each other. Often, however, when the engine is blamed, although it is a fact that it has sometimes deserved it, the fault lies not in the engine but in its size or in that of the boiler. Electric lighting on a large scale is even yet very young, and electricians have been gaining information as to the difference between electrical horse-power in the machine and horse-power in the engine, and their demands for indicated horse-power are greater now for the same work than they were when electric lighting was in its infancy. In not a few places engines have been put down which are not sufficiently powerful. They have done the work ordered, but the requirements have exceeded the electrician's original estimate, and hence the engine has had to run very closely indeed to its full power. When this is the case, and especially if it obtains with boiler as well as with engine, any considerable irregularity in the consumption of power makes itself felt in the engine with notable effect. The engine has no reserve, and governors have not the power of governing unless both engine and boiler are sufficiently master of the work. The governor must have something to draw upon.

In considering the complaints made by electricians on this subject, and remembering successful illustrations of electric lighting by temporary arrangements and with engines with but very modest pretensions as to refinement, we are much inclined to think that time and money are both likely to be wasted if either are further expended in scheming elaborate cut-off and governor gear. Some engines without anything of the kind have given electric lighters a good deal of satisfaction; some with every refinement have failed. Why? Simply because when the common engine has been used one of ample nominal power was selected to allow for contingencies. In the case of the refined engine the power required was carefully calculated and compared with indicated horse-power of the engine. Things are, in short, in such cases cut fine, and the power of the engine at normal speed and pressure is so near the work it has to do that it must be nursed and the firing performed by a skilful stoker. For electric lighting, as well as for other dead-pull work, strong, well-made engines are required, and the admisssion and cut-off of the steam should be tolerably quick and precise. A powerful

governor should be employed. For the purpose to which these engines are to be put, that which good slide valves will not effect will not be effected by any valves or valve arrangement, and complication should be entirely absent in such engines designed to run without hitch of any kind occasionally for hours at a stretch. Engines for the purpose should be well above the work to be done; but more important still it is that the boiler or boilers should be of ample power and able to give steam in extra quantity and of extra pressure whenever required. To prevent any material irregularity in the speed of such engines—say three to six revolutions per minute—a good boiler and a powerful governor will prove excellent servants. But to prevent the minute irregularities in the speed of an engine when the time considered is only a fraction of a minute at any period, we do not think any form of valve gear will afford us any aid. For this we must look to the fly-wheel, or to some such rotary energy accumulator. Very few of the engines employed for electric lighting, even when they have been destined to work approximately up to their indicated power, have had fly-wheels remarkable either for weight or diameter. Great weight is not to be adopted without due thought, for this will occasionally raise the temperature of the bearings and the temper of the attendant. Large diameter is not always convenient, so diameter and weight must be proportioned according to circumstances. But whether it is obtained by greater weight or by greater diameter, we believe that greater energy-storing capacity in fly-wheels is much wanted for the purpose above mentioned. Larger diameter may often be adopted without any inconvenience; and this is to be preferred because of the greater efficiency of an increment of radius than of even considerable weight. Increase of velocity is effective for fly-wheels used in the sense we are considering in proportion to the cube, not the square, of that increase; but increase in weight is only effective in simple proportion to that increase. The regulating power of a fly-wheel may thus be greatly increased where large diameters may be used, and this would, there is little doubt, do much to reduce the small range irregularities in the velocity of rotation of electric lighting engines.

STATE OF THE CLYDE SHIPBUILDING INDUSTRY.

It is estimated that over one-third of the building berths in the various shipyards of the Clyde are at present vacant. It cannot be said that this, of itself, evinces a state of matters about which much alarm need be felt; but taken in conjunction with other facts, it would appear that a period of decline has already set in. Deducting vessels which fall to be launched before the end of the year, the number of ships on the stocks is only about half that in hand about the close of last year. It will thus lie with the two months which have yet to run to make the close of the present as plentiful with new work as the close of the last year. There is, however, no likelihood of this being the case, and builders, while feeling perhaps justly gratified at the extraordinary gross result of their efforts during the past year, will have to begin 1884 with restricted forces and a limited field for operation. However, there is not a positive stoppage in the flow of new orders, some of the most recent contracts being two large steamships of 5000 tons for the Shaw, Savill, and Albion Company, Limited, secured by Messrs. Denny, of Dumbarton; a steamer of over 4000 tons for Messrs. Paggio, of Italy, by Messrs. McMillan and Sons; several sailing ships by the same firm; two twin screw vessels, by Messrs. Thomson, of Clyde Bank, one of which is for Mr. John Burns to undertake a daily service between Scotland and Ireland, the other for the Cunard Company to serve as tender upon their larger vessels. There is certainly not, however, the steady demand for new vessels which has so long prevailed. To help matters, several of the builders in tendering for the few orders that are going are discounting labour 10 per cent.—an ominous fact generally, and one particularly so for those who have reaped such a harvest from the high wages that prevailed, but who, we are afraid, have failed to profit by it as they might have done. The fact proves that builders are counting on a reduction in wages pretty soon, and at least in one yard, though some distance from the Clyde, viz., Dundee, that reduction has already been made, although the men have struck against it. The shipbuilding trade of Leith, it is said, has never been in such a state of decline as at the present time. Four building slips in Messrs. Ramage and Ferguson's yard are now vacant, only one vessel being in course of construction. A large number of men in the principal yards have been thrown out of employment, and the prospects for the coming winter are anything but bright. One reason, and the only one adduced, for the decline is that the unreasonable and exorbitant demands of the ironworkers have almost paralysed the shipbuilding trade, and entirely stopped new orders being placed till prices become more satisfactory. This was also the burden of a strong complaint made at the launch of a large vessel from the shipyard of the London and Glasgow Engineering and Iron Shipbuilding Company on the 16th ult. Mr. Thomas Reid, one of the directors of the company, in responding to a toast, said the dividends of the company were so extremely meagre that they could scarcely be called dividends at all. He attributed that to the extravagant demands of the workmen, who had taken advantage of the position of matters to exact wages which were unexampled in the history of the trade, and the builders were now beginning to feel that instead of having ships to build they were less busy than suited their books. The men had acted without looking to the future, and the worst of it was that they had spent the money in such a way as to render them unfit for work. Some of them seemed to act as if it was unnecessary to earn 40s. a week if they could live on 30s. In former times he had seen grass growing in the streets of Govan and soup kitchens open, and from the way they were acting he was afraid the soup kitchens would require to be opened again. He had no desire to dwell on such doleful matters, but unless the men took less wages they would drive away trade from the Clyde. Another speaker averred the workmen had got all the profit; there had been no lack of orders, but a great lack of certainty as to when the orders would be turned out. Slackness seemed to be coming on them, and the prospect should do the men good.

THE ARLBERG TUNNEL.

In The Engineer of the 10th June, 1881, will be found a full description of the objects, direction, and mode of construction of the Arlberg Tunnel. The piercing of the mountain was, we are glad to hear, successfully completed as far as the advance heading is concerned, on Tuesday, the 13th inst. The tunnel proved to be 3 metres shorter than had been calculated, and thus the meeting took place a day sooner than was intended. A similar miscalculation in the St. Gothard Tunnel was attributed to the attraction of the mountain. The official ceremony of levelling the rock is to take place on Monday in presence of the Austrian Minister of Commerce and other distinguished guests from Austria, Switzerland, and Italy. Another great Alpine highway will then be preliminarily opened up, just two years after the first experimental trip conveyed about sixty passengers—contractors, engineers, and their friends—through the tunnel of the St. Gothard. The new tunnel is 10,270 metres in length, while the Mont-Cenis Tunnel is 12,323, and the St. Gothard 14,900 metres. The first took fourteen years and a-half, and the second about eight to bore; the Arlberg Tunnel will have taken, when vaulted and ready to receive the first locomotive, about four years. Dynamite has been largely used, and the Brandt revolving rock drill has been employed, as well as the Ferroux percussion drill. For these drills several streams from the heights of the snow-covered Arlberg, were gathered on the eastern side into reservoirs from which turbines which compressed the air to five atmospheres, for the Ferroux borers, were worked; while on the western side pumped water was passed through pipes to the pressure of over a hundred atmospheres, to work the Brandt revolving borer, which cuts cylindrical blocks of rock from the mountain. The gallery has been driven on a level with the bottom of the future tunnel, and not on the Belgian system, as was formerly done, on a level with the top. Large money premiums were granted for completing the work before the stipulated time—in which premiums the contractors allowed their workmen to share. The two halves of the work were allotted on December 21st, 1880, to two contractors—Ceconi for the eastern part, and the Brothers Lapp for the western side; but the piercing of the galleries, effected in the beginning by ordinary tools, as the nature of the stone did not allow the employment of boring machines, had already begun in June, 1880. On November 13th and November 17th respectively, the percussion and the rotating borers began their work, which advanced on each side at an average of from 5 to 7 metres daily, the greatest effort having been achieved in 1882, when 3590 metres were bored, while the St. Gothard Tunnel had a maximum of boring in 1878 of only 2530 metres. The whole cost, including the double-tracked railway through the tunnel, will not exceed eighteen million florins, or one and a-half million pounds, including the premium to the contractors for early completion; while the cost of the whole railway line from Innsbruck, in the Tyrol, to Bludenz, in the Austrian province of Vorarlberg, passing through the Arlberg Tunnel, will be forty million florins. The third Alpine tunnel connects parts of the same country, and not foreign countries as in the case of its forerunners.

BRITISH AND FOREIGN VESSELS.

Some time ago in The Engineer we called attention to the largeness of the number of foreign vessels at some of the timber importing ports, and recent returns enable us to carry the comparison a little further. During the last month 319 British and 300 foreign vessels left the port of Newcastle coal laden. From Sunderland 77 British and 82 foreign vessels left with coal cargoes for foreign ports. From West Hartlepool the numbers of the vessels taking coal for export were 35 British and 125 foreign; from the small port of Middlesbrough, 10 British and 28 foreign; from Grangemouth, 18 British and 65 foreign; and from Grimsby, 35 British and 67 foreign. Looking over the list of the vessels at most of our ports, we find that the preponderance is in favour of the foreigner at the east coast ports, and that it is found that most of the vessels are of small tonnage. For instance, the largest number of the vessels from one of these ports sailed to Kiel, and the average weight of coal carried was 175 tons. From another port the largest number went to Christiania, and the average quantity of coals carried was 190 tons; and from a third the average tonnage was 370 tons, the vessels going to Dantzic. It is evident, then, that these boats were of small dimensions, and that after bringing a cargo here they took another home. At the same time they are rendered necessary in the trade, because the British mercantile navy is more and more becoming one of steamers, and these are of large size—too large to enter into the trade that is carried on by these small sailing vessels. One of the wants of the day for our British trade is a small vessel—a steam vessel and one that can be cheaply worked. If this could be furnished there would be an employment for some of our shipbuilders in a period that may be dull; and there would also be a recovery of a trade that seems to some extent drifting into the hands of the foreigners, both to and from this country. The difficulty would be found to be more in the cheap working of the vessel than in its construction, and if this could be overcome the want would make itself so felt that shipbuilders would speedily enter into the trade. The subject is one that is worth the attention of those interested both in shipbuilding and in marine engineering, for if these industries could be turned to account to produce a vessel that would be safely navigated with less cost than is at present needful, there would be a stimulus given to the trade in some of its centres.

LITERATURE.

Energy in Nature, being, with some additions, the substance of a Course of Six Lectures upon the Forces of Nature and their Mutual Relations, delivered under the auspices of the Gilchrist Educational Trust in the autumn of 1881. By W. Lant Carpenter, B.A., B.Sc., &c. London: Cassell and Co. 1883.

Mr. Carpenter tells his readers in his preface that this "book may be shortly described as an endeavour to expound in popular yet accurate language the meaning and consequences of that important principle known as the conservation of energy." In one sense Mr. Carpenter has succeeded—that is to say, he told his hearers when he lectured, and now he tells his readers, a great deal that they probably did not know before, or knew in a vague and unsatisfactory way; but he has not succeeded in using accurate language in doing this. Indeed, we very much doubt whether our author has very clear ideas himself concerning the nature of energy. His teaching is altogether of a kind behind the age. It is of the sort abandoned some time ago by all honest, thoughtful men who are prepared to admit that they neither understand nor pretend to understand everything; and it involves not a few fallacies which shrewd men in the lecturer's audience would not have failed to find out if only they could have got a complete grasp of the subject.

In talking of energy it was, of course, essential that Mr. Carpenter should speak about force, and even explain what that is. But before doing this he dealt with the "forces of nature," and explained that gravity, chemical attraction, electricity, heat, magnetism, and so on, "are not 'things' in themselves, in the sense in which sand, wood, &c., are 'things' in themselves, and that they are only known, and can only be investigated, by their effects upon substances, or, to use a more precise phrase, upon what the scientific man calls matter." As we do not quite understand the object of this statement, we shall say nothing more about it; but a good deal may be said concerning the succeeding statement, that "the so-called forces of nature have been well and truly spoken of as the moods or affections of matter. The relations of an individual to the objects which surround him vary with the mood in which he is; in a similar way the relations of any object in nature to other objects in its immediate neighbourhood vary with the mood of these objects, or with the way in which they affect each other." Further on we are told that when a leaden bullet is melted it is in a heated mood; when fired from a rifle, in a very destructive mood; and when influenced by a current of electricity, in an attractive mood; and so on. It is, we think, much to be regretted that any science teacher should write or utter such a farrago of nonsense as this. Mr. Carpenter let himself down to the possibly low intellectual level of his audience, instead of trying to lift them up to his own. No greater mistake could be made by a lecturer. It is of course possible that he has himself been taught physics so badly that he attributes to matter properties which no well-instructed man at present believes it to possess. Matter is, the world has been taught from the days of Newton to this moment, absolutely inert itself, and the mere creature of the impulses conferred on it by forces. To say that it can have moods is simply to attribute to it volition, which is not only rank nonsense but something much worse. If matter could do as it pleased if what it did depended on the mood it was in, than the law of the conservation of energy could have no existence, and Mr. Carpenter need not have written the book before us. We find all through the work, however, that Mr. Carpenter has followed old stereotyped lines without in the least caring what inconsistencies or absurdities they lead up to. For example, he talks about attraction, and goes blithely on his way, entirely oblivious to the fact that, if matter can attract matter, then the doctrine of the conservation of energy must be untrue; but with such things as this he does not concern himself. For the sake of those who read his book, as well as this notice of it, we may point out that if two bodies are at rest, and mutually attract each other, some force is in activity and yet is doing nothing. If the bodies move toward each other, or one moves while the other remains at rest, energy will be developed, that is to say, the power of doing work, or more accurately, the power of imparting motion, will have been conferred on the moving body. But according to the principle of the conservation of energy, this particular energy can never be destroyed; consequently attraction has created energy without itself performing work, or loss of any kind. Again, the two bodies are just as ready to attract each other after they have moved as they were before, and should we call in an extraneous force to separate them, after they have been in contact, or nearly so, this force produces no effect whatever on the attractive powers of the bodies—the very thing it is called in to overcome. It is absolutely impossible to controvert the accuracy of this statement. If bodies intrinsically attract each other, then there is no truth whatever in the doctrine of the conservation of energy.

In no place throughout the volume can we find anything like a definition of the word energy which is in any sense or way satisfactory. Energy, we are told, is the power of doing work in the strict sense of the term. This, of course, means anything or nothing. "Force," we are told, "is simply the expression of the rate or speed at which any change takes place in matter; what its essence or primordial cause is, is a problem that science does not attempt to solve." The origin of this definition of force is obvious enough; but we do not know on what authority Mr. Carpenter makes the statement that science does not concern itself in the solution of the problem. Putting Mr. Carpenter's theorem in other words, we have: "Science does not attempt to say what is the cause of the rate at which any change takes place in matter." This is a puzzling assertion. Suppose our author carried his ideas one step further, and defined what he meant by change in matter. Let him ask himself whether change of any kind can take place without motion, and then use his reasoning powers to ascertain whether or not a very intimate relation exists between force and motion. Perhaps, if he does this, he will find that the search after the primordial something is not so far beyond the ken of science as he thinks.

It is much to be desired, we hold, that when lectures are delivered, the audience should always have the power of asking the lecturer certain reasonable questions. The benefit would be great, because it would set the lecturer thinking for himself. For example, in speaking of secondary batteries, our author is very properly careful to tell us that electricity is not stored in the batteries. "Energy, not electricity, is stored in them." Suppose that one of his hearers had stood up then and there and asked him how he knew that energy was stored in the battery, what reply would he have made? So far as is known, there is no energy stored in the battery. That it can do work is certain, but the power of doing work is developed from second to second, and the battery cannot be instantly emptied of energy. That in the battery cells matter is put into a condition to produce certain forms of motion in certain directions, and places, and sequences, is quite certain, but to say that energy is stored up in it is as misleading as it would be to say that Mr. Carpenter's name could be done up in brown paper and sent by parcel post. He was extremely careful in his first lecture to explain that the forces of nature are not things, but in dealing with secondary batteries he forgot this, and assumes that they may be "stored up."

It will be readily understood from what has gone before that we have the old old story of the storing away of energy in coal by the sun millions of millions of years ago told all over again. It is a great pity this pretty conceit is not quite true. "When a thing, coal for example, is burned, the energy

thus generated is simply a re-production of the solar energy which separated the carbon and oxygen during the growth of the plant." With all due deference to Mr. Carpenter, it is nothing of the kird. It is the production of energy equivalent to that expended by the sun, let us say; but it is not the same energy. It is, too, a really marvellous fact that everyone who adopts this line of argument quietly ignores the oxygen, and assumes that the whole of the energy is stored in the coal. It is in gases that we must seek for the energy developed in combustion, and the energy is largely represented by the difference between the densities of the gas before and after combination. Thus, for example, hydrogen, the least dense of gaseous substances, developes the greatest energy. Hydrogen when burned with oxygen developes heat representing 62,000 units per pound of hydrogen, equivalent to 21,368 foot-*tons*. How much of the energy is in this case developed by the oxygen, and how much by the hydrogen, is not accurately known. The result of the combustion is water, enormously more dense than the gas producing it. The truth of the matter is, that almost the whole of the energy of combustion is represented not by the coal, but by the oxygen. We refer to hydrogen in this connection only to recall the fact that the energy which, on Mr. Carpenter's theory and that of the school to which he belongs, is developed by combustion, does not need a solid.

Of the main body of this book we have said but little, and, indeed, it demands but little. We may sum it up in a few words by saying that it is, what it pretends to be, a popular treatise on energy—or the power of doing work by electricity, heat, light, &c. It is by no means a bad or misleading book of its kind. It lacks precision of definition, but it may, and we think will, serve a useful purpose. For example, it may be put with advantage into the hands of boys of a scientific turn of mind. Its faults,moreover, are not, we think, those of its author, but of those by whom he has been taught.

The Patents, Designs, and Trade Marks Act, 1883: *With Introduction, Notes, and Index to the Sections relating to Patents.* By James Johnson, of the Inner Temple, Barrister-at-Law, and J. Henry Johnson, Assoc. Inst. C.E., Solicitor and Patent Agent. London: Longmans, Green, and Co., and Stevens and Sons.

This is a reprint in a convenient form of the new Act. It is scarcely to be expected that much can be said by way of notes to the various sections, having regard to the fact that up to now there are no new rules of practice and no authoritative decisions as to the construction of the new enactment. The notes, however, so far as they go, are useful; and the introduction is a concise summary of the changes which the new measure will work, so far as letters patent are concerned.

It is a moot question whether a professional writer should indulge in speculative observations upon the construction of provisions in an Act of Parliament which have not received judicial consideration. Many people hold that such discussions are irrelevant in a text book, if not misleading. We incline to an opinion that they are useful. The authors of the little book before us occasionally indicate their opinions as, for instance, in the case of Sec. 32, where they point out, and we think perfectly correctly, that the section has not effected any substantial alteration of the law. It has, we believe, been completely established that a patentee has no right to threaten for an indefinite period alleged infringers if he is challenged to bring an action and does not. It is open to the persons so attacked to prove that they do not infringe, and then to obtain an injunction restraining the defamatory statements. We cannot help wishing, however, that editors with an experience admittedly great had condescended even further to the expression of their opinions. Something might have been said, for example, as to the effect of Sec. 45 upon the payment of fees in respect of applications prior to the 1st of January, 1884. It is notorious that there has been much discussion as to the construction of this section. Our own columns and those of the daily press have contained many letters on the subject, and even in our present impression we publish the official statement of the practice. Sub. sec. 3 of that section states that, "In all other respects (including the amount and time of payment of fees) this Act shall extend to all patents granted before the commencement of this Act or on applications then pending in substitution for such enactments as would have applied thereto if this Act had not been passed." Now it appears from the letter which we publish in another place that the authorities claim to charge old fees on proceedings down to the filing of the final specification. This contention is in our opinion open to much doubt. We fail to find any authority for the imposition of the old fee on the filing the specification. The Act says that the *new* fees are to extend to "all *patents*" granted before the Act or on applications then pending, and therefore logically, to all proceedings subsequent to the grant of the patent. The patent is complete and effective on the application of the seal. The specification is filed subsequently, and if not filed the patent becomes void. The patent is perfectly good until the time elapses during which the specification ought to be filed, and only becomes void when that condition is not complied with. We shall not be surprised to find considerable friction when the Act comes into operation. We hope to be disappointed, but rumour is not re-assuring. Those whose duty it will be to administer the new practice cannot be too careful to adhere strictly to their enabling authority.

Professional Papers. Royal Engineers. 1882. Vol. viii. London: Ed. Stanford. 1883.

This volume contains the following papers:—(1) "Provisional Fortification," by Capt. G. S. Clarke, R.E., in continuation of the author's paper, vol. iii. By provisional fortification is meant the construction of as good works as can be made in the time on any area of ground needing them in war, either made during the war, as at Plevna, or of a more perfect character when more notice is given, as at Adrianople. It is thought that England has special engineering power to carry out such operations in case of invasion. The works erected at Adrianople by Bluhm Pasha are illustrated by many cuts, and specially reviewed as good examples. (2) "Graduated Arcs for Heavy Guns." The question is mathematically investigated by Capt. M. H. G. Goldie, R.E. (3) "Campaigns of Lord Lake against the Marattas, 1804-1806," by Major H. Helsham Jones, R.E., taken as good illustrations of warfare against Asiatics. A comparison is drawn between the mistaken policy advocated in 1805 of withdrawing and clinging to a river frontier, the Jamna, and that put forward and acted on in 1881. (4) "Blasting Operations at Timlin's Narrows, Bermuda, in 1879-1881," by Lieut. C. K. Wood, R.E. The description of the operations is accompanied by statements of the total cost per foot under various conditions. (5) "Demolition of the Barque Carolina Z, in St. George's Harbour, Bermuda," by Lieut. C. Penrose, R.E. In this, as well as the last paper, the use of gun-cotton is described. (6) "Construction of Bridges over the Kabul River, near Jalalabad, in 1880," by Capt. R. H. Brown, R.E.—a detailed account of construction and history, with calculations, is given. (7) "Railway Curves," by the late Capt. W. H. Johnstone, R.E.—a mathematical investigation of the subject. (8) "Triangulation of Northern Afghanistan," by Major T. H. Holdich, R.E., being extracts of a report to the Surveyor-General of India. (9) "Organic Compounds in the Sun," by Capt. W. de W. Abney, R.E., F.R.S. (10) "Railways for Military Communications in the Field," by Col. J. P. Maquay, R.E. This paper is one to which special attention is called by the editor, Major Vetch, as being specially important at the present time. Various descriptions of railways designed for war operations are dealt with, and the questions of locomotives, rolling stock, cost of different gauges, &c., discussed, and the conditions for a military railway and the most suitable plant, according to the author's judgment, finally given. Without going into the matter of the various papers, we think their general scope and value must be apparent to those interested in engineering work, civil or military.

Internationale Revue uber die gesammten Armeen und Flotten. Herausgegeben und redigirt von Ferdinand v. Witzleben-Wendelstein. Max Hesse's Verlag in Leipzig. July to September, 1883.

This furnishes recent contributions from Germany, Austria, Russia, France, Italy, England, Holland, &c. The French and English papers are given in their respective languages. We do not propose to notice the contents of the various papers here. The French, we may observe, is a careful review of the proposals to re-organise the "artillerie de fortresse." In it there is one question discussed repeatedly, which is of constant interest in this country, viz., the separation of artillery into the field and garrison branches. The writer is strongly in favour of such separation, dwelling on the fatal results that might follow the appointment of garrison artillery officers, pure and simple, to the command of field batteries in a campaign. Unquestionably the reverse picture might be shown, only that the circumstances of garrison or siege artillery work enable a man to get information and advice from those round him, which the necessity for speed would preclude in an action in the field.

BOOKS RECEIVED.

Local Taxation and Rating of Machinery. By Thomas Fenwick Hedley. Second edition. London: Knight and Co. 1883.

Treatise on the Law of Electric Lighting: With the Acts of Parliament and Rules and Orders of the Board of Trade, a Model Provisional Order, and a Set of Forms, and a Description of the Principal Apparatus used in Electric Lighting. By Henry Cunninghame, Barrister. London: Stevens and Sons. 1883.

The Architects' and Contractors' Handbook and Illustrated Catalogue of Materials and Manufactures. Edited by J. D. Matthews, Architect. London: B. T. Batsford. 1883.

The Mason Science College, Birmingham: Calendar for the Session 1883-1884. Birmingham: The College. 1883.

Arithmetical Chemistry, or Exercises for Chemical Students. By C. J. Woodward, B.Sc. Part II. London: Simpkin, Marshall, and Co. 1883.

Glossary of Terms Used in Coal Mining. By W. Stukeley Gresley, A.M.I.C.E. London: E. and F. N. Spon. 1883.

Book-keeping by Double Entry, Explaining the Science and Teaching the Art. By Astrup Cariss. London: Effingham, Wilson, and Co. 1883.

A Royal Road: Being the History of the London and South-Western Railway from 1825 *to the present time.* By Sam. Fay. Kingston-on-Thames: W. Drewett. 1883.

Conversion Tables of Metric and British or United States Heights and Measures, with an Introduction. By R. H. Thurston, A.M.C.E. London: Trübner and Co. 1883.

Farm Roads, Fences, and Gates. By John Scott. Weale's Series. London: Crosby Lockwood and Co. 1883.

Irrigation and Water Supply. By John Scott. Weale's Series. London: Crosby Lockwood and Co. 1883.

Draining and Embanking. By John Scott. Weale's Series. London: Crosby Lockwood and Co. 1883.

Sanitary Work in the Smaller Towns and Villages. By Chas. Slagg, A.M.I.C.E. Second edition. Weale's Series. London: Crosby Lockwood and Co. 1883.

The Sheet-metal Worker's Guide: A Practical Handbook for Tinsmiths, Coppersmiths, Zincworkers, &c., comprising numerous Geometrical Diagrams and Working Patterns, with Descriptive Text. By W. J. E. Crane. London: Crosby Lockwood and Co. 1883. Weale's Series.

The Modern Applications of Electricity. By E. Hospitalier. Translated and enlarged by Julius Maier, Ph.D. Second edition. Vol. II., the Telephone, Applications, Electrical Transmission of Energy. London: Kegan, Paul, and Co. 1883.

Transactions of the Sanitary Institute of Great Britain. Vol. iv. Congress at Newcastle-upon-Tyne, 1882-3. London: Edward Stanford. 1883.

Die Refer der Patent Gesetzgebung in der Neuzeit. Von Franz Wirth. Frankfurt-am-Main: J. D. Sauerlaender. 1883.

Modern American Locomotive Engines—their Design, Construction, and Management: A Practical Work for Practical Men. By Emory Edwards. Philadelphia: Carey, Baird, and Co. London: Sampson Low and Co. 1883.

Metropolitan Sewage, and what to do with it: A Scheme of Sewage Disposal for the Metropolis and for the Lower Thames Valley. London: T. B. Batsford. 1883.

Kinematics; A Treatise on the Modification of Motion as Affected by the Forms and Modes of Connection of the Moving Parts of Machines for the use of Draughtsmen, Machinists, and Students in Mechanical Engineering. By Charles W. MacCord, A.M., Sc.D. London: Trübner and Co. 1883.

The Standard of Value. By W. Leighton Jordan. Third edition. London: David Bogue. 1883.

Internationale Revue ueber die gesammten Armeen and Flotten. Von Ferd. v. Witzleben-Wendelstein. Erste Jahrgang. Heft 12. Leipsig: Max Hesse. 1883.

The Amateur's First Handbook: A Complete Guide and Instructor in the Art and Practice of Modern Dry Plate Photography. By J. H. T. Ellerbeck. Liverpool: D. H. Cussons and Co. 1883.

Workshop Appliances, Including some Descriptions of some of the Gauging and Measuring Instruments, Hand-cutting Tools and Machine Tools Used by Engineers. By C. P. B. Shelley, M.I.C.E. Sixth edition. Revised and enlarged. London: Longmans, Green, and Co. 1883.

The Laws concerning Public Health, including the various Sanitary Acts passed in the Session 1883, *and the Circulars issued by her Majesty's Privy Council and the Local Government Board.* Edited by W. R. Smith, M.D., D. Sc., and H. Smith, M.B. Lond. London: Sampson Low and Co. 1883.

Die Hebezeuge; Theorie und Kritik Ausgefuehrter Konstructioner. Ein Handbuch fuer Ingenieure und Architekter, sowie zum selbstunterricht fuer Studirende. Von Ad. Ernest. Texts and plates. Berlin: Julius Springer. 1883.

Nautisches Technisches Woerterbuch der Marine: Deutsch, Italienisch, Franzoesisch, und English. Bearbeitet von P. E. Dabovich. Erster Band. London: Dulau and Co. 1883.

Proceedings Institute of Mechanical Engineers. July, 1883. Belgian meeting. London: the Institute.

AUTOMATIC CIRCUIT CLOSER.

This simple device is designed to automatically close the circuit of telegraph keys, and may be applied to either old or new keys or to keys of various sizes. A spring lever A, Fig. 1, presses upward, either normally or aided by a spring placed beneath it, against a projection B, from the side of the key. Fig. 2 is a plan view of the lever and projection. One end of this lever is so bent that its extremity rests about three-eighths of an inch above the finger button of the key. The rear end of the lever is secured to the frame by a screw. When operating, the forefinger is placed on the end of the lever A, which is pressed down until it

FIG 1

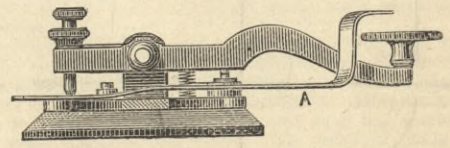


FIG 2

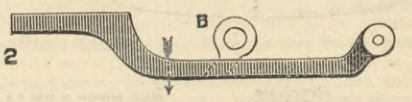
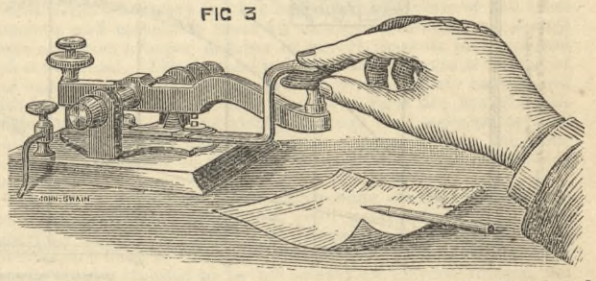


FIG 3



rests on the button of the key, which is grasped by the thumb and middle finger. When the lever is released, it presses against the projection and automatically closes the circuit. The device is very convenient, as the operator need not take the trouble to close the circuit every time he stops telegraphing, as it can never be left open. This invention has been patented by Mr. Samuel J. Spurgeon, of Liberty, Missouri.—*Scientific American.*

South Kensington Museum.—Visitors during the week ending Nov. 10th, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 11,146; mercantile marine, Indian section, and other collections, 2366. On Wednesday, Thursday, and Friday, admission free, from 10 a.m. to 4 p.m., Museum, 1332; mercantile marine, Indian section, and other collections, 174. Total, 15,018. Average of corresponding week in former years, 14,914. Total from the opening of the Museum, 22,564,260.

Tramways for Barrow-in-Furness.—Mr. R. Vawser, of Cooper-street, Manchester, has made an offer to the Corporation of Barrow-in Furness, to obtain the necessary provisional order, to lay down a system of tramways in the borough along the principal thoroughfares, and work the same for twenty-one years, without calling upon the Corporation for any financial help. The Town Council has accepted the offer, and the necessary movements are being made to obtain the consent of the Board of Trade, It is believed that 3ft. 6in. gauge will be adopted. Mr. Vawser has had considerable experience with tramways in other parts of the country. It is intended to run one-horse trams, but the roads in the town have been laid to suit steam trams.

The Multicharge Gun.—A report of some trials of a gun of this name of Mr. Haskell is given in the United States *Army and Navy Journal*. The velocities, weights, &c., are given. Mr. Haskell claims to gives a penetration of 20in. to 24in. with a pressure of 30,000 lb.—13 tons 8 cwt. nearly—and a range of ten miles. The following figures are given as results:—

Round.	Weight of shot.	Charge.	Energy.	Velocity.	Penetration.
13th	109	83	2306	1747	17·52
14th	110	83	2389	1770	18·11
19th	111	87	2608	1841	19·82
27th	155	86	2395	1493	18·20
30th	110	109	2855	1935	21·69

We do not understand the calculated penetration. With the above data we calculate round No. 13 to have 11¼in., and round No. 30 nearly 13in. perforation through wrought iron, the gun being 6in. in calibre.

Society of Arts.—The 130th session of the Society of Arts will commence on the 21st inst., with an opening address from Sir William Siemens, the chairman of the Society's council. Previous to Christmas there will be four ordinary meetings, in addition to the opening meetings, and for these the following arrangements have been made:—November 28th, A. J. R. Trendell, "The International Fisheries Exhibition of 1883;" December 5th, Thomas T. P. Bruce Warren, "The Manufacture of Mineral Waters;" December 12th, Thomas Fletcher, F.C.S., "Coal Gas as a Labour-saving Agent in Mechanical Trades;" December 19th, W. H. Preece, F.R.S., "The Progress of Electric Lighting." There will be six courses of lectures delivered during the session, under the bequest of Dr. Cantor. These will be:—(1) "The Scientific Basis of Cookery," by W. Mattieu Williams, F.C.S.; (2) "Recent Improvements in Photo-mechanical Printing Methods," by Thomas Bolas, F.C.S.; (3) "London Houses," by Robert W. Edis, F.S.A.; (4) "The Alloys used for Coinage," by Professor W. Chandler Roberts, F.R.S., chemist to the Royal Mint; (5) "Some New Optical Instruments and Arrangements," by J. Norman Lockyer, F.R.S, F.R.A.S.; and (6) "Fermentation and Distillation," by Professor W. Noel Hartley, F.C.S. The usual short course of juvenile lectures will be delivered during the Christmas holidays,

ON THE STABILITY OF SHIPS AT LAUNCHING.

By Mr. J. H. Biles.*

The question of the stability of ships at launching has been brought prominently into notice in the last few months by the deplorable accident to the Daphne at launching, and by the report of the Government Commissioner, Sir E. J. Reed, who conducted the official inquiry into the causes of this accident. Consequently, in responding to the invitation kindly given me by the secretary of this Institution, to contribute a paper, I have considered that the subject chosen would be especially interesting at the present time, and is one upon which comparatively little has been written. The subject naturally divides itself into two leading considerations. First, how much stability will a ship have when afloat? Secondly, how much stability should she have in order to be safely and successfully launched? The first may be termed a theoretical question, and is one which can only be settled by calculation and experiment; the second may be termed a practical question, and can only be settled approximately, by comparing the behaviour of ships at launching with their known qualities as to stability deduced by calculation and experiment. The first is within the power and reach of any ship draughtsman, and is a branch of ship calculation which has been very much simplified by the invention of the integrator of M. Amsler. It is not my intention in this paper to attempt to explain the method of calculating the amount of stability which a ship has; but it may, however, be not considered out of place if an explanation is here given of the terms generally used in connection with the question of stability. Stability may be defined to be the tendency of a vessel to remain n an upright or normal position. Consequently, for still water, moves away from the vertical through the centre of gravity of the weights at any given angle of heel, the stiffer the ship is. Hence, this distance is a measure of the stiffness of the ship, and having found it, we can say that, for the given angle, we know how much stability the ship has. In a paper which I had the honour of reading in March, 1882, before the Institution of Naval Architects, in London, will be found a full explanation of the method of determining this distance for any angle of heel. Suppose that we have found the values of the distance G Z between the two verticals referred to in Fig. 2, for several different angles of inclination—say 10, 20, 30, 40, 50, &c., and, referring to Fig. 3, set off along a line distances representing 10 deg., 20 deg., 30 deg., 40 deg., 50 deg., &c., and at these points set up the values G Z, of the distances between the weight and buoyancy verticals determined for these angles of heel. The curve drawn through the points Z, Z, Z, so set off, is called the curve of stability, or, if we wish to particularise the kind of stability, we may call it the curve of stiffness. We are in the habit of speaking of the stiffness of a ship in reference to small angles of inclination, near the upright position, and therefore the part of the curve up to 10 deg. represents the stiffness we usually speak of; the greater the slope of this part of the curve, that is, the more rapid the increase of G Z, the greater is the stiffness of the ship as ordinarily understood. Referring to Fig. 2, if we produce the vertical through the centre of buoyancy, it will cut the original vertical in the point M. For a given angle, the higher this point is, the greater must be the distance G Z between the buoyancy and weight verticals, and therefore the distance G M measures the distance quite as well as the distance G Z for a given angle. For small angles it is found that this point M does not vary much, and therefore calculated, and I have their permission to publish a few, which may be interesting to the members of the Institution. Fig. 4 represents the curves of two steamers which were launched successfully. The centre of gravity of each was found by experiment immediately after launch. A is a vessel 275ft. long, 35ft. beam, 21½ft. deep, moulded. B is a vessel 430ft. long, 43ft. beam, 35ft. deep, moulded. The first was launched, and did not give the slightest sign of heeling; the second took an inclination of about 20 deg. at launching, but came to rest in an upright position after some five or six rolls. In the latter case there was nothing in the ship which could shift, so that the condition usually assumed in stability calculations was the actual condition of the ship. These two cases are interesting as showing in one case how much stability a vessel may have when launched, and in the other how little is actually necessary when proper precautions are taken and circumstances are favourable. Fig. 5 gives the curves of stability of several types of ships all reduced to 25ft. beam and 6·665ft. draught, with a centre of gravity 11ft. above the keel. The table below gives the particulars of the different types arranged in their order of fineness as measured by their block co-efficients.

The finer types appear at a disadvantage compared with the fuller ones. For the same moulded depth, however, a fine ship will usually have a greater draft than a full one at launching. Fig. 7 gives the curves of stability of the fullest and finest of these types, modified as in (3) by increasing beam and length of the finest (C), to give it the same displacement as the fullest (A). (4) in Fig. 7 is the curve obtained by increasing the draft and length, instead of the beam and length, as in (3). These three sets of curves are interesting as showing the effect, first, of form on the same dimensions; second, of draft, on the same breadth and displacement in different forms; third, the effect of beam upon the same length and draft but different forms. We come next to the consideration of the second part of this question, How much stability should a ship have, in order to be safely and successfully launched? This is a question which is difficult of exact solution. So many disturbing forces are at work, in the short interval which elapses between the time at which a ship leaves the ways and that at which she is safely floating at rest, that an *a priori* solution is impossible. Until the ship comes to rest, the conditions which hold are not those which are assumed as the basis of the curve of stability. The principal differences are due to the following:—(1) The disturbance which the ship herself creates by her sudden intrusion into the comparatively small quantity of water in the vicinity of most shipbuilding yards. In narrow rivers, where the water is shallow, waves are produced which may be reflected from the opposite bank on to the ship. Whether they are or not must depend upon the angle at which the ship is launched, her form, speed of entry, and the breadth of the river, but it is not difficult to conceive of a wave being reflected back on to a ship so as to cause her to heel considerably. If there is any considerable tide in a shallow river, the sudden introduction of a large ship, stretching in many cases half way across the river must have the

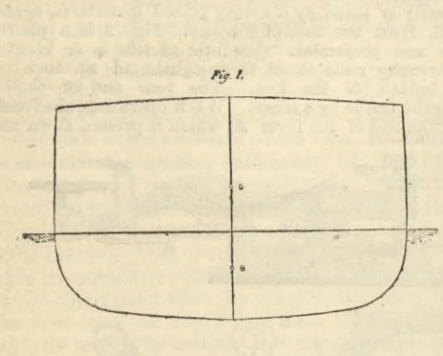


Fig. 1.

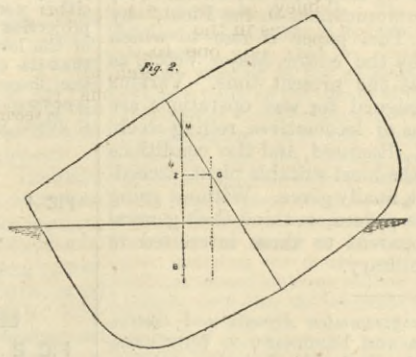
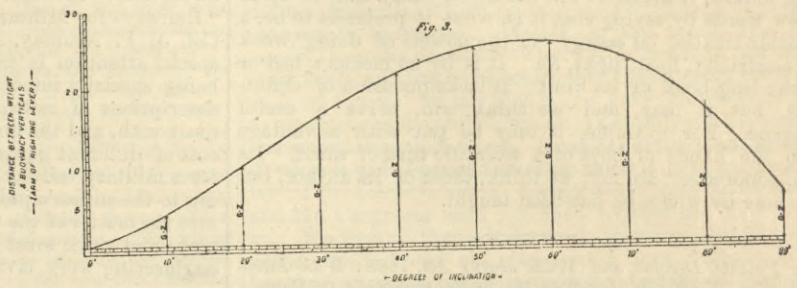
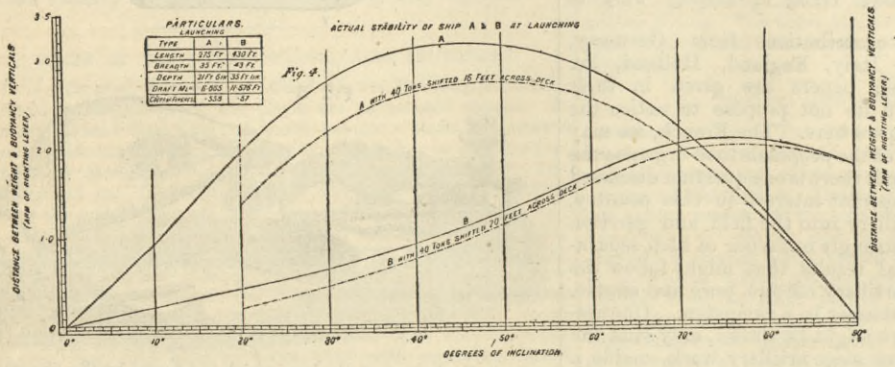
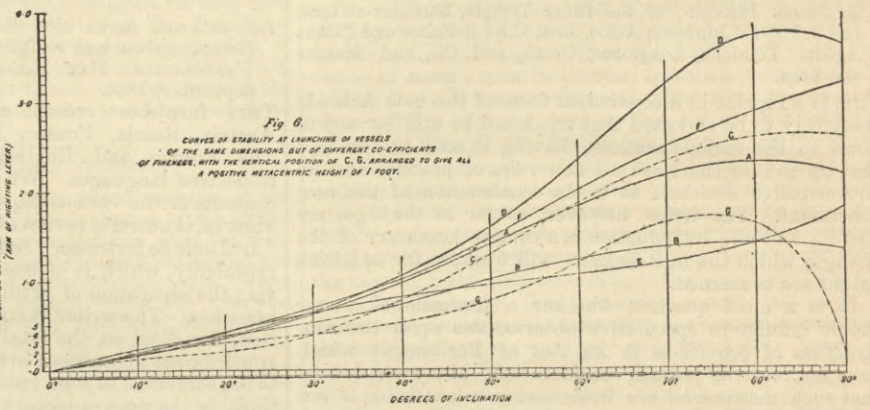
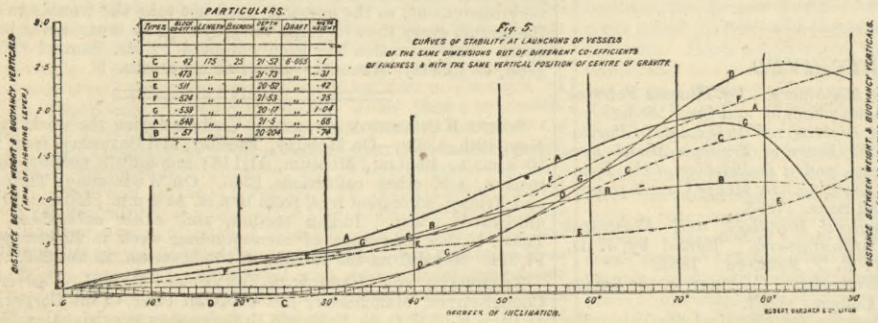


Fig. 2.

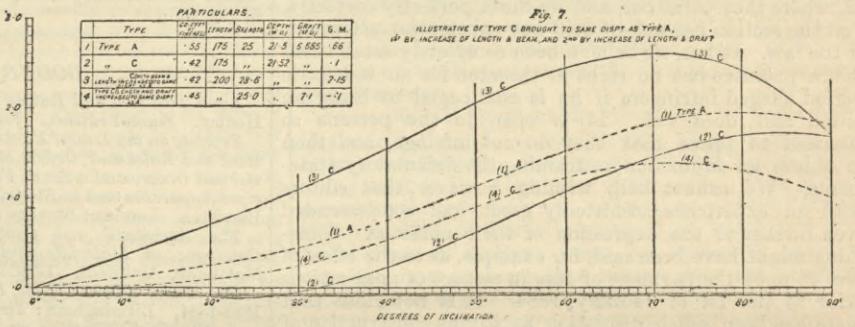








Types	Block Coefficients	Length	Breadth	Depth Mld.	Draft	Metacentric Height
C	·42	175	25	21·52	6·665	·1
D	·473	,,	,,	21·73	,,	−·31
E	·511	,,	,,	20·62	,,	·42
F	·524	,,	,,	21·53	,,	·25
G	·539	,,	,,	20·17	,,	1·04
A	·548	,,	,,	21·5	,,	·66
B	·57	,,	,,	20·204	,,	·74



	Type	Coefficient of fineness	Length	Breadth	Depth in ft.	Draft in ft.	G. M.
1	Type A	·55	175	25	21·5	5·685	·66
2	,, C	·42	175	,,	21·52	,,	·1
3	Length, breadth & depth increased to make displt same as A	·42	200	28·6	,,	,,	2·15
4	Type C, length and draft increased to make displt same as A	·45	,,	25·0	,,	7·1	−·1

* Read before the Institution of Engineers and Shipbuilders in Scotland, October 23rd.

effect of heaping up the water on one side, and causing a depression on the other, thus tending to give the ship an excess of buoyancy on the tide side of the vessel. The evidence in favour of the existence of two currents flowing in opposite directions has not received much support from observers of tidal action, and it is somewhat difficult to imagine that the currents would flow in the directions they are stated to flow; for the up current would almost certainly be salter and therefore denser than the down current, and would consequently be an underneath one. The opposite view is the one which was taken by some eminent witnesses in the recent inquiry. (3) The pressure of the wind upon the side of the vessel. In the case of the vessel B, the total wind pressure upon her side is 5·4 tons for every pound per square foot of wind pressure, and its moment is about 100 foot tons. One pound per square foot of wind pressure is capable of heeling the ship about 3 deg. (4) The unequal effect of the buoyancy of the bilge ways caused by the release of a larger quantity on one side than on the other. If the whole of one side be assumed to be released but only the half of the other, the moment tending to upset the ship B would be 50 foot-tons, and the angle of heel caused by this would be about 1½ deg. This cause is not a very powerful one. (5) The shifting of loose weights on board the ship if she is heeled by any of the above causes. This is most likely to be dangerous to a ship, as it is a cause of disturbance of a permanent nature, and not like the preceding ones, which may all act only for a short time. In the ship B if a weight of 40 tons—not an unusual quantity for a large ship to have loose upon her deck—be assumed to slide nearly half way across the ship after she has heeled to 20 deg., the effect will be represented by the alteration in the curve of stability, Fig. 4. This represents a considerable reduction of her margin of stability. The curve is also shown reduced on the same assumption for the ship A. The percentage of reduction is not so large in this case, though on account of the smaller size of the ship the actual reduction is very much larger. (6) The heeling action due to the checking of one drag chain before the other. If a ship is continuing to move in the line of the ways and she is checked on one side only there will be a tendency to slew the ship, and this must necessarily cause her to heel as the resistance to slewing is acting under the water at about half draft, whereas the force producing the slewing is acting considerably above the water. If before the chains check the ship the tide has slewed her, this action may be aggravated. It is very difficult to calculate the actual heeling effect of the drag of the chains, but from observation of the distance the anchors are dragged through the ground, the time taken to drag them, and the speed of the ship, some idea of this force may be obtained. I regret that the information which I have at present on this point is not sufficient to enable me to give any definite opinion, but from observation taken at launches, the heeling of a ship by drag chains does not seem to be very frequent. There are probably other causes which have not been mentioned, but as some already mentioned cannot be measured, it is very difficult, if not quite impossible, to say, without experience, how much stability a ship ought to have at launching. The best information which we have on this point is represented in curve B, Fig. 4. This ship was launched successfully with ·66ft. of metacentric height, but she took a considerable roll, and had anything been loose in her it is probable that she would not have returned. Later on we launched a ship with the same metacentric height, but there happened to be sufficient loose material about, and this, combined with other causes, were sufficiently potent to prevent the ship from returning to the upright. Hence, it is fair to assume that ·66ft. is too little, but when proper precautions are taken and circumstances are favourable, a ship may be successfully launched with this metacentric height. As a working minimum, however, if the curve of stability does not show any great peculiarities, but if it increases gradually between 0 and 50 degs., it seems that one foot may be taken. I am of opinion that at least this amount should be given in all ships, whether large or small, but that in small fine ships a curve of stability shonld be calculated. Fig. 6 shows the ships in Fig. 5, on the assumption that each has a metacentric height of one foot. A careful study of the curves given will, it is hoped, be of interest and value to the members of this Institution; and if in the least degree I have added to the available stock of knowledge in this question, my object in reading this paper will have been attained. I venture to express a hope that the experience of other shipbuilders than Messrs J. and G. Thompson may be laid before this Institution at some time, in order that a correct solution shall be given to the general question:—How much stability does a ship require to perform an intended purpose?

Old Ammunition.—The huge pyramids of spherical shot and shells deposited in various parts of the Royal Arsenal, Woolwich, are condemned to the melting furnaces for conversion into projectiles more adapted to modern requirements. One heap alone contains about 40,000 of the 13in. shells which were supplied at the time of the Crimean war, and were the most formidable missiles used in the siege of Sebastopol. The 13in. mortars, from which they were fired, have long ago disappeared out of use, but lie in hundreds in a distant part of the Arsenal waiting orders for their demolition, and no round shot or shell of any size have been made since the introduction of rifled ordnance and elongated projectiles. They are being all gradually broken up. Another ancient description of shell of the class known as smoke balls and ground light balls has been declared obsolete, and all that are remaining in store will be destroyed. They are of various sizes, varying from 4½in. to 13in. in diameter.

Cost of Electric Lighting.—Mr. Frank Geraldy has published some statistics comparing the cost of the electric light with gas, both as to its actual cost and its cost per candle-power:—

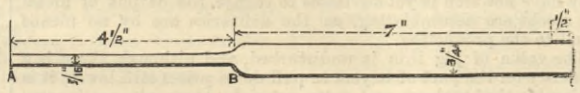
Installation.	Electric light system.	No. of lamps.	Candle-power of lamps.	Motor.	Total cost per hour gas.	Total cost per hour electric light.	Cost per candle-power gas.	Cost per candle-power electric light.
Salle de Télégraphistes at Brussels (Nord). ..	Jasper	3	235	Gas	1·86	3·82	0·0265	0·0054
Halle aux marchandises, Lyons Station (Paris)	Lontin	18	64	Steam	6·825	6·625	0·0273	0·0054
Spinnery at Riverside (U.S.)	Brush	71	75	,,	36·80	11·68	0·0353	0·0022
Ducommun Establishment at Mulhouse ..	Serrin	4	110	,,	—	6·64	0·044	0·015
Passage in the Friedrichstrasse (Berlin)	Siemens	10	50	Gas	9·14	6·45	0·040	0·013
Thames Embankment..	Jablochkoff	20	28	Steam	—	0·487	0·0150	0·018
Spinnery of E. Manchon (Rouen)	Sautter-Lemonnier	6	150	,,	9·550	7·387	0·0597	0·0082

This is only an extract from a longer list, but conclusively shows that in large installations electric lighting may be cheaper than gas on the total cost; whilst considered per candle-power it is far cheaper. An exception to the rule seems to occur in the first on the list; this is due to the smallness of the installation. In the case of the Thames Embankment the light is reduced by the use of ground glass globes. If we bear in mind the fact that the economy consists in having large installations, we shall be brought face to face with the fact that whereas gas is now made in as large quantities as is practicable, electricity has still to be brought to that state of economy. Thus we may expect a greater economical advantage than is shown by the above figures. The above we extract from *Nature*, which does not say what is meant by candle-power.

APPARATUS FOR ESTIMATING CARBON IN STEELS.

By Addison B. Clemence, Worcester, Mass.

A description of the apparatus in use at the works of the Washburn and Moen Manufacturing Company, of this city, will, I think, be of interest to those who desire an accurate method for the estimation of carbon in steels. The apparatus has been in use in the works for the past three months, and has given entire satisfaction. The method of filtering carbon on to asbestos in a glass funnel, drying, transferring to a porcelain tube, and burning in a stream of oxygen gas, is accurate if all the carbon can be separated from the sides of the funnel, which in some cases is almost impossible. Again the method of filtering on to asbestos in a platinum tube or boat-shaped apparatus, and putting all in a porcelain tube and burning as before, has also been used, and of course is less liable to error. My aim has been to do away entirely with the porcelain tube and combustion furnace, and to filter and burn in the same tube. The sketch shows the form of apparatus I have adopted, being made of platinum. The following is the process I use:—Dissolve from 3 to 5 grams steel borings in double chloride copper and ammonium, using 36 grams of the salt to 120 cc. water to 3 grams of steel. After the separated copper has completely dissolved, filter on to a plug of ignited asbestos placed at (*b*), and washed thoroughly with hot water. Any carbon that adheres to the sides of the tube may be swept down with moistened asbestos. The tube is then placed in an air bath and dried at a temperature of 150 deg. to 175 deg. C. for about one hour. A hard rubber cork, through which is a glass tube, is inserted at (*c*), the oxygen gas passing from (*c*) to (*a*). Around the tube at (*c*) is a single thickness of filter paper, about 2in. wide, kept wet by a stream of water supplied from a reservoir on the shelf above. Heat is applied at (*b*) for one-half hour, at the end of which time the potash bulb is ready for the balance. One Bunsen burner is sufficient for the combustion. The same precautions are taken to dry the gas before entering the platinum tube, as well as before entering the potash bulb, as in the case in the porcelain tube method. Six burners of a combustion furnace will consume 14ft. gas in one-half hour, while one Bunsen burner will consume 2ft. in the same time. The following table shows some results obtained by the "platinum tube" process: A is a Swedish Bessemer, with ·10 per cent. of carbon; B an American Bessemer, with ·18 per cent.; and C an American Bessemer, with ·50 per cent., all obtained by the "porcelain tube" process:—



	A.	B.	C.
1....	·09	·18	·49
2....	·10	·18	·51
3....	·10	·16	·49
4....	·10	·17	·44

Note.—If pure, closely-woven asbestos cloth can be obtained, I see no reason why with two potash bulbs, twelve combustions may not be made in one day, for each filter with its contents may, when dried, be put in the platinum tube and burned.—*Journal of the Franklin Institute.*

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

(*From our own Correspondent.*)

Local consumption causes a brisk demand for sheets, bars, and other merchant sections of iron, but it cannot be reported that the demand by merchants for home storage and for export is correspondingly active. Still there is every probability of the works keeping steadily on up to Christmas.

Best iron maintains its price, the demand for bars from the chain and cable, from the anvil and vice makers, and from such like manufacturers being good. Shipping orders are also encouraging. Round Oak bars were quoted this—Thursday—afternoon in Birmingham at £8 2s. 6d. for ordinary qualities, £9 10s. for single best, £11 for double best, and £13 for treble best sorts. Angle iron, rolled by the same firm, was £8 12s. 6d. for ordinary qualities, £10 for single best, £11 10s. for double best, and £13 10s. for treble best. Earl Dudley's tee and rivet iron was £10 10s. for single best, £12 for double best, and £14 for treble best. Bars of the other branded firms were £7 10s., and small rounds and squares of ⅜in., £8 per ton. Best horseshoe iron was also £7 10s.

Excellent bars were, however, to be had at £7, and medium qualities were plentiful at that figure down to £6 10s., from which latter quotation common bars tapered down to £6, and occasionally, in a good order, £5 17s. 6d. per ton.

Galvanisers are still in the market for black sheets, though they are not so urgent in their demands as a month or so ago. Compared with the prices ruling at that earlier date, some buyers were this afternoon able to secure what they needed on easier terms by from 2s. 6d. to 5s. per ton. There were ironmasters, however, who, being well placed, refused to give way at all. Doubles were quoted £8 5s., and trebles £1 per ton additional. Galvanised sheets of 22 to 24 w.g. were nominal at £13 5s. f.o.b. Liverpool.

Slightly more is doing in boiler plates at £8 10s. to £9, and on to £9 10s. for double best qualities; but girder plates and angles are prejudiced by competition from the North of England and other centres. "Crown" plates from the North Staffordshire mills were quoted £7 17s. 6d. per ton, and boiler plates from the same mills £8 5s. per ton for ordinary sizes. Double best branded plates from the same district were to-day quoted £10, and treble best do. £12 nominal.

Cable iron, rolled in the Tipton neighbourhood, of reliable quality, was quoted £8 easy; best chain iron, £9; and double best chain iron, £10. Tang iron of ½in. and $\frac{7}{16}$in. was named at £7 10s. for good sorts, £8 10s. for best, and £9 10s. for double best.

The orders on the books of the hoop-makers include work for South America, Australia, Spain, and Italy, and the strip-makers have orders for Canada and other colonies. The United States demand for hoops and strips is just now very quiet. An accession of orders from this market would be very welcome. Strips were to be had at £6 2s. 6d. to £6 5s., and hoops at £6 10s. to £7; hinge strip was £7 10s.

Mail advices received this week from Melbourne state that galvanised iron has been largely dealt in. Amongst other sales, 250 cases Orb 24in. gauge have been disposed of at a full figure, while 75 tons Gospel Oak have realised £21 15s. Bars and rods continue to move off quietly at from £8 10s. to £9 10s. Black sheets have been quoted at £10 10s. for Nos. 8 to 18. Hoops have been sold at £10 10s. A fair business in fencing wire was doing when the mail left, quotations ranging from £12 to £13 10s., according to number and brand. A lot of 50 tons of k. and w. No. 10 had been placed at a full figure.

In the face of the continued decline in Scotch and Cleveland pigs, it is impossible for the common pig market in Staffordshire to be strong. Nevertheless, vendors are doing their best to prevent any conspicuous decline by remaining largely out of the market. There were few quotations which were openly named on 'Change this afternoon that were not nominal. Northampton pigs in actual business were about 45s., and Derbyshire 46s. 3d. Lincolnshires were quoted at 50s., but the price could not be got. Hot blast native all-mines were 62s. 6d. to 60s., and cold blast 82s. 6d. to 80s. Common native pigs were 40s. to 38s. 6d.

Competition among sellers of minerals keeps keen, and here and there very low prices are named. Some vendors of North Staffordshire gas cokes, however, refused to accept less than 11s., and for Durham foundry cokes 23s. to 24s. delivered was the price. Purple ore was offered at 14s. without much business. From 21s. to 22s. per ton was freely offered for pottery mine, but consequent upon the late strike of miners in North Staffordshire, only a small part of consumers' requirements can be met.

Coal prices are slightly stronger upon the week. The touch of winter weather has helped sellers.

The colliers in this district have determined to unite in the agitation for an advance of wages, but not upon the 15 per cent. lines suggested at the recent Manchester Conference. At meetings which have been held since my last it has been resolved: "That the men should give notice on the 17th inst. for an advance of 10 per cent. in wages, the notice to expire on December 1st." What course the masters will pursue at the expiry of this date is very uncertain. The Cannock Chase miners propose to seek an advance with the beginning of next year, and with this object they have given notice for the termination of the wages agreement which is now in operation.

A failure in the pig iron trade, which was last week mooted on 'Change, but which was not then ripe for report, has this week been made public. It is that of the Castle Iron Company, Walsall, which has filed its petition with liabilities stated at £18,300. The assets are not ascertained. The partners are Edward Copson Peake, who is secretary to the Cannock and Rugely Colliery Company, Limited, and Alfred Francis John Fisher, of Walsall.

The mails of the week have brought a steady flow of orders for varied metal requisites for the Australias and New Zealand, while upon Canadian account purchases are going on for shipment by steamer, and there are more inquiries than had been looked for from the States. The River Plate and the Gold Coast are excellent customers for mining and similar requisites; and from all these markets there are requests for railway construction and maintenance necessities.

The Calcutta Exhibition is originating much expectation in the minds of the chief engineers and manufacturers. The contributions which have gone hence are a fair representation of the best modern work of Birmingham and Staffordshire. More business is believed to be likely to follow the enterprise than has resulted of late from most international shows. The value of India as a market increases almost monthly, alike as to machinery and to hand tools for use in manufactures as well as in agriculture, while the business and domestic requirements seek to be met with more freedom.

The safe and strong room firms are amongst the most active of the traders upon export account. India is buying these goods with freedom. One order for that market under execution is for sixty safes.

Additional machinery is being laid down by certain of the brass stampers and casters to meet an enlarged demand from several home and from a larger number of export markets both colonial and continental. The demand is from manufacturers of grates, of coal vases, and the like, which are being more freely embellished with brass in its various forms as new designs are brought out. Engineers' fittings, gas and electric fittings, and ecclesiastical and marine work are all likewise making a demand upon the brass workers, in addition to the routine work incidental to the lock business.

There is an improving inquiry for roofing shingles coated upon the calamine process as distinct from galvanising. The Anglo-American Roofing Company in Wolverhampton is alone applying the calamine alloy to this use. It is the invention of a New York chemist, and is claimed to be not simply an external coating, but also a chemical alloy that enters into the body of the metal treated, which it softens and toughens. It will unite, it is affirmed, with planished steel, and though the metal should become red-hot, yet the calamine upon it will remain undestroyed. Calamining threatens to become no insignificant competitor with galvanising for numerous uses.

The wire rod business is in only a languid state. Manufacturers are discharging hands quietly but steadily. The competition of Wesphalian wire firms is credited with most of the mischief. This is encouraged by the terms which such traders have made with the railway companies. Iron wire can now be got from Rotterdam to Birmingham, *via* London, at a freightage of only 16s. 8d., while Birmingham wire drawers are charged 22s. 6d. for the carriage of "undamageable" wire to London, and if they do not declare it undamageable, they have to pay as much as 28s. 4d. per ton. Local firms contend that they ought to be placed by the railway companies on at least equal terms with their German competitors. These unfavourable railway rates are adding point to the statements of the fair-traders. At the conference in the interest of fair-trade, held this week at Leamington, Mr. McIver, M.P., said that a few days ago he went out on a trial trip of a new steamer which had been built for the company with which he was connected, and he was surprised to see on some of the ironwork the word "Belge," showing that Belgium had had the order. He also knew, he added, that when the Great Western Railway Company was expending some £30,000 or £40,000 in works at Paddington, the girders then employed came also from Belgium.

The operative horsenail makers who are now "out" for an advance of wages state that several leading masters have already conceded the rise, and that they now "look forward to a speedy termination of the strike." At Darlaston the operative gun-lock filers are contesting a reduction, which they assess in some instances at as high a figure as 15 per cent.

It has been finally determined to hold a Fine Art and Industrial Exhibition in Wolverhampton in midsummer next. The guarantee fund already amounts to over £6000, but it is anticipated that no part of it will be required. The erection of the building in which the machinery and manufactures will be shown is to cost £2500.

The Darlaston Local Board has determined to apply to the Public Works Loan Commissioners for a loan of £4000 for the erection of public buildings.

The long-pending negotiations between the Local Boards of Handsworth and Smethwick relative to the construction and maintenance of a joint intercepting sewer, to serve parts of their several districts, under the Birmingham, Tame, and Rea District Drainage Board, have now resulted in a satisfactory agreement. Mr. Till, the engineer to the Drainage Board, has been appointed sole arbitrator between the two parties, and he has also been appointed chief engineer of the proposed works.

With the view of preventing damage to their Town Hall and to the properties in High-street, the Brierly Hill Local Board is negotiating with the Earl of Dudley's agent for the purchase of his mines, which underlie that part of the town. It is feared that, should the mines be worked, the buildings above them will give way. The Earl's agent asked £3500 at first, but he is now willing to accept £3000. It seems likely that this offer will be accepted, and that the property owners in the locality will share the cost of the purchase with the Board.

NOTES FROM LANCASHIRE.

(*From our own Correspondents.*)

Manchester.—During the past week there has been a tendency to quiet down generally in the iron trade of this district. This, of course, may to some extent be due to the fact that buyers in many cases prefer, with the approaching close of the year, to keep their transactions within a limited compass, but there are other causes operating to depress the market here. The present unsatisfactory state of trade in the large iron centres of Scotland and the North of England must, by weakening confidence in the market, necessarily have some effect upon buyers in this district,

and cause orders to be held back. Local and district makers of pig iron, however, show little or no disposition to take less money, but in Scotch iron, notwithstanding the slight recovery in prices during the last day or two, some brands have been offered at 6d. under makers' prices, and sales have during the week been made up to the end of next year on about the basis of the present low rates, whilst Middlesbrough iron, which is getting pretty near to a price at which it will be enabled to compete in this market, could be bought at under 46s. net cash for good brands delivered equal to Manchester. The local finished iron makers are still kept fairly going with the contracts in hand, but these are running out faster than they are being replaced, and here and there indications of weakness are to be found which would no doubt enable buyers with good specifications to place them on better terms than they could have obtained a short time ago.

There was only a dull market at Manchester on Tuesday, and the small business there was to be done did not keep members long on 'Change. Lancashire makers of pig iron reported no new orders of importance coming forward, but they held firmly to their full list price of 45s. 6d., less 2½, for both forge and foundry qualities delivered equal to Manchester. In district brands a few sales are being made, but at the top figures of £44 10s. for forge and £45 10s. for foundry Lincolnshire; the actual business doing is very small. In one or two cases sellers have been taking about 6d. less; the leading makers, however, do not give way.

Where there is any businens of weight doing in hematites it is at very low figures, and the tendency of prices continues in a downward direction.

In finished iron business has been quiet. Bars, however, are still quoted at £6 2s. 6d. to £6 5s. For hoops and sheets makers are not able to realise the prices they were getting a short time back, but the present quoted rates do not go below the minimum of £6 10s. for hoops and £7 15s. to £8 per ton for sheets delivered into the Manchester district.

The reports I receive both from inquiries made amongst the employers and those emanating from sources representing the interests of the men show very little change in the general condition of the engineering trades. Locomotive builders and heavy tool makers in this district keep pretty full of work, but other branches are only moderately employed. As to the demand for labour, as set forth in the returns issued by the trades' union societies in this district, it would appear to have slightly improved during the past month, whilst generally it does not seem to have got any worse. The reports issued this week by the Amalgamated Society of Engineers show a slight increase throughout the country in the number of men in receipt of out of work support, but in the Manchester and Salford district there has been a slight decrease, and trade here is reported as better than it has been for the last three or four months. In the Manchester and Salford district there are no pattern makers or smiths on the books out of work, and generally throughout Lancashire there seems to be just at present full employment for this class of artisan. The number of men returned as in receipt of out-of-work support throughout the whole of the county is about 2 per cent. of the total membership, but in the Manchester and Salford district it does not exceed 1½ per cent. The report of the Moulders' Society just issued shows a slight decrease in the number of members in receipt of out-of-work donation, but it is still in excess of November last year, being 499 as compared with 463 twelve months ago, and representing between 4½ and 5 per cent. of the total membership. In a few instances trade this month is returned as good, but these are considerably outnumbered by the returns of declining or bad trade, and in the bulk of the district trade is only reported as moderate. This may be said to be the case with pretty near all the important centres of industry, London, Manchester, Leeds, Sheffield, Birkenhead, and Middlesbrough all returning trade as moderate, whilst at Birmingham it is bad, Bolton declining, and Sunderland and Barrow very bad. The secretary of the Steam Engine Makers' Society in his last report states that there is no material change to notice; trade during the month had shown very little fluctuation, and it was hoped that for the present they had seen the worst. The number of unemployed members—which is a trifle under 2 per cent.—would have shown a reduction had it not been for disputes that were pending. The disputes which had arisen during the month had, however, not been of their own seeking, but they showed that the employers knew that there was at present an overstocked labour market, and that they were endeavouring to derive a benefit from the present scarcity of situations.

Questions affecting the safe working of mines have been the prominent subjects of discussion at the local scientific society meetings during the past week; and certainly, in view of the recent terrible colliery disasters, these are matters which it would seem might be discussed with advantage. At the meeting of the Manchester Geological Society, Mr. J. Dickinson, chief inspector of mines, introduced a new safety-lamp, invented by M. J. B. Marsant, engineer-in-chief of the Bessèges Collieries, Gard, in the South of France. The Marsant safety-lamp, in its present improved form, is in general shape and construction similar to the Muesler, but the small horizontal disc or annular diaphragm of gauze which supports the chimney in the Muesler is done away with, and replaced by an inner vertical gauze in the Marsant. Each gauze cylinder has a cap, and the whole double gauze is shielded by an external sheet iron casing, having inlet holes round the bottom for air to enter the lamp, and outlet apertures at the top. Additional safety can be secured by further covering the flat top or cap of the inner gauze with a gauze hood, so as to double the thickness of gauze at that part upon which the force of an explosion inside a lamp comes most direct, or a third complete cylinder of gauze may be added, if desired, as an extra precaution; but two cylinders are considered safe enough, and are preferred generally. I may add that the opinion has been expressed to me by one of the highest authorities in mining matters, that the lamp is the best that has yet been introduced. In the course of a paper which Mr. Dickinson read upon the subject, he observed that the advantages claimed for the Marsant of ranking high in comparative lighting power, seldom going out when tilted, not going out at all in an upward current of air, not exploding externally with a strong current of gas blowing upon it in any direction whatever, would be appreciated by all miners. The protection of the gauze by the outside casing and its help in putting the light out when gas was burning inside, and the ready way it afforded of putting the lamp out whenever desired by simply covering the outer holes, were also important safeguards. Commenting upon the conclusions at which M. Marsant had arrived after a number of experiments, Mr. Dickinson said that his conclusion that the elongation of a flame was almost always a sufficient indication of gas, without allowing the gas to explode in the lamp, and that no lamp should be withdrawn quickly when testing, were in accordance with careful practice. M. Marsant's deduction that testing for fire-damp with the lamp's full flame, and judging only by the elongation of the full flame, was safer than by reducing the flame to the utmost for the purpose of seeing the blue cap of gas better, would be startling to many persons; but it was supported by M. Marsant's reasoning that lamps should be of as small diameter as possible, and should carry as large a flame as they could without getting too hot, the aim being to make the lamp as much as possible into a mere chimney, with every arrangement for checking an undue access of gas, was entitled to full consideration. Mr. Dickinson further observed that the principle of the sheet iron casing to protect the gauze, the great value of which was now becoming fully recognised, was introduced fully a-quarter of a century ago, and in his opinion it would be the direction in which they would have to look for increased safety in the lamps of the future.

In the coal trade the recent severe weather, coupled with a somewhat uneasy feeling which is beginning to show itself amongst consumers as to the possibility of the present wages' agitation resulting in a strike, have brought forward a few extra inquiries for forward delivery at present rates, but otherwise there is no material improvement to report in the condition of the trade generally, and no better prices are being obtained. Any increased firmness is confined to an increasing cautiousness on the part of colliery proprietors in committing themselves very far ahead. Round coals move off fairly well, but engine fuel is only in moderate demand, and prices are unchanged since the commencement of the month.

Shipping is only moderate, with Lancashire steam coal delivered at the high level, Liverpool, or the Garston Docks, averaging 7s. 6d. to 7s. 9d. per ton.

The miners in this district have not yet taken any definite action in the shape of notices to cease work unless the advance of 15 per cent. in wages is given.

Barrow.—Makers of Bessemer and forge descriptions of iron have booked but few new orders during the past week. The inquiry on both home and foreign account shows a greater lack of activity than has been noticeable for some months past. No speculation at all is observable in the present buying. The trade still continues dull, and the outlook for the winter is anything but cheering. Makers still hold large stocks at their works, and as they have not seen it yet advisable to reduce the output of metal the stocks are accumulating, as the deliveries are by no means equal to the production.

The value of pig iron is undisturbed, and although there is a tendency on the part of buyers to pull down prices still lower, it is noticeable that makers, and more especially those who are favourably situated in the use of ore they raise for themselves, are preferring to run into dock rather than sell at values lower than those which are now ruling, which do not admit of any profit to the producer. Mixed numbers of Bessemer iron are quoted at 47s. per ton, and inferior qualities range from 45s. per ton at works. Steel makers are busily employed both in the rail and merchant departments, and the output from both departments has been very large. Rails are quoted at from £4 15s. to £5 per ton net at works, prompt delivery. The demand for mild steel is increasing. Shipbuilders are but indifferently employed, and there are but few inquiries. Iron ore is in quiet demand at unchanged prices. Stocks remain heavy all round. Coal and coke steady. No alterations are noticeable in prices. Shipping quiet.

The work of pumping water into the new wet dock at Maryport was commenced, and now there is something like fourteen feet of water in the dock. The gates and cofferdam have stood the test remarkably well, and so far there is not the slightest indication of any leakage. The water in the basin is being pumped out, and this work is expected to take something like two months, as it has accumulated in considerable quantities. The granite copings have been laid on the north pier, and the new lighthouse is nearly completed.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THERE is nothing more cheerful to report this week in the outlook in the coal trade. At every colliery where the contract of hiring is by the month, the miners have handed in their notices, and in several instances the coalowners have retaliated by giving their employés similar intimations. This means war, because it puts the colliery proprietors in the position of shutting their pits if they please. Judging by the present temper of the disputants, there is every fear that the first week in December will witness a very serious rupture between capital and labour, with great loss to the former and fearful suffering to thousands of unoffending women and children.

An incident of the impending disaster is the resuscitation of an association of coalowners similar to that which was registered in 1874, as the "South Yorkshire and North Derbyshire Coalowners' Association, Limited," with a capital of £500,000 in £10 shares. It was formed as a coalowners' protection society, one of its objects being to afford relief to members who are menaced by strikes. The first subscribers were Mr. Charles Markham, chairman of the Staveley Company, 1400 shares; Mr. A. M. Chambers—Newton, Chambers, and Co.—800 shares; Mr. C. Tylden-Wright, Shirecak, Worksop, 500 shares; Mr. J. Stores Smith, Sheepbridge, 800 shares; Mr. R. Whitworth, Dodworth and Silkstone Coal and Iron Company, 500 shares; Mr. H. Walker, Sheffield, 400 shares; and Mr. A. Barnes, Chesterfield, 300 shares. The organisation now formed is to prevent the men securing the 15 per cent. advance, and also to compensate those collieries which may find it difficult to stand, or may be laid idle by the action of the men. Compensation is to be on the basis of 2s. per ton of coal on the average output. This union of the coalowners appears to be practically for the purpose of checkmating the Yorkshire Miners' Association, which has of late greatly increased its influence.

The district papers teem with letters on the coal dispute. One correspondent—a consumer—directs attention to the fact "that the exports of coal go on increasing, the quantity shipped last month being 2,062,068 tons—probably the largest amount ever sent out in one month." The editor very pertinently points out that the fact of the export of coal increasing, unless it can also be shown that it is sold at an advanced price, is no evidence in support of a demand for higher wages. "Nearly 21,000,000 tons of coal, cinders, and fuel were exported in 1882, against 12,617,566 tons in 1873; yet the value of the coal, &c., in 1873 was over £13,000,000 sterling, against £9,500,000 sterling in 1882. Thus we are sending out 8,317,000 tons more than in 1873, and receiving for it £3,624,000 less."

A very fitting address was issued to the colliers employed by the Staveley Coal and Iron Company last week. The company has about 3000 men and boys in its employ, and the men have given notice for the 15 per cent. Mr. Charles Markham, the chairman of the company, points out very clearly the causes why his company cannot concede the advances asked for, and then intimates that the Staveley collieries will be kept open for such of the miners as decide to work, and that measures will be taken to protect the men who remain at their occupation. This is a quiet but firm hint to the trade unionists that the terrorism formerly resorted to will not be tolerated this time.

Two very serious gas explosions have occurred in Sheffield this week. In both cases the mains were found to be cracked, and the gas, leaking from the pipes, found its way through the loose soil into the cellar, and afterwards to the living rooms. In the latter case it exploded in coming in contact with the kitchen fire, blew in the wall abutting on the passage, and seriously injured three children. In the other case, the owner, perceiving a smell, lighted a candle, and went into the cellar to look for it. He found it, and found himself on the floor. It is supposed that the sudden change to frost had affected the mains; but the engineer of the Sheffield Gas Company is now engaged investigating the circumstances of the explosions.

A somewhat better feeling is reported in several of the local trades. There is a large volume of business, but the profits continue very small, except in cases where specialities are the monopoly of single firms. A very heavy business is doing in tires and other kinds of railway material, except steel rails. The steel departments, both crucible and Bessemer, keep indifferently employed, the greatest falling off being in the American market. Cutlery and electro-plated goods for the home markets are in more request. Popular taste is again turning to the old silver patterns, especially in the fluted style which were so fashionable in the reign of Queen Anne. Many of the productions are remarkably perfect in form, and have not been equalled in that respect by much of the modern work.

Mr. John Thornhill Harrison, M. Inst. C.E., Inspector of the Local Government Board, held an inquiry at Sheffield on the 14th inst., into the propriety of the new sewage works proposed to be erected by the Corporation at Blackburn Meadows, near the town, at a cost of £150,000. The scheme was opposed in several of its details by Messrs. Howell and Co., Wincebank Tube Works, which adjoin the site of the projected sewage establishments. The inspector took evidence at length, and will subsequently report to the Board. An application to borrow £10,500 for tramway purposes was unopposed.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE Cleveland pig iron trade is still in an inanimate condition. Prices were again weaker at the market held at Middlesbrough on Tuesday last; but buyers were not tempted by the lower rates. But little business was done either for prompt or for forward delivery. Merchants offer No. 3, g.m.b. at 37s. 6d. per ton; makers, as a rule, quoted 38s.; but some were willing to accept orders for large lots at 37s. 9d. per ton. No. 4 forge iron was firm at 36s. 6d. per ton, and large quantities have been sold at that figure.

Warrants are at the moment unsaleable; holders offer them at 37s. 6d. per ton; but there are no buyers disposed to give more than 37s.

Messrs. Connal and Co.'s stock of Cleveland pig iron at Middlesbrough decreased 1350 tons during last week, the quantity held on Monday being 64,545 tons. The stock in their Glasgow store amounts to 587,584 tons, being a reduction of 680 tons for the week.

Exports from the Tees have never been better than during the first few days of this month. The quantity of pig iron shipped to Monday night amounted to 47,546 tons, being about 11,000 more than during the corresponding period of October, and 20 tons more than in November last year.

As the weather continues fine, shipbuilders and other consumers of finished iron are able to keep fully at work, and the mills are consequently as busy as ever. Few new orders are being given out, but prices are not quotably lower than last week. Ship plates are £6 per ton; shipbuilding angles, £5 12s. 6d.; and common bars, £5 15s. for prompt, and £5 12s. 6d. for forward delivery; free on trucks at makers' works less 2½ per cent.

At a meeting of Cleveland mineowners, held at Middlesbrough on the 8th inst., a deputation from the Cleveland Miners' Association was present, when the following proposal from the men was considered:—"That we do not agree to sign another sliding scale, except it can be made to regulate the wages of union men only." The complaint is that a great number of men, whose wages are regulated by the scale, do not contribute towards the expenses of the quarterly ascertainments. The employers decline to be bound to engage union men only, but promise to make it a condition of employment that all workmen pay towards the sliding scale expenses.

The puddlers employed at the Britannia Ironworks, Middlesbrough, passed the following resolution at a meeting held on Monday last:—"That we do hereby record our approval of the scheme for regulating wages in the northern iron trade recently submitted to the ironworkers at Stockton." Delegates were appointed to attend a mass meeting to be held at Stockton on Monday next.

A mass meeting of the engineers on strike at Sunderland was held last week, and the following resolution was unanimously adopted:—"Seeing that our employers have refused to meet us in conference, and will not concede our requests respecting the circular, that was remitted to them on the 7th of June last, we will make no further concessions and still adhere to the circular in all its entirety."

The failure is announced of Mr. D. P. Garbutt, iron shipbuilder, of Hull. His liabilities are said to amount to about £201,865. Several Cleveland manufacturers of shipbuilding iron have been in the habit of supplying him, but the terms of payment have in all cases been cash against invoice. Consequently none are now on the list of creditors, except as regards compensation for non-completion of current contracts. It is said that six ships had been built on speculation, of which only one was really sold, the rest being worked by the builder. The yard is that which formerly belonged to Messrs. Humphrey and Pearson, but since their time several additions have been made to the buildings and machinery. A marine engine building factory is in course of construction. An attempt was made a short time since to bring out the concern as a limited liability company, but without success; hence, probably, the sudden collapse.

The Middlesbrough Chamber of Commerce has taken a new departure worthy of imitation. It has established a "Tribunal of Arbitration" for the benefit of its members and their customers. The principal features are as follows:—(1) One or both disputants must be members of the Chamber. (2) Disputes may be referred to two arbitrators, chosen from members of the Chamber, and selecting their own umpire, or to one arbitrator, who must be a member of council. (3) Pleadings shall be by the disputants themselves, and not by legal substitutes, unless by express consent of the arbitrator or umpire. (4) Costs shall be borne by the disputants, as the arbitrator or umpire shall determine. There is every prospect that this "Tribunal" will be of great service to the Northern iron trade.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE condition of our pig iron market is still highly unsatisfactory. In the course of the past week the quotations of warrants were depressed to 43s. 9½d., and although a recovery to some extent has since taken place, there is an almost complete lack of confidence in the market. The shipments of the past week were much lower than usual, amounting to only 7574 tons, as compared with 12,167 in the preceding week, and 12,199 tons in the corresponding week of last year. Of course, this reduction may only be of a temporary nature. The current production has been still further curtailed by the damping-out of the whole of the blast furnaces at Dalmellington, in consequence of a strike of workmen against a reduction of wages. Connal's Glasgow stocks also show a decrease for the week of about 600 tons, and as the production is 3200 tons a week less than it was a month ago, it is not unreasonable to expect that the downward course of quotations should be arrested.

Business was done in the warrant market on Friday at 43s. 10½d. per ton. On Monday forenoon transactions took place at 43s. 9d. to 43s. 10d. and again at 43s. 9d. cash, the afternoon prices being 43s. 9½d. to 43s. 10½d. cash, and 43s. 11d. to 44s. one month. Business was done on Tuesday at 43s. 10½d. to 44s. 1½d. cash. On Wednesday business took place at 44s. 3d. to 44s. 6½d. cash. To-day—Thursday—there was an improvement up to 44s. 9d. cash and 44s. 10½d. one month.

The values of makers' iron in the market are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 53s. 3d.; No. 3, 50s. 6d.; Coltness, 56s. and 51s. 3d.; Langloan, 56s. and 51s. 3d.; Summerlee, 55s. and 49s. 6d.; Chapelhall, 54s. and 51s.; Calder, 56s. and 47s. 6d.; Carnbroe, 54s. and 48s.; Clyde, 48s. 6d. and 46s.; Monkland, 45s. 6d. and 43s. 9d.; Quarter, 45s. 3d. and 43s. 6d.; Govan, at Broomielaw, 45s. 6d. and 43s. 9d.; Shotts, at Leith, 56s. and 53s.; Carron, at Grangemouth, 49s. (specially selected, 56s. 6d.) and 47s. 6d.; Kinneil, at Bo'ness, 48s. and 47s.; Glengarnock, at Ardrossan, 53s. 6d. and 46s. 6d.; Eglinton, 47s. and 44s.; Dalmellington, 48s. and 46s. 6d.

The malleable iron trade remains in a fairly active state, and the improved condition of the foundry trade, to which I recently alluded, is confirmed by the fact that the ironmoulders in the northern district of Glasgow have received an advance which raises their minimum wage to 7¾d. per hour. The past week's shipments of iron manufactures from Glasgow embraced £33,800 worth of machinery, £4720 sewing machines, £13,536 steel manufactures, and £27,500 miscellaneous iron manufactures. There has been a good demand since last report for coals, the best household sorts in Glasgow and the West of Scotland being

particularly in request; and an advance of 6d. to 1s. per ton has been obtained on all quantities since the beginning of the present month. At Glasgow the foreign shipments of coals in the past week exceeded 12,000 tons, while the pressure for inland deliveries has been very great. The week's shipments of coals at Ayr have been 8134 tons; Troon, 7833 tons; Leigh, 7000; and at Grangemouth, 9061 tons. So far the prices appear to have been well maintained all over the country, and the hope is that the advanced rates established on the Clyde will continually be obtained elsewhere.

The wages' question is still engaging attention in those districts where a concession has not yet been made to the men. In the neighbourhood of Hamilton the advance has been given at pits belong to ironmasters, this being rendered necessary, as the men might have left, and gone to coalmasters' pits where the increase is paid. It is also believed that some addition will be made to the pay of the ironstone miners, although the condition of the pig iron trade at present is certainly not such as can well afford an increase in the cost of production.

The Executive Board of the Fife and Clackmannan miners held a meeting at Dunfermline on Saturday last, when resolutions were adopted to the effect that as the miners in the West of Scotland have now begun to work at an increased wage, there is no substantial reason why an increase should be longer withheld in Fife and Clackmannan, that an advance of 6d. per day should be conceded at once, and before the negotiations for a sliding scale be proceeded with; and that if it should afterwards be found that such an advance is not in accordance with the agreement under the sliding scale, a proper rate should then be fixed whether it be an advance or a decrease. The resolution of the employers is not to grant an advance until the selling prices of coals rise by 1s. 10d. to 2s. per ton. In the West of Scotland the example of the Hamilton masters is being gradually followed. Still it is regarded as doubtful whether it will be possible long to maintain the increased wages.

It is reported that a Glasgow firm of engineers has been intrusted with orders to supply engines for six steamers now being constructed on the Weir, the strike in Sunderland being given as the cause of the work coming to the Clyde.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THE air is alive with rumours of railway and colliery enterprise. I referred lately to a project for starting the Glamorganshire Canal, and this is now very prominent matter for discussion. The idea, I presume, would be to utilise also the old tramway first used by Trevithick, and the first for which Parliamentary powers were obtained; but against this the Taff might be expected to protest somewhat forcibly.

There is also an idea that the Newport, Caerphilly, and Pontypridd line, which will scarcely be opened now until January, will go in for powers for a branch from Nantgarw to Cardiff.

Still another railway is spoken of, a conversion of the Rhondda tramway.

In colliery speculations a good deal has been done of late. Both the Powell Duffryn and the Ocean Companies have been adding to their area, and now the London and South Wales Company, as the principal members, is doing the same thing. Last week it bought the National or Cutsh Collieries, Rhondda, for £180,000, and sinkings are contemplated in the Merthyr Valley, and from Treforest, in the direction of Pentyrch. A new company has also been formed for the deeper measures near Blackwood. I shall expect a good deal of colliery enterprise in Monmouthshire, especially now, as the projected line from Risca to Cardiff is tolerably certain to pass. The error which threw it out last session was only clerical.

The iron trade is indifferent; some few cargoes have left the Welsh ports for America of late, and some small quantities for home requirements have been supplied. On the whole, there is nothing very promising to be noted, and things would be worse but for the little spurt that has taken place of late in the tin-plate trade. This continues fairly well, American and the colonial trade keeping tolerably brisk; but a falling off is to be noticed from Australia.

A singular fluctuation takes place in the trade of ordinary coke, just as popular prejudice ebbs and flows with regard to tinned meat. There is a prejudice now started against potted salmon, and it is already felt in some quarters.

Good steel plates, large sizes, in free demand.

The coal trade is all that could be wished, and the utmost briskness has reigned at the various ports and at the collieries. Prices if not moving upwards are very stiff, and for quality and dispatch there is no fencing for price; 12s. f.o.b. can be readily obtained for best samples.

The Sliding Scale Committee, under the chairmanship of Mr. W. T. Lewis, has again done excellent work in arranging a "grievance" between the Cwmbach colliers, Aberdare, and their employers, and between the hauliers of Dowlais and the company's. The committee, which includes good representative men from the colliers, have adopted a peripatetic course, visiting the districts where grievances exist, personally examining and confronting plaintiffs and defendants. Such a course, from the first admirably carried out, should end strikes and afford the North of England a good example for imitation. An advance of 5 per cent. has been conceded to the colliery engineers of the Caerphilly district.

The Taff Vale servants are still complaining, but with small reason and less success. The directorate has promised the fullest attention as soon as certain changes are carried out which are expected to do away with the extra long hours. What the railway men are dextrously aiming at is to get a reduction of hours, and then claim for the difference as overtime. No one knowing Messrs. Fisher, Hurman, and Riches would credit them with other than most impartial government, and the grievance can well be left in their hands.

The London and North-Western Railway Company is arranging to have a four miles branch at "Nine Mile Point," Caerphilly, having a connection with Cardiff; to obtain an Extension Act for the Mumbles, Swansea; and to absorb the Vale of Towy line. Pitwood is quoted at 22s. 6d.

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.

6th November, 1883.

5251. RECEIVING INSTRUMENT of SPEAKING TELEPHONES, H. J. Allison.—(*J. H. Robertson, Brooklyn, U.S.*)
5252. ELECTRIC LAMPS, H. J. Haddan.—(*F. H. Werner, Lindenthal, Germany.*)
5253. MICROMETER VALVES, J. Ohren, Rio de Janeiro.
5254. CARRIAGE with MULTIPLE LUMINOUS PROJECTION APPARATUS for PURPOSES of PUBLICITY, L. L. y Loyola, Paris.
5255. AGGLOMERATED METALS, &c., for WORKING METALS, &c., P. Gay, Paris.
5256. SOUNDING APPARATUS, J. B. Hannay, Glasgow.
5257. OBTAINING GLYCERINE, G. Payne, Wakefield.
5258. ADJUSTABLE COLLAR CLIP, A. Hogg, Manchester.
5259. CAR COUPLINGS, A. J. Boult.—(*R. H. Dowling and C. H. Follet, Newark, and E. Crowl, Cleveland, U.S.*)
5260. TRICYCLES, A. Gent and C. N. Spencer, Nottingham.
5261. GAS METERS, T. G. Marsh, Oldham.
5262. DISINTEGRATOR, C. Schütze, Prussia.
5263. GALVANIC BATTERIES, C. D. Abel.—(*G. Przibram, H. Scholz, and W. Wenzel, Vienna.*)
5264. GEAR-WHEELS, W. R. Lake.—(*R. K. Noye, G. Urban, jun., and B. Ortman, Buffalo, New York, U.S.*)
5265. GAS ENGINES, P. M. Justice.—(*W. E. Hale, Chicago, U.S.*)
5266. ROTARY STEAM ENGINES, J. Sant, Newcastle-under-Lyme.
5267. APPARATUS for HATCHING and REARING OVIPAROUS ANIMALS, &c., C. E. Hearson, London.
5268. MOULDING MACHINERY, J. Walker, Cleveland, U.S.

7th November, 1883.

5269. LINED CONDUITS, C. A. Day.—(*C. Detrick, Brooklyn, U.S.*)
5270. VENTILATORS, T. Bauchop, Alloa, N.B.
5271. MAKING BOOTS and SHOES, I. Frankenburg, Salford.
5272. PRODUCING, &c., ELECTRIC and MAGNETIC FORCES, J. S. Fairfax, London.
5273. GRINDING FILE BLANKS, A. G. Brookes.—(*A. Weed, Philadelphia, U.S.*)
5274. SHIRTS for TROPICAL CLIMATES, A. B. Rodyk.—(*W. R. Grey, Singapore.*)
5275. COUNTERPOISED BRAKE, W. Teague, jun., Cornwall.
5276. WINDING MACHINERY, J. C. Jefferson.—(*C. Meinicke, Clausthal, Germany.*)
5277. MULES for SPINNING, T. Rawsthorne, Preston.
5278. CORSET CLASPS, W. R. Lake.—(*J. M. Cohn, New York, U.S.*)
5279. GROOVING METAL ROLLS, D. Burr, Croydon.
5280. PENCIL-CASES, O. Bussler, London.

8th November, 1883.

5281. SPRING HINGES for DOORS, J. S. Stevens and C. G. Major, London.
5282. VACUUM BRAKE APPARATUS, A. S. Hamand, London.
5283. SHIFTING, &c., GRAIN, J. H. Johnson.—(*H. Stubbendorff, Montreal, Canada.*)
5284. FRAMES for BED BOTTOMS, &c., E. Hoskins, Birmingham.
5285. BLINDS, E. and B. Barber, Tring, Herts.
5286. GLASSWARE, L. J. Murray, Birmingham.
5287. WHEELS for TRAMWAY, &c., VEHICLES, R. A. and J. B. Hansell, Sheffield.
5288. MOUNTS for TOBACCO PIPES, &c., R. W King, London.
5289. COMPOSITIONS for HEATING, &c., H. J. Haddan.—(*U. K. Mayo, Massachusetts, U.S.*)
5290. PERMANENT WAY of RAILWAYS, H. J. Haddan.—(*A. C. Dienheim-Sczawinski-Brochocki, Rome, and B. Vogdt, Vienna.*)
5291. APPARATUS for GOVERNING STEAM and other MOTORS, P. W. Willans, Thames Ditton.
5292. BREECH-LOADING FIRE-ARMS, D. Bentley, Aston, and W. Baker, Handsworth.
5293. COMMUTATORS, &c., of ELECTRICAL MACHINES, J. H. Johnson.—(*Z. T. Gramme, Paris.*)
5294. GRINDING MILLS, A. J. Boult.—(*J. Boullier, fils, France.*)
5295. CAGES or BOBBIN-HOLDERS, J. Chapman, New Basford.
5296. IRON, P. L. T. von Schöning, Austria.
5297. PETROLEUM MOTORS, F. Wirth.—(*J. Söhnlein, Germany.*)
5298. MEASURING DISTANCES, A. M. Clark.—(*Dany and Lepage, Paris*)

9th November, 1883.

5299. ELECTRIC ARC LAMPS, H. Springmann.—(*H. A. Earle and E. Golstein, Hanover.*)
5300. DRYING WOOL, &c., J. and W. McNaught, Rochdale.
5301. MULTIPLE DRILLING, &c., MACHINES, J. Carver, Nottingham.
5302. FASTENINGS for GLOVES, &c., G. and C. Ball, Birmingham.
5303. COUPLING, &c., RAILWAY WAGONS, W. Dean, J. Holden, and W. H. Stanier, Swindon.
5304. LIGNEOUS MATERIALS, J. M. Webster, Bootle.
5305. EXCENTRIC SWIVELLING, &c., CHAIRS, R. Cruikshank, jun., Denny, N.B.
5306. PULP or PAPER STOCK, G. B. Walker, London.
5307. CHAIRS for THEATRES, &c., P. Jensen.—(*The Mac Kaye Manufacturing Company, New York, U.S.*)
5308. MATHEMATICAL INSTRUMENTS, P. Marks, London.
5309. ELASTIC WEBBING, &c., L. Turner, Leicester.
5310. FILTERS, G. F. Marshall, London.
5311. MAKING EXTRACT from the BARK of TREES, J. Fisher.—(*C. M. Allen, Singapore.*)
5312. CONSTRUCTING LIFEBOATS, H. Critten, Cobholm.

10th November, 1883.

5313. PERAMBULATORS, L. L'Hollier, Birmingham.
5314. POCKET RAZORS, A. B. Ball, Sheffield.
5315. GAS ENGINES, J. H. Johnson.—(*J. Lenoir, Paris.*)
5316. SAVING LIFE at SEA, J. H. Johnson.—(*P. T. Ramakers and F. X. Nyer, Paris.*)
5317. HOT-AIR ENGINES, W. Schmidt, Germany.
5318. SIGNALLING at SEA, W. Balch, Greenwich.
5319. PREPARING COTTON, &c., R. Tatham, Rochdale, and T. Bentley, Oldham.
5320. FIREPLACES, &c, J. N. Moerath, London.
5321. FIRE-ARMS, E. G. Brewer.—(*E. Sèches, Paris.*)
5322. TROUSER SUSPENDERS, &c., H. Bellman, London.
5323. COMPOUND STEAM ENGINES, S. Lake, Milford Haven.
5324. PRODUCING SURFACES for PRINTING PURPOSES, J. J. Sachs, London.
5325. CARBONS for INCANDESCENT ELECTRIC LAMPS, J. Wavish, J. Warner, and M. Bailey, London.
5326. ANTISEPTIC, W. R. Lake.—(*T. A. Breithaupt, Strasbourg.*)
5327. CLEANING KNIVES and FORKS, E. Greenfield, Bromley.

12th November, 1883.

5328. VALVES for STEAM MOTORS, G. Temple, Sheffield.
5329. MINERS' SAFETY LAMPS, J. Wilkinson, Sheffield.
5330. ANTIFOULING COMPOSITION SUITABLE for SHIPS' BOTTOMS, W. F. McIntosh and W. Croudace, Dundee.
5331. GAS ENGINES, J. Robson, Shipley.
5332. NAVIGATING WATER, O. Wartmann, London.
5333. RETAINING, &c., WINDOW-BLIND CORDS, W. P. Kelly, Mount Brandon, Ireland.
5334. BRACES, F. Tew, London.
5335. COCKS and VALVES, J. Fenby, Sutton Coldfield.
5336. BREAKWATERS, L. W. Leeds, London.
5337. STEAM VESSELS, L. W. Leeds, London.
5338. AUTOMATIC ELECTRIC COPYING, &c, MACHINES, J. Wetter.—(*A. Schmid, Zurich.*)
5339. OBTAINING MOTIVE POWER, C. Barker, Shadwell.
5340. TREATING OILS and FATS, E. S. Wilson, London.
5341. HEAT-REGULATING APPARATUS, H. H. Lake.—(*J. Garadot, Paris.*)
4312. SCREW-BOLT for BEDSTEADS, A. J. Boult.—(*Boitiat-Bernot et Fils, France.*)
5343. SOAP, A. Boult.—(*Tisserant and Martin, France*)
5344. BROOMS, &c., A. J. Boult.—(*St. J. Lacam, France.*)
5345. CONSTRUCTING FIRE, &c., PIPES, E. A. Brydges.—(*G. Sokoff, Janpol, Russia*)
5346. DUMMIES for DISPLAYING ARTICLES of DRESS, J. H. Johnson.—(*E. and A. Merle, Paris.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

5227. TREATING ZINC ORES, &c., L. von Neuendahl, Prussia.—*3rd November*, 1883.
5268. MOULDING MACHINERY, J. Walker, Cleveland, U S.—*6th November*, 1883.
5273. GRINDING FILE BLANKS, A. G. Brookes, London.—A communication from A. Weed, Philadelphia, U.S.—*7th November*, 1883.
5282. VACUUM BRAKE APPARATUS, A. S. Hamand, London.—*8th November*, 1883.

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

4543. JACQUARD NEEDLES, W. Martin and J. Hind, Nottingham.—*5th November*, 1880.
4604. SEWERS or DRAINS, G. E. Waring, jun., Newport, U.S.—*9th November*, 1880.
4614. ELECTRIC LAMPS, C. W. Siemens, London.—*10th November*, 1880.
4549. BELTS or BANDS, J. Heap, Ashton-under Lyne.—*6th November*, 1880.
4583. VACUUM BRAKE APPARATUS, J. Gresham, Salford.—*9th November*, 1880.
4608. GENERATING, &c., ELECTRIC CURRENTS, C. F. Heinrichs, London.—*9th November*, 1880.
4647. SIFTING PORTLAND CEMENT, S. Mayell, Halling.—*11th November*, 1880.
4943. EXPLOSIVE COMPOUND, W. R. Lake, London.—*27th November*, 1880.
5023. WIRE ROPES and CABLES, A. S. Hallidie, San Francisco, U.S.—*2nd December*, 1880.
4589. DRESS for GRINDING, &c., MILLS, J. Higginbottom, Liverpool.—*9th November*, 1880.
4600. CUT PILE FABRICS, R. Atherton, Bradford—*9th November*, 1880.
4637. PULVERISING MATERIALS, T. R. Jordan, London.—*11th November*, 1880.
4592. LOOMS for WEAVING, F. O. Tucker, Hartford, U.S.—*9th November*, 1880.
4632. PUDDLING FURNACES, W. S. Williamson, Congleton.—*11th November*, 1880.
4653. VELOCIPEDES, T. Pritchard, jun., Coventry.—*11th November*, 1880.
4673. PREPARING and SPINNING COTTON, J. M. Hetherington, Manchester.—*13th November*, 1880.
4715. PAPER-FOLDING MACHINERY, W. Conquest, London.—*16th November*, 1880.
5122. GAS GOVERNORS, W. Cowan, Edinburgh.—*8th December*, 1880.
5192. SPINNING MACHINERY, J. C. Fell, Ashton-under-Lyne.—*11th December*, 1880.
4622. STEAM REDUCING VALVES, J. Wright, Tipton.—*10th November*, 1880.
4737. LOOMS for WEAVING, E. Crossley, Halifax.—*17th November*, 1880.
4609. DIRECT-ACTING HYDRAULIC MACHINES, R. H. Tweddell, London, and J. Platt and J. Fielding, Gloucester.—*10th November*, 1880.
4610. KIERS for BLEACHING WOVEN FABRICS, W. Birch, Salford.—*10th November*, 1880.
4620. LOCKS for BAGS, E. Pfeiffer, London.—*10th November*, 1880.
4643. EXPLOSIVE COMPOUNDS, C. D. Abel, London.—*11th November*, 1880.
4666. CANDLES, W. H. Beck, London.—*12th November*, 1880.
5172. LAMPS, &c., F. Siemens, London.—*10th December*, 1880.

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

4280. MAGNETO-ELECTRIC MACHINES, H. J. Haddan, London.—*6th November*, 1876.
4282. GRAIN SEPARATORS, &c., H. J. Haddan, London.—*6th November*, 1876.
4372. TREATMENT of SLAG, C. Wood, Middlesbrough-on-Tees.—*11th November*, 1876.
4566. ACTUATING the SLIDE VALVES of STEAM ENGINES, J. N. Floyd, Handsworth.—*25th November*, 1876.
4746. ARMOUR PLATES, A. Wilson, Sheffield.—*7th December*, 1876.
4353. ROLLING, &c., BARS of IRON, J. O. and A. E. H. Butler, Leeds.—*10th November*, 1876.
4382. HOPPER DREDGERS, W. Simons and A. Brown, Renfrew, N.B.—*11th November*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, *30th November*, 1883.)

3293. INDICATOR for RAILWAY TRAINS, F. G. G. Lines and J. Kendall, London.—*3rd July*, 1883.
3323. MACHINE for CUTTING CORK, J. Hix, London.—*4th July*, 1883.
3324. SIGNALLING APPARATUS, R. Chidley, London.—*5th July*, 1883.
3347. DIFFERENTIAL VALVE GEAR, H. Lawrence and R. M. Ogle, Durham.—*5th July*, 1883.
3348. LOOMS, R. L. Hattersley and J. Hill, Keighley.—*6th July*, 1883.
3351. BLEACHING KIERS, J. K. J. Foster, Bolton.—*6th July*, 1883.
3352. SMALLWARE LOOMS, T. Hirst, Manchester.—*6th July*, 1883.
3355. MIRROR, &c., GLASS, W. P. Thompson, Liverpool.—A com. from Baron F. del Marmol.—*6th July*, 1883.
3356. JOINTS for CORNERS of SCHOOL SLATES, E. M. Owen, Festiniog.—*6th July*, 1883.
3357. GROOVING CYLINDRICAL SURFACES, W. Robertson, Johnstone.—*6th July*, 1883.
3367. LIFE BELTS, M. Bauer, Paris.—A communication from A. Harivel.—*6th July*, 1883.
3371. CHILLED IRON ROLLERS, T. Miller, Edinburgh.—*6th July*, 1883.
3374. TIP WAGONS, &c., A. G. Margetson and W. S. Hek, Bristol.—*7th July*, 1883.
3377. RAILWAY SLEEPERS, J. Imray, London.—A communication from J. Monier.—*7th July*, 1883.
3380. TELEGRAPHIC, &c., APPARATUS, D. Sinclair, Glasgow.—*7th July*, 1883.
3389. MOUNTING, &c., SPINDLES, J. Marsh, Ashton-under-Lyne.—*9th July*, 1883.
3395. PREVENTING INCRUSTATION in BOILERS, S. Pitt, Sutton.—A communication from A. A. Rosenberg.—*9th July*, 1883.
3434. ATTACHING LABELS to ENDS of ROLLS of DRAWINGS, &c., H. N. Maynard and H. J. Cooke, London.—*12th July*, 1883.
3437. MALTOSE, J. Imray, London.—A communication from L. Cuisinier.—*12th July*, 1883.
3458. PORTABLE PLATFORM for SHEEP, J. Hornby, Watton.—*13th July*, 1883.
3467. GRATES, H. J. Haddan.—A communication from E. Breslauer.—*13th July*, 1883.
3469. CORD FASTENER, H. J. Haddan.—A communication from D. W. Ernsting.—*13th July*, 1883.
3478. CONNECTING PARTS of CONDUCTORS, C. A. C. Wilson, London.—*14th July*, 1883.
3495. CHEMICAL DEPOSIT CURRENT METERS, Sir D. Salomons, Tunbridge Wells.—*16th July*, 1883.
3512. WATER-CLOSETS, E. and A. E. Gilbert, Dundee.—*17th July*, 1883.
3524. PREPARING MATCH STICKS, W. R. Lake, London.—A com. from W. H. H. Sisum.—*17th July*, 1883.
3737. UMBRELLAS, E. G. Charageat, Paris.—*31st July*, 1883.
3818. RESERVOIR for PENS, M. Myers and J. Lowe, Birmingham.—*4th August*, 1883.
3853. AUTOMATIC SAFETY-CAR SIGNALS, W. H. Rushforth, Camden, U.S.—*8th August*, 1883.
4025. BOILERS, &c., C. H. Simpson, Bushey.—*20th August*, 1883.
4555. FOLDING BOXES, A. Wells and F. Fleischmann, Weybridge.—*24th September*, 1883.
4799. HARVESTING MACHINES, B. Samuelson, Banbury.—A communication from the Marsh Harvester Company.—*9th October*, 1883.
5060. AUTOMATIC CAR COUPLERS, H. J. Haddan, London.—A com. from E. N. Gifford.—*24th October*, 1883.

(*Last day for filing opposition*, *4th December*, 1883.)

3182. GALVANIC BATTERIES, J. R. and J. W. Rogers, London.—*27th June*, 1883.
3186. PICKS, G. W. Elliott, Aintree, near Liverpool.—*27th June*, 1883.
3223. DYNAMO-ELECTRIC MACHINES, L. F. Lamkin, London.—*29th June*, 1883.
3383. GAS ENGINES, W. R. Lake, London.—A communication from C. F. L. Gardie.—*7th July*, 1883.
3394. WOOD-WORKING MACHINERY, A. A. Cook, Eastbourne.—*9th July*, 1883.
3411. BREECH-LOADING REPEATING RIFLES, G. Baron de Overbeck, London.—*10th July*, 1883.
3421. ALLOYS of TUNGSTEN, F. W. Martino, Sheffield.—*11th July*, 1883.
3424. GALVANIC BATTERIES, J. Gray, Gateshead.—*12th July*, 1883.
3442. LOOMS, J. S. Park, Stockport, and J. Park, Manchester.—*12th July*, 1883.
3456 SEWING MACHINES, W. E. Gedge, London.—A communication from E. Cornely.—*13th July*, 1883.
3459. VOLTAIC BATTERIES, A. Clark, Glasgow.—*13th July*, 1883.
3493. MACHINE GUNS, H. S. Maxim, London.—*16th July*, 1883.
3497. LAND ROLL, E. Otto, Wuerben, and G. Peisker and A. Rittner, Schweidnitz, Prussia.—*16th July*, 1883.
3508. DECORATING GLASS ARTICLES, C. D. Abel, London.—A com. from A. Schierholz.—*17th July*, 1883.
3554. BOTTLE STOPPERS, M. F. Roberts, London.—*19th June*, 1883.
3562. HOT-AIR CALORIC ENGINES, E. Field, London, and H. Aydon, Whitton.—*19th July*, 1883.
3665. METALLIC PACKING CASES, C. H. W. S. Brodersen, London.—A communication from Messieurs Braun and Bloem.—*26th July*, 1883.
3692. ELECTRICAL DISTRIBUTION, St. G. L. Fox, London.—*28th July*, 1883.
3722. STOP MOTIONS for LOOMS, A. W. Reddie, London.—A communication from Messieurs Pruvot Bouy et Compagnie.—*30th July*, 1883.
3779. REGULATING the MOVEMENT of CARBONS, E. G. Brewer, London.—A communication from La Société Anonyme des Ateliers de Construction Mécaniques et d'Appareils Electriques.—*2nd August*, 1883.
4356. GLUE, W. R. Lake, London.—A communication from C. V. Flodgvist.—*11th September*, 1883.
4552. WATER METERS, A. E. H. Johnson, Washington, U.S.—A com. from L. H. Nash.—*24th September*, 1883.
4647. PACKING TEA, A. Carson, Stirling, and S. R. Baildon, Glasgow.—*29th September*, 1883.
4772. STOPPERS for BOTTLES, J. S. Davison, Sunderland.—*8th October*, 1883.
4776. HEATING, &c., GASES, W. A. Bartlett, Washington, U.S.—A communication from G. E. Haight, W. H. Wood, and W. E. Winsor.—*8th October*, 1883.
4791. PERMANENT WAY, J. Kenyon, Blackburn.—*9th October*, 1883.
4805. BEARINGS for JOURNALS, &c., W. R. Lake, London.—A com. from R. W. Traylor.—*9th October*, 1883.
5282. VACUUM BRAKE, A. S. Hamand, London.—*8th November*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 9th November*, 1883.)

1840. LUBRICATING APPARATUS, T. Holland, Troy, U.S.—*11th April*, 1883.
1863. WASHING MACHINES, W. R. Lake, London—*12th April*, 1883.
2405. STEAM BOILERS, H. Lane, London.—*11th May*, 1883.
2415. DISINFECTING RAGS, J. Illingworth, Batley.—*12th May*, 1883.
2422. TAKING SAMPLES of WINE, &c., A. J. Boult, London.—*12th May*, 1883.
2433. JOINTS of DRAIN PIPES, D. Edwards and J. Williams, Cardiff.—*15th May*, 1883.
2458. METALLIC PACKING of PISTONS, A. Spagl, Munich.—*16th May*, 1883.
2490. LOOMS, W. Tristram and W. Westhead, Bolton.—*18th May*, 1883.
2529. OPERATING GEAR for SHIPS' DAVITS, H. McCollin, London.—*21st May*, 1883.
2557. BARBED WIRE, H. H. Lake, London.—*22nd May*, 1883.
2564. BALLING HEADS of GILL BOXES, P. Smith, jun., S. Ambler, and J. Lund, Keighley.—*22nd May*, 1883.
2582. REFINING FULLERS' EARTH, C. R. Dames, Bath.—*23rd May*, 1883.
2613. TRAPS for FLUSHING, &c., F. Newman, Ryde.—*25th May*, 1883.
2632. DRYING FABRICS, H. B. Barlow, London.—*26th May*, 1883.
2641. CLEANSING, &c., COTTON, J. Imray, London.—*28th May*, 1883.
2647. FOOD for INFANTS, &c., W. R. Barker and A. L. Savory, London.—*28th May*, 1883.
2657. ELASTIC WATERPROOF COMPOUNDS, W. Burnham, Chicego, U.S.—*29th May*, 1883.
2677. CHANGING PHOTOGRAPHERS' BACKGROUNDS, A. M. Clark, London.—*30th May*, 1883.
2699. COKE OVENS, F. Wirth, Frankfort-on-the-Maine.—*30th May*, 1883.
2727. RECEIVING, &c., NIGHT SOIL, A. M. Clark, London.—*1st June*, 1883.
2761. COMBING MACHINES, E. de Pass, London.—*4th June*, 1883.
2805. PENCIL POINT PROTECTORS, F. Byron, Chesterfield.—*6th June*, 1883.
2867. QUARTZ CRUSHER, H. Sutherland, London.—*8th June*, 1883.
2875. BABY JUMPERS, A. M. Clark, London.—*8th June*, 1883.
3026. CARBON PLATES, R. Applegarth, London.—*19th June*, 1883.
3130. RINGS of SPINNING MACHINES, J. Wetter, New Wandsworth.—*23rd June*, 1883.
3370. GETTING COAL, W. F. Hall and W. Low, Haswell Colliery.—*6th July*, 1885.
3399. FASTENINGS for DOORS, F. Newman, Ryde.—*10th July*, 1883.
3463. BAKERS' OVENS, R. A. Gilson and W. J. Booer, London.—*13th July*, 1883.
3858. FASTENERS for GLOVES, &c., E. K. Dutton, Manchester.—*8th August*, 1883.
4001. TREATING SOLUTIONS of AMMONIA, A. McDougall, Penrith.—*17th August*, 1883.
4005. PROMOTING COMBUSTION of FUEL, A. M. Clark, London.—*17th August*, 1883.
4063. LACING HOOKS, H. H. Lake, London.—*22nd August*, 1883.
4139. TREATMENT of IRON and STEEL, W. Arthur, Cowes.—*28th August*, 1883.

(*List of Letters Patent which passed the Great Seal on the 13th November*, 1883.)

2431. MAINTAINING PRESSURE APPARATUS, J. C. Stevenson, Liverpool.—*14th May*, 1883.
2438. INCANDESCENT ELECTRIC LAMPS, J. H. Guest, Brooklyn, U.S.—*15th May*, 1883.

2439. Rubbing, &c., Types, G. S. Eaton, Brooklyn, U S.—15*th May*, 1883.
2440. Reproducing Facsimile Writing, A. T. Collier, Wadebridge.—15*th May*, 1883.
2441. Lace, &c., F. E. A. Büsche, Schwelm, Germany.—15*th May*, 1883.
2449. Ringing Bells, E Edwards, London.—15*th May*, 1883.
2452. Automatic Coupling, G. F. Belling, London.—16*th May*, 1883.
2457. Looms, A. J. Boult, London.—16*th May*, 1883.
2460. Utilising the Force of Wind, &c., E. A. Roy, London.—16*th May*, 1883
2478. Stays or Corsets, F. H. F. Engel, Hamburg.—17*th May*, 1883.
2483. Utilising Liquid Fuel, H. H. Lake, London.—17*th May*, 1883.
2487. Oil Cans, L. A. Walters, London, and J. Bradbury, Braintree.—18*th May*, 1883.
2517. Gas Engines, W. B. Haigh and J. Nuttall, Oldham—21*st May*, 1883.
2530. Embroidering Machines, W. L. Wise, London.—21*st May*, 1883.
2601. Fire-proof Screen, A. Clark, London.—24*th May*, 1883.
2626. Moulding Clayware, W. Crawford, Glasgow, and P. Graham, Stockton-on-Tees.—26*th May*, 1883.
2644. Locking Device for Wearing Apparel, H. J. Haddan, London.—28*th May*, 1883.
2654. Gas Burners, S. Leoni, London.—29*th May*, 1883.
2671. Tramways, W. P. Hope, Edinburgh.—29*th May*, 1883.
2749. Sheet Delivery Apparatus for Printing Machines, W. Conquest, London.—2*nd June*, 1883.
2834. Rotary Engines, T. Nordenfelt, London.—7*th June*, 1883.
2835. Cartridges, T. Nordenfelt, London.—7*th June*, 1883.
2926. Lamp Burners, P. C. G. Klingberg, London.—12*th June*, 1883.
2980. Railway Carriages, H. E. Newton, London.—15*th June*, 1883.
2996. Blank Cartridge, C. D. Abel, London.—16*th June*, 1883.
3163. Compasses, A. M. Clark, London.—26*th June*, 1883.
3988. Holders for Paper in the Roll, H. J. Fitch, London.—17*th August*, 1883.
3999. Concentrating Sugar-cane Juice, G. Davies, Manchester.—17*th August*, 1883.
4105. Harvesting Machinery, J. Hornsby and J. Innocent, Grantham.—24*th August*, 1883.
4115. Sewing Machines, A J. Hurtu, Paris.—25*th August*, 1883.
4138. Producing Gases for Heating, W. Arthur, Cowes.—28*th August*, 1883.

List of Specifications published during the week ending November 10th, 1883.

384, 2d.; 528, 2d.; 636, 2d.; 648, 2d.; 720, 2d.; 746, 2d; 891, 2d; 903, 2d.; 1081, 2d.; 1085, 2d.; 1166, 2d.; 1175, 2d.; 1256, 2d; 1373, 6d.; 1383, 6d.; 1386, 6d.; 1397, 2d.; 1407, 2d.; 1411, 2d; 1443, 2d.; 1455, 2d.; 1457, 2d.; 1466, 2d.; 1470, 6d.; 1472, 4d.; 1475, 2d.; 1476, 6d.; 1480, 2d.; 1482, 6d.; 1484, 4d.; 1489, 6d.; 1492, 6d.; 1496, 2d.; 1499, 2d.; 1501, 6d.; 1502, 10d.; 1504, 6d.; 1506, 6d.; 1508, 4d.; 1509, 8d.; 1511, 6d.; 1512, 2d.; 1513, 2d.; 1514, 2d.; 1517, 2d.; 1519, 6d.; 1520, 6d.; 1521, 6d.; 1522, 6d.; 1525, 6d.; 1526, 6d.; 1527, 10d.; 1528, 6d.; 1529, 6d.; 1530, 2d.; 1531, 6d.; 1532, 4d.; 1533, 2d.; 1535, 2d.; 1536, 2d.; 1537, 2d.; 1538, 6d.; 1539, 2d.; 1541, 6d.; 1542, 6d.; 1543, 2d.; 1547, 6d.; 1548, 4d.; 1549, 2d.; 1550, 6d.; 1552, 10d.; 1553, 4d.; 1556, 2d.; 1557, 2d; 1558, 6d; 1559, 10d.; 1560, 6d.; 1561, 1s. 4d.; 1563, 4d.; 1566, 2d.; 1567, 6d.; 1568, 6d.; 1569, 2d.; 1571, 6d.; 1572, 6d.; 1573, 6d.; 1574, 6d.; 1576, 6d.; 1578, 6d.; 1579, 2d.; 1584, 6d.; 1585, 6d.; 1586, 6d.; 1587, 8d.; 1588, 2d.; 1589, 4d.; 1591, 6d.; 1592, 8d.; 1593, 6d.; 1594, 6d.; 1596, 4d.; 1597, 6d.; 1598, 2d.; 1600, 6d.; 1602, 4d.; 1603, 6d.; 1606, 6d.; 1609, 6d.; 1610, 2d.; 1614, 8d.; 1618, 6d.; 1619, 6d.; 1621, 2d.; 1623, 6d.; 1625, 6d.; 1628, 2d.; 1631, 6d.; 1640, 2d.; 1659, 6d.; 1662, 4d.; 1671, 6d; 1677, 6d.; 1697, 4d.; 1731, 6d; 1736, 6d.; 1737, 6d; 1770, 6d; 2102, 6d.; 3690, 2d; 3728, 6d.; 3747, 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.*

5002. Fittings for Incandescent Electric Lamps, *M. Evans, Wemyss Bay, Renfrew.*—20*th October*, 1882.—(*Not proceeded with.*) 2d.
A block of ebonite is fitted with two hook-like springs, to which the terminals of the circuit lead. The ring-like terminals of the lamp engage with these hooks. An elastic sheath embracing the block and the neck of the lamp ensures good contact.

6241. The Toggle and Machines to which the same may be Applied, *A. M. Clark, London*—30*th December*, 1882.—(*A communication from E. Dervaux, Ibled, and G. N. Schoenberg, Paris.*) 1s.
This relates to improvements applied to the mechanical power known as the toggle, the improvements relating to the various joints of the toggle, and also to the means of applying power thereto.

384. Filtering Media, *J. Cross and G. I. J. Wells, Widnes.*—24*th January*, 1883.—(*Provisional protection not allowed.*) 2d.
This consists in the use of peat as a filtering medium.

528. Hose Connections, *H. J. Haddan, London.*—31*st January*, 1883.—(*A communication from E. F. Gilbert, New York.*)—(*Provisional protection not allowed.*) 2d.
This invention consists of two short pipe connections or tubes, one of which has male couplings on both ends, and the other has female couplings on both ends, the said connections being made an attachment to the length of hose, whereby the connection of two lengths of hose or a single length with a hydrant or engine is readily made.

636. Substitute for the Ironwork of Carriages, &c., *W. E. Gedge, London.*—6*th February*, 1883.—(*A communication from G. Lefèvre, Paris.*—(*Provisional protection not allowed.*) 2d.
The invention is characterised by the substitution of cast steel, or of any other material susceptible of being cast, in lieu of wrought iron, for the manufacture of solid or hollow pieces.

648. Adaptation of the Incandescent Electric Lamp to Stage and other Purposes, *W. J. Saward and A. Koerber, London.*—6*th February*, 1883.—(*Provisional protection not allowed.*) 2d.
This relates to a portable battery and incandescent lamp, the former consisting of a number of cells arranged in a leather belt, which can be attached to the person, and from which the conductors lead to the lamp, which can be fixed on the head or other suitable part.

720. Oxidising Alcohols, &c., *E. T. Hughes, London.*—9*th February*, 1883.—(*A communication from D. Sandmann, Charlottenburg.*)—(*Provisional protection not allowed.*) 2d.
This relates to the general process.

746. Sleeping Berths for Railway Carriages, *T. R. Hutton, Disley, and R. A. Gartside, Manchester.*—10*th February*, 1883.—(*Provisional protection not allowed.*) 2d.
The object is to support or suspend sleeping berths by means of india-rubber or other springs, or by chains.

891. Tobacco-pipes, *M. Perl, London.*—17*th February*, 1883.—(*Provisional protection not allowed.*) 2d.
The object is to construct tobacco-pipes in such a manner that the smoke is screened and purified on its passage from the bowl to the mouthpiece.

903. Manufacture of Flower Pots for Artificial Flowers, *B. Löwy, Berlin.*—19*th February*, 1883.—(*Provisional protection not allowed.*) 2d.
The pots are made of cardbroad, pasteboard, or *papier mâché*.

1081. Colour Alphabet and Figures, *C. R. Söderström, Upsala, Sweden.*—28*th February*, 1883.—(*Provisional protection not allowed.*) 2d.
The object is to combine with the reading of printed matter exercise in the discernment of colours.

1085. Manufacture of Medicated Food, *C. J. Flasschoen, Paris.*—28*th February*, 1883.—(*Provisional protection not allowed.*) 2d.
The object is to introduce medicine into food.

1166 Apparatus upon which to Hang Coats, &c., *A. Elliot, London.*—5*th March*, 1883.—(*Not proceeded with.*) 2d.
The apparatus consists essentially of a pair of arms or pegs hinged to a central block, and provided with springs to throw up the said arms to a convenient height to enable the arm holes of the coat or other garment to be readily hung upon them.

1175. Ornamenting Net Tulle with Artificial Flowers, &c., *L. Schwabacher, London.*—5*th March*, 1883.—(*A communication from R. Reichenheim, Paris*)—(*Provisional protection not allowed.*) 2d.
Ornamental designs composed of artificial flowers alone or combined with glass, metal, or other beads and bugles, metallic thread or wire, chenille, silk, velvet or other suitable materials are attached to the net tulle or other fabric.

1256. Combined Letter Sheet and Envelope, *B. J. B. Mills, London.*—8*th March*, 1883.—(*A communication from R. W. Stevens, Alton, and G. R. Moore, St. Louis, U.S.*)—(*Provisional protection not allowed.*) 2d.
This consists of a sheet of paper, formed and perforated or cut so that it admits of folding in various ways to constitute a closed or opened envelope.

1375. Gas Stoves, *A. J. Boult, London.*—14*th March*, 1883.—(*A communication from P. Géoffroy-Gomez, Toulouse.*) 6d.
This relates to improvements in gas stoves which burn a mixture of gas and air, and in which the carbonic acid which is evolved is absorbed by quicklime or the like.

1383. Mechanism for Controlling and Registering Clocks, *H. J. Haddan, Kensington.*—15*th March*, 1883.—(*A communication from A. Lasmoles, France.*) 6d.
This relates to controlling or registering clocks, applicable as a watchman's time detector, and has for its objects, First, to obtain security of control by placing the apparatus out of reach of the watchman, who has only to press on a button to actuate the apparatus; Secondly, to record the time of visit; Thirdly, to record how many times the apparatus has been set in operation; Fourthly, to connect the apparatus with a dial indicating the number of visits and places visited; Fifthly, to adapt the apparatus for exercising a control over carrier pigeons by indicating their arrival; and Sixthly, to cause the apparatus to serve as an ordinary clock, its working not being affected by its functions as a controlling apparatus.

1386. Appliances for More Securely Holding Braces to Trousers, *N. P. Davison, London.*—15*th March*, 1883. 6d.
This consists in fastening the buttons by rivetting or otherwise to plates, the buttons being so formed that the shanks pass through the plates, such shanks forming the rivets.

1397. Apparatus for Use in Loading Vessels with Coal, *G. Taylor, Penarth.*—16*th March*, 1883—(*Void.*) 2d.
The object is to reduce the cost and difficulty of conveying the coal from the staith to the hatchway, of lowering it into the hold, and of trimming the cargo or distributing it in the various parts of the hold, and to avoid or reduce the breakage of the coal in these various operations.

1407. Treating Ores or Regulus for Extraction of Metals, *T. Bowens, London.*—16*th March*, 1883.—(*Void.*) 2d.
This relates to the general treatment of the ores.

1411. Self-closing Letter Paper or Card, *E. Edwards, London.*—16*th March*, 1883.—(*A communication from A. Callewaert, Brussels.*—(*Provisional protection not allowed.*) 2d.
This relates to the mode of folding the paper or card.

1443. Penholders, Pencil-cases, &c., *C. E. Orrell, Kidsgrove.*—19*th March*, 1883.—(*Void.*) 2d.
The object is to attach a knife point or blade to the end of a penholder, pencil case, and lead or crayon pencil, and to cover it with a sheath or cap in such a manner that the penholder, pencil-case, or pencil may be carried in the pocket, held in the hand, or otherwise used, without risk of injury from the blade, &c.

1455. Safety Electric Switch, *C. J. Wharton, Holborn Viaduct.*—20*th March*, 1883.—(*Provisional protection not allowed.*) 2d.
This consists in preventing the switch being left in any position except in perfect circuit or entirely broken circuit, by means of a trigger spring and tumbler or spiral spring.

1457. Portable or Removable Conservatories, Greenhouses, &c., *E. H. Harris, London.*—20*th March*, 1883.—(*Void.*) 2d.
This relates to the general construction of a portable conservatory, &c.

1466. Machinery for Spinning and Doubling Cotton, Wool, Silk, &c., *A. Higgins, Salford.*—20*th March*, 1883.—(*Provisional protection not allowed.*) 2d.
This relates, First, to arrangements for imparting rotary motion to the spindles; Secondly, to the collars and bolsters; Thirdly, to the employment of a current or currents of electricity for imparting rotary motion to the spindles.

1470. Pumps, chiefly Designed for Use in Ships, *A. Russell and F. Curtis, Newburyport, U.S.*—20*th March*, 1883. 6d.
This relates to improvements in the general construction of the pump.

1472. Propelling Cars or Other Vehicles by Electricity, &c., *P. R. Allen, Strand.*—20*th March*, 1883.—(*Void.*) 4d.
This relates to the use of expanding pulleys, for the purpose of varying the speed of vehicles propelled by electro-motors, without changing the speed of the motors. The speed may also be varied by regulating the current sent through the motor, in combination or not with the expanding pulleys. A brake is described which is actuated by an electro-magnet, and an arrangement is described for changing the cells or accumulators when exhausted.

1475. Voltaic Batteries, &c., *G. Gray, Gateshead-on-Tyne.*—21*st March*, 1883.—(*Void.*) 2d.
The electrodes are zinc and carbon, which are separated by a porous cell, the zinc being immersed in a saturated solution of chloride of sodium or chloride of ammonium, and the carbon in either of the three following oxidising mixtures:—First, one part of bichromate of potash dissolved in six parts sulphuric acid and one of water, to which is added from one to two parts nitric acid, and five grains to the ounce of permanganate of potash. Secondly, one part bichromate of potash dissolved in six parts sulphuric acid and one of water, to which is added about two parts nitrate of potash, or other equivalent nitrate, and five grains to the ounce of permanganate of potash. Thirdly, one part nitrate of potash or equivalent nitrate added to three parts sulphuric acid.

1476 Stopping Gear for Machinery, specially Applicable to Looms, *W. H. Beck, London.*—21*st March*, 1883.—(*A communication from W. Dawson, Paris.*) 6d.
The object is the production of an instantaneous stoppage without the employment of brake pressure, and is applicable, First, to machinery in general, an accidental derangement of which increases the weight of the parts in motion; Secondly, to jacquard looms when a card is displaced; and Thirdly, to the same machines in which the cards become unlaced or the loops thereof broken.

1479. Purifying the Spent Lyes formed during the Manufacture of Soap, and the Production of Liquor from which Glycerine can be Obtained, *T. Venables, Glasgow.*—21*st March*, 1883.—(*Not proceeded with.*) 2d.
The spent lyes, as run off from the soap pans after being filtered or before filtration, and which contain glycerine, caustic soda, carbonate, sulphate and chloride of soda in solution, besides a large quantity of fatty and organic matters, are neutralised by a solution of sulphate of alumina, alum, or any other soluble salt of alumina or aluminium, or by any substance containing soluble alumina. The caustic and carbonate of soda combining with the acid precipitate the alumina, the alumina combining with some of the organic matters, and carrying off the rest, purifies the spent lye. The liquor is then filtered and concentrated.

1480. Attaching False and Reversible Cuffs to Shirt Sleeves, *F S. Turner, London.*—21*st March*, 1883.—(*Provisional protection not allowed.*) 2d.
This relates to the means of sewing or attaching the cuffs to the shirt sleeves.

1482. Apparatus for Measuring, Indicating, and Recording the Speed and Direction of Rotation of Shafts, Wheels, &c., *Sir A. G. Campbell, Blythswood, Renfrew, and W. T. Goolden, London.*—21*st March*, 1883. 6d.
This relates to an apparatus for indicating and recording or registering the speed and direction of rotation of a shaft or the like, or the difference in or ratio of the speed of two or more rotating bodies, in which a cone or a disc and a screw are caused to revolve in opposite directions, the said cone or the disc revolving a nut on the screw, the position of the nut being indicated by suitable mechanism, so as to indicate the speed of revolution of the shaft or the like.

1483. Manufacture of Screw Augers and Boring Bits, *G. Heaton, near Birmingham.*—21*st March*, 1883.—(*Not proceeded with.*) 2d.
This relates to the means of twisting the bars for the manufacture of screw augers and boring bits.

1484. Nut Locking Device, *W. J. Brewer, London.*—21*st March*, 1883. 4d.
This relates to the construction of a nut locking device consisting of a plate with lapping tongues, together with formation or appliances for the resistance to rotation.

1485. Apparatus for Compressing and Cooling Air for Preservative or other Purposes, *O. J. Ellis, Derby.*—21*st March*, 1883. 6d.
This relates to the general arrangement of the cylinders and valves.

1486 "Lap" forming Machines for Feeding Wool and other Fibres to Carding Machines, *J. Walker and T. G. Beaumont, Dewsbury Mills.*—21*st March*, 1883. 6d.
This consists, First, in a combination and arrangement of apparatus for giving the necessary to-and-fro motion to the carriage, and this is accomplished by means of a connecting rod, one end of which is attached to the carriage and the other end to an endless travelling chain, which imparts the necessary to-and-fro motion to the carriage. It relates, Secondly, to the means of operating the cutting or reversing rollers each time the carriage arrives at the end of its traverse.

1487. Apparatus for Rolling Angular Wire, and Machines for Grooving Rollers Employed therein, *J. W. and J. Hirst and J. Bottomley, Brighouse.*—21*st March*, 1883. 6d.
The apparatus employed for making the wire consists in a pair of rollers mounted in suitable framework and caused to revolve by gearing. On the periphery of each roller, and exactly opposite each other, are formed angular grooves, which when put together leave a space or opening forming two angles twice the size of one wire. Two wires are then fed between the rollers (through the angular space) and are squeezed while passing between the rollers into the required angular form and wound upon winders. Another part of the invention relates to the means of forming the grooves in the rollers.

1488. Construction of Stable Drains and Floors, *A. M. Clark, London.*—21*st March*, 1883.—(*A communication from P. A. H. Basserie, Le Mans, France.*) 6d.
This relates to the construction of stable drains or gutters provided with perforated hinged lids or covers recessed in the upper edge of the drain, which is flush with the surface of the floor, whereby the latter may be laid perfectly horizontal, while yet permitting of the thorough and rapid draining off of the liquid.

1489. Apparatus for the Detection of Waste of Water from Water Mains, Pipes, and Fittings, *G. F. Deacon, Liverpool.*—21*st March*, 1883. 6d.
This relates to the employment of stethoscopic appliances for the detection of waste of water.

1490. Apparatus for Utilising Rope Driving in Machines or Countershafts, *F. Holgate, Burnley.*—21*st March*, 1883.—(*Not proceeded with.*) 2d.
This relates more particularly to those machines or countershafts in which fast-and-loose pulleys are ordinarily used, and consists in substituting a V-grooved or other suitable pulley to give bite or adhesion to the rope.

1491. Manufacture of Caramel, *E R. Southey, London.*—21*st March*, 1883.—(*Not proceeded with.*) 2d.
This consists in heating the sugar, or mixture of sugar and dextrine, in the form of a syrup, in a close vessel, and under a sufficient pressure.

1492. Construction of Union Joints, *J. T. Garratt, London.*—21*st March*, 1883. 6d.
The object is to prevent any turning of the lining.

1493. Manufacture of Garden and other Hose, *J. Burbridge, R. C. Thorpe, and T. Oakley, Tottenham.*—21*st March*, 1883.—(*Not proceeded with.*) 2d.
The hose is made in lengths on a mandril and passed through a die supplied with india-rubber compound in a plastic state, which, as the hose is drawn through the die, surrounds it with a thin waterproof coating. The coated hose with its mandril still in place is then submitted to the action of heat to cure or vulcanise it.

1495. Machines for Cutting Machine Screws, *W. P. Thompson, Liverpool.*—21*st March*, 1883.—(*A communication from H. H. Taylor, Detroit, U S.*)—(*Complete.*) 6d.
This relates to improvements in that class of screw-cutting machines in which the blanks are held between jaws carried by a rotatable head.

1496. Hand Drill and Tool Holding Chuck, *W. P. Thompson, Liverpool.*—21*st March*, 1883.—(*A communication from R. F. Hyde, Springfield, U.S.*)—(*Not proceeded with.*) 2d.
This relates, First, to the drill stem and its operating mechanism, and the Second part relates to the tool-holding chuck.

1498. Rams and Valve Seatings for Potter's Slip Pumps, &c., *J. Teggin, Longton.*—21*st March*, 1883.—(*Not proceeded with.*) 2d.
This relates to the employment of glass.

1499. Construction of Bath Chairs and Perambulators, *A. W. J. Swindells, Manchester.*—22*nd March*, 1883.—(*Not proceeded with.*) 2d.
This relates to an arrangement for steering.

1500. Ring Spinning Frames, *J. and W. Monks and W. J. Redman, Bacup.*—22*nd March*, 1883. 6d.
This consists in automatic arrangements by which a wire or its equivalent is stretched from end to end of a ring frame so as to be brought in contact with the threads, and withdrawn therefrom at the required time, in the spinning of each set of cops or bobbins, and by which the wire or its equivalent is also withdrawn or removed out of the way automatically when the cop or bobbins have to be doffed.

1501. Application and Storage of Gas to Motors for Driving Tramcars or other Vehicles, and for Starting and Working Gas Engines, &c., *R. M. Marchant and T. Wrigley, London.*—22*nd March*, 1883. 6d.
The object is the application of compressed illuminating or other like gas for the purpose of producing the power required to work and run tramcars at the required speed and on any gradient; it provides an engine which requires no boiler or furnace and no condenser.

1502. Ventilating Appliances, *W. P. Buchan, Glasgow.*—22*nd March*, 1883. 10d.
This relates to the general arrangement of the parts of ventilating appliances.

1503. Umbrellas and Parasols, *R. H. Brandon, Paris.*—22*nd March*, 1883.—(*A communication from E M. L. Blaguière, Paris.*) 4d.
The object is to attach the cover on the mount in such a manner that any person can readily and rapidly detach and replace the same.

1504. Generators for Generating Carbonic Acid Gas or other Gases, *J. McEwen, Manchester.*—22*nd March*, 1883. 6d.
This relates to improvements in generators for generating carbonic acid gas or other gases, and consists of a novel method for filling, emptying, and washing out, without loss of gas or admitting atmospheric air.

1505. Fan or Ventilator for Mines, Tunnels, Buildings, also for Driving Blast Furnaces, &c., *F. L. Jeyes, London.*—22*nd March*, 1883. 6d.
This consists of a screw fan or ventilator fixed to a shaft, and capable of revolving therewith and receiving the air parallel to its axis, and discharging it in the same direction, and it is thus distinguished from ordinary fans which drive the air radially or at right angles thereto.

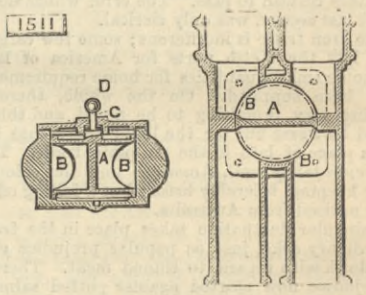
1506. Staying or Holding in Position Swing or Pivotted Windows, Dampers, Ventilators, Looking-glasses, &c., *E. and J. M. Verity, Leeds.*—22*nd March*, 1883. 6d.
The inventors claim the construction, application, and use of notched, indented, or corrugated cheeks, discs, or faces, acting circumferentially round or in connection with the centre pin or pivot of swing or pivotted articles, and an "independent joint" modification thereof.

1507. Apparatus for Cleaning the Interior of Tobacco Pipes, *S. Grafton, Birmingham.*—22*nd March*, 1883. 2d.
This relates to the employment of a small boiler for injecting steam through the pipe.

1508. Production of Stereotype Plates for Rotary Printing Machines, *A. Sauvée, Westminster.*—22*nd March*, 1883.—(*A communication from H. Marinoni and J. Michaud, Paris.*) 4d.
The First part consists in casting the plate as usual with a bevel at each end, but with a disposition of movable studs which keep the plate tight to the cover when opening the box, but which are forced down by the pressing action of the cover on the rest when thrown fully back. The Second part consists in taking the plate at once to a combined plate-boring jet-cutting machine, in which the action of boring the plate and cutting off the jet are done at one operation.

1509. Apparatus for the Manufacture of Iron and Steel, *T. Griffiths, Abergavenny.*—22*nd March*, 1883. 8d.
This relates to improvements on patent No. 1372, dated 28th March, 1881. The inventor dispenses with the use of plugs, pistons, and cylinders for closing the passage through the tuyeres, and affords facility for repairing or renewing the blocks, which receive the tuyeres, from the outside of the converter, thereby avoiding the necessity which hitherto existed for cooling the converter, and for removing the same from the interior thereof.

1511. Valves, *B. W. Davis, Lambeth.*—22*nd March*, 1883. 6d.
The drawing shows a four-way junction in plan and sectional elevation. The valve is in the form of a diaphragm A, bearing circumferentially against seatings B, formed concentrically therewith. The diaphragm



A is of sufficient diameter to close either pair of orifices across which it may be turned. The diaphragm has a rigid spindle C passing through the cover of the valve casing, bearing a crosshead D, which serves to operate the valve, and at the same time indicate its position.

1512. Mouth Organ, *H. J. Haddan, Kensington.*—22*nd March*, 1883.—(*A communication from O. Zabkow, Berlin.*—(*Not proceeded with.*) 2d.
This relates to a mouth organ or harmonica to be operated by the breath of the performer—like a flute—but in which the different sounds are produced by means of a travelling music sheet moved before suitable air openings by means of rollers turned by hand.

1513. Pavements, &c, *R. M. Odish, Westminster.*—22*nd March*, 1883. 2d.
The improvements relate to forming blocks or slabs of pavement.

1514. Apparatus for Warming "Explosive Stores" and other Buildings, *W. Whittle, Whitehaven.*—22*nd March*, 1883.—(*Not proceeded with.*) 2d.
This relates to an apparatus in which lime is employed.

1515. Breech-loading Small-arms, *H. Tolley, Birmingham.*—22*nd March*, 1883. 6d.
This relates partly to the locking mechanism.

1517. Apparatus intended to Multiply a Pattern, Design, &c, *H. Walbrodt and W. Wolff, Prussia.*—22*nd March*, 1883.—(*Not proceeded with.*) 2d.
This relates to the employment of mirrors for multiplying the pattern.

1519. Pulverising and Treating Diamondiferous Ore, &c., *A. J. Struthers, Glasgow.*—22*nd March*, 1883. 6d.
This relates to the mode of pulverising diamondiferous ore, which consists in first softening the broken ore by passing it through a vessel in which it is subjected to the combined action of hot air or furnace gases and steam or moisture, and then passing the softened mass through disintegrating and crushing apparatus.

1520. Steam Boiler and other Furnaces, *S. Schuman, Glasgow.*—22*nd March*, 1883. 6d.
The improvements comprise a swivelling, angled, or curved division plate A, which is fitted within the

back or inner end of the ash-pit B of the furnace, on a horizontal axis below the fire-bars C, some distance from or in front of the back wall D. The lower horizontal part and edge of this division plate A is angled or curved to reach close up to the back wall to form a receptacle for the ash or clinkers passing through, between, or over the back end of the furnace-bars C: and the plate is fitted at such a height from the bottom of the ash-pit that it may be tilted from time to time by a rod *a* reaching to the front of the furnace, and operated by hand to deliver the contents of the plate into the ash-pit. The upper edge of the plate is curved or angled forward over the fulcrum to reach within a few inches of the furnace-bars to limit the extent of opening through which air is admitted to the close heating air space or chamber, which is

1520

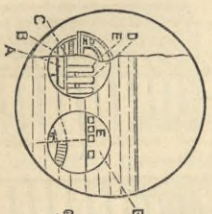


FIG 1

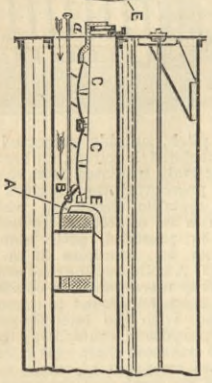


FIG 2

formed between the upper part of this division plate and the back wall D. The air admitted to this space becomes highly heated therein, and passes up through the back end of the furnace bars, or between them and the back wall, to keep up a high state of combustion. A considerable portion of the air from the heating chamber at the back of the ash-pit and swivelling plate A is led up through ducts or channels E opening from the chamber, and fitted within or close in front of and resting on the upper part of the brick bridges D.

1521. Steam Lubricators, *P. Jensen, London.*—22*nd March*, 1883.—(*A communication from J. Rudolph, Stockholm.*) 6*d.*

This relates to the construction of a lubricator for greasing the steam passing through the steam cylinders and other internal frictional parts.

1522. Treating Sewage and Sewage Deposits to obtain Gas, Manures, &c., *J. H. Kidd, Wrexham, and T. J. Barnard, London.*—22*nd March*, 1883. 6*d.*

This relates to the process of treating sewage, and the apparatus employed therefor.

1523. Apparatus for Synchronising or Setting Clocks, &c., *J. A. Lund, London.*—22*nd March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 3924, dated 11th October, 1876. The object is to simplify the mechanism which transmits the movement of the armature of the electro-magnet to the pins for setting the minute hand.

1524. Attaching Shanks to Buttons, &c., *J. H. Johnson, London.*—22*nd March*, 1883.—(*A communication from J. F. Bapterosses, Paris*) 8*d.*

The operation consists, First, in arranging the prepared button heads in such a manner that the hollows or cavities in the said button heads are all turned in one direction for the reception of the shanks; Secondly, in filling the said hollows or cavities with a liquid cement; and Thirdly, in placing the shanks in the said cement, which, on hardening or setting, fixes the shank firmly to the button heads.

1525. Cartridge Boxes and Carriers, for use with Magazine Guns and Mitrailleurs, *G. Pitt, Sutton.*—22*nd March*, 1883.—(*A communication from Lieut.-Colonel G. V. Fosbery, Liege.*) 6*d.*

The boxes for holding cartridges are constructed in such a manner that when taken to pieces they form handy cartridge carriers, which, if used with magazine guns, form for the time parts of the magazine, or for machine guns parts of the feeding apparatus.

1526. Apparatus for Checking the Number and Amount of Fares paid by Passengers, &c., *T. A. Silverwood, Brighton.*—24*th March*, 1883. 6*d.*

According to this invention the number of persons who enter and leave a vehicle or other place is registered by the act of the persons depressing steps, preferably two, upon which they must tread to enter or leave, the said depression actuating a registering arrangement, no registery in either case taking place unless both steps have been depressed; and to ascertain where or at what stage the passengers enter and leave, a second registering arrangement is used, automatically worked preferably from one of the wheels of the vehicle.

1527. Knitting Machinery, *F. and S. Keywood, Nottingham.*—24*th March*, 1883. 10*d.*

This relates to several improvements in the general construction and arrangements of the parts.

1528. Flexible Wheel Bases or Under-carriages of Railway and other Carriages, *T. Slater and S. Owens, London* – 24*th March*, 1883.—(*A communication from E. Krebitz, Charlottenburg.*) 6*d.*

This consists essentially in placing the axles of the carriage (and when there are more than two axles in the carriage by placing the end axles only) on an under-frame separated from the principal frame of the carriage, and to which the traction apparatus is directly attached, which under-frame is attached to the principal frame by means of a bolt forming an axis of motion thereto, and through this bolt the whole power necessary for the traction of the carriage is communicated to the principal frame.

1529. Skates, *W. P. Thompson, Liverpool.*—24*th March*, 1883.—(*A communication from E. H. Barney, Springfield.*) 6*d.*

This relates to devices for operating the clamping mechanism of skates.

1530. Utilisation of an Improved Natural Fibre in the Manufacture of Paper or Papier-mache, &c., *G. Johnston and J. Molony, Belfast.*—24*th March*, 1883.—(*Provisional protection not allowed*) 2*d.*

This relates to the employment and treatment of certain vegetable fibres.

1531. Jacquard Apparatus, *J. Chapman, Nottingham.*—24*th March*, 1883. 6*d.*

This relates principally to improvements in the construction of the cylinders.

1532. Automatic Flushing Apparatus, *A. C. Boothby, Kirkcaldy.*—24*th March*, 1883. 4*d.*

The inventor claims, First, the construction of flushing apparatus wherein a buoyant sluice valve is held down by catches connected by toggle joints to a float, the ascent of which releases the catches, allowing the sluice valve to rise and open the outlet of a tank; Secondly, in combination with the flushing apparatus, a cataract cylinder and piston for governing the descent of the sluice valve.

1533. Apparatus for Trimming Grain, Salt, &c., *H. Holt, Rawtenstall.*—24*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to trim the grain so as to bring it to the foot of an elevator that the feed may be more regular and continuous.

1535. Window Frames, Skylights, &c., *J. Booth, Bolton.*—24*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the construction of window frames, &c., for fixing the glass without putty.

1536. Looms, *T. Taylor and J. Whittaker, Oldham.*—24*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the tappet motion.

1537. Bicycles, Tricycles, &c., *G. Allix, London.*—24*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates partly to a means of balancing the vehicles.

1538. Electrical Conductors or Cables for Telephonic Purposes, *H. H. Lake, London.*—24*th March*, 1883.—(*A communication from C. de Cazenave, Belgium.*) 6*d.*

The object is to obviate the inconvenience resulting from induced currents in telephonic lines consisting of a number of wires, and the invention consists, First, in the use of an "anti-inductor" composed of a metallic frame arranged around overhead line wires, without touching the same, but in close proximity thereto, to receive the induced current, such frame being connected with the ground to lead the induced currents to earth; Secondly, in an electrical cable, winding for a certain length at irregular intervals around each insulated wire an additional metallic wire which is in communication with the ground.

1539. Pulsometers, *P. Dunlop, Clapham.* — 24*th March*, 1883.—(*Not proceeded with*) 2*d.*

The First part relates to the admission valve and steam passages or nozzles in the neck of pulsometers; the Second part relates to the combining of three, four, or more pump chambers, all controlled by one steam admission valve and ports; the Third part relates to the arrangement of suction and delivery valves.

1540. Ring Spinning Frames, *A. M. Clark, London.*—24*th March*, 1883.—(*A communication from J. J. Bourcart, Zurich.*) 1*s.*

The chief object is the conversion of mules into continuous ring spinners.

1541. Electric Batteries, &c., *H. H. Lake, London.*—26*th March*, 1883.—(*A communication from Messrs. Radiguet et fils, Paris.*) 6*d.*

This relates chiefly to electric batteries, the object being to render them not liable to polarisation by adding to the positive element, or between it and the negative element, metallic or non-metallic points, tongues, wires, or projections for the purpose of facilitating the formation and liberation of gaseous bubbles produced by the decomposition of the water.

1542. Pans or Boilers to be used in Melting Pitch, &c., *J. B. Stewart, Liverpool.*—27*th March*, 1883. 6*d.*

This consists essentially in so constructing pans or boilers that the heat from the furnace acts on the substance being melted mainly at some distance above the bottom of the said pan or boiler, so that any sediment formed shall not rest on the crown of the furnace.

1543. Calendars, *J. C. Sellars, Birkenhead.*—27*th March*, 1883 —(*Provisional protection not allowed.*) 2*d.*

This relates to perpetual calendars.

1547. Machinery used in the Manufacture of Paper Bags, *J. and J. Bibby, J. and W. Baron, and J. Duerden, Lancaster* - 27*th March*, 1883. 6*d*

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

1548. Manufacture of Materials suitable for being used in the Process of Mordanting or Sizing Fabrics, &c., *C. F. Cross and J. B. Bevan, South Kensington.*—27*th March*, 1883. 4*d.*

The liquid obtained when wood is boiled with sulphurous acid and a base is treated first with sulphurous acid and then with gelatine, whereby a precipitate is thrown down which is dissolved in solutions of the sulphites, alkaline salts or alkalies, and the gelatine precipitated by the addition of an acid or certain salts. This soluble compound can be used as a size for paper or for mordanting or sizing fabrics. Albumen may be employed instead of gelatine.

1549. Shears for Clipping and Trimming Horses' Tails, &c., *T. W. White and F. Awdas, London.*—27*th March*, 1883 —(*Not proceeded with.*) 2*d.*

The shears consist of two hook-shaped steel knives jointed together, the handles being bent at an angle behind the joint.

1550 Brewing Apparatus, &c., *W. and F. S. Bucknall, Kidderminster.*—27*th March*, 1883. 6*d.*

This relates to the mash tun, and consists in converting the goods and circulating the wort by the direct action of steam conveyed to the tun by means of pipes.

1552. Aerial Navigation, &c., *B. W. Maughan and S. D. Waddy, London.*—27*th March*, 1883. 10*d.*

This relates to aerial machines and a motor for same, which is also applicable for other purposes, and which is formed with two annular parts, enclosing a channel containing valves and abutments, and arranged to be operated by gunpowder or other explosive. A firing machine is provided for exploding the gunpowder. The aerial machine is provided with propellers, one half of which are arranged to revolve in the opposite direction to the other half.

1553. Metals and Alloys or Mixtures of the same, *J. Lewthwaite, Halif x.*—27*th March*, 1883. 4*d.*

This relates to the employment or addition in the process of melting metals, or afterwards whilst in a molten state, of titaniferous iron or steel sand, such as found on the west coast of the North island of New Zealand.

1554. Liquid Compound for Extinguishing Fires or Preventing Combustion, and Apparatus for the Same, *C. D. Abel, London.*—27*th March*, 1883. (*A communication from B. F. Neven, Paris*) 6*d.*

This relates to the chemical compound used for generating gases to be mixed with water for extinguishing fires, and to a force pump contained within the receptacle.

1555. Extracting Cobalt and Manganese from their Ores, *J. Imray, London.*—27*th March*, 1883. —(*A communication from H. Herrenschmidt, and M. Constable, Sydney, New South Wales.*) 2*d.*

This consists in the use of sulphate of iron or any substance or compound which will form sulphate of iron, for the purpose of extracting the oxides of cobalt and manganese from their ores.

1556. Electrical Accumulators, *H. E. Newton, London.*—27*th March*, 1883.—(*A communication from D. Monnier, Paris.*—(*Not proceeded with.*) 2*d.*

This relates to the production of the plates of accumulators, and it consists in increasing the porosity of such plates by amalgamating two metals, one of which is afterwards eliminated. The two metals best suited for this purpose are lead and zinc, which are mixed in suitable proportions and formed into plates, which are subjected to electrolytic action or to the action of an acid to eliminate the zinc.

1557. Production from Lignite and Analogous Substances of Carbon, Dyes, &c., *J. W. Gatehouse, Bath.*—27*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The lignite is placed in a solution of soluble silicate, and when it is found to contain from 10 to 30 per cent. of silicious matter, it is submitted to distillation at a dull red heat in a retort until gaseous products cease to be evolved. The gases pass to a receiver, and are treated to obtain paraffine in a solid form, together with pigments, dyes, deodorants, disinfectants, sulphate of ammonia, and other products. The residuum of distillation is called carbosilicum, and is granulated or ground, according to the purpose for which it is to be used.

1558. Lock Nuts, *E. and A. E. Gilbert, Dundee.*—27*th March*, 1883. 6*d.*

The Figs. 1 and 2 are respectively a section and an elevation of a modification of the lock nut as used to secure the fish-plates on a railway. The nut A is formed with lugs or projections *a* on each side, which, when the nut is screwed home on the bolt B, come over recesses or notches *c* formed in the fish-

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FIG. 1.

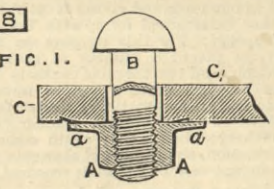


FIG. 2.

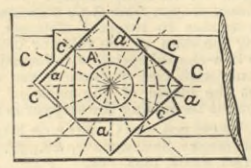


plate C. The recesses or notches *c* are so disposed around the bolt hole that the turning of the nut to a slight extent brings one or other of the lugs *a* opposite one of the recesses or notches *c*. That lug is then knocked into the recesses by a slight blow from a hammer, and the nut is thereby securely locked.

1559. Automatically Opening and Closing or Working the Doors or Shutters of Hoists or Lifts, *J. Stones, Ulverston, and T. Kirby, Barrow-in-Furness.*—27*th March*, 1883. 10*d.*

The object is to automatically raise and lower revolving shutter doors as the cage of the hoist ascends or descends, and according to one arrangement it consists of a rack attached to the top of the cage, and which gears with a toothed wheel, with inner teeth on part of its periphery, which gear with a pinion on the shutter roller. A smaller wheel on the same shaft as the first wheel has also outer teeth on part of its periphery, which are caused to gear with the pinion and reverse its motion.

1560. "Pulsometer" Steam Pumps, &c., *J. E. Hodgkin, London.*—27*th March*, 1883.—(*A communication from M. Neuhaus, Berlin.*) 6*d.*

This relates to improvements in the valves and details of Pulsometers or similar pumps. The water valves are formed of flexible materials, and provided with stiffening bars or plates, so that when the valve bends to the pressure of the liquid it assumes the form of a segment of a hollow cylinder. The valves are supported in guides, and can rise until they come in contact with adjustable stops. The steam distribution valves are connected to an oscillating carrier by ball and socket joints, so that the valves may more perfectly seat themselves. To enable the passages for the injection water into the chambers to be cleaned, removable screw plugs are provided.

1561. Fluid Meters, and Registering Apparatus to be used therewith, &c., *W. R. Lake, London.*—27*th March*, 1883.—(*A communication from J. Thomson, Brooklyn, and C. E. Barton, New York.*) 1*s.* 4*d.*

This consists, First, in a piston meter having a cylindrical shell, within which is arranged a filling and collapsing lining, both operating freely without contact with each other. Also in a spring valve action combined with a positive valve action, arranged so that the motor springs also act as retaining springs, until the reversal of the valve movement is required, while the positive action only operates when the motor springs fail. Also to the construction of the valves and seats. Also to the construction and operation and location of the valves, the construction of the valve chamber, the combination of ports, sluices, and fluid ways, and the adaptation of a compound piston to the cylinder. Also to the combination of a compound cylinder and compound co-acting pistons. Also in registering apparatus.

1563. Ventilation of Railway Tunnels, *Captain E. Walter, near Wokingham.*—27*th March*, 1883. 4*d.*

A ventilating channel is formed along the top of the roof and is connected to an exhaust fan.

1566. Apparatus for Cleaning Knives, &c., *R. Wallwork, Manchester.*—28*th March*, 1883.—(*Not proceeded with*) 2*d.*

Two surfaces of felt, leather, or india-rubber are forced together by springs, cleaning power being supplied to such surfaces, and the knives inserted between them and moved to and fro.

1567. Apparatus for Preventing Down-draught in Chimneys and for Ventilating Railway Carriages, &c., *W. Lord, Middlesbrough.*—28*th March*, 1883. 6*d.*

The upper part of the chimney is surrounded with concentric rings partly overlapping each other, so that there are spaces between the overlapping parts. The chimney top and each ring has a number of external inclined blades. A plate covers the top and is supported above the upper ring.

1568. Saddles or Seats for Bicycles, Tricycles, and other Velocipedes and Back Rests for same, *J. B. Brooks, Birmingham.*—28*th March*, 1883. 6*d.*

The upper part or support of the saddle is formed of a series of links in combination with plate levers and springs connected to the base and covered with leather. The back rest is made adjustable to suit the rider.

1569. Incrusting Metal to represent Sculpture, &c., *A. Baillif, Paris.*—28*th March*, 1883. 2*d.*

The metal article is first cleaned and then coated with a composition consisting of Mendon white dissolved in water, to which glue made from leather cuttings is added, and a little clear size, the whole being diluted with water and then heated to boiling point and poured over the article to be encrusted.

1571. Fire-arms, and Cartridges and Wads for the same, *H. Pieper, Liège.*—28*th March*, 1883. 6*d.*

According to this invention breech-loading fire-arms are not only so made that the ignition of the cartridge is effected by electricity, either by a spark or by incandescence, but also so that—except at the moment of firing—the electric circuit is broken in two or more places.

1572. Fulling Machines for Fulling Woollen Fabrics, &c., *A. Roger, Paris.*—28*th March*, 1883. 6*d.*

The invention has for its object a system of continuous fulling machines, with alternating friction, for the fulling of all woollen fabrics and other stuffs; in this system the fulling is effected by the alternating friction of the stuff, which is, at the same time, pressed on its two faces by plates or tables, movable longitudinally and transversely, and provided with grooves or ridges.

1573. Shuttles, *T. Brooks and T. Tweedale, near Rawtenstall.*—28*th March*, 1883. 6*d.*

The objects are to improve the construction of the peg or tongue or top spring of the shuttle, and to form it so that the cop or spool may easily be placed on it when raised, and held more securely when pressed down into the shuttle than is the case in shuttles of the ordinary construction, and also to prevent lateral motion of the peg when it is shut or closed.

1574. Lavatories, Baths, Water-closets, Sinks, &c., *A. F. Morrison, Manchester.*—28*th March*, 1883. 6*d.*

The object is to construct lavatories, baths, water-closets, and similar articles of porcelain and fireclay or concrete combined, and to simplify the supply and discharge fittings.

1576. Electro-magnetic Printing Telegraphs, *W. P. Thompson, London.*—28*th March*, 1883.—(*A communication from H. van Hoevenbergh, New Jersey, U.S.*) 6*d.*

This relates both to transmitting and receiving devices for electro-magnetic printing telegraph systems, the principal object being to increase the speed of operation. The type wheel is caused to advance by successive steps a distance corresponding to the space occupied by three characters instead of advancing the space occupied by one character only, and a supplementary movement brings the required character into position for printing.

1578. Furnaces for Calcining or Burning Cement, *P. M. Justice, London.*—28*th March*, 1883.—(*A communication from C. Dietzsch, Germany.*) 6*d.*

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

1579. Construction of Underneath-fired Horizontal Boilers, *P. Jensen, London.*—28*th March*, 1883.—(*A communication from W. Tesch, Stockholm.*) —(*Not proceeded with.*) 2*d.*

This relates to the construction of the brickwork.

1584. Apparatus for the Distillation and Purification of Glycerine, *J. F. O'Farrell, Dublin.* —29*th March*, 1883. 6*d.*

This relates to the general construction of the apparatus.

1585. Heating Apparatus for Domestic, Hotel, and other use, *W. P. Thompson, Liverpool.*—29*th March*, 1883.—(*A communication from C. Launoy, Paris.*) 6*d.*

This relates to an apparatus for heating air for warming rooms or buildings, in which the air passes through a chamber wherein it comes in contact with the flame issuing from a series of gas-jets, in which the gas is mixed with air sufficient for its combustion.

1586. Apparatus for Dating and Stamping Railway and other Tickets, *J. B. Edmondson and J. Carson, Manchester.*—29*th March*, 1883. 6*d.*

This relates to a method of dating and stamping railway and other tickets, which is accomplished, First, by constructing hand nippers for the use of ticket collectors and others in which types, figures, letters, or other marks are held in a bracket or otherwise, so that they may be readily removed, exchanged, or replaced.

1587. Apparatus for Coupling and Uncoupling Railway Carriages, *J. T. Leighton, Edinburgh.* —29*th March*, 1883. 8*d.*

This relates to the construction of couplings which obviate the necessity for any person entering between or under railway carriages or trucks.

1588. Ring Spinning Machinery, *E. de Pass, London.* 29*th March*, 1883.—(*A communication from J. Imbs, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates principally to the construction of the traveller.

1589 Blue Colour to be Used as a Substitute for Indigo for Dyeing Cotton, Wool, and Silk, *W. H. Spence, London.*—29*th March*, 1883.—(*A communication from A. F. Chesnais, Rouen.*) 4*d.*

A new conversion of the induline base is effected in order to produce, with the addition of violet methylaniline and blue nitrosodimethylaniline, sulpho-conjugated and other derived violets, as well as methylaniline iodide of ethyl and rosaniline, and even other blues derived from aniline, methyline, rosaniline, an indestructible blue, giving as a result the shade obtained from indigo, and its application in dyeing on the materials above mentioned.

1591. Automatic Self-acting Apparatus for Feeding and Delivering Sheets of Paper to and from Platen Printing Machines, *A. Godfrey, near Stockport.*—29*th March*, 1883. 6*d.*

This relates to the employment, use, and adaptation to that class of printing machine known as the platen, of grippers or a series of grippers which will act singly or in continuous succession, and take hold of and feed separate sheets of paper direct from the feeding board or boards of such machines on to the platen surface for receiving the type impressions, and from thence to the receiving board, whereon such sheets as released by the said grippers are deposited.

1592. Stoves, *L. C. Besant, Greenock.*—29*th March*, 1883. 8*d.*

A special feature is the arrangement of the parts to cause the fire to burn downwards through the fire-grate.

1593. Steam Traps, *J. Gillies, Glasgow.*—29*th March*, 1883. 6*d.*

This relates to improvements in the arrangement or combination of parts of steam traps for drawing-off condensed steam or water from steam pipes or vessels, and comprises also improvements in the construction of valvular details, whereby the action of the trap or syphon is rendered extremely sensitive.

1594. Oil Lamps, *A. Chamberlain and G. Hookham, Birmingham.*—29*th March*, 1883. 6*d.*

This relates to the employment of a fan or blowing apparatus.

1596. Ice-making or Refrigerating Machines or Apparatus, *J. H. Johnson, London.*—29*th March*, 1883.—(*A communication from T. Rose, New York.*)—(*Not proceeded with.*) 4*d.*

This relates to several improvements in the general construction of the machine.

1597. Wire Fencing, &c., *W. J. Smith, Inverness.*—29*th March*, 1883. 6*d.*

This refers to the means whereby wire ropes or chains are strained and held in position.

1598. Reservoir or Fountain Pens, *B. S. Cohen, London.*—29*th March*, 1883.—(*A communication from G. A. Ogle, Baltimore.*)—(*Not proceeded with.*) 2*d.*

This relates to various improvements in fountain pens.

1600. Fastenings for Gloves, &c., *F. J. Martin, London.*—29*th March*, 1883. 6*d.*

This relates to a spring hook fastening.

1602. Utilising Slags obtained in Dephosporisation of Iron, *C. Pieper, Berlin.*—30*th March*, 1883. —(*A communication from C. Scheibler, Berlin.*) 4*d.*

This relates to the chemical treatment of the slags.

1603. Cutters employed in Boring Machines, *J. Wade, Halifax.*—30*th March*, 1883. 6*d.*

The object is the construction of an adjustable cutter, composed of two parts, for the purpose of boring holes of different diameters with great accuracy and truth.

1604. Apparatus for Heating and Cooling Fluids, *W. A. G. Schönheyder, London.*—30*th March*, 1883. 6*d.*

This relates to the general construction of the apparatus.

1606. Spring Scales, *C. Pieper, Berlin.*—30*th March*, 1883.—(*A communication from E. Ubrig Moabit, Berlin.*) 6*d.*

This relates to providing the balance with two or more springs, which are so arranged that they will come successively into action.

1610. Preventing the Entrance of Wind, Rain, or Dust under Doors, Windows, &c., *D. B. Gibson, Manchester.*—30*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a weather board.

1609. Fire and other Alarms, *J. Thomas, Aberdare.* —30*th March*, 1883. 6*d.*

This relates to the employment of a stretched cord, which, when severed by fire or otherwise, ceases to

restrain the alarm apparatus, and permits a signal to be given.

1614. Apparatus for Effecting Interchange of Temperature between Liquids and Gases, &c., *J. H. Johnson, London.*—30*th March*, 1883.—(*A communication from J. A. Saladin, Paris.*) 8*d.*

The principle upon which the invention is based is the forcing of air or gases through a series of sieves or filters rotating in the liquid which is to be heated, cooled, or evaporated, or which is used for lowering or elevating the temperature of or condensing the said air or gases.

1618. Electro-magnets, *A. M. Clark, London.*—30*th March*, 1883.—(*A communication from L. C. A. J. G. d'Arlincourt, Paris*) 6*d.*

This relates to improvements on the magnets described in patent No. 255, A.D. 1882, in which the action is based on the natural inversion (produced by the breaking of a current) in the part of the magnet situated in rear of the bobbins, that is to say at the breech end, and an armature polarised by one of the poles of a permanent magnet is placed between the secondary poles existing beneath the bobbins of the electro-magnet, and is attracted by one of them during the passage of the line current, and repelled towards the other pole when the current is broken. It consists in providing a second armature placed at the free extremity of the bobbins on the same axis as the other armature placed at the rear or breech end, the second pallet being magnetised by the other pole of the permanent magnet, the object being to oppose the perturbative effect due to natural currents traversing the electro-magnet.

1619. Puddling Furnaces, *J. Imray, London.*—31*st March*, 1883.—(*A communication P. J. Dujardin and J. B. F. Fredureau, Paris.*) 6*d.*

The principal object is to protect the bed of the furnace and its lining by circulation of water.

1621. Machinery for Feeding Thrashing Mills or Machines Automatically and Cutting the Bands of the Sheaves Supplied thereto, *E. G. Rock, London.*—31*st March*, 1883.—(*A communication from H. Roxburgh and J. Crawford, New Zealand.*)—(*Not proceeded with.*) 2*d.*

This relates to an apparatus which is placed upon any ordinary thrashing mill or machine, by which sheaves of corn or other produce which is to be thrashed are, after being placed on a hopper, passed along into the thrasher, the bands around the sheaves being cut while so passing.

1623. Electric Arc Lamps, *F. M. Newton, Belfast.*—31*st March*, 1883. 6*d.*

The object is to automatically feed the carbons to maintain the electric arc. An iron tube of considerably larger diameter than the carbon is surrounded by an insulated coil so as to form a magnet, and at one end of the tube a short piece of tube is held at a short distance by a spring. The outer end of the tube is supported by a metal sheath which completes the circuit through the coil forming a shunt of high resistance to the arc, or a shunt circuit which is only completed when the arc exceeds its normal length. When the circuit is complete the shunt current starts from the positive terminal of the lamp, passes round the coil, thence through a spring to the short tube, and from it through the sheath to the negative terminal. This current causes the short tube to oscillate rapidly between the first tube and the sheath. The two tubes have each a number of metallic arms, fingers, or feelers converging towards the axial line and inclined slightly in the direction in which the carbon is to travel, so that the latter is embraced and its weight supported by the friction of the fingers.

1625. Apparatus to be Applied to Steam Ships or other Vessels to Nullify or Minimise the Effects of Collisions, *N. N. Smith and R. R. Swann, London.*—31*st March*, 1883. 6*d.*

This relates to the general construction of the apparatus in which a fan is employed.

1628. Manufacture of Crucibles and other Vessels Suitable for Chemical and Metallurgical Purposes, *J. C. Waterhouse, Wakefield.*—31*st March*, 1883. 2*d.*

The materials consist of powdered aluminous fireclay 3 parts by weight, pulverised plumbago free from lime 2½ parts, purified asbestos 2 parts, magnesia ¼ part, quartz ¼ part, and as much liquid silicate of soda as will make the ingredients plastic enough to work and mould into the desired shapes.

1631. Traction Engines, *W. Wilkinson, Wigan.*—31*st March*, 1883. 6*d.*

This relates to improvements in boiler and blast pipe arrangements, governors, and geared driving connections.

1640. Apparatus for Controlling Petroleum Gas or other Lamps by Electricity, *G. W. von Navrocki, Berlin.*—31*st March*, 1883.—(*A communication from P. Richter, Germany.*)—(*Not proceeded with.*) 2*d.*

This relates to apparatus which by the simple compression of an india-rubber ball filled with air, or by pulling a string or wire, enables lamps fitted to the wall or ceiling to be ignited by an electric current. The compression of the ball causes the metal electrode of a battery to be immersed, and at the same time allows hydrogen gas to escaps from a jet near the burner of the lamp, so that the current generated will ignite the hydrogen, and the flame produced will then light the lamp.

1659. Lead and Crayon Holders, *J. H. Johnson, London.*—3*rd April*, 1883.—(*A communication from J. Reckendorfer, New York.*) 6*d.*

This relates to a lead and crayon holder, consisting of the combination of a stem terminating at the front in a screw thread, and provided with an axial hole combined with metallic spring jaws inserted and held in the said hole and the screw tip.

1662. Folding Chair, *E. Smith, West Dulwich.*—3*rd April*, 1883.—(*Complete.*) 4*d.*

This relates to the arrangement of the side bars.

1671. Attaching Handles to Cutlery, &c., *G. T. Tuke, Sheffield.*—3*rd April*, 1883. 6*d.*

This relates to securing the handles to cutlery by means of ferrules and solder.

1677. Gas Motor Engines, *C. D. Abel, London.*—3*rd April*, 1883.—(*A communication from N. A. Otto, Deutz-on-the-Rhine.*) 6*d.*

This consists in causing the power produced by the combustion of a gaseous charge to be partially expended in compressing air during the outstroke of the piston, which air is allowed to expand again on the return stroke of the piston, thus giving out the power previously stored up.

1697. Manufacture of Alcohol and Alcoholic Solutions of Colouring Matters, &c., *G. H. Loder, Holland.*—4*th April*, 1883. 4*d.*

This consists in the use of catechines like moritannic acid quercetine, that of resorcine trinitro resorcine, extract of orchella paste, mononitro phenols, monoamidophenols, trinitro phenolaniline, nitric acid, arotates, iron salts, sulfocyanates, methylamines ricinoleic acid, phosphate of calcium in a glucose solution, to obtain from them by the act of fermentation colouring matters, vanilline, benzoyl, aldehydine, salicylaldehydine, and to oxygenate the fusil oils during the fermentation.

1729. Construction and Fixation of Apparatus Remedying Physical Defects of the Mouth and Palate, *R. H. Brandon, Paris.*—6*th April*, 1883.—(*A communication from B. J. Bing, Paris*) 6*d.*

This relates to the means of attaching and holding artificial palates and artificial teeth.

1736. Dynamo-electric Machines of Pacinnoti's Sort, *M. Deprez, Paris.*—6*th April*, 1883. 6*d.*

This consists in making the iron of Pacinotti rings in two parts, and in forming the coils or sections of wire separately by means of moulds, and after these sections have been placed on the ring, the two parts of the latter are connected together. The gaps at the points of junction are covered either by applying coils or sections thereto in the ordinary way, or by opening out a little the coils or sections already on the ring.

1731. Apparatus for Rapidly Heating a Small Quantity of Water for Shaving, &c., *W. H. Williams, Birmingham.*—6*th April*, 1883. 6*d.*

This consists of a small lamp supporting a movable vessel to hold the water, the cover of the vessel carrying a shaving brush.

1737. Apparatus for Transforming Electric Currents, *M. Deprez, Paris.*—6*th April*, 1883. 6*d.*

This consists in combining with accumulators a continuous transforming apparatus receiving the current in one form, and giving it off at the same time in another determined form, with the least possible loss of energy. For this purpose on the generator current are placed a number of elements of some accumulator, and two movable contacts are caused to embrace between them a certain number of these elements, and are automatically shifted from one group to another as they become discharged, the latter beidg recharged before they again come into action. By a regulation, the numberof elements comprised in group current can be varied as required.

1770. Bottle Stopper and Apparatus for Use of same, *W. R. Lake, London.*—7*th April*, 1883.—(*A communication from C. G. Hutchinson, Chicago.*) 6*d.*

This relates to internal stoppers, and consists in forming the stem of the valve or disc of the stopper with a bow-shaped spring wire forming laterally yielding arms with free or loose lower ends, which bear against the inside of the neck of the bottle. An instrument for raising the stopper is also described.

1908. Seats for the Outside of Rail or Tram-cars, Omnibuses, Steamboats, &c., *W. Walker, London.*—14*th April*, 1883. 6*d.*

This relates to the attachment of the seat or cushion to the car or other fixture in combination with a movable cover, which in its normal position covers the seat.

2102. Extraction of Oils by Diffusion and Preparation of Materials and Arrangement of Apparatus for that Purpose, *J. Imray, London.*—25*th April*, 1883.—(*A communication from J. A. Bang and C. A. Sanguinetti, Paris.*) 6*d.*

A light and volatile hydrocarbon obtained by fractional distillation of petroleum is purified by agitating it repeatedly with sulphuric acid until colour disappears, and then has mingled with it a small percentage of fuming or anhydrous sulphuric acid; this liquid decanted is employed for extraction of oils by acting on the materials in a series of vessels suitably connected, and through which it is caused to pass successively.

2298. Inkstands, *H. H. Lake, London.*—5*th May*, 1883.—(*A communication from J. A. Wiedersheim, Philadelphia, U.S.*)—(*Complete*) 6*d.*

This consists partly in adapting an inkstand cover to be opened by the weight or pressure of the hand of the writer, and providing it with means for holding it permanently open. It also consists of a binder which straddles side pieces of the device and interlocks with the base, thus firmly holding the separable parts in position.

2780. Automatic Momentum Railway Car or Carriage Brakes, *H. J. Allison, London.*—5*th June*, 1883.—(*A communication from the American and Foreign Automatic Car Brake Co., Limited, New York.*)—(*Complete.*) 6*d.*

The invention consists of a car brake adapted to operate automatically whenever the motion of the train is resisted by the inward movements or compression of the drawbar, with either end of the car forward.

3001. Dynamo-electric Machines, &c., *S. Pitt, Sutton, Surrey.*—16*th June*, 1883.—(*A communication from N. H. Edgerton, Philadelphia, Penn., U.S.*) 8*d.*

The armature has a number of separate bobbins arranged in opposite pairs and wound with connected coils, the terminals of which are connected to roller contacts attached to, and revolving with the armature, over a fixed commutator. The field magnets are attached in sets to the outer sides of two oppositely-placed semi-cylindrical shells.

3007. Insulators for Electric Wires, &c., *L. B. Gray, Boston, Mass., U.S.*—16*th June*, 1883. 6*d.*

The insulator is made of glass or other suitable material, and is formed with an internal cavity to permit the head end portions of the spring support to pass through a contracted portion of the internal cavity, and then spring apart. A portion of the cavity and support are rectangularly formed to prevent the insulator turning.

3035. Gear Cutting Machines, *H. J. Allison, London.*—19*th June*, 1883.—(*A communication from U. and H. Eberhardt, New Jersey, U.S.*)—(*Complete*) 6*d.*

This relates to an automatic feeding device for propelling a revolving cutter through the rim of a metallic blank for cutting teeth thereon, an automatic shifting device for turning the blank around a specific amount before cutting each tooth, and a locking mechanism for the latter operated by the former, after each tooth has been cut and the cutter retracted.

3096. Preparation of Food for Infants and Invalids, *H. J. Haddan, Kensington.*—21*st June*, 1883.—(*A communication from W. Horlick, Washington.*)—(*Complete.*) 4*d.*

The objects are, First, to provide a non-farinaceous highly nutritive food easy of assimilation for infants and invalids by combining the nutritive parts of the cereals with milk; Secondly, to render such food free from all souring tendency irrespective of the climate or state of the atmosphere to which it may be subjected, and yet of such a nature as to be readily soluble in water and so ready for immediate use.

3111. Separating Ortho-toluidine from Para-toluidine, Ortho-toluidine from Aniline and Para-toluidine by means of Phosphates and Arsenates, *Dr. J. Weiler, near Cologne.*—22*nd June*, 1883.—(*Complete.*) 2*d.*

This consists in the process of separating para-toluidine from ortho-toluidine and also aniline and para-toluidine from ortho-toluidine by treating the bases with phosphates or arsenates.

3141. Elevator Stops, &c., *F. P. Carfield, Boston.*—25*th June*, 1883.—(*Complete.*) 6*d.*

This relates to an elevator safety stop consisting of a vertical rack-bar and a pinion loosely mounted within a guide box provided with notches within its top portion adapted to engage with the teeth of the said pinion.

3160. Manufacture and Application of Compounds for Lining Furnaces, &c., *J. Imray, London.*—26*th June*, 1883.—(*A communication from G. Duryee, New York.*)—(*Complete.*) 4*d.*

This relates to the manufacture and application of compounds to form, First, refractory linings for surfaces exposed to heat, such as those of furnaces, kilns, stoves, and the like; Secondly, material for making filters and lining for cellars or apartments when surfaces have become musty, mouldy, or otherwise foul, fœtid, or impure, the like compound being applicable for tiles, pavements, and the like; Thirdly, non-conducting lining for refrigerators and other constructions where a non-conductor of heat is desired.

3191. Brick-making Machines, *P. Effertz, London.*—27*th June*, 1883. 8*d.*

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

3299. Method and Apparatus for Preserving Ensilage or Food for Cattle, *W. R. Lake, London.*—3*rd July*, 1883.—(*A communication from S. M. Colcord, Dover, U.S.*)—(*Complete.*) 6*d.*

This relates to means for removing the air for a silo.

3401. Lock Nuts and Screw Bolts, *A. M. Clark, London.*—10*th July*, 1883.—(*A communication from B. T. Crocker and W. H. Hill, Topeka, and A. Monroe, Lawrence, U.S.*)—(*Complete.*) 6*d.*

This consists in the combination of a bolt having intersecting right and left-hand threads with the nuts having corresponding threads, one nut being provided with projections and the other with corresponding depressions on their meeting faces.

3412. Manufacture of Reeds and Reed Plates for Musical Instruments, *W. R. Lake, London.*—10*th July*, 1883.—(*A communication from M. Bray, Newton, U.S.*)—(*Complete.*) 6*d.*

The object is to reduce the cost of the reeds and reed plates, by using thinner metal, without necessitating any change in the construction of the reed boards.

3473. Apparatus for Dyeing the Seams of Gloves, applicable to Glove Sewing Machines, *A. M. Clark, London.*—13*th July*, 1883.—(*A communication from E. F. Peyre, Paris.*)—(*Complete.*) 6*d.*

The apparatus is applicable to all kinds of glove-sewing machines, and it consists principally of a stationary die-holder and a movable part carrying a brush to take up a proper quantity of dye and apply it to the cut edges at the seams of the gloves whilst the sewing mechanism is in operation. A special dye is described, consisting of extract of logwood, extract of sumach, sulphate of iron, oxide of zinc, and alum, made in the form of a cake.

3494. Bearings for Axle and other Journals, *H. H. Lake, London.*—16*th July*, 1883.—(*A communication from G. W. Stewart, Atalanta, U.S.*)—(*Complete.*) 6*d.*

The object is to produce inexpensive, almost frictionless, and very durable bearings, with means for holding them in working position, and strengthening them. The bearing is made of compressed, condensed, or solidified wood or fibrous material, and supported, strengthened, and held in working position by a metal shoe or box. To render the bearing self-lubricating, it is boiled in linseed oil.

3499. Steam Engines, *H. J. Allison, London.*—17*th July*, 1883.—(*A communication from E. F. Spaulding, J. H. Hallock, and E. S. Smith, Erie, U.S.*)—(*Complete.*) 8*d.*

This relates to automatic variable cut-off engines, and it consists chiefly in combining with the cut-off valve gear, in which the regulator is not on the driving shaft, with a dynamometrical regulator, which is on the driving shaft, and is operated from the resistance of the load upon the driving wheel, which is mounted loosely on the driving shaft. Fixed on the latter is a cross arm, which is flexibly connected to the driving wheel by rods and springs. As the load increases the springs are compressed, and the wheel and arm move apart, this movement being communicated to a sliding collar on the shaft by bell crank levers pivotted on the arm. From the sliding collar the action of the dynamometrical governor is conveyed by gearing to the cut-off valve gear. The invention further relates to improvements in the construction generally of the engine, and particularly of the steam valve.

3501. Machines for Making Cigarettes, *A. M. Clark, London.*—17*th July*, 1883.—(*A communication from H. E. Casgrain, Quebec.*)—(*Complete.*) 6*d.*

This consists in a cigarette machine formed of a band attached to two cylinders, journalled in frames hinged to each other, so that they can be parted, one cylinder being provided with a handle for turning it, and the other with an internal tension spring, whereby if the tobacco and paper are placed on the band, which is stretched swinging the frames apart, and the crank handle turned, the paper will be rolled around the tobacco, and the cigarette formed. When the handle is released, the spring winds the band on the spring cylinder, and the cigarette is thrown out.

3504. Fog Signals, *H. A. Bonneville, Paris.*—17*th July*, 1883.—(*A communication from F. Brown, New York.*)—(*Complete*) 6*d.*

This relates to fog signals known as sirens, and consists in causing compressed air or steam to issue through a series of oblique openings in the casing, and another series formed in an opposite direction in the siren cylinder, whereby rapidly succeeding sounds are produced as the siren revolves. The amount of air or steam can be regulated as desired by opening or closing suitable ports. Brakes automatically limit the speed of rotation of the siren.

3506. Sewing Machines, *J. W. Post, New York.*—17*th July*, 1883.—(*Complete.*) 6*d.*

The object is to produce a machine free from irregular motions, and which is capable of forming a lock-stitch or chain-stitch, the number of parts being greatly diminished, and which is easily operated and is substantially noiseless. The rotary devices which co-operate with the needle to form the stitches are interchangeable, so as to form different kinds of stitches.

3509. Embroidering Machines, *R. H. Brandon, Paris.*—17*th July*, 1883.—(*A communication from J. Becker, Boston, U.S.*)—(*Complete.*) 6*d.*

The object is to produce mechanism for attachment to embroidering or sewing machines having a universal feeding device to feed the fabric in any desired direction, whereby the feeding device may be automatically moved to feed the material in a circle of greater or less radius, or to so move the fabric as to enable the needle to produce with its thread lines of stitches varying more or less from a true circle or from a straight line. A pattern plate is used to move the actuating gear, which acts to rotate the universal feeding device in a more or less irregular line, according to the pattern plate employed.

3518. Bending or Shaping Blanks for Chain Links and the like, &c., *F. C. Glaser, Berlin.*—17*th July*, 1883.—(*A communication from W. Hegenscheidt, Germany.*)—(*Complete.*) 6*d.*

The blanks are first bent by the combined action of stamping dies, a mandril, and pushers into a U form, after which the ends are bent over and the blanks linked together before the joints are welded up. Suitable apparatus is described for bending or shaping the blanks.

3598. Corsets, *H. H. Lake, London*—21*st July*, 1883.—(*A communication from C. N. Chadwick, Brooklyn, U.S.*)—(*Complete.*) 6*d.*

This relates more particularly to the hip sections of the corset, and to such corsets as are provided with a certain amount of elasticity in the hip section.

3655. Looms for Weaving, *R. H. Brandon, Paris.*—25*th July*, 1883.—(*A communication from G. Crompton, Worcester, Mass, U.S.*)—(*Complete.*) 1*s.*

This relates to several improvements in the general construction of the machine.

3690. Alcohols, *H. A. Bonneville, Paris.*—28*th July*, 1883.—(*A communication from A. Ralu, jun., France.*)—(*Complete.*) 2*d.*

This relates to reducing alcohols in order to facilitate their removal or shipment, and at the same time to transforming them instantaneously into brandy equal in quality to Cognac by the addition of an equal quantity of water. In operating by distillation, 1 kilog. of juniper berries, 10 kilogs. of prunes, and 1 kilog. of orange blossom are added to every 100 kilogs. of grape pulp to be distilled. This is left to macerate for twenty-four hours, it is then distilled, and afterwards about half a litre of pure glycerine is poured into the alcohol obtained.

3728. Burners &c;, *J. S. Muir, Highgate.*—31*st July*, 1883.—(*Complete.*) 6*d.*

The object is to produce a better flame by causing a more perfect combustion of the gas and by fitting a special appliance to the burner. The gas is caused to pass through perforated discs heated by the burner, and the air, to support combustion, is caused to pass through perforations in a disc closing the bottom opening of the globe.

3747. Nut-lock, *W. R. Lake, London.*—31*st July*, 1883.—(*A communication from W. J. McTighe, Pittsburgh, U.S.*)—(*Complete.*) 4*d.*

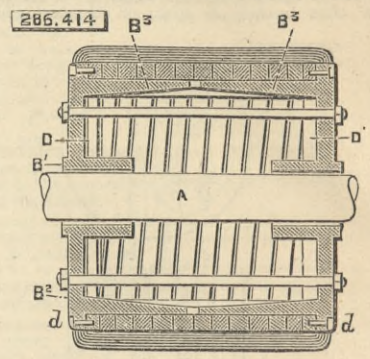
A plate is formed with a central hole, the edge of which is of spiral or helical shape, with a notch where the edge begins and ends, so that the plate can be screwed on to a bolt like a nut, and by screwing tight against the ordinary nut, will act as a jamb-nut.

SELECTED AMERICAN PATENTS.

(From the United States' Patent Office Official Gazette.)

286,414. Dynamo-electric Machine, *Geo. W. Fuller, Norwich, Conn.*—*Filed August 16th*, 1883.

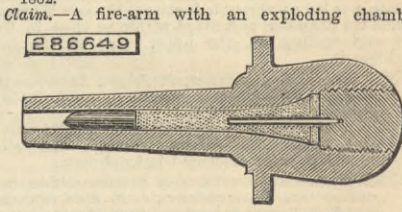
Claim.—(1) In a dynamo-electric machine, a hollow cylindrical armature the core of which is composed of one or more spirals, in combination with induction coils, the convolutions of each of which traverse longitudinally the interior and exterior surfaces of the cylinders composed of the said spiral or spirals, and means for supporting the said cylinder and induction coils upon the armature shaft. (2) A hollow cylindrical armature-core composed of iron spirals of like dia-



meter and pitch, suitably supported upon a rotating shaft, but insulated therefrom, and having their convolutions respectively insulated from each other, for the purpose of preventing the presence in the core of a continuous metallic circuit, in which currents of electricity can be established by induction when the said core is provided with induction coils and employed as an armature in a dynamo-electric machine. (3) A hollow cylindrical armature-core composed of one or more spirals, in combination with the star-shaped heads B^1, affixed to the armature shaft A, and provided with the laterally-projecting fingers B^3, for the purpose of centralising the said core relatively to the armature shaft. (4) A hollow cylindrical armature-core composed of one or more spirals, substantially as set forth, and the rings D and D^1, each composed of the segments *d*, secured to the radial arms B^2 of the heads B^1, and means for longitudinally clamping the heads and core together, substantially as and for the purpose set forth.

286,649. Breech-loading Ordnance, *Julius H. Stewart, San Francisco, Cal.*—*Filed December 14th*, 1882.

Claim.—A fire-arm with an exploding chamber



having curved sides, in combination with the tube D, substantially as and for the purpose set forth.

CONTENTS.

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