THE INSTITUTION OF NAVAL ARCHITECTS.

On Friday at noon, the Earl of Ravensworth in the chair, proceedings were resumed, the first paper read being by Mr. Jenkins, on "Some Points of Interest in Connection with the Construction of Metacentric Diagrams and the Initial Stability of Vessels;" and the second by Mr. Ludwig Benjamin, entitled "Contributions to the Solution of the Problems of Stability." In the afternoon the first paper read was by Mr. J. C. Spence, "On the Graphic Calculation of the Data Depending on the Forms of Ships Required for Determining their Stability." This was followed by a paper "On the Uses of J. Amsler-Laffon's Integrator in Naval Architecture," by Dr. Amsler. Thus it will be seen that there was a complete glut of stability papers. We make no attempt to reproduce them, either in whole or in part. They will not bear abstracting, and they were illustrated by copious diagrams, which cannot be reduced. The discussion which followed possessed little practical value of any kind, and no value whatever apart from the papers which elicited them. The general impression produced was that the way in which the stability of a ship is to be calculated is more a matter of taste than anything else; and we cannot help agreeing with Mr. McFarlane Gray, who, in the discussion which followed one extremely long and complex paper, said that the whole gist of it could be put into a paper half a page long. The great elaboration introduced is for the most part quite useless, because it deals with conditions which never obtain. Thus the stability of a ship is calculated to the foot-ton, and the height of the metacentre to a tenth of an inch, from drawings to which the ship's hull only approximately conforms. The righting moment again is calculated for still water, and takes no account of the effects of waves. If we bear this in mind it will be seen that readier and more convenient methods than those now in use are urgently required, although they would sacrifice accuracy to some extent. To illustrate this we may say that even with the aid of Amsler's integrator as much as six days are required to make complete calculations for a ship; and the graphic method of Mr. Spence only reduces this time by less than one-half. The origin of this sudden rush of stability papers is to be attributed to the capsizing of the Daphne and Austral. It is to be regretted that their number proved wearisome to the audience, and deprived the meeting of much of its interest and value. The only paper bearing on the subject which we need concern ourselves much about was by Mr. Alexander Taylor,

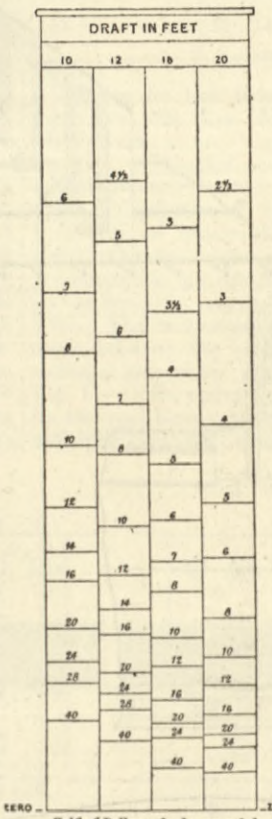
On a Stability Indicator for Showing the Initial Stability and Stowage of Ships at any Displacement.

The usual way to determine a vessel's stability is to find by calculation the position of the metacentre for the upright position, and, by shifting weights, experimentally incline the vessel to find the position of the centre of gravity. The metacentre and the centre of gravity having thus been found, the vessel's stability at various angles of heel is next determined, and a stability curve made for that particular displacement and disposition of weights; but if the vessel is a merchant vessel, and the above information has been got for the light condition, it will give no indication of the vessel's stability when loaded; and even if the stability curve has been determined for the load displacement, it may be no true indication of the vessel's stability with a different cargo on the same displacement, or even with a similar cargo differently stowed; and unless the listing experiment is repeated for each voyage, nothing positively reliable is known of the vessel's stability, and the ordinary method of inclining is costly, and demands more time than can be expected to be given up each voyage for such a purpose. The author wished particularly to have it understood that this "Stability Indicator" does exactly the same work as is done in an ordinary inclining experiment, but in a much simpler manner, if it is permanently fixed on board, and the experiment can be repeated for various displacements and disposition of cargo; and either in harbour or at sea, under reasonable weather, the whole experiment need not occupy half an hour. At each side of the ship is fixed a suitable tank of known capacity and distance apart; also, but independent of the tanks, the glass gauge A is fixed at one side of the ship, and connected by top and bottom pipes to the small reservoir B at the other side of the ship; if glycerine or other suitable liquid be run into B until it half fills B and A with their lower connecting pipe, we have an instrument which will show the slightest list a vessel may take. It would be noticed that instead of the usual plumb line we have a liquid surface to record the list, and instead of the usual ballast to move from side to side, we have fixed tanks of suitable and known capacity and distance apart, which can be filled by the deck hose at pleasure.

Now to make the instrument capable of giving the metacentric height for any displacement, as well as any disposition of cargo, we must use a set of tables—see Fig. 3—or some such contrivance as the roller scale C, shown at one side of the glass gauge A. This roller scale carries on its centre a zero pointer, which pointer moves up and down with the roller scale; this movement is to allow for the ship having a slight permanent or initial list at the commencement of the experiment; say that the vessel has a list of 3in. or 4in. either to port or starboard, the vertical movement permits of the roller scale and pointer being moved up or down until the position is on a level with the liquid. This roller scale has also a revolving motion, which is given for convenience of observation. It will be noticed that round the top part of this scale is engraved "draught in feet," and that the roller scale is divided for its entire length into four vertical parts, which are headed by four different draughts corresponding to four known displacements. We will, for clearness, call those displacements 1500, 1900, 3120, and 3550 tons, corresponding to the light, ballast, and load draughts. These are all draughts at which it is important to know the vessel's stability, and instead of troubling ships' officers with displacement calculations, each of the divisions on the scale is headed under draught in feet simply by 10, 12, 18, and 20, as the case requires. Now each of these vertical divisions is again divided alike above and below the zero pointer, and engraved to show various metacentric heights, corresponding to the varying angles of heel caused by filling one of the tanks. And as the distance between the small reservoir and glass gauge is known, together with their varying areas, and the ship's displacement is also known for all draughts, the calculations for various metacentric heights are easily made beforehand, and are engraved in position upon the roller scale. Fig. 1 is the upper half of the above roller scale expanded.

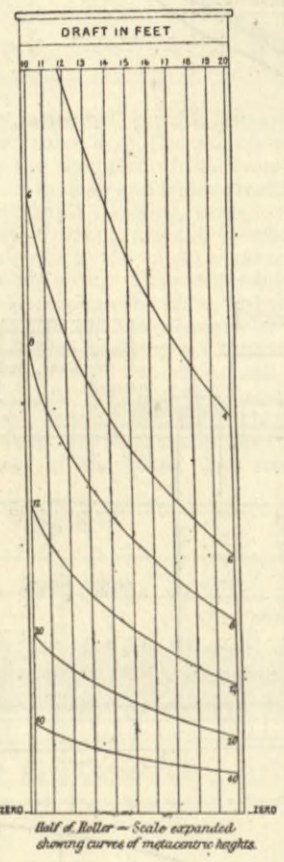
It may be thought advisable to mark the roller scale as on Fig. 2, which shows curves of various metacentric heights, which would allow the metacentric height for any draught to be read off directly. The author was told by those who have used this instrument at sea, that in a comparatively smooth sea, and on a course when the helm is

FIG. 1.



Half of Roller – Scale expanded.

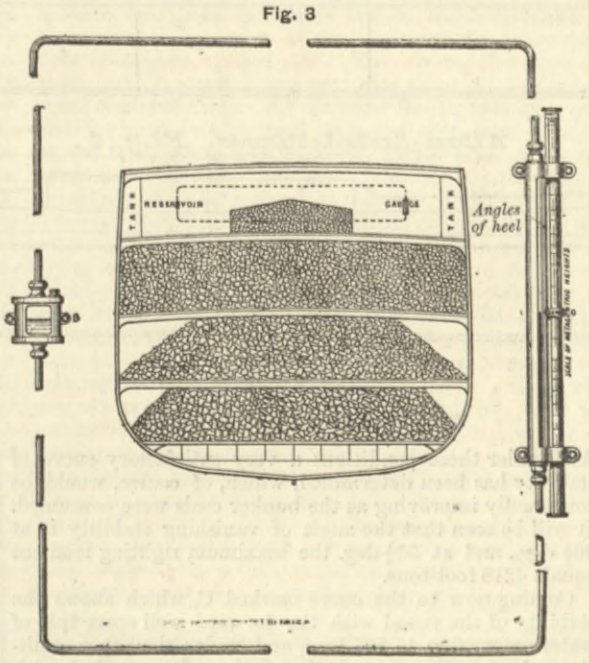
FIG 2



Half of Roller – Scale expanded showing curves of metacentric heights.

not altered, the metacentric height can be most satisfactorily tested, because the glycerine being a sluggish liquid, its mean level can be correctly noted, and as the roller scale is movable vertically, if the vessel has a small permanent list the zero pointer can be placed opposite the liquid, and then if a tank is filled they soon find that the liquid has taken to rise and fall about another point, which point will of course show the metacentric height. One steamer having this instrument fitted for the first voyage left Cardiff with 11in. metacentric height; next voyage, with a similar cargo, by paying a little more attention to the stowage, the metacentric height was increased to 14in. In each case, after eight days out, and using coals prin-

Fig. 3



cipally from the top bunkers, the metacentric height was found to be increased about 2in. Captain Stacey, in a letter, said:—"With light cargoes, by trying it before leaving port, I know exactly how the ship is going to behave in a gale of wind. If the indicator stands at less than 10in. I run up one of the ballast tanks; but if at 10in. or more, then I am perfectly satisfied that the ship is fit to face anything, as far as her stability is concerned. When in ballast this vessel's metacentric height is about 30in." Another and smaller steamer on which this instrument was fitted showed metacentric heights ranging from 20in. to 45in.

In conclusion, he would like to say that the more that stability curves and curves of metacentres are worked out for ships, the more valuable this instrument becomes, because if a stability curve has been got for a certain displacement and metacentric height, if the instrument shows a different metacentric height, a new curve of stability and vanishing point can be laid off in a few minutes.

The next paper read was by Mr. Thomas Phillips,

On the Comparative Safety of Well-decked Ships.

The author began by a defence of well-decked steamers, illustrations of which will be found on page 288, and went on to say that on the occasion of the recent visit to West Hartlepool of the Load Line Committee the following facts were adduced, viz.:—Mr. Matthew Gray said that during the last ten years his firm had built 103 well-decked steamers. Of that number eleven had been lost. The average number afloat per year was fifty, so that the total loss represented about 2 per cent. per annum. The percentage of losses of other steamers was from 4 to 4½ per cent. The cause of the loss in all the eleven cases was known. Collisions and strandings accounted for the whole, and not one of them was due to the construction of the ships. Mr. R. M. Middleton, jun., said that the total number of voyages to and from America made by well-decked ships from the port during the year was 768. These voyages had been distributed fairly over the year, and the cargoes had included pig iron, iron ore, and cattle. One ship had brought cattle in her well, and had passed through a gale without losing a single animal. There was no record of any Hartlepool steamer foundering, missing, or capsizing on the Atlantic passage. Mr. G. H. Hogg, secretary of the East Coast Marine Association, stated that during the last ten years his association had had 72 cases of steamers foundering, exclusive of collisions. Of these 56 were other than well-decked ships, and 16 were well-decked. The experience of the association was that one well-decked was lost to about four and three-quarter flush ships. His association had formed the opinion that, from an assurance point of view, the well-decked ship was the most profitable, and shipowners in the port had arrived at the conclusion that it would be wise to form an insurance club for well-decked steamers. Such a club was formed a year ago, with a capital of £300,000, at £2000 a bottom, and representing 220 steamers. They started their second year with a capital of £1,115,000, distributed over 400 steamers. During the year they had had five losses; one ship was lost in a river, two got ashore in the Baltic, one broke on Bilbao bar, one was lost on the coast of Spain, and one was lost in collision. They found that the cost of their club for the year was £3 19s. per cent., while most other clubs were nearly £11 per cent. Statements of this character, proceeding from such reliable sources, cannot fail but to increase public confidence in these vessels, and simplifies also the task I have undertaken. It will be naturally asked why this type of steamer is so popular, and a pretty positive reply can be given, viz., that a vessel so constructed is capable of carrying a maximum dead-weight of cargo with a minimum weight of hull; they offer superior advantages in the shipping of grain cargoes, and reduce the liability of cargo shifting; because there being no 'tween decks laid, there cannot be large spaces unfilled with grain; and, furthermore, the engine-room being enclosed in the modern description of raised quarter-deck vessel, by a substantially constructed bridge-house, the deck of which being about 9ft. out of water, reduces the possibility of damage to the engine-room skylights to the lowest limit, and which fittings are in many cases entirely constructed of iron, as a matter of extra precaution, and are as shown on Fig. 1. As the result of experience, the bulkhead forming the front of the bridge-house is made exceptionally strong, to effectively withstand the severe strains that it has constantly to bear from water in the well space. In the modern type of steamer these bulkheads are in many cases curved, as shown on Fig. 2; and in the generality of cases are formed of plates $\frac{6}{16}$in. thick, stiffened by strong vertical angle bars, spaced about 30in. apart, which are attached by knee plates to the main deck plating; and further support to this bulkhead is also given by means of a number of deep web-plates.

A main feature in these vessels is the termination of the main deck, at the break of the raised quarter deck, and Fig. 3 illustrates the usual plan adopted to provide the necessary strength at this part. To the eyes of inexperienced persons a flush-decked vessel seems to possess a great advantage in point of safety, and even to experienced naval architects and to competent navigators the comparative lowness of the main deck before the bridge in well-decked vessels does not appear at the first glance to be everything desirable. But when the position of the main deck is also considered in conjunction with the height of freeboard in relation to the height of the bridge and raised quarter decks, the apparently objectionable feature has been minimised, as can be readily seen by comparison with the drawings of the longitudinal elevation, Fig. 4, of a three-decked vessel, both vessels being practically of the same dimensions, as regards their length, breadth, draught of water, and dead-weight carrying capacities. Without entering on any calculations, it will be readily seen that the three-decked vessel, when laden with a homogeneous cargo completely filling the hold spaces, must of necessity have the centre of gravity at a greater height than in the raised quarter-decked vessel supposed to be similarly laden, and it will be very generally admitted that the main deck of the "well-decker" being relatively lower, that the centre of gravity must be relatively lower also, when considered in connection with the full scantlings of the three-decked vessel, against the reduced scantlings in the well-decked steamer. It may be here mentioned that the large open holes in the bulwarks, just before the bridge, which have been cut in a number of vessels, as advised by the Board of Trade, appear, without careful consideration of the matter, to be a most important and satisfactory arrangement, as the water must by these means almost instantly leave the well. But on further deliberation, and especially in view of the experiences of those who have sailed in these vessels, and from the result of Board of Trade inquiries, it seems that the great source of danger, and to which many cases of loss have been attributed, is from foundering, caused by the forward part of these vessels becoming overwhelmed by the shipping of an immense body of water during the 'scending motion, and when the vessel is, so to speak, "staggered" by being deeply depressed at the bow, due to the superincumbent weight of water; and therefore, under these circumstances,

as the danger is of a momentary character, the large holes in the bulwarks are practically useless, and the safety of the vessel must necessarily depend on her stability of form. The vessel shown in Fig. 5 was built by Messrs. E. Withy and Co., of West Hartlepool, and may in every respect be considered a good type of a large number of the description of "well-deckers" in existence, and of similar vessels in course of construction. Many new steamers, however, have improvements not found in this vessel, they having an extended forecastle, whereby the well space is reduced in length, so that the case investigated is that of a steamer with a well space of a rather greater than a less average length. The general particulars are as follows, viz :—

Length per register	267·5ft.
Breadth	35·5ft.
Depth of hold	19·7ft.
Displacement in tons	3870
Mean draught of water	19ft. 4½in.
Freeboard	2ft. 4½in.
Gross register tonnage	1866
Net register	1009
Under deck	1509

Deck Erections.

	Length. ft.	in.	Height. ft.	in.	Height above load-line. ft.	in.
Poop	38	0	7	6	11	3
Raised quarter-deck	70	0	4	6	7	0
Bridge-house	66	6	7	6	9	10½
Topgallant forecastle	32	0	7	6	14	0

The experiment to determine the position of the centre of gravity took place when the vessel was in a light condition, and the water ballast tanks empty. Twelve tons of pig iron were used in the experiment, and the vessel at this time was exceedingly stiff, and had a metacentric height of 3ft. 2in.; it was therefore thought unadvisable to prepare a curve of stability for the light draught. The vessel sailed on her first voyage with a cargo of coals and bunkers quite full—Fig. 6—for which the curve A—Fig. 6—is drawn under the following conditions, viz.:—Freeboard, 2ft. 4½in.; displacement, 3870 tons; and a metacentric height of 1ft. 6in., and from the curve the following results can be taken, viz., that the range of stability reaches 112½ deg., and at 60 deg. the maximum righting moment equals 6656 foot-tons.

The curve marked B is constructed on the supposition of the whole of the hold spaces being filled to the height of the main and raised quarter decks with a cargo of a homogeneous character, the bunkers are taken as quite full, and the displacement and amount of the freeboard being as in the previous case, and the metacentric height found to be ·85ft. And under these conditions a very satisfactory curve of stability has been determined, which, of course, would be continually improving as the bunker coals were consumed. It will be seen that the angle of vanishing stability is at 96½ deg., and at 55¼ deg. the maximum righting moment equals 4218 foot-tons.

Coming now to the curve marked C, which shows the stability of the vessel with the forward well space full of water amounting to 267 tons, and under the other conditions of curve B as regards description of cargo, but with the following alterations, viz., an increased displacement to 4137 tons, and a reduced height of freeboard to 1ft. 2½in. It will be noticed that, under this extreme condition, the vessel has a very satisfactory amount of stability, there being a a maximum righting moment of 1820 foot-tons at an angle of 46½ deg., and the extreme angle of stability reaches 80½ deg.

In order to take the vessel under the worst possible circumstances, it has been assumed in the investigation that the whole of the water remains in the well throughout the inclination of the vessel to the extreme angle, which, of course, is an exaggeration, as the water would naturally be carried away over the bulwarks. The actual curve of stability is continually tending to conform with the curve B, and when the edge of the bulwarks has been reached the curve B would show the stability of the vessel; and the curve D has been drawn showing the actual stability of the vessel due to water in the well space. Referring again to steamer—Fig. 5—and for the time assuming that the whole of the ship formed by the erections is omitted above the height of the main deck, continued fore and aft, the amount of the stability under such an impossible condition is represented by the curve of stability E, and it will thus be seen what an important part the erections bear on the question of stability, as the area formed between the curves E and B shows clearly that, except in the small angles of inclination, the stability of the vessel almost entirely depends on the erections. If it were assumed that the projections of the erections above the sheer line of the main deck were distributed over the entire length of the vessel, it would be equivalent to a raised platform, just 5ft. high above the main deck, extending parallel to the sheer, entirely fore and aft. He had therefore extended the raised quarter deck line—which stands 4½ft. above the main deck—entirely fore and aft, and have obtained a curve of stability with such an assumed height of platform, and which is shown by the curve F. It will be readily noticed that this latter curve of stability to an inclination of the vessel of 45 deg., is practically identical with the curve of stability marked B; and seeing that the curves B and F are calculated under precisely the same conditions as regards metacentric height and displacement, it may be fairly considered that a suitable value for the deck erections has been fixed. If we assume that of this raised platform, 4½ft. high, extending fore and aft, an allowance for deck erections be made of 3in. to each foot of its height, we shall then have 1ft. 1½in. as the allowance in freeboard for erections in the particular case in question, which he found was identical with the allowances for deck erections for this vessel by Lloyd's freeboard tables.

Fig. 1.

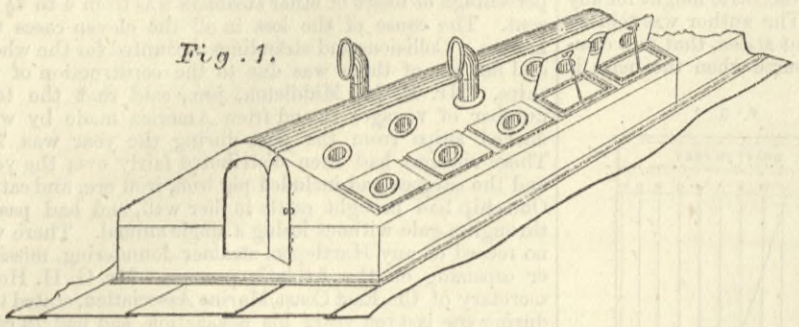


Fig. 2.

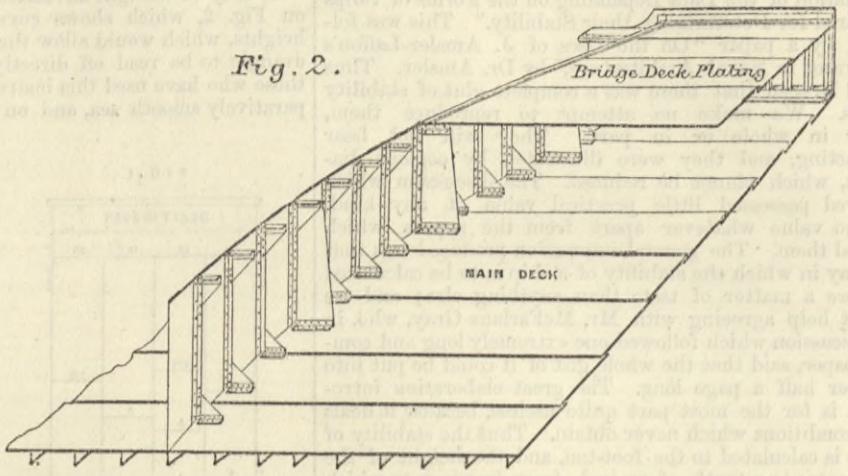
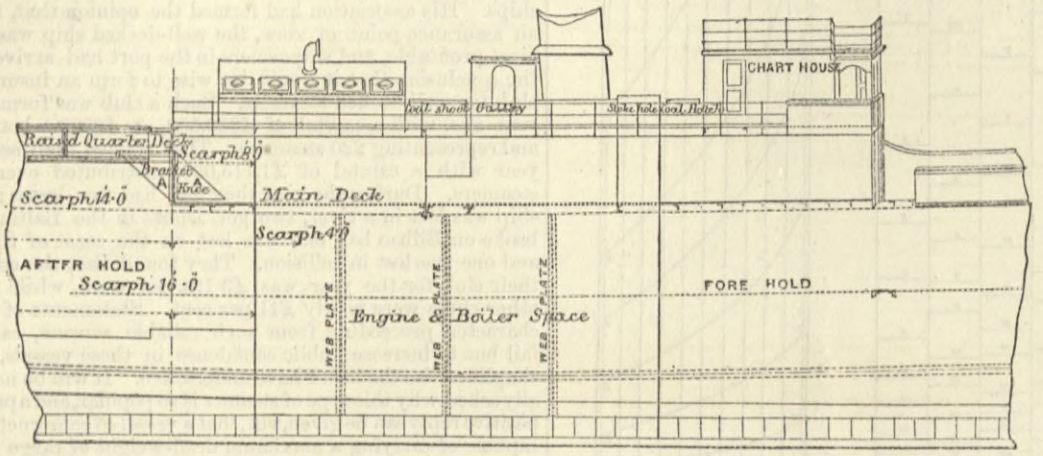


Fig. 3.



SECTION AT E.F

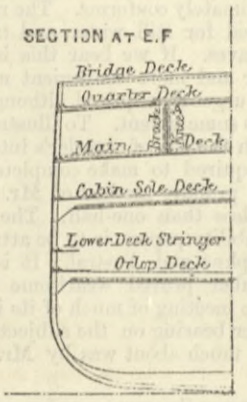
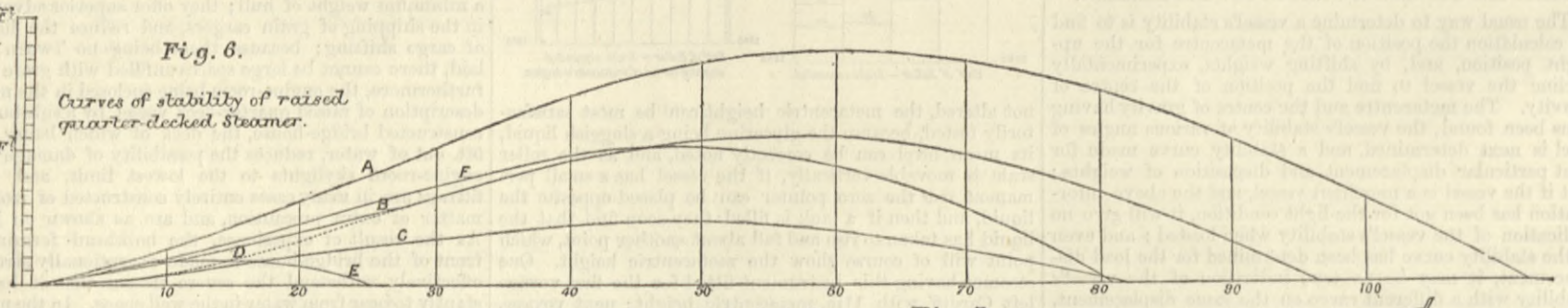
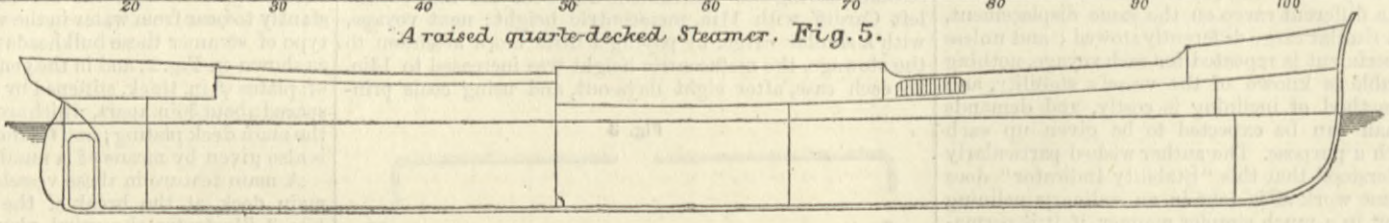


Fig. 6.

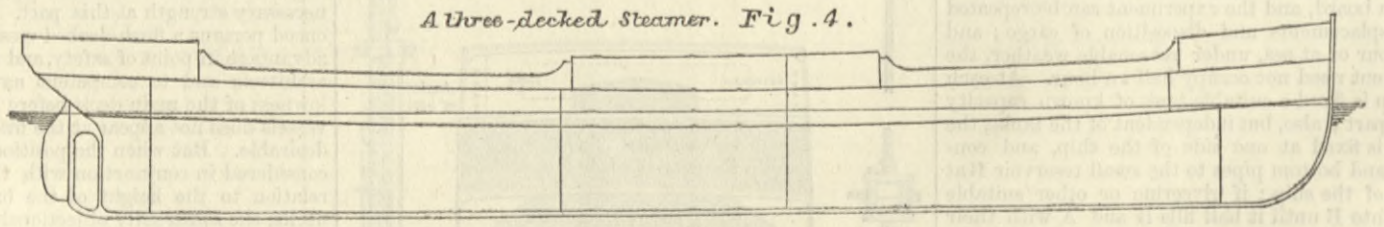
Curves of stability of raised quarter-decked Steamer.



A raised quarte-decked Steamer. Fig. 5.



A three-decked Steamer. Fig. 4.



Scale 1/16 = 1 F.

WELL-DECKED CARGO STEAMER.

On Friday evening the first paper read, by Mr. Henry H. West, was

On Some Considerations respecting the Rivetting of Iron Ships.

In this paper Mr. West, who is Chief Surveyor of the Underwriters' Registry for Iron Vessels, briefly reviewed the present practice of iron shipbuilders as to the arrange-

ments of butt rivetting in iron merchant ships, and then went on to consider whether that practice secures the most efficient and economical joint. It is required both by Lloyd's and the Liverpool rules that all butts of shell-plating, deck stringers, and ties shall be at least double-rivetted, and in some cases certain specified parts are required to be treble-rivetted. The Liverpool rules provide in certain cases for quadruple-rivetting, but Lloyd's do not at present make any such provision.

Table I.

Thickness of plate in sixteenths of an inch	5	6	6 and 7 Alternately.	7	8	9	9 and 10 Alternately.	10	11	12	12 and 13 Alternately.	13	14	15	16
Diameter of rivets in sixteenths of an inch, Lloyd's rules	10	10	12	12	12	12	12	14	14	14	16	16	16	18	18
Diameter of rivets in sixteenths of an inch, Liverpool rules	10	10	—	12	12	13	—	14	14	16	—	16	16	17	18

Table I. gives the sizes of rivets required by Lloyd's and the Liverpool rules for various thicknesses of plate. A comparison of these requirements will show that they are generally much the same, though, if anything, the Liverpool rules provide a little more rivet power than Lloyd's rules do. When two plates, united by a rivetted joint, are subjected to a direct tensile breaking strain, distributed equally across the whole width of the plates, the joint will probably yield in one of three ways; either by shearing all the rivets in the joint, or by shearing some of the rivets and tearing one* of the plates, or by tearing one of the plates at such a line as not to shear any of the rivets. Those who have investigated the problem in its relation to iron shipbuilding have generally approached it from one or other of the two following points of view:—(1) Given a certain arrangement of joint to ascertain its strength; which, as he had already intimated, provide somewhat more rivet area than Lloyd's rules do. The pitch in each case is taken at four times the diameter of the rivets for the first and second rows in double and treble rivetting, and for the third row in quadruple rivetting, while for the third, or back row, of treble rivetting, and the fourth, or back row, of quadruple rivetting, the pitch is taken as eight times the diameter of the rivets. The countersinking is assumed to go completely through the plate, and to be on the face side, one and a-half times the diameter of the rivet. The comparison for double-rivetting has thus to be made between the sectional area of two rivets, and the sectional area of the plate, in one pitch, on the line *a b*—Fig. 1—which, under the conditions named, will, of course, be two and three-quarter times the diameter of the rivet, multiplied by the thickness of the plate. For treble-

FIG. 1.

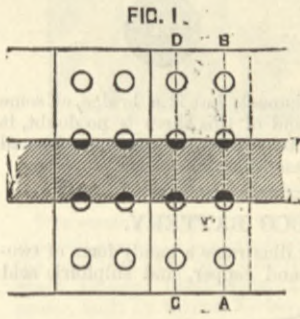


FIG. 2

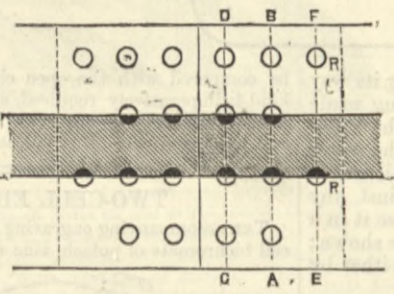
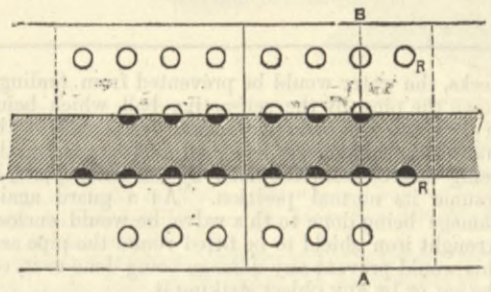


FIG. 3



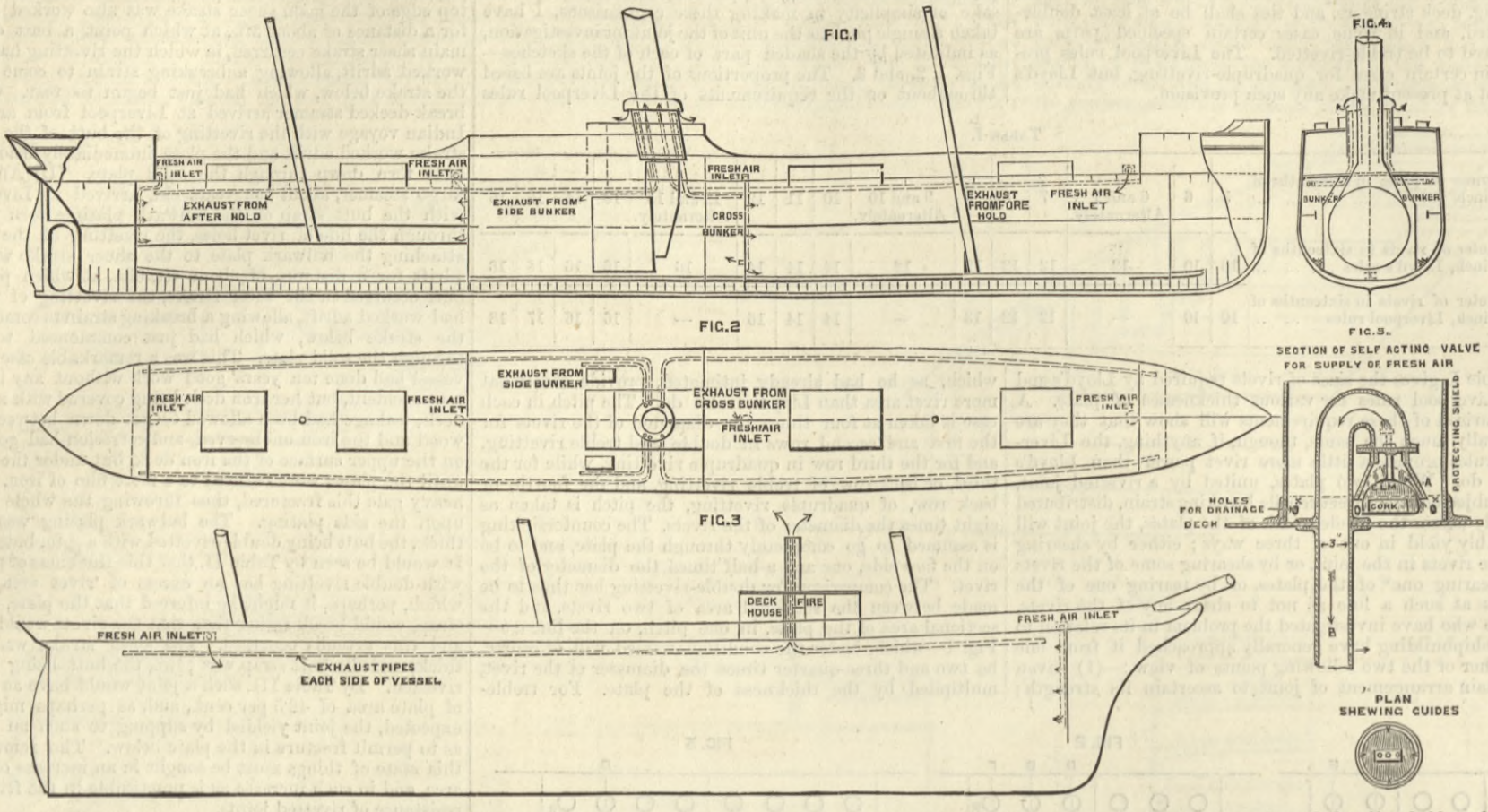
(2) Given certain limiting conditions, to provide the joint of maximum strength for those conditions. Sir Edward Reed's investigations, published in his valuable work "On Shipbuilding in Iron and Steel," may be taken as an illustration of the first method. The second method has been pursued by M. le Baron Clauzel, who, in a paper contributed to the proceedings of the Institution of Mechanical Engineers, 1881, exhaustively considers the problem of how to design a joint to yield the maximum of strength for given limiting conditions. Both these representative investigators have reduced their analyses to a practical form, by assigning certain values to the resistances of the plates and rivets in a rivetted joint to tearing and shearing respectively; but experiments have given such varying results that it is difficult to accept any particular values as finally established, or as equally appropriate to all conditions. Mr. West proposed, therefore, to deal with the matter, in the first instance, as simply a question of sectional area. Fig. 1 is part of a double-rivetted butt joint, such as the butt of two plates in an ordinary strake of shell plating. It is evident that in this case fracture may occur either by shearing all the rivets on one side of the butt, or by tearing the plate on the line *a b*, or by tearing the butt strap on the line *c d*. The elements of the comparison in this case will be the sectional area of the rivets, the sectional area of the plate on the line *a b*, and the sectional area of the butt strap on the line *c d*. If the area on the latter line is greater than the area on the line *a b*, it may be neglected in the present inquiry, as we need only consider the weakest line of plate area. If it is equal to the line *a b*, the same investigation does for both. In iron merchant ships, butts of this class are usually fitted with butt straps of the same thickness as the plates they unite, so that the difference of sectional area on the line of rivet holes will only be that which is due to the difference between plain and countersunk holes, and will be in favour of the butt strap. In this case, therefore, it is only necessary to compare the sectional area of all the rivets on one side of the butt with the sectional area of the plate on the line *a b*. Fig. 2 is part of an ordinary treble-rivetted butt joint, such as the butt of two plates in a sheer strake. In this case, fracture may occur either by shearing all the rivets on one side of the butt, or by tearing the plate on the line *a b* and shearing the rivets *r r*, or by tearing the plate on the line *e f*, or by tearing the butt strap on the line *c d*. In this class of butt the butt strap is usually made thicker than the plates united by it, so that, for the reasons given in the former case, the strap need not now be considered. Again, in all cases where the sectional area of one of the rivets *r* is less than that of the plate in twice the pitch, minus one rivet hole, the line *e f* will be of greater sectional area than the line *a b*, plus the rivets *r r*; and, as these are the conditions in ordinary ship work, we may also neglect the line *e f* in this inquiry. Thus the elements of the comparison in this case will be the area of the rivets on one side of the butt, and the area of the plate on the line *a b*, plus the rivets *r r*. Fig. 3 is part of an ordinary quadruple-rivetted butt joint, such as the butt of two plates in some sheer strakes, as required by the Liverpool rules. For the rivetting the comparison will be between the sectional area of two and a-half rivets, and the sectional area of the plate, in one pitch, on the line *a b*—Fig. 2—added to the sectional area of half a rivet in the back row. As before, the area of the plate on the line *a b* will be two and three-quarter times the diameter of the rivet, multiplied by the thickness of the plate. For quadruple rivetting the comparison will be between the sectional area of three and a-half rivets, and the sectional area of the plate, in one pitch, added to the area of the half rivet in the back row; this compound quantity, manifestly, being the same as in the case of the trebled-rivetted butt. The paper contained a set of tables calculated on this basis. The first thing that will strike the observer in these tables is that both in double and in treble rivetting the plate area is in excess of the rivet area for every thickness of a plate, except $\frac{5}{16}$in. The rivets, therefore, fall short, and in most cases very far short, of the rule of equal sectional areas. Sir Edward Reed's values for plate and for rivet, in a rivetted joint, are such as to justify an excess in the plate area, of about 22 per cent. of the rivet area, and this value has been endorsed by the qualified acceptance of other eminent authorities. The author held, however, that the conditions on which these figures were taken are not those to which the rivetted work of sea-going ships is subjected. The strains are not always equally distributed over the whole width of each joint, one edge being often more severely strained than the other; the strains are not constant, but are alternating in direction, and are compounded of twisting and transverse as well as tensional and compressional strains; the strains are not steadily and continuously applied, but come with sudden shocks and jerks, and the structure, whilst sustaining these severe and complex strains, is often subjected to the impact of the most terrible strokes of the sea. These are conditions which will favour the development of slipping between the surfaces of the most severely strained rivetted joints; and it is evident that all such slipping in a butt under strain will throw upon the contiguous material an undue share of the load. The resistance to slipping should therefore be taken as the measure of strength of rivetted joints in ship work. It appeared to him that there is scope here for much useful experimental inquiry by those who have the time and means at their disposal; and if he might venture to suggest to the Research Committee of the Institution of Mechanical Engineers, who have this subject in hand a fresh field for their investigations, he would point to the friction of rivetted joints as one likely to yield a fruitful harvest of useful information. He quoted a few instances in which the deficiency of rivet area has had serious consequences, and might even have led to fatal results:—(A) A large passenger steamer, which had been built regardless of expense, and which in all respects accorded with the best practice of her day, came home from one of her early voyages with the rivetting of some of her sheer strake butts worked adrift. Neither the plate of the sheer strake nor its butt strap was fractured, but the strake below the sheer strake was torn down through the solid plate immediately under the sheer strake butt. (B) An Atlantic steamer of equally unexceptionable character came home with the butt of the upper deck sheer strake drawn and the rivetting started, the seam rivetting on its lower edge started for about 18in., at which point the topside plating was torn down through its whole width through the solid plate; the rivetting of the seam attaching this plate to the top edge of the main sheer strake was also worked adrift for a distance of about 3ft., at which point a butt of the main sheer strake occurred, in which the rivetting had also worked adrift, allowing a breaking strain to come upon the strake below, which had just begun to tear. (C) A break-decked steamer arrived at Liverpool from an East Indian voyage with the rivetting of the butt of the sheer strake worked adrift and the plate immediately below the butt torn down through the solid plate. (D) An iron cargo steamer, about ten years old, arrived at Liverpool with the butt strap of the bulwark plating torn down through the line of rivet holes, the rivetting of the seam attaching the bulwark plate to the sheer strake worked adrift for a distance of about 4ft. 6in., at which point a butt occurred in the sheer strake, the rivetting of which had worked adrift, allowing a breaking strain to come upon the strake below, which had just commenced to tear through the solid plate. This was a remarkable case. The vessel had done ten years' good work without any important accident, but her iron deck being covered with a wood deck, leakage had been allowed to get down between the wood and the iron unobserved, and corrosion had gone on on the upper surface of the iron deck, but under the wood until the plates were reduced to a mere film of iron. In a heavy gale this fractured, thus throwing the whole strain upon the side plating. The bulwark plating was $\frac{5}{16}$in. thick, the butt being double-rivetted with a $\frac{5}{16}$in. butt strap. It would be seen by Table II. that this thickness of plating with double rivetting has an excess of rivet area, from which, perhaps, it might be inferred that the plate, or the strap, would break rather than that the rivets would yield, and this actually occurred. The sheer strake was $\frac{13}{16}$in. thick, and the butt strap was $\frac{11}{16}$in., the butt being treble-rivetted. By Table III. such a joint would have an excess of plate area of 42·5 per cent., and, as perhaps might be expected, the joint yielded by slipping to such an extent as to permit fracture in the plate below. The remedy for this state of things must be sought in an increase of rivet area, and in such increase as is practicable in the frictional resistance of rivetted joints.

In conclusion, he urged upon shipbuilders the importance of endeavouring to extend the application of power rivetting to the shell plating of iron vessels. By this means we shall both increase the frictional resistance, and also, by more completely filling the rivet holes, vastly improve the rigidity of the rivetted joints. The difficulty of completely and exactly filling the countersink of a countersunk hole with a machine-closed rivet suggested to his friend Mr. Kirk the idea of entering the rivet from the outside, both the rivet and the countersink being made to gauge, and then closing up with a machine snap point on the inside of the ship. What progress he has made in this direction he did not know, but the difficulty did not appear to be an insuperable on.

It will be seen that the point of Mr. West's paper is that the ultimate strength of a rivetted joint is a matter of secondary importance to the shipbuilder. That is to say, the moment a joint begins to give way or slip it becomes useless; and this is in a large measure due to the circumstance that in ships both tensile and compressive strains are put on the same joint at different times. The discussion was opened by Mr. Denny, who spoke in high terms of the value of this very suggestive paper. He had tried to get a good formula for rivetted joints in ships without much success. As regarded countersinking, practice differed. Mr. West allowed 1½in. for a 1in. rivet; so did he for thick plates, but others allowed 1¼in. and 1⅜in. only. More was wanted for a thin than a thick plate. The great beauty of the paper was that it contained the first clear statement he had come across of the morbid anatomy of a ship. He found in one case where a ship ten years old had given way in the sheer strakes, that the iron deck, laid under a wooden one, had corroded away, so that it added nothing to the strength of the ship. He found that red lead paint had come off in flakes, leaving the iron exposed; wet got through the wooden deck and corrosion set in. He now payed over his iron decks with Stockholm tar, which was sprinkled with Portland cement, and this was again coated with tar. This stuff became like india-rubber in a little time, and was practically indestructible. He was very doubtful whether it would be possible to machine rivet the hull of a ship. Men could work up to ⅞in. rivets; beyond that they were uncertain in the quality of the rivetting turned out by them. Mr. Davidson said that he did not like double butt straps because they required so much fitting. Caulking put a strain on rivets which should not be overlooked. Mr. Shaw said that he always used double butts, and there was very little difficulty in doing so. Mr. Mumford called attention to the behaviour of steel rivets, which stretched when iron would have broken. Mr. Martell felt the importance of Mr. West's suggestions, but he did not like to alter good old rules without very sufficient reasons. He desired at one time to use rivets of fractions differing from $\frac{1}{16}$in., but the shipbuilders did not like these abnormal dimensions, so he had to do the best he could with the usual sizes of rivet iron. Mr. West had overlooked the value of break of joint. When all things were taken into consideration, in a practical ship it would be found that rivets as per Lloyd's rules were quite strong enough for the plates, it being understood, of course, that the rivets were 22 per cent. stronger than the plates by calculation. In treble-rivetting ⅞in. rivets were quite large enough. The great objection to the 1in. rivet was that it weakened the frames seriously, and he objected to quadruple rivetting as practised by Messrs. Harland and Wolff because it could only be got in by cutting the top off every alternate frame, a very bad thing to do. He mentioned the case of the Glen Stuart, which went ashore. The rivetted seams did not part, but they gave way by the elongation of the holes. One great cause of slipping in a joint was indifferent workmanship. Mr. White held that the rivets were quite enough for the plates. Experiments

* It is possible to have an arrangement of rivetting in which both plates might tear simultaneously with the shearing of some of the rivets in the joint.

WEBB'S SYSTEM OF VENTILATING SHIPS.



made when the Iris was being built in the Royal Dockyard showed that in steel plates a ⅞in. steel rivet was good for ten tons, and an iron rivet for eight and a-half tons, however the joint was made up. He did not think machine rivetting could be done in combination with proper countersinking.

Mr. West replied, insisting on the importance of guarding against slipping, which, as far as he could learn, took place within about 23 per cent. of the gross or breaking strain.

A vote of thanks having been returned, a paper was read Mr. James Webb, Lloyd's surveyor,

On the Ventilation of Merchant Ships.

Mr. Webb said he had ventured to propose a system which he hoped would be the means of preventing losses of valuable lives, ships, and cargoes. He found from the Board of Trade returns that from 1871 to 1881 there were 231 vessels lost or damaged and seventy-five lives lost owing to explosions of coal gas, or to spontaneous combustion of the coal cargoes carried by the vessels, and which may be, in a great measure, attributable to the want of efficient ventilation. After alluding to various systems of ventilation, he went on to suggest his own. This consists of ordinary round iron pipes from 2in. to 4in. diameter—according to the size of the vessel—perforated with small holes from 6in. to 12in. apart, which pipes should be led fore and aft, close under the main deck beams in each cargo hold and coal bunker, and, if considered necessary, may also be carried athwartship close under the deck. After carrying the pipes around each cargo hold, &c., they should be led through the coal bunkers and brought up into the funnel casing—see Figs. 1, 2, and 4—taking care that after leaving the cargo space the pipes are not perforated, so as to make the ventilation of every compartment independent of each other, and a suitable means found for discharging the foul air, either as shown in Figs. 1, 2, and 4, which is, I think, the best plan, and is the usual method, or by any other method in connection with utilising the waste heat from the boilers, upon which the success of the plan depends.

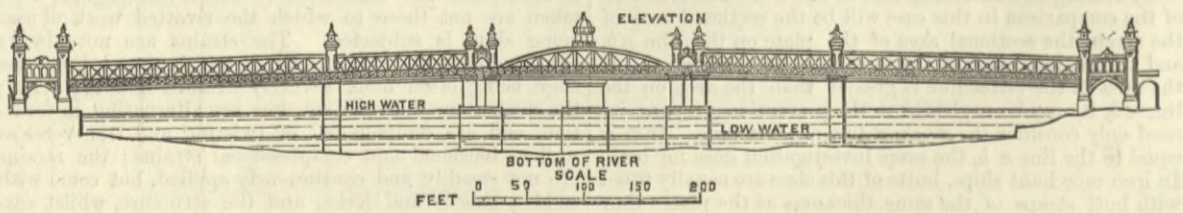
Although in some systems he had mentioned provision is made for drawing the vitiated air from a compartment, there is nothing fitted for renewing the supply of fresh air except the deck ventilators, which are often not available, and to ensure perfect ventilation it is necessary to adopt means which will effect this, even in bad weather. For this purpose he would propose a small valve fitted on the upper deck, of the same area as the exhaust pipes, and which shall also be automatic. Referring to Fig. 5, which shows an enlarged section of the proposed valve, it will be seen that it consists of a bent pipe of from 2in. to 4in. diameter, and about 12in. high, made either of cast iron or metal, and secured to the deck with nuts and bolts.

The open end A has a bell mouth, and from this mouth is suspended a ball of elmwood and cork or hollow globe of metal supported by a spigot and guides. The valve should be fitted to each end of the compartment near the boundary bulkheads, and a hole cut in the deck of the same size as the internal diameter of the valve, and to the under side of the deck it would also be advantageous to fit a pipe B, leading to the bottom of the compartment, and secured to the bulkhead with straps. This pipe also to be perforated. Under ordinary conditions, when the exhaust pipe was drawing the foul air from the compartment, the fresh air would find its way between the ball and the edge of the pipe A and down the pipe B, which, being perforated, no matter whether the hold was full or nearly so, the fresh air would escape through the holes into the compartment in the same proportion as the foul air was withdrawn, and thus a thorough circulation would be maintained. In bad weather, supposing a sea to flood the decks, the water would be prevented from finding its way down the pipe by the self-acting ball, which being made of cork and elm or hollow metal, would rise in the water and fill the entrance of the bell mouth, and, on the water being cleared from the deck by the water ports, it would resume its normal position. As a guard against any damage being done to this valve, he would enclose it in a wrought iron shield to be fitted round the pipe as shown; this would prevent any damage being done to it, either by the sea or by any object striking it.

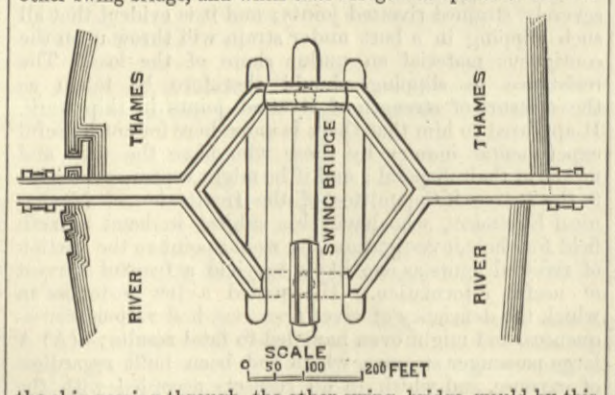
A very brief discussion followed, favourable to Mr. Webb; and the reading of a paper by Captain Heathorn on the use of his well-known balanced rudder as water brake for stopping the way of ships, brought the meeting to an end. It was one of the least interesting held for years by the Institution, as there was too much sameness in the papers, the great bulk of which dealt only with questions of stability.

PROPOSED LOW-LEVEL LONDON BRIDGE.

The engravings which we publish below are illustrations of a bridge designed by Messrs. Bell, Miller, and Bell, Westminster, for crossing the Thames below London Bridge, and for the construction of which powers are now being sought from Parliament. It is a low-level bridge, and at its soffit would be of the same height as London Bridge. It would be carried on iron cylinders, so as to give the least interruption to the waterway, so that the barges, ordinary river steamers, and other small craft traffic would not be interrupted. It is proposed that the bridge should cross the Thames from Tower Hill to Horsely-down, and start from each side in a straight line; but when approaching towards the centre of the river it would bifurcate into two branches of a V-shape, the ends of which on both sides would be joined by opening swing bridges revolving on their centres, and forming two passages for ships to pass through.



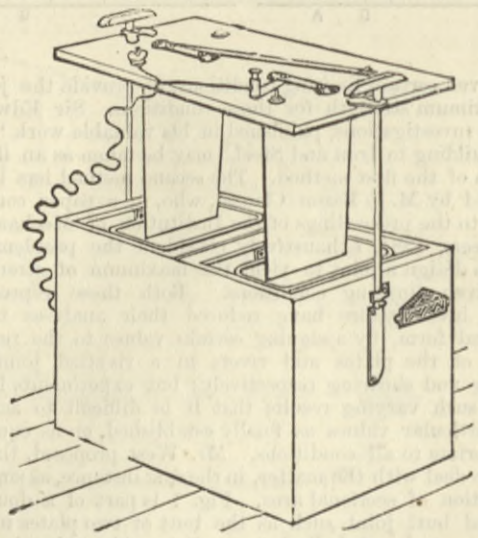
On a ship passing through either from above or below, the swing bridge on one side would be opened, while the traffic of the bridge would be diverted by a simple arrangement along the other swing bridge, and when that bridge was opened to allow of



the ship passing through, the other swing bridge would by this time be closed, and the traffic of the roadway passing over. The traffic along the bridge would therefore be uninterrupted. The advantages of this system would be that it would form practically a level bridge across the river; that the road traffic for both vehicles and passengers would be continuous and without stoppage of any kind; that ships of the largest class could pass through with ease. Of course for navigation, nothing can be compared with the open channel; but if a bridge of some kind is imperatively required, and of this there is no doubt, it seems that this system could be constructed at a very small cost compared with other systems which have been proposed.

TWO-CELL EDCO BATTERY.

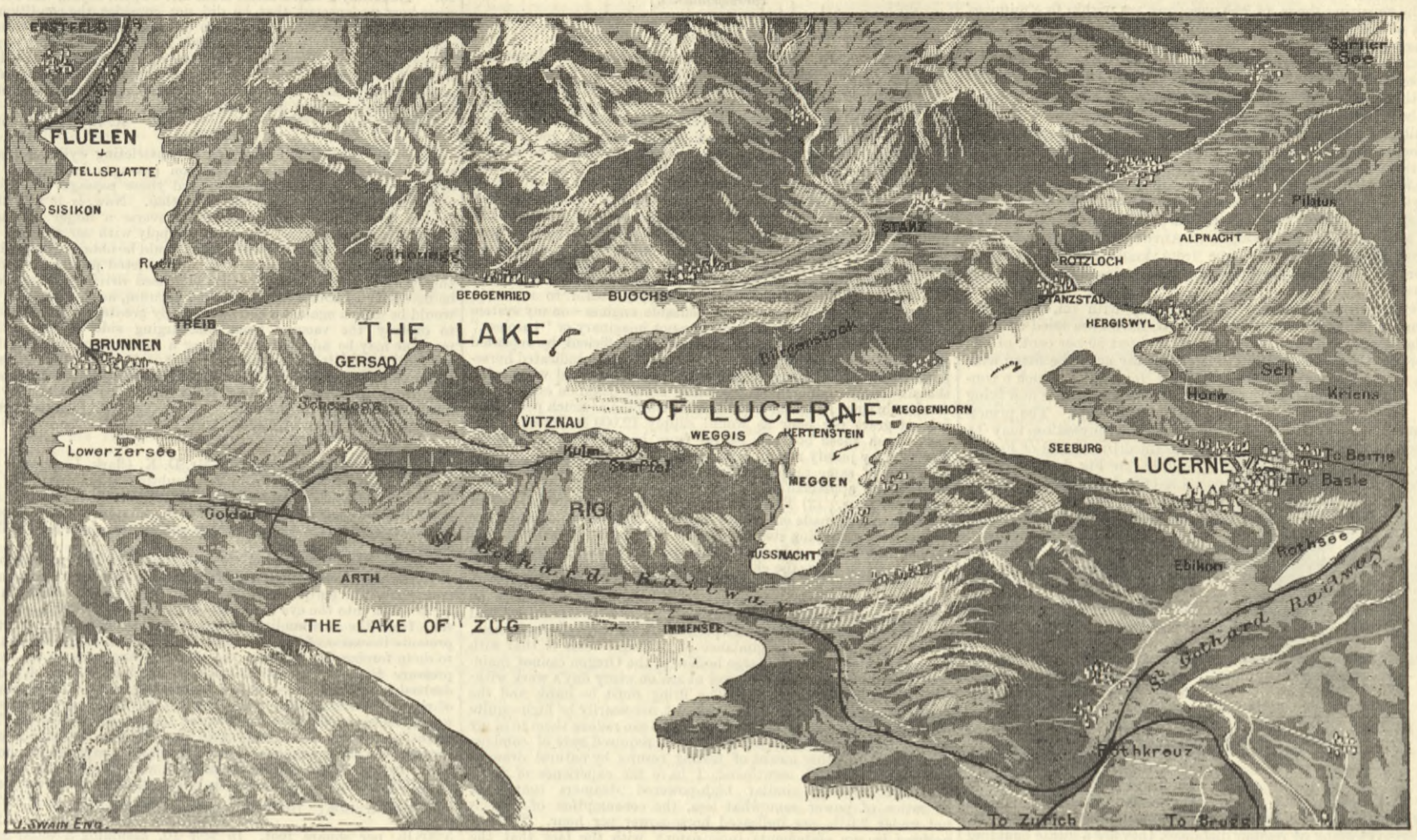
The accompanying engraving illustrates a handy form of two-cell bichromate of potash, zinc and copper, and sulphuric acid



battery, and known as the "Edco" battery, and sold for working the small Griscom motor, for running a table fan or a sewing machine. As will be seen, it is arranged so that the zinc electrodes may be raised and held in position by rods and bayonet locks when a current is not required. It will give a current for from sixty to ninety hours for driving one of the small fans we noticed a short time since, and may, of course, be used for other purposes, two or more of the batteries being employed. The battery, as well as the Griscom motors, is being supplied by Mr. C. Heap, of Archway House, Bush-lane, Cannon-street, and the materials for charging the cells are also to be had ready prepared. Two of these, each about 12in. by 12in. by 15in., will drive a sewing machine.

General Engineering Construction.—The eighth and last of a course of lectures on "General Engineering Construction," by Mr. J. W. Wilson, principal of the Crystal Palace School of Practical Engineering, was delivered on the evening of April 3rd, in the reading-room of the Society of Engineers, Victoria-street, Westminster. The lecturer commenced by giving a short history of the origin of the Exhibition of 1851, and the manner in which the novel form of structure then adopted was arrived at. He then proceeded to describe the general nature of the building, and the way in which the difficulties of construction were surmounted, giving also statistics as to the enormous amount of material employed. He then described the removal of the Hyde Park building to Sydenham, the manner in which it was altered to suit the new requirements of the position, adding information as to the arrangement of the water towers and the fountains, together with a description of the various engines employed for the purpose of pumping the water, concluding with some general remarks upon the advantages and disadvantages of such temporary structures, together with information upon the cost of maintenance.

THE LAKE OF LUCERNE.



THE LAKE OF LUCERNE STEAMBOATS.

The steamboat service on the Lake of Lucerne, so popular and well known to tourists from all parts of the world, began in the year 1836; the first steamboat floated on the lake was the Stadt Luzern, 125ft. long, 17ft. breadth of beam, 40-horse power, built by Messrs. Escher, Wyss, and Co., of Zurich. This boat in more recent times carried goods only, and ceased running in 1880. The second boat was the St. Gothard, built in 1842 by Messrs. Escher, Wyss, and Co.; its length was 130ft., breadth of beam 15ft., and 42-horse power. This first steam navigation of the lake was commenced by the Lucerne Steamboat Company, which, from 1836 to the end of 1839, had but the one boat, the Stadt Luzern, and the directors established six piers on the lake, namely, Lucerne, Weggis, Beggenried, Gersau, Brunnen, and Fluelen. In the summer the boat made two runs to and fro per day, and in the winter, one. It could accommodate 350 passengers.

Mr. C. F. Knörr, a Lucerne banker, who also was one of the directors, gradually bought up the shares of this company, until he became the sole proprietor of the service. He remained the sole proprietor from 1839 until 1847, and the service was carried on under the name of "Knörr's Steamboat Company;" under his management the St. Gothard was purchased, and but two boats were running on the lake until 1847. In that year another organisation was formed, called "The Postal Steamboat Company," with which Mr. Knörr was also connected; this was at the time of the civil war in Switzerland, when two more boats were required for the transport of soldiers, consequently the two new boats then built, named the Waldstätter and the Rigi, were for years afterwards popularly known as "the Sunderbund ships." Mr. Müller, President of the Government of Canton Uri, was the president of this company.

These two companies, with their four boats, carried on the traffic until 1859, when the Swiss Central Railway Company bought the Stadt Basel and the Stadt Mailand, and rented one each of these ships to the two steamboat organisations. In 1863 the Schwan was built by the two companies, to compete with a little steamboat, the Rotzberg, built by Mr. Blättler, of Rotzloch, a paper manufacturer, who not only carried his goods, but the goods of other people, as well as passengers. The Rotzberg was built at Hamburg in 1862, so commenced running a little before the Schwan. Before long the directors made a somewhat large payment to Mr. Blättler to cease carrying passengers and public goods. His little boat has been out of use and rotting away ever since. The two companies built a new boat each in 1863, the Winkelreid and the Wilhelm Tell.

In 1870 the two companies were united under the present title of the "Vereinigte Dampfschifffahrt-Gesellschaft des Vierwaldstättersees," or, "The United Steamboat Company of the Lake of the Four Forest Cantons." By this time the people of Lucerne began to surmise that as the existing companies could pay a dividend of 15 per cent. per annum, a competing company could reasonably expect to make 7 or 8 per cent., so The Steamboat Company of Lucerne was formed; and ordered the construction of the Schweiz and Victoria, by Messrs. Sulzer Brothers, of Winterthur, but by July 1st, 1870, before the boats were finished, there was a fusion of this company with the older one. In the same year a little company at Meggen bought a little boat, the Rutli, of 8-horse power, 45ft. length, 9ft. breadth of beam. This company was at once, by mutual agreement, fused with the larger one, which was thus freed from all competition. In 1870 the United Company built the Helvetia. Two years later Mr. Knörr founded another organisation, The Saloon Steamboat Company, of which he was sole proprietor, and under his orders the Germania and Italia were built, and subsequently launched at Vitznau. As he was a member of the directorship of the United Company when he initiated this competition, the other directors threatened him with an action at law for the act. He stopped all legal action by selling his two boats to the United Company at cost price, and before they were finished.

Since 1872 there has been no change, and the United Company paid a dividend of 5 per cent. during the earlier years of existence, and from 6 to 8 per cent. per annum during the last five years, the rise being chiefly due to the transport of materials for the construction of the St. Gothard Railway. At the present time the chairman of the United Steamboat Company is Mr. Schultheiss Jul. Schneyder, and the managing director and secretary, Mr. Ed. Schmid.

The following table gives statistics as to the present steamboat fleet on the Lake of Lucerne. The six steamers at the head of the list are non-saloon boats.

The Lake of Lucerne Steamboat Fleet, 1883.

Steamboat.	Builders.	Date of launching.	Horse-power.	Length in metres.	Breadth in metres.	Estimated value, 31st Dec., 1882.
						fr.
1. Germania ..	Escher, Wyss, and Co... ..	1872	110	59·40	6·39	137,525·70
2. Italia	Ditto	,,	110	59·40	6·39	137,525·70
3. Schweiz	Sulzer Bros. ..	1870	100	60·45	5·91	131,819·40
4. Victoria	Ditto	,,	100	60·45	5·91	131,819·40
5. Helvetia	Escher, Wyss, and Co... ..	,,	70	51	5·40	81,860·50
6. Waldstätter ..	Sulzer Bros. ..	1879	60	43·40	4·80	70,053·15
7. Wilhelm Tell ..	Escher, Wyss, and Co... ..	1864	55	48	4·98	63,498·55
8. Winkelried ..	Ditto	1863	55	48	4·98	38,292·05
9. Stadt Basel ..	Ditto	1859	45	45	4·80	58,939·65
10. Stadt Mailand.	Ditto	,,	45	45	4·80	58,939·65
11. Rigi	Ditchborn and Mare	1848	32	37·80	4·20	40,278·10
12. Schwan	Escher, Wyss, and Co... ..	1863	12	22·50	3	13,912·65
						964,464·50

were seventy-five foggy days, and the minimum number of foggy days on the lake in one year has been twenty-five. In foggy weather the boats which have to cross each other *en route* must cross at the particular pier named for the purpose, and not out in the open. In foggy weather, at one or two projecting points of land near the track of the ships, fires are lit on the ground at night and bells rung by day by men appointed for the purpose. Under a police regulation it is ordered that in foggy weather a bell must be sounded every half minute on board the ship; by another police order every barge or rowing boat out on the lake must carry a horn to be able to warn a steamboat in a fog of its proximity. With these safeguards the steamboats go at full speed through the fogs, and are steered by compass. There has been but one steamboat accident on the Lake of Lucerne. In the year 1871 the Schweiz ran into the little Brunig amidships, cutting open the engine room, and the Brunig sank off Meggenhorn. Two passengers out of the fifteen persons on board were drowned. The collision was at night, and due to a mistake in steering on the part of the pilot of the Brunig, who, after an official investigation of the case, was fined 15,000f., being the amount of the damage done. He was able to pay the whole; but after he had paid 5000 the directors paid the other 10,000 to save him from ruin. One of the deceased passengers had no near relatives, and the parents of the other, at Meggen, refused to receive any money compensation for the death, so the 1000f. offered them by the directors was given to a public school at Meggen. The captain of the Schweiz was not in fault, but had actually backed his engines when the Brunig came upon the stem of his ship broadside on. By means of four barges with

Passenger Traffic in 1881 *and* 1882.

Months.	Fluelen Route. Number of Passengers.		Alpnacht Route. Number of Passengers.		Küssnacht Route. Number of Passengers.		Total number of Passengers.	
	1882.	1881.	1882.	1881.	1882.	1881.	1882.	1881.
January ..	18,740	19,721	3,987	4,216	3,610	3,337	26,337	27,274
February ..	19,354	23,504	4,763	4,810	3,009	4,010	27,126	32,324
March	29,137	31,398	6,326	6,375	3,945	5,205	39,408	42,978
April	32,081	30,850	7,646	6,982	5,334	4,650	45,061	42,482
May	54,752	52,370	10,877	11,663	7,865	7,527	73,494	71,560
June	55,147	60,233	10,949	11,057	6,643	6,428	72,739	77,718
July	91,844	104,136	19,361	21,619	9,002	11,250	120,207	137,005
August	122,014	127,932	25,269	27,017	10,563	11,694	157,846	166,643
September ..	68,695	80,403	13,024	20,076	7,616	9,934	89,335	110,413
October ..	33,424	41,129	9,419	10,418	5,621	6,943	48,464	58,490
November ..	18,477	27,037	5,970	6,238	3,461	4,368	27,908	37,543
December ..	12,954	19,614	4,300	4,485	3,646	3,535	20,900	27,634
	556,619	618,337	121,891	134,856	70,315	78,881	748,825	832,064

Performances of the Lucerne Steamboats and Coal Consumed in 1882.

Name of steamboat.	Horse-power.	Kilometres run.	Hours of running.	Consumption of coal in hundreds of kilogrammes.	Consumption of coal. Per kilometre.		Per hour.		Per horse-power. Per kilometre.		Per hour.	
					1882.	1881.	1882.	1881.	1882.	1881.	1882.	1881.
					kilog.	kilog.	kilog.	kilog.	kilog.	kilog.	kilog.	kilog.
Germania	110	22607·95	1302·40	5911·1	26·1	27·7	453	447	0237	0252	4·12	4·06
Italia	110	17921·40	1059·50	4785·9	26·7	28·2	451	476	0243	0256	4·10	4·33
Schweiz	100	19893·60	1187	4527·3	22·7	24·3	381	419	0227	0243	3·81	4·19
Victoria	100	28031·25	1654·55	6737	24	24·4	407	420	0240	0244	4·07	4·20
Helvetia	70	36459·25	2216	6496·7	17·8	18·7	293	293	0254	0267	4·18	4·18
Waldstätter	60	35875	2245·55	5501·5	15·3	15·6	245	250	0255	0260	4·08	4·16
Wilhelm Tell	55	31555·20	1927·45	4676·9	14·8	15·1	242	242	0270	0273	4·40	4·40
Winkelried	55	8686·35	800·55	1101·6	12·7	12·4	137	137	0230	0225	2·49	2·49
Stadt Basel	45	25512·10	1587·10	3061·9	12	12·2	193	197	0270	0271	4·29	4·38
Stadt Mailand	45	20075·15	1261·55	2544·6	12·6	13	201	213	0280	0289	4·47	4·73
Rigi	32	18334·10	1260·35	2506·5	13·6	13·7	198	196	0425	0428	6·19	6·12
Schwan	15	16766·90	1167·55	906	5·4	8·9	77	123	0360	0890	4·46	12·30
Rütli	8	5400·50	408·25	238·4	4·4	4·1	58	54	0550	0512	7·25	6·75
Merkur	12	2465·70	327·10	432	17·5	16	132	121	1458	1133	11	10·08
		289584·45	18408·10	49427·4	—	—	—	—	—	—	—	—
		Average consumption of coal			17·06	16·9	268·5	246				

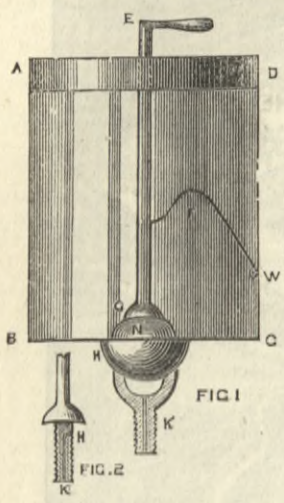
In 1882 the total income from the passenger traffic was 765,358·14f., and from goods, luggage, cattle, &c., 146,482·64f. The accompanying table of the passenger traffic for 1881 and 1882 shows how the tourist season affects the interests of the company, and how the traffic is divided on the three steamboat routes on the lake, which routes may be traced by the aid of the map above. The falling off of the number of passengers in 1882 is ascribed to the opening of the St. Gothard Railway.

The United Steamboat Company at the present time employs 5 captains, 2 engineers, 14 ticket collectors and examiners, 12 pilots, 38 seamen—or lakemen, 11 engine drivers, 23 stokers—total 105 men engaged on the boats. From 65 to 70 men are engaged in the various workshops on land. There are 24 landing stations and 35 piers, some of the stations having two or three piers, Lucerne has five. The running of these boats is never stopped by fog, nor is the speed then slackened. In one exceptional year there

windlasses the Brunig was subsequently raised from 84ft. of water, and is now running, none the worse under the name of the Schwan.

The repairing sheds of the company are within five minutes' walk of the St. Gothard terminus at Lucerne, and all the machinery therein is driven by an engine of 15-horse power. A winding machine made by Messrs. Escher, Wyss, and Co., and driven by a vertical engine of 12-horse power, is used for drawing the ships out of the lake and up the slip for repairs; a model of the winding machine was on view at the late Swiss National Exhibition at Zurich. Steamships are repaired and transformed in these works, but not built; at the present time the steamship Helvetia is being transformed into a saloon ship on the slip. The long cradle which carries the ship is prevented from running back by ratchet work catches between the rails on which the wheels of the cradle run. In the carpenters' shop is a quantity of Canadian pitch pine bought at Antwerp; it is found to be longer, harder, and more free from knots than Swiss pine. After dark the shops are lit with Edison's incandescent electric lights.

New feeders for supplying machinery with oil, under the patent of M. Louis Bourgeois, of Paris, have been tried on some of the ships, with the result of saving about 50 per cent. of oil; consequently all the engines of the company are to be fitted with these feeders, of which a considerable number are now lying in the workshops. The principle of the invention may be explained by the aid of Figs. 1 and 2. In Fig. 1, A, B, C, D, is a cylindrical glass vessel to hold the oil, and fitted with the loose brass cap A, D. The place at which the supply of oil is regulated is in N and H. The lower part of G is of leather, to stop the flow of oil when G is completely screwed down by the handle E. Through the screw K the regulated supply of oil reaches the machinery, and the number of drops falling per minute can be seen in the opening above the screw K. There are several vertical grooves in the interior of the glass vessel, into which the little leaden ball W falls in succession whenever E is turned, and because of the constant pressure of the wire spring F. The grooves being at regular distances, they are a guide enabling the engine driver to give any large fraction of one rotation of the handle he chooses. The bottom of the vertical shaft E G is represented in Fig. 2, in which H K represents the channel in the screw through which the oil flows. More or less of the hole H is covered by the top of the female screw in which H K works, and the extent to which this hole is covered is governed by rotating the handle E, Fig. 1, whereby the supply of oil is regulated. Thus the driver can give a steady flow of as many drops of oil per minute he chooses, and this supply he exactly proportions to the work the engine is doing at the time.



By the panoramic map on the preceding page it will be seen that because of the lake and mountains in its way, the St. Gothard railway makes a large circuit through comparatively level country before reaching Fluelen and the beginning of the mountain-climbing part of the line at Erstfeld, where the mountain engines are put on the trains. Hence, in fine weather, passengers often quit the railway at Lucerne, go on by boat to observe the scenery, and rejoin the railway at Fluelen. Between Brunnen and Fluelen the railway runs in galleries and tunnels halfway up the perpendicular mountains, which here border the lake, and nothing is more surprising to a passenger on the boats, who is previously unaware of the path of the railway, than to have it revealed to him by white puffs of steam that a railway has actually been driven along the centre of the face of these precipices. In time the St. Gothard railway will have a more direct route to Fluelen, for one part of the intended system of lines includes the construction of a railway from Lucerne to Immensee direct; the line has just been planned, and the route decided. The construction of the new section will involve much tunnelling, but a path involving less tunnelling would probably be just as expensive, because of the high price of the land of an alternative route.

The Lake of the Four Forest Cantons is not bordered everywhere by factories and works, like the great Lake of Zurich; it bears the general reputation of being the most beautiful lake in Europe, wherefore it is bordered by expensive villa residences, standing in their own wooded grounds, and the cost of land and residences at eligible parts of the borders of the lake is very high. The whole district is one more of pleasure than of manufacturing industry, and has been so much more thronged by visitors since the opening of the St. Gothard railway, that several of the large hotels on the borders of the lake, near Lucerne, which formerly were regularly closed during the winter, are now open all the year round. H.

Iron and Steel Institute.—The annual meeting for 1884 will take place at 25, Great George-street, London, S.W., on Wednesday, the 30th of April, Thursday, the 1st, and Friday, the 2nd of May next, commencing each day at 10.30 a.m. On Wednesday, April 30th, there will be at 9.45 a.m., a meeting of the Council in the Council-room at 25, Great George-street; at 10.30 a.m., a general meeting of members. Scrutineers will be appointed for the examination of the voting papers. The Council will present their report for 1883. The treasurer will submit the financial statement for 1883. The Bessemer gold medal for 1884 will be presented to Mr. E. P. P. Martin and Mr. E. Windsor Richards. A selection of papers will be read and discussed. On Thusday, May 1st, the 10.0 a.m. meeting of Council, at 25, Great George-street; 10.30 a.m., general meeting of members. A selection of papers will be read and discussed. On Friday, May 2nd, 10.30 a.m., general meeting of members. A selection of papers will be read and discussed. There will be adjourned discussions (1) "On the Tin Plate Industry," by Mr. E. Trubshaw, Llanelly; (2) "On the Coal Washing Machinery used by the Bochumer Verein," by Mr. F. Baare, Bochum; (3) "On the Manufacture of Anthracite Pig Iron," by Mr. J. Hartman, Philadelphia, U.S.A. Adjourned papers (1) "On recent results with Gas Puddling Furnaces," by Mr. R. Smith-Casson, Brierley Hill; (2) "On a new form of Gas Sampler," by Mr. J. E. Stead, F.C.S., Middlesbrough, and new papers (3) "On the use of Raw Coal in the Blast Furnace," by Mr. I. Lowthian Bell, F.R.S., &c., Rounton Grange, Northallerton; (4) "On the Behaviour of Armour of different kinds under Fire," by Captain C. Orde-Browne, Lecturer on Armour at Woolwich; (5) "On Recent Progress in Iron and Steel Shipbuilding," by Mr. William John, Barrow-in-Furness; (6) "On the most Recent Results obtained in the Application and Utilisation of Gaseous Fuel," by Mr. W. S. Sutherland, Birmingham.

LETTERS TO THE EDITOR.

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

FORCED DRAUGHT STEAM BOILERS.

Sir,—There are, I believe, few of your readers who will not consider the discourteous and unjustifiable remarks in The Engineer of last week on my paper "On Combustion of Fuel, &c.," read at the Institution of Naval Architects, as unbecoming any respectable journal. The character of these remarks will satisfy your readers that the Council of the Institution, whose judgment you impugn, are infinitely better able to judge what papers should be read at their meetings than the incompetent or malevolent writer of the paragraph on my paper in your journal.

As you have given publicity in your pages to a gross caricature of my paper under the guise of a criticism thereof, I request the same publicity for a few remarks I have to make in regard to some of the statements in my paper which you attempt to ridicule. The points to which I would specially direct attention are:—(1) That the dimensions of the boilers and area of fire-grate which I give in my paper as sufficient to supply steam to maintain 12,000 indicated horse-power, in suitable engines—on my system of combustion under air pressure—are not imaginary or "baseless," but what has already been amply proved sufficient by repeated trial. Further, the consumption of 1·6 lb. of coal per indicated horse-power, which I state in my paper would not be exceeded when using the six smaller boilers on my system, is also based on evaporative results obtained in actual trial when consuming as much per square foot of grate per hour as would supply 12,000 indicated horse-power from these boilers. So far from having overstated these results, they justify me in undertaking to maintain in boilers and fire-grate of same proportion an equal ratio of indicated horse-power at an appreciably less consumption than 1·6 lb. per horse-power per hour. (2) The estimate of the consumption of coal in the Oregon was made on the assumption, and no other, that her boilers were supplying steam sufficient to maintain 12,000 indicated horse-power in the engines in regular work at sea. If this is not kept clearly in view, the chief point of my comparison will be lost, and the object of my illustration misunderstood. The comparison is entirely one between the economy of combustion in boilers by natural draught when a high evaporative power is demanded, and that of my system by air under pressure in the same circumstances. What I affirm under the guidance of practical tests is that with natural draught even the large boilers of the Oregon cannot maintain 12,000 indicated horse-power at sea on every day's work without a sacrifice of economy. The firing must be hard, and the temperature of the escaping gases must necessarily be high—quite 300 deg. at least higher than what I find I can reduce them to in my air pressure system when working at the required rate of combustion. Besides other means of testing results by natural draught under the condition mentioned, I have the experience of those who are running similar high-powered steamers that even at ratios of power somewhat less, the consumption of coal is not under 2·6 lb. per indicated horse-power per hour. There is nothing in my statements inconsistent with the fact that the Oregon may be the most economical steamer of her class afloat. From the great experience and skill of her builders, I am quite prepared to believe that she is so; but a high actual economy will necessarily be found at more moderate powers. The consumption per indicated horse-power will be very different when working at 8000 or 9000-horse power than when 12,000 are maintained. This is the chief point at issue in my comparative statement of the two sets of boilers. While I maintain that boilers worked by natural draught are unnecessarily large, and are less economical in all cases than boilers worked by air under pressure on my system, it is in such cases as these high-powered ocean steamers that the contrast becomes so marked. It will be evident, however, to any reader of my paper that as the Oregon has been put forward as a hypothetical case for the sake of comparison, should the consumption be found in actual running to be less than 2·6 lb. per horse-power when maintaining 12,000 indicated horse-power at sea, then my figures must be subject to the correction of this difference, whatever it may be. (3) The weight of air assumed in my paper as used in the two sets of boilers per pound of coal consumed, and the power required to supply the air by engine and fan in the air pressure boilers, are referred to by the writer of the paragraph in The Engineer with an apparent effort at sarcasm.

In assuming 15 lb. of air for the combustion of 1 lb. of coal as a basis of calculation it is evident that this comparatively low proportion of air is rather in favour of the natural draught boilers. Had a higher proportion of air been assumed, the difference in economy would have been still more in favour of the boilers worked by mechanical supply. Then as to the power required to supply the weight of air by the engines and fans, the calculations, I presume, will be found to be correct. It scarcely requires to be mentioned that the actual power in some cases may be increased by various causes, such as a lower efficiency of fan, friction in pipes and passages, effect of back pressure, &c. If we suppose, however, that even double the power given in my paper may be necessary in some cases from such causes, then 37-H.P. instead of 18·6-H.P. will not be felt to be a very extravagant increase to effect perfect combustion in boilers supplying steam to engines indicating 12,000-H.P. James Howden.

Glasgow, April 15th.

[We have commented on Mr. Howden's letter in another page.—Ed. E.

THE EFFICIENCY OF FANS.

Sir,—I wrote on the 1st December, 1883, "The Capell fan is an absurdity from beginning to end"—since that time we have had letters, leading articles, and experiments, and now, after four months, I repeat, "The Capell fan is an absurdity from beginning to end." The only new point to be considered is the report of Mr. Clark—what has he added to our knowledge? I say, absolutely nothing; the fan was running light, it had no work to do, and if I invented a new cannon, knowing nothing whatever about it, and got a series of experiments made to prove that Krupp and Sir W. Armstrong were left far behind, what would you say when you came to examine the report, if you found that every shot had been fired with blank cartridge?

With respect to the experiments, I say it is utterly impossible correctly to measure the air under such circumstances. (1) Because one cannot get anything like a true average over the sectional area. (2) Because the shielding reduces the result to mere guesswork. (3) Because neither Cassella nor anyone else can give the correction to be applied to an anemometer under a speed of 5000ft. per minute. Let me ask, how was it got? Then we come to the power used. In all tests that have been made on fans to my knowledge the gross indicated horse-power has been taken, and no deduction or allowance made for anything; but here we meet with a deduction of 25 per cent. at one slap—but no, I am wrong, one deduction is for slip and another for internal resistance, but the result is 25 per cent. Now, having found the fan doing more than the power applied amounted to, what is the use of flying off at a tangent to prove that this was owing to some occult influence of "the compensatory action of a fluid flowing through a constricted conduit?"

Careful experiments made upon the best types of ventilators working on mines show that something like 5 per cent. is as much as any of them exceed the others in useful effect, and that the choice depends most upon first cost and durability; but if an allowance of 25 per cent. has to be made from the indicated power applied, the results may well warrant the Rev. Mr. Capell in saying, "I have long been aware of their puzzling character." I am a good deal puzzled, too, but not with the fan. My difficulty is with the people, who, as Mr. Hearson says, have got muddled over it.

I asked on the 8th December that we should have a reasonable sized fan upon a mine. On the 5th March I had a letter from Mr. Evers-Swindell, saying a Capell fan was working at Homer Hill Colliery: "Would I go and test it?" I said, "if Mr. Emerson Bainbridge, of Sheffield, is going, as was mentioned, I will try to do so." Next day I had a letter from Mr. Capell, saying the results were very unexpected, that he did not consider the conditions of trial such as to show any fan to advantage, but that he hoped shortly to be able to show me a 10ft. fan, when he would be glad to see me. I have since heard that the results at Homer Hill have been of such an extremely puzzling character that it has proved absolutely necessary to have that fan stopped at once, and taken away, before any more good men go wrong.

Durham, April 11th. A. L. Steavenson.

Sir,—The Capell fan possesses a constricting cylinder placed within, and having limited admission passages leading to the driving vanes surrounding same; and these passages are partly closed and opened again during revolution. Now, is it not likely that as the vanes of the working fan traverse a larger displacing space than the passages can readily supply with air through the constricted parts, that a higher vacuum would be obtained on the inlet side than would be the case with unrestricted passages? But if this be so, is it not also likely that increased driving power would be necessary to obtain such improved vacuum, as the vanes of fan would be driven against a correspondingly greater pressure tending to destroy the vacuum from discharging side of fan. This machine may be adapted for getting a better vacuum than fans without intermittent restriction; but whatever advantage is obtained by it in improved vacuum will be surely lost in diminished weight of air discharged over what would be obtained by an unrestricted supply to the fan. J. Ramsbottom.

Saynor-road, Hunslet, Leeds, April 14th.

Sir,—Having been invited by Mr. D. K. Clark, I ask your permission to re-state my reason for doubting the accuracy of the figures in the table accompanying his report on the Capell fan, published in your issue of March 28th. As in my last letter, I confine my attention to the results which are given for the 30in. blast fan.

The centrifugal action on the air, caused by the rotary motion of a fan, produces a difference of pressure in the air at the centre, and that at the periphery of the fan wheel. In the blast fan the air is taken into the eye of the wheel at atmospheric pressure, and sent from the surrounding casing into the delivery pipe with a pressure in excess of the atmosphere. The work which the fan has to do in forcing the air into the delivery pipe against the excess pressure there is the useful work of the fan, and is, of course, derived from the engine-power delivered to the fan. The quantity of work so done is equal to the product of the excess pressure per square foot, and the volume in cubic feet of air delivered. This quantity of work is identical with the work to be done in compressing the given quantity of air. It may be expressed in horse-power by taking the volume per minute, and dividing the product by 33,000. The excess pressure is to be estimated from the water-gauge indication; 1in. of water being equivalent to $\frac{62{\cdot}5}{12}$ = 5·208 lb. per square foot. In test 10, assuming a water-gauge pressure of 7ft. 6in., as in my letter of April 4th, the work of compression is equivalent to $\frac{7{\cdot}6 \times 5{\cdot}208 \times 9{\cdot}856}{33{,}000} = 11{\cdot}8$ horse-power.

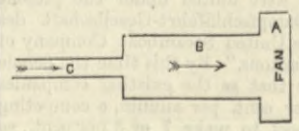
Next, in order that a quantity of air may be delivered through a comparatively small pipe, the air must have a considerable velocity, and will possess by virtue of it a considerable amount of energy of motion. This energy of motion may be expressed in horse-power by means of Mr. D. K. Clark's formula $\frac{A\,v^3}{465{,}300}$, and amounts, for test 10, to 3·805-horse power as stated in the table. This must also be derived from the engine power delivered to the fan. If the excess pressure and the velocity are both measured at the same section of the delivery pipe, the horse-power expended in driving the fan must be at least equal to the sum of the quantities for compression and motion; and in practice will probably much exceed it. The energy of motion alone is no measure of the useful work of the fan, as Mr. Clark appears to assume, though some of it may, by proper arrangements, be made available for doing useful work in addition to the directly useful work of compression.

If we add together 11·8 and 3·8, we obtain 15·6-H.P., which, according to Mr. Clark, is derived from 4·9-H.P. delivered to the fan. This being impossible, I venture to doubt that the figures given in the tables are even approximately accurate. If Mr. Clark should say that he had no pressure in his blast in test 10, then I would observe that the fan was not tested under practical conditions, and the figures are valueless. In that case, I call his attention to test 8, made half an hour earlier, and apparently under the same conditions, in which the water-gauge pressure is given as 8in., and volume of delivery, 9577 cubic feet per minute from the same fan, and ask him the amount of the corresponding indicated horse-power, omitted from the tables. The horse-power due to the pressure of delivery amounts to 12·09, and that due to velocity to 3·488, or together to 15½-H.P., a quantity which is very different from anything mentioned in the report. Thos. A. Hearson.

Royal Naval College, April 15th.

Sir,—Mr. D. K. Clark's letter is very ingenious, but I fear he has missed the point I have raised, no doubt through my clumsy way of expressing myself.

The question is this: In a pipe of given length, it is said that the work stored in air passing through the pipe is greater in some places than in others, and that in some places it is greater than the power exerted by the engine propelling the air. This seems to me to be a statement the accuracy of which is open to doubt, and I must ask Mr. Clark to try and further enlighten me. I want to see how the connecting link between the engine and the place of greatest energy in the air is established. In the suction fan, the work done by the engine consists in making a vacuum, or partial vacuum, in the fan case and pipe. Here let us for simplicity suppose that, in the accompanying sketch, A is the fan, B an enlarged tube, C the suction tube. Now the whole of the resistance offered to the rotation of the fan depends on the difference of pressure on the driving and following faces of the fan blades, referred to by Mr. Hearson. I am not now dealing with work done on air, or energy stored up, but with resistance only. This resistance being known, and the speed of the centre of effort of the fan blades, the power can be calculated. The fan and the engine know nothing at all about the tube C, or the enlargement B. They keep a steady vacuum of, say, 10in. of water in B.



If now we measure the work stored in the air in B we shall find it to be, say x, and calling the power exerted by the engine y, then x is always less than y. But the power stored in the air in C may be $2x$, or, at all events, it is greater than x. I want to know why?

The only reason alleged is that the air flows faster through C than through B, but it can only do this because B, so to speak, pulls on it, as I understand Mr. Clark. B first pulls on the air in C, and sets up a high velocity in it, and part of this velocity is given back again to the air in B, urging it forward, and reducing the difference of pressures on the backs and fronts of the fan blades. This seems to me very like a man getting into a basket and trying to lift himself. The difference in pressure is a function of the vacuum in B, and the difference can only be reduced by diminishing the vacuum; but if the vacuum is reduced so must be the velocity in C, and so would be the work in the air at C. It is like a row of bricks on end; if we push down one they all fall.

Furthermore, Mr. Clark must admit that the velocity must be put into the air in C by some force, and this force represents a

resistance, and this resistance must be overcome by the engine. Now, how can the engine overcome a greater resistance than that proportionate to the horse-power it is exerting? We have an air rope, so to speak; how, can the work done in pulling it be greater in one place than in another?

One more question, and I have done. Let us suppose that the fan is fitted to deliver into C, instead of exhausting from B; it would then be a pressure fan. Would the power exerted be in this case greater if measured in C than if measured in B? I assume that it would. But then we should have a difference in back and front pressure on the fan blades measured by the work done in getting the air through C, and no compensating action from B could reach the fan; yet the fan would do more work than the engine, although the total work done on the air if measured in B would be less.

In few words, it seems to me that Mr. Clark treats the fan as if it was a motor. He says it does more work—in C—than is realised as a useful result—in B—and this test is, of course, the true measure of efficiency. We say this of an engine. We get less useful work out of it than indicated power; but I cannot see how the same can hold good of a fan.

Can it be shown that if there was a pressure in B, and the air escaped through C, more work would be done in C than was expended in forcing air into B?

Bilston, April 15th. C. T. W.

Sir,—The fan which extracts a given quantity of air from a mine at the least cost may not be the one which gives the highest percentage of useful effect when applied outside of a mine. I have a 20ft. Guibal fan which gives 1000 cubic feet of air per revolution. At 40 revolutions it gives 40,000 cubic feet of air, with ½in. of water gauge. There are two air-ways, each 70ft. sectional area and 1200 yards long, so that you see there is not much resistance. In No. 4 experiment, Mr. Clark says that a 5ft. Capell fan, with 394 revolutions per minute, or a periphery speed of 6190ft., gave 26,460 cubic feet of air, the indicated horse-power being 4·94. My fan, with 26·46 revolutions, would give 26,460ft., and the water gauge would be ·21in. The horse-power in the air would be ·84, and the speed of the periphery would be 1663ft. Assuming the useful effect at 50 per cent., the indicated horse-power would be 1·68. That is to say, it would take only one-third of the power to raise the same quantity of air with the large fan as it would with the small one.

Now supposing that I had not tested the power by a large fan, and put on this small fan, I might have thought that this 4·94-horse power was necessary to raise the air, and, if the percentage of useful effect was high, that I had got the best fan, which would have been a great mistake. I do not think that the tests applied to the fan by Mr. Clark are at all as useful as if he were to put one of the fans at a colliery, side by side with another large fan, and test the one against the other, by making first a trial with the large fan and then shutting it off and testing the small one with the same drag. Or another test would be to have the same speed of periphery in the large fan as the small one, and ascertain the quantity of air and the horse-power developed by each engine. Simple proportion would then decide which was the best fan. R. T. M.

Glasgow, April 16th.

THE CREATORS OF THE AGE OF STEEL.

Sir,—As the correspondence which is appearing in your columns under the above heading can only answer two purposes, and both personally beneficial to Mr. W. T. Jeans, I hope he will not think me impertinent for pointing out how grateful he should be to you. In the first place, the advertisement for his book is one of such prominence that few other means could have secured it; and secondly, only Mr. Jeans appears to doubt the evidence of facts regarding Mushet's claims to the discovery of the spiegel process—hence he only can benefit by the discussion. However, if the result should be the speedy exhaustion of the first edition of Mr. W. T. Jeans' work and the appearance of a second free from the errors that are attributed to the present one, your courtesy may then have been for the general good.

For Mr. Jeans to quote from Sir William Siemens to prove that manganese does not take up oxygen in the steel processes is not unlike quoting from the Bible to prove that "there is no God." If Mr. Jeans is honestly in search of the truth, and can free his mind from bias, let him go into a Bessemer shop and carefully watch the converter each time that the spiegel mixes with the blown metal. If he can stay long enough he will see very varied phenomena at the mouth of the converter when the two molten substances come together, from the appearance of scarcely any flame at all to the issue of so large a volume that in exceptional instances it becomes an explosion, with streams of slag and metal shooting across the shop, so sudden and violent is the combination of the oxygen in the blown metal and the carbon in the spiegel, when manganese is not present in sufficient quantity to fix a great proportion of the oxygen that necessarily remains in the blown metal after complete decarburisation has taken place. Imagine, then, what would be the result of using iron and carbon without manganese to recarburise the blown metal. The shop would soon look like a slaughter-house. A compound of iron and carbon is, I suppose, what Mr. Jeans means by "carbonate of iron," as if he really intends to say the carbonate he is writing nonsense.

Little can be gained by prolonging this discussion, as the impression that Mr. Jeans' letter in your current issue produces on the mind of an impartial reader is that he thinks, "Well, if you do prove that Mushet first pointed out the value of metallic manganese in the manufacture of steel by the pneumatic process, what of that, since I shall show that it has no value?" for if the manganese does not take out the superfluous oxygen, it does nothing.

Landore, April 16th. F. J. R. Carulla.

LAND SURVEYORS AND THE ORDNANCE SURVEY.

Sir,—I shall be glad if you will permit me through your columns to bring before your notice and that of your readers the amount of injury land surveyors have suffered from our Government having taken upon themselves the business of supplying landed proprietors and others with almost every conceivable map they can require.

I believe I am right in saying that the Ordnance Survey originated from a desire to have a correct map of the whole kingdom solely for military purposes, and that the first map made was published upon a scale of 1in. to the mile; this has been followed by one of 6in. to the mile, and one of about 25in. to the mile. It is this last map that has done, and is doing, the most serious injury to the land surveying branch of the civil engineering profession, as far as country surveying is concerned, and the publication of plans of towns upon the 88ft. and 44ft. to the inch scale has almost entirely put a stop to the higher class of geodedtical operations, for careful surveys of large towns are no longer wanted where Ordnance maps of the 44ft. to the inch scale are to be obtained. The Ordnance map of 25in. to the mile is also doubly vicious in its injury, as it may be obtained with a reference which gives the acreage of every field, and at once supplies landowners with estate maps, sale plans, or whatever they may require.

It is not necessary to dilate any further upon the injury done to land surveyors, as I am confident it must be obvious to all. My contention is that the map published upon a scale of 25in. to the mile and the town's map of 44ft. to the inch are not military maps; and that whether military maps or not, their publication for sale is an infringement of all recognised laws of fair trade. Some people may say that no doubt land surveying is a ruined profession; but the maps are excellent, and absolutely cheap. Everybody likes to have them, and the interests of the minority must be sacrificed to those of the majority; besides, they may say a knowledge of surveying is requisite for our Royal Engineers, and they cannot do better than learn by practising in England and selling the plans to defray expenses. I think it would be almost as reasonable to say that army doctors might as well maintain their professional proficiency whilst in England by offering their services to the public for something like a shilling consultation fee. The public would benefit largely, and it would only be the medical profession that would be injured. Besides, our army doctors might rust if there was not something for them to do!

In many ways, as absurd as the foregoing, Government servants might be employed to the benefit of the public generally and to the ruin of some individual profession, business, or trade, and I feel sure everybody would cry out aloud against such manifestly unfair treatment; and yet we are all passively submitting to the extinction of land surveying without raising a dissenting voice or moving one finger for its protection.

Can you, Sir, or some of your influential readers, suggest what should be done with a view to the suppression of the sale of the most mischievous of the Ordnance maps? I trust that you will consider the urgency of the case sufficient apology for my having trespassed so greatly upon your space. Justitia.

March 31st, 1884.

[We publish our correspondent's letter, but we cannot propose a remedy. No professions or trades are protected; each has to fight for itself, and we cannot see what greater claim the land surveyor has for protection than the iron master, the cotton spinner, and the farmer. Land surveyors have our sympathy, but no remedy suggests itself that is not opposed to the policy of absolute free trade, with which this country is identified.—Ed. E.]

THE CONSTRUCTIVE STABILITY OF MERCHANT CARGO STEAMERS.

Sir,—The importance attached to the question of the constructive stability of merchant cargo steamers and vessels leads to the consideration of the methods involved for ascertaining the stability of these vessels under certain and variable conditions of lading, and of the relative usefulness of the methods, as determining the actual stability of a vessel, under the condition of her sailing in a light or a load trim—for vessels have been known to founder under certain conditions of lading, although otherwise with different condition of lading they have been considered safe and stable vessels. The general method involved is that of ascertaining at a certain load line or draught of the vessel the stability or power of the buoyancy to right the vessel, as calculated from an assumed approximate position of the common centre of gravity of all the weights, and from thence deducing or constructing curves of this measure of stability to certain angles of inclination; or ascertaining the length of the righting arm or lever under this particular condition of lading and draught of water. But the relative value of any other condition of lading and draught of water is not by this means determined, and cargo vessels have certain dead weight cargoes, with low centres of gravity, and deep draught of water on one voyage, giving them a good measure of stability that may be followed by a cargo of light specific gravity having a high centre of gravity and light draught of water on the next voyage, and under this condition they may not have sufficient stability to return upright or to resist overturning upon any force or power acting upon them when rolling in a sea-way.

Now, the metacentre is a point above which the centre of gravity of all the weights must not be, to ensure stability in the initial state, or a power to return the vessel upright upon any force or power acting upon her; and the centre of volume of the holds, or centre of internal capacity, may be the centre of lading, and with homogeneous cargoes entirely filling the holds, the centre of gravity of the cargo; this point, or centre of internal capacity or volume of holds, should be below the position or height of the metacentre at the particular draught of loading of the vessel, to ensure the centre of gravity of cargo, &c., being below the position or height of the metacentre; and as cargo steamers have dead weight cargo on one voyage, followed by light cargo the next, this centre of internal capacity should be below the metacentre under either of these conditions of loading. In some cargo steamers this centre of loading may be found to be above the position or height of the metacentre, and if loaded with an homogeneous cargo, or cargo of light specific gravity entirely filling the holds, such ships would be unstable and liable to capsize; and, as a matter of fact, such vessels have been known to have foundered, or have been lost, entirely from the want of sufficient stability. The problem, then, is, how to give as much stability to a vessel when loaded with homogeneous cargo filling the holds, also when floating at a light draught of water, as when more deeply laden with heavy dead weight cargoes. Admiral Fishbourne, in his work on "Stability, the Seamen's Safeguard," says:—"The position of the centre of gravity being all important, and the difficulty of entering into a detailed estimate of all the points changed by cargoes varying in specific gravity and quantity is so great, that it is most desirable to give a rule that will apply to all cases that shall be safe and effective." And "That of the vast number of vessels that we have a record of, not one appears to have been rolled over because of having too much stability, while numbers are clearly lost every year from having too little." And again he says:—"The extreme ranges of draught in steam vessels from lessened specific gravity of cargoes and other things involve the advocates of high centres of gravity with little stability in the very gravest responsibility."

This would seem to be the whole cause lying at the root of the question, viz., that vessels have too little stability with light cargoes at light draught of water, while such cargoes as coal or grain, being homogeneous, and filling the holds, the centre of gravity is high in proportion to the position or height of the metacentre. Any power acting upon the vessel has rolled her over. The object to be sought is that vessels designed for these cargoes should have their centres of internal capacity, or volume of holds, below the position or height of the metacentre at the corresponding draught for these cargoes at which the vessel floats.

The illustrations given in your issue of the 14th March show the principle involved in this consideration of the subject, and by reference to those sections may be seen the conditions of stability under different conditions of loading, and the relative positions of centre of internal capacity, and position or height of metacentre at any variable draught of water and under any condition of lading. The centre of lading, centre of internal capacity or volume of holds, being above the metacentre, renders the vessel unstable when laden with homogeneous cargoes, or cargoes of light specific gravity filling the holds. But with the centre of lading or internal capacity below the metacentre, it would be impossible to render the vessel unstable under any condition of lading, or at any draught of water. J. Andrews.

Charlton, March 29th.

THE MANCHESTER SHIP CANAL.

Sir,—I wish to refer those interested in the economical promotion and ultimate completion of the Manchester Ship Canal scheme to the suggestion thrown out by Mr. Eades, of America, at the end of his evidence before the Committee of the House of Lords on the 3rd inst. Mr. Eades there suggests a scheme which I advocated more than twelve months ago—January 26th and February 9th, 1883—in these columns. He said:—"If he were asked to make Manchester a port, he should bring the canal through the land to Garston, and should make the mouth of it there; that was his idea without having given very much consideration to the question.' On referring to The Engineer of above dates, it will be found that I gave cogent reasons, physical, monetary, and practical, in favour of a land cut from Runcorn to Garston. I am convinced that this is the simplest solution of the estuary difficulty, and I am glad it is supported by no less an authority than Mr. Eades. Wellwishers will regret if the completeness of the project be marred by the exigences of a hasty initiation, which precludes a thorough and economical definition of route. James Glover.

Birkdale, April 8th.

COUPLINGS FOR SCREW SHAFTS.

Sir,—In your last number you give drawings of Mr. Brotherhood's elastic coupling, as designed for screw propeller shafting, and call attention to the butting of the shafts' ends for transmitting the forward thrust. But you do not say how the thrust is taken going astern. As the requirements of an elastic coupling for a dynamo-machine are not identical with those of propeller shafts, would a universal joint not serve the purpose, with trunnions forged on the shafts' ends and coupled with a disc having ordinary bearings to receive the trunnion?

I should be glad to hear the opinion of some of your readers on this subject if you can spare me the space in your paper for my letter. C. G. R.

London, April 9th.

STEAM HAMMERS.

Sir,—Referring to the letter in your issue of the 5th, we should be sorry to make any insinuation, and do not see that we have done so. Probably we have made the matter clear to impartial outsiders; and it is they, and not disputants, who must judge. Your correspondent's section does not show our construction at all, so that to speak of copying is absurd. We adopt what we think much better; though, of course, that is a matter of opinion. We hope we have not been discourteous—certainly we have been accurate. B. and S. Massey.

Steam Hammer Works, Openshaw, Manchester, April 9th.

THE INSTITUTION OF CIVIL ENGINEERS.

EXPERIMENTS ON THE COMPOSITION AND DESTRUCTIVE DISTILLATION OF COAL.

At the ordinary meeting on Tuesday, the 1st April, Sir J. W. Bazalgette, C.B., President, in the chair, the paper read was on "Experiments on the Composition and Destructive Distillation of Coal," by Mr. William Foster, M.A., F.C.S.

The first portion of the paper dealt with the chemical composition of six samples of coal raised in different parts of the United Kingdom, and of widely different characters. One was a specimen of Scotch Cannel; a second a specimen of English cannel; two were from Yorkshire; one from Durham; and one was Welsh anthracite. The samples were of good repute, either for the manufacture of illuminating gas or of foundry coke. The amounts of each and all of the elementary components were given in the form of tables. Each sample was then submitted to the process of destructive distillation, and the coke produced was then fully analysed, the same details having been worked out as in the case of the parent coals. The connection between the composition of a sample of coal and of the coke which it furnished was thereby elucidated. In this way some instructive details were brought to light. The relation between the amount of sulphur present in a particular sample of coal and that remaining in the coke was then discussed, and a table was given showing the amounts of sulphur evolved by the respective coals when treated as in the manufacture of coal-gas. In all the cases under notice the amount of sulphur remaining in the coke was less, and occasionally considerably less, than that present in the parent coal. It was remarked that this was in opposition to the generally received opinions on the subject, which were to the effect that one of the drawbacks to the use of coke as a domestic fuel arose from its containing more sulphur than raw coal. The behaviour of the nitrogen of each of the samples of coal was discussed at great length, so that the paper formed a continuation of the author's earlier researches on this branch of the subject. The chief interest centred in the nitrogen remaining in the coke, which was shown to contain from 50 to 66 per cent. of the original nitrogen of the coal. The amount of the nitrogen of the coal, coming off as ammonia during the process of destructive distillation, was also given for the different samples, and estimates were furnished of the amount coming off as cyanogen during the same process. By the author's methods of experiment, a considerable proportion of nitrogen was still unaccounted for, which he believed to exist partly in the tar in the form of alkaloidal substances, but principally as free nitrogen in the coal-gas. The paper then dealt at great length with the question of recovering the nitrogen of coke as the valuable product ammonia, and showed how this might be effected by the action of steam at a high temperature. By "gasifying" coke, in the manner stated in the paper, until it lost a little more than 40 per cent. in weight, more than 60 per cent. of the total nitrogen of the coke was evolved as ammonia gas. In other words, 100 tons of coke, when submitted to this limited influence of steam, furnished ammonia equal in amount to 4 tons of ammonium sulphate. The author then discussed the bearing of these researches on the question of supplying gaseous fuel for industrial purposes. Coke was frequently, owing to local circumstances, and varying conditions of the weather, almost unsaleable in certain districts. By converting it into gaseous fuel of the highest thermal value, through the agency of steam at a high temperature, a considerable proportion of the nitrogen of the coke might be simutaneously obtained as a by-product. In the course of the treatment with steam, the sulphur of coke made its appearance in the form of sulphuretted hydrogen, a condition most favourable for its ready and profitable removal from the gaseous fuel. In this way it was suggested that a sulphur-free product could be obtained which could not fail to commend itself if supplied for use in such industries as those of Sheffield and Birmingham. Allusion was made to the fact that it was twenty years since the late Sir William Siemens applied gaseous fuel to the heating of the retorts of the Paris gasworks, with perfect success. A similar application in this country had not been known for more than three or four years. Some calculations were made of the thermal value of the gaseous fuel which it was proposed to manufacture; but they were extremely brief, and related to the figures obtained in the course of the experiments.

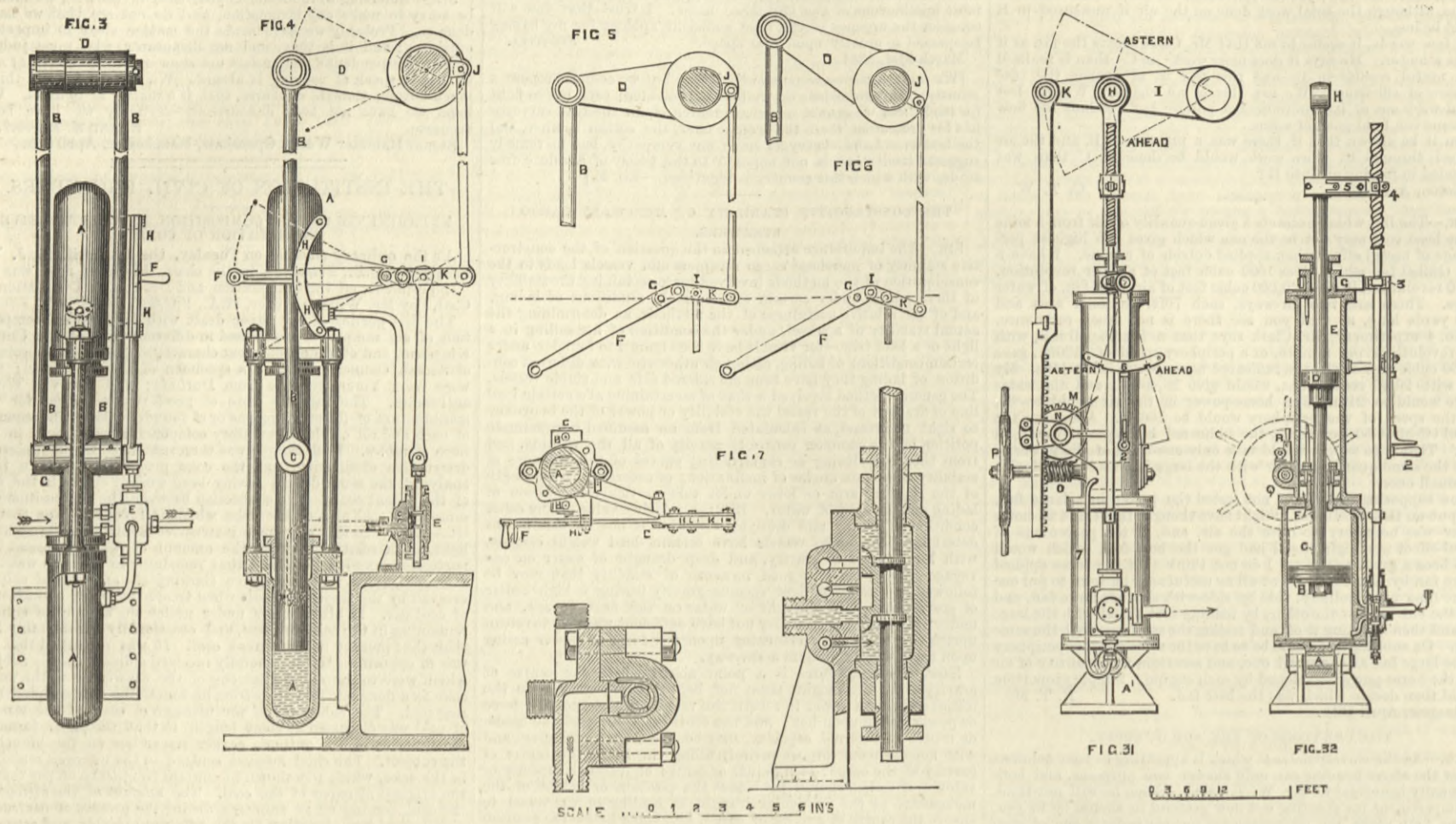
The Ouse Bridge.—In our impression of the 4th inst. we published engravings of the hydraulic machinery and its arrangement in the Ouse Bridge of the Hull and Barnsley Railway. We mentioned the name of Messrs. Sir W. G. Armstrong and Co. in this matter, and should have said that the hydraulic machinery was entrusted to that eminent firm, the bridge and railway having been constructed under the engineers mentioned in our general account of the bridge given on the 25th of January last.

London Association of Foremen Engineers and Draughtsmen.—The Thirty-first Anniversary Festival of this society took place at the Cannon-street Hotel on the evening of Saturday week, Mr. Charles M. Palmer, M.P., in the chair; Mr. J. D'A. Samuda and Mr. H. Stokoe, Captain Bedford Pim, Lieut.-Col. Hughes, Major Davis, Mr. G. A. Wallis, C.E. and about two hundred and fifty others sat down at dinner, Lord Wolseley, Sir Andrew Clarke, and several others of distinguished positions being absent in consequence of the death of the Duke of Albany. In the course of the evening Mr. Palmer spoke at length, and Mr. Samuda spoke at length on some industrial questions, the importance to England of the maintenance of a first-class navy being dwelt upon, Captain Bedford Pim commenting adversely on the capabilities of most of our men-of-war, and objecting to the Channel Tunnel scheme as adverse to the interests of the cross channel shipping, while the two former speakers were generally in favour of the tunnel. The influential position of foremen engineers as controllers of large numbers of workmen, the part they played and might play in maintaining and improving our position as the greatest manufacturers of the world, was dwelt upon by the former speakers, and Mr. Stokoe in referring to foreign competition and improvement in our methods of doing work, said the increase in the application of machine tools had been always accompanied by increase in the number of skilled artisans required, and in the rate of wages. Mr. Joseph Newton spoke of the satisfactory position of the society, and the extent to which it is supported by employers, although for years after it was started he had great difficulty in getting employers to believe that it was not simply a better form of trades union. The funds of the society were stated to be continually increasing, and the benefits conferred on disabled members and their dependents greater year by year. A considerable sum was subscribed during the evening.

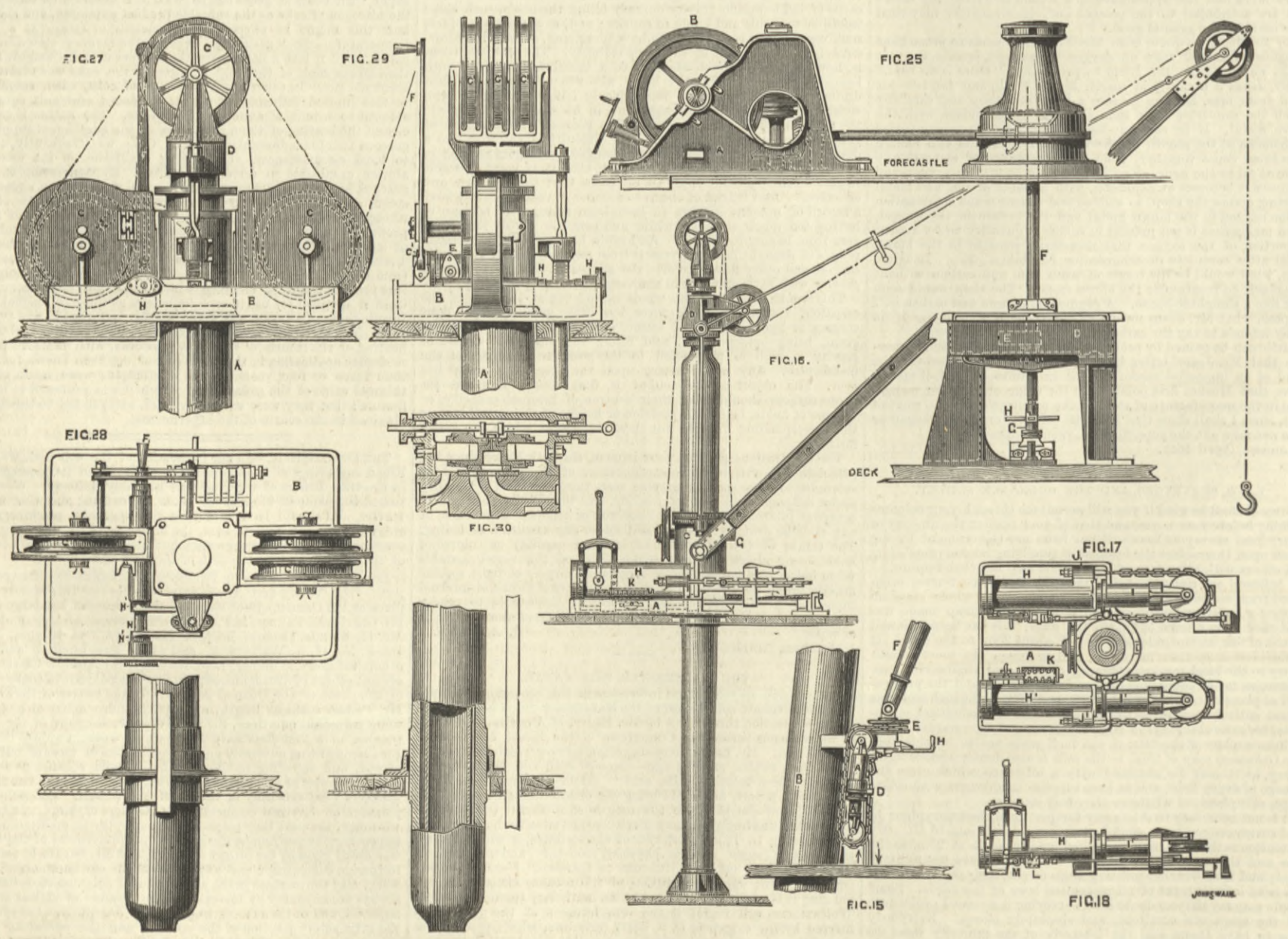
HYDRAULIC MACHINERY, STEAMSHIP QUETTA.

MESSRS. A. B. BROWN, AND CO., ROSE BANK, EDINBURGH, ENGINEERS.

(*For description see page* 299.)



HYDRAULIC AND STEAM AND HYDRAULIC REVERSING GEAR.



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BERLIN.—Asher and Co., 5, *Unter den Linden.*
VIENNA.—Messrs. Gerold and Co., *Booksellers.*
LEIPSIC.—A. Twietmeyer, *Bookseller.*
NEW YORK.—The Willmer and Rogers News Company, 31, *Beekman-street.*

TO CORRESPONDENTS.

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

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

Cambridge.—*So far as we can see, you have certainly not made an overcharge.*

E.—*You can get the book "On Gas Engines" from A. Seigel, Berlin. Perhaps Mr. David Nutt, Strand, London, can supply you.*

Shears.—*You will find some information on the subject in the "Proceedings" of the Institution of Mechanical Engineers for* 1858, *page* 73. *See also Clark's "Rules, Tables, and Data," page* 587.

J. S.—*There is no book of the kind. The system of testing to be adopted is always stated by the engineer who draws up the specification. You can read Fairbairn's "Researches on the Application of Iron to Building Purposes" with advantage.*

Reader.—*The treatise "On the Joints Made and Used by Builders," by W. J. Christy, in Weale's Series, published by Crosby Lockwood and Co., may meet your requirements. The paper "On Joints in Ironwork," read before the Civil and Mechanical Engineers' Society by Mr. H. Adams, of the City of London College, would be of service to you.*

J. W. H.—*The coupling shown by your tracing would be a very good one, if only india-rubber could be got to stand. The quantity needed would render the joint very expensive when used on a large scale, and the india-rubber would be liable to injury from oil, and would, besides, gradually lose its elasticity, when the joint would become slack and give much trouble. An elastic steel disc would give a better result. We cannot say whether your coupling is new or not.*

TELEGRAPH WIRE.

(*To the Editor of The Engineer.*)

Sir,—I wish to put up a telegraph wire 1100 yards span across an arm of the sea. Will any reader kindly tell me what thickness and quality of wire to use, and what will be the sag or versed sine in the middle?

Inverness, April 15th. Enquirer.

GRAIN ROLLS.

(*To the Editor of The Engineer.*)

Sir,—Will any reader be kind enough to tell me through your valuable columns a good brand of iron for grain rolls, not chilled? I want an iron, if possible, to be close-grained, and when turned up to look like silver; not too hard, and to show no small specks as I find most of our iron does.

Northampton, April 16th. J. H. S.

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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, April 22nd, at 8 p.m.: Paper to be read with a view to discussion, "On the Comparative Merits of Vertical and Horizontal Engines, and on Rotative Beam Engines for Pumping," by Mr. Wm. E. Rich, M. Inst. C.E.

Society of Arts.—Monday, April 21st, at 8 p.m.: Applied Chemistry and Physics Section. Adjourned discussion on the paper by Dr. Percy F. Frankland, "On the Upper Thames as a Source of Water Supply." Sir Frederick Abel, C.B., D.C.L., F.R.S., Chairman of Council, will preside. Wednesday, April 23rd, at 8 p.m.: Eighteenth ordinary meeting. "Thames Communications," by Mr. J. B. Redman, M. Inst. C.E. Friday, April 25th, at 8 p.m.: Indian Section. "The Existing Law of Landlord and Tenant in India," by Mr. W. G. Pedder. The Hon. Sir Ashley Eden, K.C.S.I., will preside.

THE ENGINEER.

APRIL 18, 1884.

FORCED DRAUGHT STEAM BOILERS.

Mr. Howden feels himself injured by the criticism we passed last week on the paper which he read before the Institution of Naval Architects. In our correspondence column will be found a letter from his pen. We pass over in silence the second paragraph of this letter. Possibly Mr. Howden will feel regret that he ever penned it when he sees it in print. The head and front of our offending is that we said that portions of his paper contained assumptions not supported by experimental facts and figures; but nothing in his letter proves the contrary. In order that our readers may be placed in a position to form their own conclusions, we reproduce on page 297 that part of Mr. Howden's paper to which our remarks more particularly applied; but the whole paper is marked by the same tendency to take for granted just what best suits Mr. Howden's object. It may be worth while to go through his paper and point out some of the defects which elicited not our criticisms alone, but those of almost every-one who took part in the discussion. It is in no unfriendly spirit that we shall speak of it. If what we have to say does not commend itself to Mr. Howden he will only have himself to thank; for if he had confined himself to facts, and manifested an intelligent appreciation of the lessons which these facts convey, he might have produced something which his audience could have heard with profit. As the paper stands, however, it is one of the most unsatisfactory ever read before a technical society. Its author has jumbled up facts and deductions in a very curious fashion; and he seems to be unable to see to what his own reasoning leads up. The paper is illogical and wants coherence. There are, however, some things in it worth reading, and with liberal excisions and alterations it may be made fit for a place in the "Transactions" of the Institution of Naval Architects.

Mr. Howden's thesis is that whereas about 11 lb. of air would suffice for the combustion of 1 lb. of coal in theory, in practice it is necessary to admit more than twice as much, and this represents a loss of 12½ per cent. in fuel. He also seems to suppose that the products of combustion are purposely discharged from the flues of a marine boiler at a high temperature in order to obtain a good draught; and that it ought to be possible to send them away little hotter than the water. His cure for all the defects and shortcomings of which he complains, is to burn coal with a limited supply of air under a forced draught obtained with a fan, and in this way, he maintains, that an enormous saving of fuel might be effected. But he implies in another place that it could not exceed 12½ per cent. For if the waste due to burning coal in the ordinary way is caused by the admission of too much air, then the saving which can be effected cannot on his own showing be more than 12½ per cent. At the very outset we are brought face to face with another example of the inconsistences in which Mr. Howden's paper abounds. He points out that in 1846 the Cornish boiler evaporated 12·89 lb. of water from 212 deg., and this he attributes mainly, so far as we understand him, to slow combustion. This result, we may add, was obtained with *a* Cornish boiler, and by no means represents the duty of all boilers in Cornwall. Indeed it is notorious that boiler management was as bad as possible in the palmiest days of the Cornish engine. A little further on we learn that slow combustion is the thing to be avoided when we desire economy, and no attempt whatever is made to explain the inconsistency. Starting with an evaporation of 12·89 lb. as a species of standard, he goes on to assert that, in the modern marine boiler, "the average evaporation is probably not more than ·6 of this Cornish economy, while in those high-speed steamships which maintain an average of about seventeen knots across the Atlantic, it is probable that barely the half of this evaporative duty is reached." Mr. Howden must pardon us if we say that he is to blame for putting such unsubstantiated assertions as these before such an audience as he addressed — or, indeed, before any audience. It is perfectly well known that a consumption of 2 lb. of coal per horse per hour is rather over than under the average of good steamship performances; and it was authoritatively stated during the discussion on Mr. Howden's paper, that the fast Atlantic liners do not burn more, although in them coal is a secondary consideration as compared to power, which must be had at any cost. If, however, their boilers only evaporate 6·5 lb. of water per pound of coal, then their engines—just as hard pushed as the boilers, be it remembered—must manage to squeeze a horse-power indicated out of every 13 lb. of steam which finds its way through their cylinders. Need we stop to explain why such a result is impossible of attainment? Again, 12·89 × ·6 = 7·734. This represents, with a consumption of 2 lb. per horse per hour, less than 15½ lb. of steam per horse per hour. Does Mr. Howden fancy that the engines of cargo boats, indicating 500 to 750-horse power, and working at 75 lb. pressure, are so economical as this implies? The truth is that the evaporation in the modern marine boiler seldom falls, with good coal, below 9 lb. of water per lb. of fuel; a result due in great measure to the clean heating surface in boilers working in communication with surface condensers. Further on we find Mr. Howden stating that "an average consumption of 100 lb. of coal per square foot per hour is burned on the fire grate of an express locomotive, and what should not be overlooked in the consideration of this subject of combustion under air pressure, this astonishing rate of combustion is accomplished with comparative ease and remarkable economy." If Mr. Howden had taken the smallest pains to verify his figures, he could not have written thus. He ought to have known, for example, that express locomotives burn at the outside, with heavy trains, only 30 lb. a mile or so; that 50 miles an hour is an average speed with this consumption; and that the grates of such engines are 18 to 20 square feet in area. If, knowing these things, he had taken the trouble to read the lesson they taught, he would have seen that an engine with 20ft. of grate burning 100 lb. of coal to the foot per hour must consume 20 × 100, or 2000 lb. of coal in one hour and in fifty miles, and $\frac{2000}{50} = 40$ lb. per mile—a consumption not reached in any English express engine. Furthermore, if he will bear in mind that 30 lb. a mile represents the total consumption of the engine while standing under steam, lighting up, and so on, he will be able to see that 70 lb. per square foot per hour is probably over the mark. Again, we find him at the beginning of his paper praising the Cornish boiler, because the rate of combustion is but 4 lb. or 5 lb. per square foot of grate per hour, and in the next breath praising the locomotive system, on which, he says, coal is burned at twenty times the rate. He speaks in very favourable terms of torpedo boat boilers worked with forced draught. He can never have been on board one during a run. The boilers are wonderfully perfect for their intended purpose, but there is no pretence of economy, about 120 lb. of coal per square foot of grate per hour is put into the fire-boxes; but certainly not more than 100 lb. of this is burned, the remainder is blown up the chimneys, and may be collected by the bucketful off the deck in the shape of cinders as large as filberts.

It is not, however, with Mr. Howden's mistakes such as those we have pointed out that we need principally concern ourselves. Men who have most carefully considered the subject know that combustion in steam boiler furnaces presents difficulties that cannot be dismissed in a few moments. All this seems to be a sealed book to Mr. Howden, and he takes it for granted that because 12 lb. of air will suffice to supply a pound of carbon with its combining equivalent of oxygen, that combustion can be effected on nearly the same terms without much trouble in a steam boiler furnace. Now, we suppose that since the world was created a pound of carbon was never yet completely burned into carbonic acid by the aid of only 12 lb. of air. We may add that Mr. Howden, in dealing with the Oregon, in order to maintain his thesis that small quantities of air will suffice to ensure perfect combustion, is apparently compelled to understate his case, and assume that combustion can be, and is, effected with an admission of but 15 lb. of air per pound of coal. No shadow of proof of this is adduced. It is far more probable that as much as 24 lb. of air per pound of coal finds its way through the Oregon's furnaces. In a word, neither with nor without forced draught is it possible to burn fuel perfectly with the small quantities of air that Mr. Howden proposes to admit. Mr. Howden holds that by cutting down the supply of air we should get rid of smoke. He clearly understands that black smoke does not represent waste, but that the escape of invisible carbonic oxide does; and his remedy is to augment the furnace temperature. But this is the very thing that should not be done, for at very high temperatures oxygen will not combine with carbonic oxide; and if it has already been combined in some cooler part of the furnace dissociation may take place. Mr. Howden is fully aware that when forced draught has been tried on board H.M. ships Satellite and Conqueror the boilers were caused to leak, but this does not deter him. He gaily careers his hobby through all obstructions, ignoring what he does not wish to see, and drawing deductions without the least warranty from a very limited stock of facts.

We have, we think, said enough to indicate the nature of Mr. Howden's paper, so far as it deals with the existing system. We may now turn to the remedy which he proposes to adopt. He supplies hot air to his furnaces by the aid of a fan. The air is warmed by passing through a space traversed by pipes in the up-take; it is, in a word, not unlike a steam superheater. This air is led down to the grate front, and supplied to the furnaces by special arrangements by which the influx of cold air to them is prevented when the fires are being fed. So far as can be gathered from Mr. Howden's drawings, the details of this arrangement are well thought out, and moderately warm air will no doubt be supplied to the furnaces. The arrangement is better than the closed stokehole in some respects. Whether, however, it will find favour at sea we are not at all prepared to say. Mr. Howden contemplates a much longer run for the products of combustion than can be had in ordinary marine boilers. To get it he suppresses the back uptakes altogether, carries his furnaces and his tubes right through the boiler from end to end, and then couples them by the aid of a brick combustion chamber built on at the back. This certainly does not commend itself to us for sea-going ships. The space occupied and the cost of Mr. Howden's boilers are both in excess as compared with the ordinary marine boiler. The question is, what is gained by the adoption of the system? On this point Mr. Howden had nothing definite to tell his audience. His first experimental boiler was, he admits, a failure; with the second and larger boiler experiments are still in progress. He burns 30 lb. of coal per square foot of grate per hour. As for the economical results, we quote Mr. Howden's own words: "What has already been accomplished shows that from 9½ lb. to 10 lb. of water at 212 deg. could be evaporated at sea from 1 lb. of Scotch coal with a rate of combustion of 30 lb. per square foot of grate per hour; but there are good grounds for expecting an evaporation of even 12 lb. may yet be reached with a rate of combustion of from 40 lb. to 50 lb. per hour per square foot of grate." Thus we find that on his own showing the result he has obtained is little if at all better than that normal to the modern marine boiler, and is very much below the results which have been obtained in other experimental boilers. Thus Lord Dundonald more than thirty years ago evaporated nearly 14 lb. of water per pound of coal, from 212 deg. in the boilers of the Janus. Mr. Howden, it will be noticed, says nothing of the probable effect of his high furnace temperatures on the crown plates of his furnaces. This is a detail not, we suppose, worth notice. Nor does he appear to think that water surface and steam space—in other words, size—are essential in a marine boiler to prevent priming.

Mr. Howden has not, we fear, as much scope to effect improvements on the modern marine boiler as he fancies. He can, of course, say that the average evaporation of the modern boiler is 7½ lb.; and if he evaporates 10 lb. he may claim a great success. But his assertion concerning the 7½ lb. really is but an assertion, unsupported by a grain of evidence, and contrary to all modern experience. The engines of the Riachuelo developed a horse power for 1·38 lb. of coal per horse per hour. The boilers must in that case have evaporated at least 11 lb. of water per pound of coal; but, on Mr. Howden's showing, such a performance with ordinary chimney draught was simply impossible. Here we leave the matter, not without admitting that there is much in Mr. Howden's subject which commends itself to us as worthy of examination and investigation by independent experts. Our contention is that Mr. Howden's paper does neither its author nor its subject justice.

THE LONDON WATER SUPPLY AND ITS CRITICS.

A prolonged discussion of more than usual interest is now in progress at the Society of Arts in reference to the metropolitan water supply, several of the leading experts coming forward on the occasion. The subject was started by a paper on "The Upper Thames as a Source of Water Supply," read by Dr. Percy F. Frankland, whose views in respect to this matter correspond very closely

with those of his father, Dr. Edward Frankland. Thus we find Dr. Percy Frankland declaring that the exclusion of sewage matter from a river like the Thames is practically an impossibility; that such sewage matter may at any time be accompanied by the germs of zymotic disease; and finally that no process to which the water is subjected can remove these germs should they be present. In the discussion which followed the reading of Dr. Percy Frankland's paper, Sir Frederick Nicolson, on the part of the Conservators, took decided exception to the statement that nothing had been done for the purification of the Thames for the last fourteen years. Of course this statement could only be justified by the theory that the effluent water from sewage and from sewage farms was no better, in a sanitary sense, than sewage in a wholly untreated condition. Sir F. Nicolson declined to discuss that theory, but gave an array of facts to show that the Thames was practically free from sewage, taking "sewage" in the ordinary sense of the term. The outlay for diversion and treatment of sewage by towns along the valley of the Thames during the last few years has amounted to more than half a million of money. Sir Robert Rawlinson, who followed Sir F. Nicolson in the debate, declared that what the chemists considered to be the purest description of water for drinking purposes had seriously affected his own health and that of his family. According to his own experience, he preferred the water supplied by the Chelsea Company to that which he had drunk when in the pure water districts, where the supply came from the granite. He did not believe in absolutely pure water, for even that which came from the granite districts would be mixed with impurities of some kind. He calculated that out of the entire population of the globe, 95 per cent. must be drinking water which ought to injure their health very considerably, and more than 50 per cent. of the water "would horrify any persons who had the chemical contents explained to them."

Some extraordinary facts mentioned by Sir R. Rawlinson and others may be satisfactorily explained if viewed in the light of the recent discovery effected by Dr. Koch in connection with the German Cholera Commission. That polluted water may, under some circumstances or other, become highly dangerous to health and life, is a fact too clearly proved to be successfully disputed. But there are incidents of a very puzzling nature which point the other way. Amid all the controversy which has raged around the question of the water supply, a supreme difficulty has presented itself in the circumstance that while a "cholera germ" was talked about, nobody had ever seen it. Hence the mere fact that a searching examination detected no actual poison in the water, could not be urged as positive proof that the water was safe and wholesome. Contrary to the popular notion, Dr. Frankland has failed to find anything worse in the Thames drinking supply than now and then, at long intervals, a "moving organism," which, so far as anybody could tell, might be totally incapable of producing zymotic disease. As for sewage, all that could be found was something which, in the philosophy of Dr. Frankland, indicated past contact with polluting matter. The sewage was gone, but something remained which was held to prove that sewage had been there. As for the moving organisms, Dr. Frankland found them in the London water supply on twenty-four occasions in 1869, on eighteen occasions in 1876, and on only two occasions in 1882. For four years he found none in the Southwark and Vauxhall supply, and during the whole range of fourteen years they were detected in the West Middlesex water supply on only three occasions.

What these "moving organisms" really mean is a point on which we are likely to gain some further light. Dr. Koch has now issued his sixth report, and feels himself warranted in saying that the actual cholera germ has at last been discovered and its identity fully established. When Dr. Frankland finds the cholera bacillus in the London water supply it will then be time for the inhabitants of the metropolis to take the alarm. Yet even then the prospect will not be wholly dark. The cholera bacilli will only grow in alkaline solutions, a very small quantity of a free acid being sufficient to check their development. A healthy stomach contains enough free acid to destroy these bacilli. Hence we see a way of escape from the uncomfortable doctrine that the germs of disease are endowed with a vitality which nothing can extinguish. We may expect that this notable fact will explain some hitherto perplexing results in connection with cholera remedies. To have found our enemy is the first step towards overcoming him. Not only has the creature an aversion for that which is acid, but he quickly expires when deprived of moisture. This, again, may show how it is that cholera rages with increased virulence after a fall of rain, a moist atmosphere seemingly serving to intensify and spread the contagion. A clue once obtained, valuable discoveries will doubtless ensue, and much that has been inexplicable will be fully elucidated. Sir R. Rawlinson states that in 1833, 1849, and 1854, cholera raged severely in towns situated above Birmingham, and the whole of the virus of the disease was washed down into the streams and tributaries of the Tame, from which Birmingham took its supply. Water so taken was neither strained nor filtered, but was sent on to the consumers as it was pumped up, and yet not a single case of cholera occurred in Birmingham. On the other hand, the Sardinian troops in the Crimea, 16,000 strong, were supplied with splendid water from the oolitic rocks, and yet a thousand of those men died of cholera in the first month after they landed.

Proofs of the non-effect of a polluted drinking supply indicate that there are causes at work which either destroy or in some way neutralise the element of danger. The theory that water, once contaminated with sewage, even in its mildest form, can never afterwards be made wholesome, is a most impracticable doctrine, and, if admitted, might make us almost quarrel with the very constitution of things. If the effluent from sewage works or a sewage farm is no better than the raw untreated liquid, why should sundry towns above London be made to spend half a million of money in order to purify their sewage? Why attempt anything if we can do nothing? Even if all the town sewage is carried off by enormous engineering works, and finally cast into the sea, there is the manured land to be taken into account; and the people of London are told that this is quite enough to pollute the supply and render it unwholesome. A new terror has lately been added to the subject by the discovery that deep wells in the chalk may become polluted; and the law affords no protection against the pollution of underground waters. If all that certain chemists say were true, the world must soon become no place for man to live in, and the human population must be exterminated by the bacilli. But there are champions on the other side, and one of the most resolute of these is Dr. Meymott Tidy. On the second night of the discussion at the Society of Arts, Dr. Frankland himself opened the ball, but was speedily followed by Dr. Tidy, in a speech of so trenchant a character as fairly to electrify the meeting. The latter vigorously assailed the doctrine that "if a river be once polluted by sewage matter, the water of that river was for ever unfit for dietetic purposes, and that no practical distance of flow would render that river safe as a source of drinking supply." Dr. Tidy discussed this subject from three points of view. First, as an ordinary observer; secondly, as a chemist; and, thirdly, as a medical man. In the first instance he referred to the river Soar, black at Leicester and clear at Loughborough; the Irwell, black at Manchester and clear at Warrington; the Colne, black at Uxbridge and clear again in a mile and a-half; the river at Witney black, but perfectly clear a mile lower down. Secondly, as a chemist, he quoted various analyses. The Colne, before the Uxbridge sewage entered the stream, had a given quantity of organic carbon, required a given quantity of oxygen to oxidise the organic matters, and contained a given quantity of free oxygen. The sewage went in, and immediately up went the organic matter, up went the oxygen required to oxidise that matter, and down went the free oxygen. Three quarters of a mile further on "the whole thing became again normal," the organic carbon, the oxygen required to oxidise the organic matters, and the proportion of free oxygen in the water, being absolutely identical with the quantities which existed before the sewage went into the river. So far was the Thames from being polluted by the Colne, that it was absolutely improved by the junction of that river.

Medically, Dr. Tidy was able to quote the fact that the lowest death rate recorded in the metropolis since 1868 was in the year 1872, when the quantity of organic matter in the Thames, according to Dr. Frankland, was higher than it had ever been. On the contrary, the highest death rate was in 1870, when the quantity of organic matter was at its lowest. Other data of a similar character were brought forward, and, after taking a general review of the subject, Dr. Tidy "unhesitatingly asserted" that Dr. Frankland had not proved his point, and that no better supply of water could ever be found for London than the supply which at present was drawn from the Thames and the Lea—so completely do doctors differ. But Dr. Tidy had yet another weapon to wield. He warned Dr. Frankland that a time would come when the Government "would not want his monthly reports." That time would be when the authorities had acquired the property of the shareholders of the London Water Companies. Dr. Tidy predicted that when that day arrived the authorities "would be perfectly satisfied with the present supply—nay, would be enthusiastic in its praise." He was able to cite a notable example of this kind in the history of the Stockton and Middlesbrough water supply. We can quite believe that Dr. Tidy may be right in his prevision. If some ready means of introducing a better water supply into London than that which now exists were in view, the question would assume another aspect. But grave doubts exist as to the possibility of drawing a permanent supply from the chalk equal to all the need of London; and so far as can be seen the water now supplied leaves little to be desired. Concerning the position of the companies, Dr. Frankland offered some very fair and sensible remarks at the second meeting at the Society of Arts, and he certainly is very far from endorsing anything like a doctrine of confiscation.

There are signs that something like a change is coming over the metropolitan water controversy. The prospect of a reform in the local government of London, to be followed by a transfer of the water supply from the companies to a public authority, has a somewhat sobering effect on a class of persons who otherwise would denounce the existing supply as intolerable. The attack is now directed rather against the revenues of the London water companies than against the commodity which they distribute. Mr. Archibald Dobbs leads the affray rather than Dr. Frankland. If the idea of a competitive supply is entertained, it is more for the purpose of driving down the value of the companies' property than for any distinct sanitary reason. "Annual value" is of greater interest now than "moving organisms;" and at a recent conference of delegates from metropolitan vestries and district boards, a resolution proposing that London should be supplied with water "from other and purer sources than the Thames and the Lea" was negatived. At an adjourned meeting of the delegates, a motion declaring it desirable that a commission should be appointed "to thoroughly examine the whole question of the water supply of the metropolis" was also thrown overboard. All that the delegates could agree upon was to do their best to support the Bill of Mr. Torrens, so as to ensure that all water rates should be levied on the "net annual rateable value." Chemistry thus gives way to finance, and it is curious to find a growing disposition on the part of chemists to moderate their views as to the impurity of water. The alarmists have had their day. They have done good, inasmuch as they have pressed the water companies to adopt improved arrangements, both as to the situation of their intakes and the character of the filtration effected. Larger impounding reservoirs have been introduced, so as to avoid, in a great measure, taking in water when the river is in flood. We now find Dr. Frankland himself saying that the question why the Thames water was not considered suitable for the supply of the metropolis "was a very serious question indeed.' He refers to the fact that "an enormous amount of capital has been spent in the construction of waterworks," and he declares himself compelled to say that he is one of those who does not think that property of this description ought to be lightly meddled with. Dr. Frankland is content that the water should be taken from the Thames basin, and all he asks for is that a portion of the water flowing over Teddington Weir should be intercepted higher up, so as to prevent it from going into the Thames at all. London would thus have the benefit of an uncontaminated supply of spring water. But he acknowledges that the water supply as it is exhibits great improvement, and he highly commends the measures recently carried out by the companies. Such expressions from the lips of Dr. Frankland have particular weight. By-and-bye there is to be a conference on water supply, to be organised by the Society of Arts, in connection with the International Health Exhibition. The Prince of Wales intends taking the chair, and something more will, of course, be said as to the character of the metropolitan water supply, together with that of the country at large.

RAILWAY ACCIDENTS IN 1883.

In another page we publish the summary of railway accidents in 1883, issued by the Board of Trade. The deductions which can be drawn from it are not numerous, or novel. The most noteworthy feature is, perhaps, the great number of failures of tires; no less, indeed, than 1247. Of these 1100 were of iron and 147 of steel. As 1143 were wagon tires, it is a legitimate deduction that steel is but little used as yet for this class of rolling stock. Of the whole number which failed, as many as 1026 split longitudinally, while only 21 failed at a weld; from which it may be gathered either that welding is done much better now than it used to be, or that the number of welded tires in use is extremely small; and this is no doubt the case. Tire-makers would do well to investigate the causes which lead to splitting. By many persons it is attributed to the action of the tire rolling mill. We confess we cannot quite see why. As many as 450 axles broke, of which 247 were crank or driving and 28 leading or trailing axles. The superiority of steel over iron is not demonstrated; on the contrary, the average life of an iron axle is 213,719 miles, and that of a steel axle only 199,471 miles. Steel-makers would do well to take this statement into consideration, and supply an explanation which we are assured can easily be provided. Thus the steel axles may be more severely tried than those of iron. Shunting operations still prove extremely dangerous. Forty-five persons were killed while coupling or uncoupling trains, and 395 were injured. There appears to be some inseparable difficulty in the way of introducing a coupling arrangement which will ensure the safety of the servants of railway companies. The proportion of deaths and serious accidents incurred in this way is enormous compared to the number of those employed in shunting operations. The whole question demands investigation. Ostensibly the problem presents very little difficulty, and there are numerous inventions available which have all proved satisfactory in a mechanical sense. What is the reason none are adopted? That there must be a reason, and a good one, we have little doubt, but we have never heard it stated. We have heard it urged that to alter existing couplings would entail a large outlay. This, however, is not a good reason. A large outlay is entailed in keeping permanent way in first-class order, but this does not prevent English railroads from being the best in the world. We have heard that excellent results are being obtained on the North-Eastern Railway with the pole and hook. Why is so good an example not followed? Other questions might of course be asked, and we fancy that railway companies would find themselves in an unpleasant predicament in some cases if they were compelled to answer them. For passengers railway travelling is almost absolutely safe; but the life of a railway company's servant seems to be as full of risks as that of a sailor. Perhaps Mr. Chamberlain may yet bring in a Bill to promote his safety.

THE DECLINE OF THE SHIPPING TRADE.

The depression which now exists in the shipping trade of this country may with propriety be discussed here, because as a consequence of that depression the iron industries have suffered their heaviest blow. It is because the shipowner can find no remunerative freights that a stagnation unparalleled in industrial annals has fallen upon the iron trade and its allies. The effects are very visible throughout the North of England, and particularly in the Cleveland district. But in these days of hurry and half investigation the first cause is not often reached when inquiry is made into the reasons for depression. We see mining villages half tenanted, streets of houses in manufacturing towns falling to decay, the sunshine of April days penetrating without let or hindrance into nooks once obscured by the smoke of countless chimneys, idlers by hundreds standing at street corners; and every now and then the sad tale of destitution makes its wail heard above the humdrum of daily life. But we are too much accustomed to view these things as matters of course, which must happen after a time of prosperity as surely as the ebb of the tide follows the flow. Iron-masters and merchants meet on 'Change, and hope for better things, without being able to give any reason for that hope. About the soundest bit of philosophy now heard is that when things become desperately bad they invariably mend It does not yet appear to have occurred to the great majority of the reflecting community that, under the surface though the cause may be, there is a cause for the depression which is dragging thousands upon thousands of workmen to misery as swiftly as the malevolent spirit in Coleridge's "Ancient Mariner" drew the fated ship towards its doom. The beginning of the evil will be found in the utterly prostrate condition of the shipping trade. That prostration is not due, as some suppose, to over production of steamers, at any rate not in a very great degree. The world must, commercially and industrially speaking, either make progress or lose ground. It is no use a short-sighted man ascending a hill in the hope of having his horizon extended, and the parallel applies to an industry like that of the shipping trade. There cannot, in the true meaning of the word, be "over-production," but there may be limitation of area, which practically has the same effect. It would have been useless for English shipbuilders to stop building two years ago, because they would merely have made way for foreign competition. What was wanted was that simultaneously with the great development of British shipping which has taken place within recent years, fresh fields should have been opened up for British enterprise, so that ships might have found the carrying trade remunerative. Here is the source of the great evil the country is now experiencing, and which before it is removed will in all likelihood deepen into a bitter curse. Shortsightedness has gone on pouring a torrent of capital into the stream of shipping, but has left

the outlet dammed up. It was not wrong to pour the torrent, but it was wrong not to make an outlet. The one absorbing problem should now be, can the shipping trade be improved? Once start that trade on a career of improvement, and like the officers of the enchanted palace when the Sleeping Beauty awoke, every branch of trade connected with the working of coal and iron would soon become re-invigorated.

LITERATURE.

Scott's Farm Engineering Text Books: Draining and Embanking; Irrigation and Water Supply; Farm Roads, Fences, and Gates; Farm Buildings. London: Crosby Lockwood and Co. 1883-84.

These four little volumes, which Messrs. Lockwood and Co. have added to what, with all the additions, is still known as "Weale's Rudimentary Series," are by Mr. John Scott. In the first, the reasons for draining land, and the methods of draining it, are described, modern implements for the purpose being referred to, and sufficiently illustrated to render the explanations clear. The drainage by the simpler and cheaper methods in use on ordinary farm lands is followed by the more expensive drainage of lands subject to floods and under the influence of tides, and by descriptions of the usual methods of embanking lands near low-banked rivers, or against the sea. Ample reference is made to the writings of others who have treated the subjects at greater length, and special cases are cited, and the cost of the various works is given.

The second—which is on water meadows, sewage irrigation and warping, construction of wells, ponds, and reservoirs, and raising water by machinery for agricultural and domestic purposes—may be said to take up the twin subjects, drainage and irrigation, where the first book leaves it. The irrigation question is treated without any evidence of partiality for particular views, and well-known writers are frequently quoted. The salient questions on the subjects handled are clearly put before the reader. In a small book of 145 pages it is, of course, impossible to give much space to any one of the subjects dealt with, and therefore fault cannot be found when it is noticed that, in giving particulars of any particular thing or work, dimensions for average cases are supplied—as, for instance, where the thicknesses of the different strata for filter beds are stated. Only one form of carbon filter described. A so-called self-cleansing charcoal filter is illustrated by diagram, and briefly described, but without explanation of the self-cleansing action—probably because the author does not wholly agree with the idea that charcoal may be cleansed by simply passing a reverse current of water through it.

The third book is on the roads, tramways, and waterways of the farm, the principles of enclosure, and the different kinds of fences, gates, and stiles. It is fully illustrated with drawings or diagrams of modern implements and fixtures, and many farmers would do themselves and others a service by reading the parts relating to roads, paths, and fencing.

In the fourth book—which is on buildings necessary for various kinds of farms, their arrangement and construction, with plans and estimates—there is much that will interest the architect likely to be called in to assist in planning new farm buildings, and much that will make the farmer wonder what sort of seasons and crops will pay for all the nice things in buildings and fittings which are described. He will, however, be able to answer most of the questions which may occur to him under this head, as estimates and actual prices are freely given. The author is fully alive to the necessity for economy in the cost of farm structures, and consequently dwells upon the most efficient arrangement of buildings, and cheap yet satisfactory methods and materials of construction. All these books will be found of great use as valuable introductions to the important subjects treated in them. They are well and clearly written, and are not mere compilations.

JEAN BAPTISTE DUMAS.

On Good Friday there died at Cannes, at the ripe old age of eighty-four, a great man, who has lived through stirring times, who saw the birth of chemistry as chemistry now is, and who laid down his life after reaching the highest position which a man of science may attain. One man writing of him says: "His influence, direct and indirect, on the progress not only of his own science, but on scientific research generally, it would be difficult to calculate; and those who knew him and his work best will probably be inclined to class him with Liebig in Germany and Davy in England."

He was born at Alais, in the Department of Gard, on July 14th, 1800, of an ancient family, a Protestant branch of which emigrated at the revocation of the Edict of Nantes. The events of 1814-15 compelled his parents to apprentice the future chemist to an apothecary in Alais; in 1816 he went to Geneva to pursue his pharmaceutical studies, and there he had the advantage of attending the lectures of such men as De Candolle, Pictet, and De La Rive. With De La Rive he formed a life-long friendship. Another Geneva physician, Dr. Prevost, worked with him, their purpose being to put physiology on a new and more scientific basis. Discoveries were made on the constitution of the blood, and these have ever since formed the starting point of similar researches. Alexander von Humboldt called on him about this time, desiring to form his acquaintance. Paris was naturally the goal of Dumas' aspiration, and shortly after going there, in 1823, he was appointed Assistant Professor of Chemistry at the Ecole Polytechnique. Here he became acquainted with Audoubon, Brongniart, and Milne-Edwards, and in conjunction with the two first named he founded, in 1824, the "Annales des Sciences Naturelles." In 1828 appeared the first volume of his famous "Traité de Chimie Appliquée aux Arts," and three years later, at the early age of thirty-two, he was elected a member of the Academy of Science. Thus success came to him in the prime of life, and he was a happy man in other ways, for in 1826 he made a marriage which was to fill his home with sunshine for nearly sixty years. The gifted lady who became his wife, and who survives him, was Mdlle. Herminie Brongniart, the sister of his friend, and daughter of the illustrious geologist, Brongniart. He now devoted his time almost entirely to almost reconstructing organic chemistry, and worked much in the same field as Liebig, whose admiration for him was so great that the "Familiar Letters on Chemistry" were dedicated to him. Then came researches on some points in the atomic theory, others on the ethers, on carbon, on oxygen, and others. He was next appointed to the Professorship of Chemistry in the Ecole de Médicine, and turned his attention to the connection between animal and vegetable life; and some years later he published his celebrated "Leçons sur la Philosophie Chimique." The papers which he issued now it would bewilder one to mention in detail, but they will be found recorded in Poggendorff's Dictionary and the Royal Society Catalogue. Forty-four years ago he was elected a foreign member of the Royal Society, and forty years ago he received the honour of the Copley medal. When the Chemical Society, after the death of Faraday, established the Faraday medal, with one consent it was agreed that no one but Dumas could be asked to deliver the *éloge* the first time. Those who were present at its delivery in 1869 in the theatre in Albemarle-street will not forget how he spoke with a richness of eloquence rare indeed among scientific men.

He mixed in politics, of course, and was a constant Liberal. In October, 1849, Louis Napoleon appointed him Minister of Commerce, and he held this appointment till January, 1851, doing an immense amount of good in these fifteen months. He instituted the Crédit Foncier, which still flourishes in great prosperity. Soon after the restoration of the Empire he was created a Senator, and in 1855 was appointed president of the Municipal Council of the Seine. The assistance which M. Dumas gave Baron Hausmann during the re-edification of Paris was of the most beneficial kind. The Baron traced new streets, but M. Dumas showed how the houses in them were to be made healthy; and the Parisians owe him much for the vigour with which he insisted that the mighty works of drainage, commenced by the engineer Bellegrand, should be carried on to rapid completion, instead of being retarded for the sake of more showy operations.

Later on he was made Master of the Mint; but he never took up his residence at the Mint, fearing lest he should be surprised there some day by a revolution which would disperse his valuable scientific collections. With the downfall of the Empire he withdrew from active life, but was as busy as ever with the demands of science. Until last year he spoke frequently at the meetings of the Academy of Science, of which he had long been permanent secretary. Only a year ago he delivered in the Academy a tender and touching reply to friends and colleagues, who had presented him with a medal commemorative of the fiftieth anniversary of his membership of that body. In 1876 he was president of the French Association for the Advancement of Science, and delivered an address possessing all that fire and eloquence which only he could put into it.

THE AMALGAMATED SOCIETY OF ENGINEERS.

The thirty-third annual report of this Society is being sent out this week to the various branches. The report is as usual a bulky volume of nearly 400 pages, and the general secretary, Mr. John Burnett, in his introduction states that 1883 had, on the whole, been a good year for the Society. It had brought with it its mixture of good and bad fortune, but he ventures to think that a brief review of their position would show that the good predominated over the bad. The year opened hopefully and well in nearly every department of trade, and for three-fourths of its course continued bright and prosperous. The demand for steam shipping had been unusually active, and to this fact their recent prosperity had been mainly due. But in the autumn this demand fell off almost entirely, and the shipbuilding trade underwent a remarkably sudden change; in fact it went to the bad in some districts with almost the suddenness of a collapse. At no time during the year could the general trade of the country be said to be in a high state of prosperity, and in the engineering trades, therefore, they had so far been exceptionally fortunate in being so busy when other trades were comparatively depressed. To a large extent this had been due to the increased foreign trade done in their special productions, which had been £1,480,924 in excess of the best year previously on record. But in addition to this the home demand for their productions had been almost equally as good. It was therefore easily to be seen that the employers had had better times of it than they ever had before, and to some extent this also applied to the men; but the 5 or 10 per cent. more wages they had gained bore but a small proportion to the general profits of the trade. The returns from the various branches as to the state of employment showed that from the beginning of the year up to the month of May trade steadily improved, and at that date only 726 of their members were out of work through want of employment, which, with a single exception, was the lowest point their trade indicator had reached for many years. Turning to the progress made by the Society during the past year, Mr. Burnett states that the branches had increased by four, and now numbered 424, distributed as follows:—In England, 305; Scotland, 41; Ireland, 14; Australia, 10; India, 1; New Zealand, 3; Queensland, 1; Canada, 6; Malta, 1; United States, 41; and France, 1. The number of members had increased from 48,388 at the close of 1882 to 50,418 at the close of 1883; the admissions had been 4265 and the exclusions 1431, the admissions being not quite so numerous and the exclusions a little higher than in 1882. The total income of the past year had been the second highest in their history, and from all sources amounted to £134,649, which was an increase of £10,241 over the previous year. Their expenditure had, however, also gone up considerably. In 1882 they spent but £102,165, but in 1883 their expenditure amounted to £124,724. This was an increase of £22,569, due chiefly to the decline of trade and the Sunderland dispute. Donation benefit had called for no less an amount than £31,211, which was £9275 more than in 1882; contingent benefit had taken £3782, or £2922 more than in the year of peace, 1882, when it was only £860, and the great rise in the cost of this benefit was due to the Sunderland strike. Sick benefit had gone up to £26,436, which was £1141 in excess of 1882, and £1744 more than in 1881. The funeral benefit had also called for a larger sum, and rose to £8620, or £972 more than in the previous year. The average age of their members at death was 45½ years, and the chief causes of mortality were lung, chest, and heart disease, after which came deaths from drowning. Superannuation benefit had again displayed an increasingly upward tendency, and had risen from £26,312 in 1882 to £28,496 last year. Accident benefit, which showed a slight decrease, had amounted to £1500, and the sum expended for branch officers and committees and district committees was £2618. Grants from the special funds raised by levy had risen considerably on account of falling trade and the great dispute at Sunderland on the apprentice question. Benevolent grants had absorbed £2259, or £328 more than in 1882; and grants to their own and other trades had been made to the amount of £4653, an expenditure which was also chargeable to the long-standing dispute at Sunderland. Summing up the numerical and financial position of the Society, the general secretary says he may state that they had now 50,418 members enrolled in 424 branches, which were situate in every quarter of the globe, penetrating even into countries in which the English tongue was not spoken. Their total income for the year was £134,649, and their total outlay £124,724, leaving a balance in their favour of £9925, which, added to their previous cash in hand, made a total sum in the possession of the Society of £178,125, or an average value of £3 10s. 7½d. per member. In conclusion, Mr. Burnett adds that 1883 had come and gone, and they had not only held their own in their greatest trade struggle of the last ten years, but they had saved nearly £10,000, and had it not been for that struggle they would probably have doubled their savings for the year.

MR. HOWDEN ON THE BOILERS OF THE OREGON.

The following extract is from Mr. Howden's paper read at the last meeting of the Institution of Naval Architects:—

The economic advantage of supplying the air of combustion by mechanical means, instead of by the rarefying of a column of air in a chimney by heat, as in natural draught, is given in the concluding illustration. I close this paper by giving an example of the reduction which, basing on the results I have already attained, may with safety be made in the number and dimensions of boilers in large ocean steamships. I take for comparison the Oregon, the latest of the large high-speed Atlantic liners. The published accounts give the boilers as nine in number, each 16ft. 6in. diameter, length 18ft., with eight furnaces, or seventy-two in all, each 3ft. 6in. diameter; fire-grate 6ft. in length, making a total fire-grate of 1512 square feet; proposed indicated horse-power, 12,000; assumed consumption of coal per indicated horse-power per hour, 2·6 lb.; total consumption per hour being thus 31,200 lb., or 13·92 tons. I have here assumed the consumption per indicated horse-power at 2·6 lb. per hour, without inquiry, as there might be reasons for her owners or her builders withholding this information. It is well known, however, that the high speeds in these large steamers are only maintained by a considerable sacrifice of economy, and I have, on the authority of the managing owners of another high-speed Atlantic steamer of about same size and power, that 2·6 lb. does not overstate the rate of consumption in their experience. I am not aware that 12,000 indicated horse-power has been actually attained in this steamer at sea, but if it has, it could only be attained by stoking of the most severe character. The enormous space occupied by these boilers, and by the coal bunkers, can easily be calculated from the above particulars. Using data already verified by actual trial, the boilers which, on the system of combustion, I have had the honour to bring before you, would easily supply steam to the engines sufficient to develope 12,000 indicated horse-power, would be six in number, 15ft. in diameter, with six furnaces only in each boiler, or thirty-six in all, each 3ft. 9in. diameter; the fire-grate 4ft. 6in. long, making an aggregate of 641·25 square feet of grate. The consumption of coal in the engines working from the boilers I believe I may safely assume as 1·6 lb. per horse-power per hour, seeing there are engines which approach this rate of consumption supplied with steam from boilers worked by natural draught having a lower evaporative economy. The consumption of coal at this rate is therefore $12{,}000 \times 1{\cdot}6 = 19{,}200$ lb., being 8·57 tons per hour, or 320 lb. per minute. In comparing the expenditure incurred in supplying the air for combustion by an engine and fan in the one set of boilers with that incurred by supplying the same by natural draught in the other of these two sets of boilers, I will assume that the air supply to the furnace per pound of coal consumed is the same in both cases, though the reduction of the air admission is one of the chief objects of my system of mechanical supply. Assuming the air supply to the furnace to be at the very moderate rate of 15 lb. per pound of coal consumed, and that the temperature of the escaping gases of the boilers with mechanical supply is 300 deg. less than the escaping gases of the boilers with natural draught, we have now the means of calculating the required expenditure of each form of air supply. This difference in temperature I assume, because it would be realised in practice. One of the essential points in this system of forced combustion is the reduction of the temperature of the escaping gases to a point far lower than would be possible in such boilers worked by natural draught.

Taking first the boiler with natural draught, consuming 31,200 lb. of coal per hour, or 520 lb. per minute, we have the weight of air supplied to the furnaces for combustion $520 \times 15 = 7800$ lb., to which has to be added the gaseous products of combustion, or the weight of coal less the ash, which, if taken at 7½ per cent., will give $7800 \times (520\text{-}30) = 8281$ lb., as the total weight of gaseous products passing up the chimney per minute, from the combustion of 520 lb. of coal. With the specific heat of the escaping gases at ·246, the total units of heat wasted or expended in obtaining the power of combustion by natural draught beyond that required to supply air by a fan—the temperature of the escaping gases being 300 deg. higher in the former case than in the latter, as explained—are therefore $8281 \times {\cdot}246 \times 300 = 611{,}137$ units, less the equivalent of the power required for the fan supply. The mechanical equivalent in horse-power of these 611,137 units of heat is $\frac{611{,}137 \times 772}{33{,}000}$ = 14,296-horse power. This, of course, supposes the total heat converted into work, and expressed in horse-power units. The actual value of this expenditure of heat is correctly stated in the ratio of the economy of the engines and boilers, which, at 2·6 lb. per indicated horse-power per hour, is very nearly a utilisation of one-twelfth of the total heat of combustion of coal of average quality. Therefore, $14{,}296 \div 12 = 1191$ is the actual horse-power equivalent of the 300 deg. of heat lost in maintaining the temperature of the funnel in the natural draught boilers.

Coming now to the boilers with the mechanical supply of the air of combustion, and consuming 19,200 lb. of coal per hour, or 320 lb. per minute, and taking the weight of air supplied per pound of coal at 15 lb., as in the natural draught boilers, we have $320 \times 15 = 4800$ lb. of air supply required per minute for the combustion of 320 lb. of coal. The volume required at 60 deg., or 13 cubic feet, per pound, is therefore $4800 \times 13 = 62{,}400$ cubic feet. To supply this volume per minute from three fans, each having discharge orifices 30in. diameter, or 6·25 square feet area, giving a total area of 18·75 square feet, a velocity of 55·46ft. per second is required, as $18{\cdot}75 \times 60 \times 55{\cdot}46 = 62{,}400$. The horse-power required to supply this weight of air at this velocity per second is found by the usual formula, $\frac{W.v^2}{2g}$. Here $W = \frac{4800}{60}$, or 80 lb. air per second, and $\frac{80 \times 55{\cdot}46^2}{64} = 3845$ foot-pounds per second, and $\frac{3845}{550} = 7$-horse power nearly. This 7-horse power is the power required to supply the whole air of combustion for 12,000 indicated horse-power, supposing perfect efficiency in the fans, and in the engines that drive them. Assuming 75 per cent. efficiency in the engines, and 50 per cent. in the fans, we have $\frac{7 \times 100}{75} = 9{\cdot}3$ and $\frac{9{\cdot}3 \times 100}{50} = 18{\cdot}6$ as the gross horse-power for supplying the total air of combustion to the furnaces mechanically. Th s 18·6-horse power, as against an expenditure equivalent to 1191-horse power—required to maintain a temperature in the funnels necessary to give a sufficient supply of air by natural draught to boilers supplying an equal quantity of steam—shows the vastly superior economy of the mechanical supply of air to boilers, if this air is otherwise judiciously used. The reduction in the weight and number of the boilers, of the space occupied in the vessel, and the saving of coal in a vessel of the power of the Oregon, and proportionately in other large steamers, by the adoption of the system of combustion I have endeavoured to explain, could not fail to affect the commercial character of these large vessels to a very remarkable extent.

RAILWAY MATTERS.

There are just a few fiends loose in America as elsewhere. On the 10th inst. some of them, by unfastening a rail on the Panhandle Railway, near Dayton, Ohio, wrecked a passenger train at the Miami River bridge. The driver and stoker were killed, the locomotive being overturned. The other train servants were injured, but the passengers were unhurt.

Lost car agents, the *Railroad Gazette* says, find cars in all sorts of curious places; but Mr. Rogers, of the Pennsylvania Road, recently had an experience which was out of the way even for him. In search recently of two missing coal cars out in the flooded district in Ohio, he found one of them in a cornfield—which was not so uncommon—but soon after he found the other on the top of a tree.

On the railways of the United Kingdom during the past year the grand total of accidents of all kinds to persons reached 1167 persons killed and 4187 injured. Of this large number only twenty-two were killed by accidents to trains, rolling stock, or permanent way. Eleven, or half of these, were railway servants, so that were it not for carelessness, thoughtlessness, or suicides, the casualties on railways would be wholly insignificant.

The electric railway running from the Brighton Aquarium to about a mile along the Madeira-road has been in successful operation over about 1000 yards of its length since the 9th inst. During the Easter holidays it has been most enthusiastically supported by the Brighton residents and the visitors, and it is in every way clear that the line will be looked upon by everyone not only as an attraction but as of very great convenience.

The *Railroad Gazette* record of train accidents in the United States in February contains notes of 31 collisions, in which 13 persons were killed and 40 hurt; 71 derailments, in which 9 persons were killed and 109 hurt; and 8 other accidents, in which one person was hurt—a total of 110 accidents, in which 22 persons were killed and 150 injured. As compared with the preceding month, January, there was a decrease of 37 accidents, of 34 killed, and of 90 injured. As compared with February, 1883, there was a decrease of 74 accidents, of 39 killed, and of 36 injured.

On the 7th inst. a deputation of several Irish members, of all shades of politics, had an interview with Mr. Trevelyan at the House of Commons, with reference to the Tramways Act of last session. Mr. O'Shea, M.P., in introducing the subject, pointed out that the usefulness of the Tramways Act of last session would be materially increased if power were given to the companies to contract the baronies out of the liabilities which, under Section 10, must be imposed upon them to construct, maintain, and work, in case of default by the companies, and also if the Imperial guarantee of 2 per cent. were given to the companies direct instead of being first levied with the county cess and subsequently recouped by the Treasury. Mr. Trevelyan said he was very favourably impressed by their arguments, and that during the recess he would carefully consider the whole matter.

The February accidents in the United States are classed as to their nature and causes as follows:—Collisions: Rear, 17; butting, 13; crossing, 1; total, 31. Derailments: Broken rail, 10; broken bridge, 3; spreading of rails, 6; broken axle, 2; accidental obstruction, 9; cattle, 2; land-slide, 4; wash-out, 2; snow, 2; wind, 1; misplaced switch, 11; open draw, 2; malicious obstruction, 1; purposely misplaced switch, 1; unexplained, 15; total, 71. Other accidents: Boiler explosion, 1; cylinder head blown out, 2; broken axle not causing derailment, 3; broken wheel not causing derailment, 2; total 8. Total accidents from all causes, 110. Four collisions were caused by mistakes in orders, three by trains breaking in two, two by flying switches, two by misplaced switches, and one by fog. Of the three broken bridges, one was caused by the washing out of abutments; of the others we have no special particulars.

The *Port Jervis Gazette* gives an account of a train being stopped by a dog. It says, "A very singular occurrence, and one which gave the train men no small amount of annoyance, occurred at Binghamton Thursday afternoon. When Erie train No. 8 was ready to proceed East the engineer found that he could not start the train, and an investigation to discover the why and the wherefore was begun. He first examined the locomotive thoroughly, but discovered nothing wrong, and again attempted to start, but the train would not move. Another examination was begun, which included the entire train, and the difficulty was discovered. It was found that the air brakes on one of the day coaches were set, and on inquiry it was ascertained that while the train was standing at the station two dogs passed under the coach, and in playing struck against the trial stop-cock attached to the air-brake cylinder, which extends downwards. The stop-cock was broken off, and as a result the air-brakes were set. When the train arrived it was forty minutes late, and nearly that much more time was lost before the train was got under headway again.

Wheat is carried on the East Indian Railway, from Delhi to Calcutta—a distance of 954 miles, or about the same as from Chicago to New York—for the same charge as that made by the American trunk lines, and under this liberal tariff of rates the Indian export of wheat increased from one million hundredweights in 1879 to over eight millions in 1882. The exact rates charged on the East Indian Railway—taking the exchange at 1s. 8d. per rupee—for the carriage of one ton of 27·22 maunds, equal to 2240 lb., per mile, is the following:—Under 100 miles, ·9451 of a penny; 101 to 450, ·4725 of a penny; above 450, ·3544 of a penny. The average rate from Delhi to Calcutta is ·3423 of a penny per ton per mile. On the American lines the rate of 20 cents per 100 lb. for the whole distance between Chicago and New York—taken at the same mileage as between Delhi and Calcutta—is 4 dols. say, 16s. 8d. But the American ton is of 2000 lb. only, while the Indian is 2240 lb. or about one-eighth more than the American. Making allowance for this difference in the weight of the ton, this would give the charge for the carriage of one ton of wheat from Delhi to Calcutta £1, as compared with 16s. 8d. on the American line at the present 20 cent rates. At 30 cents, from which, the *Railway News* says, the rate has just been reduced, the charge on the Canadian and American lines would average 25s. per ton, as compared with 20s. on the Indian line. It would appear, therefore that the rate which has been fixed on the East Indian Railway is practically equivalent to 25 cents per 100 lb. in the United States.

On the 15th February an accident occurred near Castle Douglas, on the Kirkcudbright branch of the Glasgow and South-Western Railway, to a train consisting of engine and tender, milk van, third-class carriage, first-class carriage, third-class carriage, and brake van, which left the rails at the west end of a bridge over a watercourse about a mile from Castle Douglas, and, after running for about 76 yards off the rails, the whole train, with the exception of the first-class carriage, fell over the embankment into 5ft. of water. The engine and tender were turned upside down in the water, the milk van was in the water broken up, the leading third-class carriage was on its side against the tender, the first-class carriage was on the edge of the embankment and tilted over, the other third-class carriage was on the side of the embankment and partially in the water, and the guard's van was on its side in the water. There were no passengers in the train, but the driver and fireman were both drowned. Speaking of the cause of the accident, Major Marindin says:—"The effect of running engines over the bridge gave, in my opinion, very conclusive proof of the causes of this accident. There was a considerable deflection in the longitudinal timbers, and all the piles went down also as the weight came upon them, so that there was a most remarkable wave in the superstructure of the bridge under a fast-running engine. The manner in which the train was wrecked would seem to indicate that it was running at considerable speed; and I attribute the accident to the speed of the engine being too high for safe running over a bridge the piers of which are upon a bad foundation, and go down under the weight of an engine."

NOTES AND MEMORANDA.

The density of liquid oxygen is estimated at between 0·84 and 0·895, but the former is probably much too low.

The number of persons employed about the mines of the United Kingdom, per fatal accident, was 559 in 1833 and 575 in 1882. Per life lost, the number of hands employed was 488 in 1883, and 447 in 1882. The number of tons of mineral wrought per fatal accident was 194,097 in 1883, and 195,586 in 1882. Per life lost, the quantity of mineral wrought in 1883 was 169,665 tons, and 152,161 tons in 1882. The number of lives lost by accidents in mines in 1883 was 1054, and in 1882, 1126. Mr. Jeans does not explain the difference between "lives lost" and "fatal accident," but that he draws a distinction is evident, because on no other assumption can his figures be regarded as in any sense or way intelligible.

For the week ending March 15th 1884, in twenty-nine cities of the United States, having an aggregate population of 6,435,800, there died 2703 persons, which is equivalent to an annual death-rate of 21·8 per 1000. This rate exceeds that of the preceding week by 0·8, and is the highest rate recorded for any week since September 15th 1883, when the same rate, 21·8, was reported. For the North Atlantic cities the rate was 18·7; for the Eastern cities, 23·5; for the Lake cities, 15·8; for the River cities, 18·8; and in the Southern cities, for the whites 21·4, and for the coloured 35·2 per 1000. Of all deaths 33·8 per cent. were under five years of age, the proportion of this class being highest in the Lake cities, viz., 35·7 per cent., and rising to 61·2 in Milwaukee.

The bricks used in the construction of the Edinburgh Gasworks chimney, 339ft. in height, when tested gave a crushing resistance of from 440 to 448 tons per square foot. The greatest pressure on any part of the brickwork in the chimney is given, in a paper on chimneys read by Messrs. R. M. and F. J. Bancroft before the Civil and Mechanical Engineers' Society, as 8·1 tons per square foot. Craigleth, Humbie, and Hailes stones, also used in the chimney, were tested with 1in. cubes, which crushed at 315, 240, and 225 tons respectively; but when Hailes stone was tested with a 4in. cube, the crushing resistance was 567 tons per square foot. On the five concrete piers of the Newlands Mill chimney, Bradford, the fall of which killed so many people, there was a pressure of 22·4 tons per square foot, though the pressure per foot super of foundation area was but 4·5 tons.

During recent months the thermometers in the Sevres International Bureau of Weights and Measures have been calibrated after the methods suggested by Dr. Thiesen and M. J. Marek—"Repertorium der Carl," t. xv. 1879—and were corrected for "exterior pressure" to a barometric height of 760 mm. at 0 deg. latitude = 45 deg., as well as for "interior pressure," or vertical position, the thermometers reading from 0·02 deg. to 0·06 deg. C. too high when placed in a horizontal position. This apparatus has been used in determining the rates of expansion of the platinum-iridium metres deposited at the Bureau, which are intended hereafter to be the universal standards or prototypes of the metric system. The linear coefficient of expansion for 1 deg. C. of the platinum-iridium was found to vary from 0·000008668 to 0·000008689, with a probable error of only ± 0·0000000075.

Professor Quincke has lately read before the Berlin Academy a paper on the measurement of magnetic forces by hydrostatic pressure. He has examined the magnetic inductive capacity, or, as he calls it, the "di-magnetic constant" of a number of liquids, by observing their rise in a open-air gauge when subjected to a field of powerful, but known, intensity, the observed change of pressure being, *Nature* says, proportional to the square of the intensity of the field and to the difference between the magnetic inductive capacity of the substance and that of the air. A number of tables are given, with copious numerical data. The di-magnetic constant of such liquids as ether, alcohol, turpentine, nitric acid, bisulphide of carbon, glycerine, water, &c., showed small negative values; whilst the values were positive and in many cases much more considerable for solutions of chloride of iron, chloride of manganese, sulphate of nickel, and of cobalt, and for solutions of magnetic salts in general

The production of coal in the United Kingdom in 1883 was 163,737,327 tons, against a total output of 156,499,977 tons in the preceding year. This is an increase of 7,237,350 tons, or 4·6 per cent., on the production of 1882. To this increase the chief contributors were:—Glamorganshire, with an advance of 1,315,487 tons; Yorkshire, with an advance of 1,037,399 tons; Scotland, with an advance of 710,633 tons; Lancashire, with an advance of 704,672 tons; Monmouth, with an advance of 623,542 tons. The total production of coal in 1882 exceeded by 2,315,677 tons the output of 1881, and by 9,530,568 tons the output of 1880. Within the last three years therefore the production of coal in the United Kingdom has increased to the extent of 16,767,918 tons. Mr. J. S. Jeans, secretary of the British Iron Trade Association, remarks:—"It is not without interest to note that this amount of increase is within 4,000,000 tons of the whole coal output of France, is approximately the same as that of Belgium, and is more than equal to the whole annual production of the United Kingdom previous to 1810.

The *Scientific American* says, platinum wire has been drawn down so fine by Mr. H. F. Read, of Brooklyn, as to be invisible to the naked eye, although its presence upon a perfectly white card could be detected by the touch and could be seen with the aid of a small magnifying glass when the card was held in such a position that the wire cast a shadow. A small platinum wire, about No. 18, was inclosed in a close fitting tube of silver. The tube was made by taking a long and narrow sheet of silver, about one-twentieth of an inch thick, folding it over into a cylinder, and drawing down until the wire would just fit in it. This was then drawn down until the tube containing the wire was only as large as the original wire. A short length of this was cut off and incased in a second tube of silver, which was drawn down in the same way. This operation was repeated until the platinum wire had been reduced sufficiently in diameter. The last wire was drawn as fine as the dies would permit, when the silver coating was removed by an acid. During the work it was necessary occasionally to anneal the wire. The resulting wire was in short lengths and had no strength. It was designed to be used for the cross wires in telescopes, its perfect opaqueness and fineness rendering it particularly applicable, but its extreme weakness made its handling almost an impossibility.

At a recent meeting of the Geological Society a paper was read on "A delta in Miniature—twenty-seven years' work," by Mr. T. Mellard Reade, F.G.S. The author described a delta deposit, which, during a period of twenty-seven years, had formed in the Rake reservoir—Rivington Waterworks—from materials brought down by a stream of that name. The reservoir at this part was divided by a road, water communication being maintained by a culvert, once 8ft. high, now almost silted up. The author described the stratification of these deltas; that near the influx of the Rake consisted of peaty matter, gritty sand, gravel, shingle, and boulders of millstone grit up to about one foot diameter; the other chiefly of fine sand with some peaty matter. The former covered an area of 2508 yards with an average thickness of two yards; the latter, an area of 430 yards, with an average thickness of three yards. These materials had come from the drainage-area of the Rake. This is estimated as 1·176 square mile, and the delta being estimated at 6306 cubic yards, and the time being 27 years, gives, as the annual rate of denudation over the whole area, $\frac{1}{4\frac{1}{2}}$in. per annum, or one foot in 5184 years. The mean rainfall of the Rake Brook watershed for the last ten years was 49·57in. per annum. In this calculation no account is taken of the finer materials which have doubtless been distributed over the rest of the bed of the reservoir. The author pointed out that this rate of denudation was rather more rapid than that of the Mississippi—one foot in 6000 years—and that the arrangement of the materials under the varying conditions of the stream illustrated the phenomenon of larger deltas.

MISCELLANEA.

Within the past few days a number of fresh contracts have been placed with the Clyde shipbuilders, these in the majority of cases for sailing vessels, steamers being just now not at all in request.

The new Witham Outfall Channel between Hobhold sluice and Clayhole, in the estuary of the Wash, is now open for navigation, The new channel is three miles in length, and its cross section is much in excess of either that of the Suez or Amsterdam Ship Canals.

The sixth annual National Exhibition and Market of Brewers, Mineral Water, and Licensed Victuallers' Machinery and Appliances will this year be held on October 20th to 25th—inclusive—at the Agricultural Hall. For the convenience of exhibitors, the secretary and manager, Mr. Dale, has opened a central office at 24, Wellington-street, Strand, W.C., where plans can be seen.

There were 39 coal mines in operation in New South Wales during the year 1882. The total output was 2,109,282 tons, valued at £948,965. The total number of hands employed was 4647. The produce from the Northern coalfields amounted to 1,569,517 tons, the average price per ton being about 9s. 1½d. The quantity raised from the Southern and Western fields was 539,765, of the value of £233,028, which gives an average of 8s. 7½d. per ton.

The Corporation of Wolverhampton on Tuesday determined to apply to the Local Government Board for the suspension of the Rivers' Pollution Act, 1876, within that borough, pending the consideration of the plans and report touching the further sewerage of Wolverhampton, which had been prepared by the borough engineer, Mr. G. Eastlake Thoms, C.E. The occasion for the application appears in that notices of action have been served upon the Corporation by certain authorities for alleged pollution of a brook course at Bilston.

The progress of the North Staffordshire Miners' Relief Society is steady. The members have increased by 895 since 1881, and now stand at 5413. This is a minority of the miners in the district. The men's subscriptions have increased by £61, being £2425 for 1881, but the employers' subscriptions have decreased by £33, being only £636. The death rate has been about 3½ per 1000, against 8¼ during the first eight years of the society's existence. This circumstance is attributed to the successful working of the Employers' Liability Act.

An important trial of electric light, gas, and oil lamps for lighthouse illumination is now being made by Captain Nisbet, as head of a Trinity House committee, on the hill behind the South Foreland High Lighthouse. The electric current is supplied by a De Meriten's machine, and is used in an arc lamp using square carbons, made up of forty-nine small square carbons grouped together and making a carbon about 1·5in. square. The gas lamps are by Mr. Wigham, and the oil lamps are those of Sir J. W. Douglass. Every arrangement has been made to test the relative penetrative powers of the different lights in fogs and generally to test their lighthouse values.

A joint meeting of the Corporations of Stockton and Middlesbrough was held last week to consider the desirability of increasing the charges for water to the ironmasters. After considerable discussion the following resolution was unanimously adopted:—"That this meeting of the joint Corporations is of opinion that the time has arrived when action should be taken by the Corporations' Water Board with a view to increase the water charges to the 3d. per 1000 gallons consumers to at least cost price." It was stated that a loss amounting to about £8000 per annum was being sustained owing to the large consumers being supplied with water at less than cost price.

The annual report of the Manchester Steam Users' Association gives a total of 13,590 boilers as having been examined during the year, in addition to 139 economiser examinations, and 1237 indications of engines. Of the boiler examinations it is remarked as many as 4832 were "entire." During the year 42 explosions occurred, resulting in the loss of 31 lives and in injury to 49 other persons. One of the boilers was under the inspection of the association and guaranteed by it, but no life was lost and no personal injury occasioned, the cause of explosion being shortness of water, owing to the attendant's having turned the blow-out tap in the wrong direction, leaving it, as he supposed, closed, whereas it was open at full bore.

The Rev. F. Bashforth, the first professor of mathematics to the advanced class of artillery officers, Woolwich, and inventor of the Bashforth chronograph, writes in *Nature* number of April 3rd on the subject of the steadiness of flight of English and Krupp projectiles. He observes that the stated superiority in steadiness of the Krupp projectiles to ours could be very easily tested, without any serious expense, by measuring the time of flight of shot over a succession of distances between screens. He would compare the drop in velocity at any point with a corresponding tabular one. He does not consider that Krupp's tables have any claim to originality, corresponding as they do to Engiish tables expressed in foreign measures, though with a slightly different co-efficient of resistance.

We learn from the *Irish Farmers' Gazette* that a new agricultural implement, to which has been given the name of the Emo Park scuffle and raking machine, was tried the other day at Emo Park, Monasterevan, Ireland, in the presence of a number of the residents of the locality. The trial was conducted by the inventor of the machine, Mr. Ennis, steward and gardener on Lord Portarlington's estate, and it is stated, "proved a conspicuous success." The machine, which is drawn by a horse, has the rake closely attached to the scuffle, and the action is described as being free and very accurate. Its effect upon the fine pine avenues of the demesne was most marked, and it proved to be an excellent and valuable addition to the implements for keeping lawns and private walks in order.

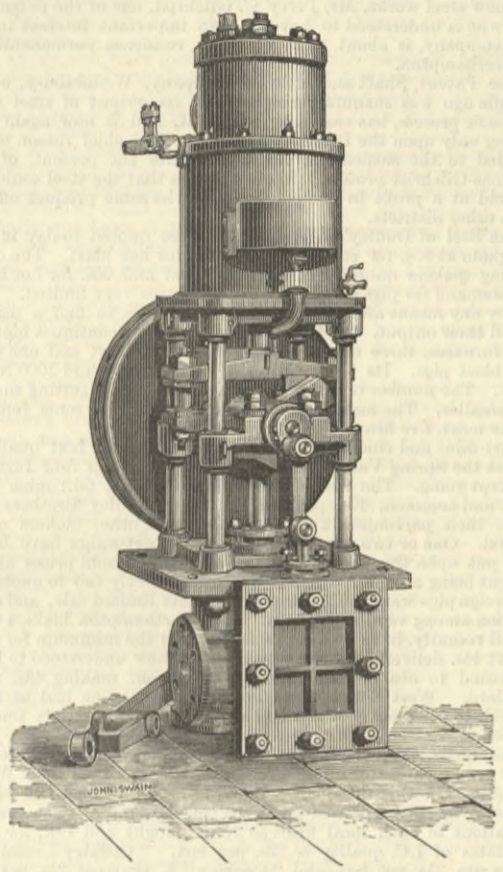
The Administration of Public Works in Paris has published a report of its expenditure for the ten years between 1872 and 1881, the total being £26,160,000, of which £15,920,000 has been for new works and the remainder for maintenance and repairs. Out of the £15,920,000 spent upon new works, £9,200,000 was for making new streets and other public roads, £1,880,000 for water and sewers, £120,000 for lighting, £280,000 for public gardens, and £4,400,000 for public buildings. Out of the £10,240,000 spent upon repairs and maintenance, £5,560,000 was for keeping the roads and pavements in order, £3,120,000 for lighting, £800,000 for public buildings, £320,000 for water and sewers, and £120,000 for the public gardens. The total length of the streets opened or widened since 1872 is about sixteen miles.

Arrangements are in progress to begin work upon the Great Eastern very shortly to fit her for her new career of usefulness in Gibraltar Bay as a coal hulk. The project is viewed with favour by the Admiralty, as the bay will no longer be disfigured with the multitude of small coal hulks which now encumber the harbour. The paddle engines and boilers are to be removed, so that she will steam out to Gibraltar with her screw power only. Before proceeding she is to have numerous side ports added to those already existing, by which the coal will be received for storage purposes. The coal from these ports will, by its own gravitation, run into a variety of receptacles, some well above the water line, others below. The vessel is to have powerful hydraulic cranes on the upper deck, by which the steam colliers from Cardiff and Newcastle bringing the coal will be very quickly discharged, thus saving greatly in cost on the existing system as practised at Gibraltar. The coal, once on board, will be shot down into the bunker receptacles on board the Atlantic and other large steamers taking in their coal alongside. A further advantage is that the Great Eastern will give such shelter that coaling from her in the Bay will, it is expected, be able to proceed in weather when it is quite impracticable with smaller hulks. She will be fitted with the electric light and the telephone, the distance from end to end of the ship being nearly one eighth of a mile in length. The exportation of coal last year to Gibraltar amounted to 458,169 tons.

NORTHCOTT'S PATENT AIR COMPRESSOR.

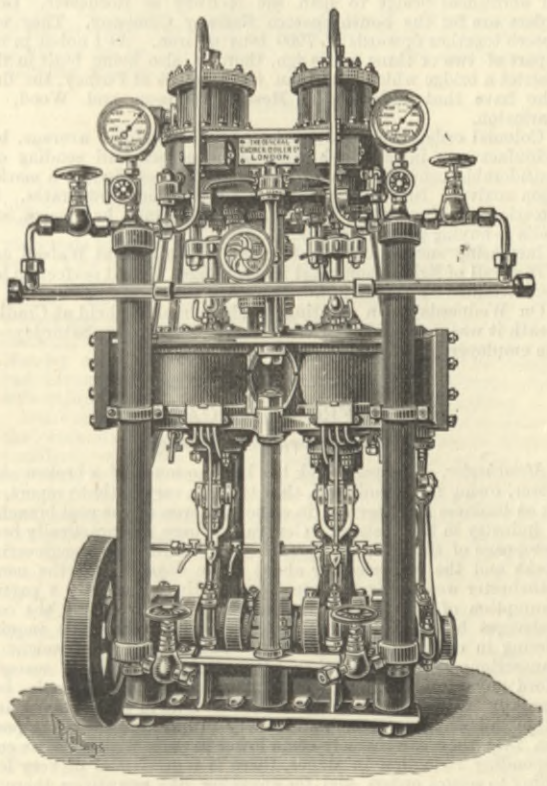
As many of our readers are no doubt aware, that clever and destructive instrument of warfare, the Whitehead fish torpedo, is propelled through the water by a miniature set of screw engines driven by compressed air stored in the body of the torpedo. The torpedo itself also is ejected into the sea generally by means of compressed air, acting either upon the piston of a telescopic impulse apparatus, or upon the torpedo direct, the torpedo being contained in a large air gun. The air carried by the torpedo for its own propulsion is pumped into the air reservoir of the torpedo at a pressure of about 100 atmospheres, or, say, 1500 lb. per inch. Torpedo boats and launches, as well as

Fig. 1



ironclads carrying torpedoes, have therefore to be fitted with special air compressing engines for charging the torpedo and main reservoirs with air of this enormous pressure. The General Engine and Boiler Company, of Hatcham Ironworks, London, have for many years past made a speciality of this class of machinery, and we illustrate herewith two types of air compressing engines made by them for the British and other Governments. Fig. 2 is a double air compressing engine suitable for corvettes, Fig. 1 is a single compressing engine suitable for torpedo boats and launches. The double engines are constructed to run at 350 revolutions, and the single engines run at 400

Fig. 2



revolutions per minute. Some small air compressing engines of the single type have been run for several hours without stopping against the full pressure of 1500 lb. per square inch at the enormous speed of over 550 revolutions per minute. The General Engine and Boiler Company has made a considerable number of these engines for the British, Russian, and Greek Governments. Some of these have been triple engines for use in large ironclad ships. Altogether they have manufactured five sizes, and they have designed compressing engines for compressed air locomotive use for delivering air at 1200 lb. pressure in very large quantities.

It will be seen from Fig. 2 that the double engines are much more complicated in appearance than the single engines. This mainly arises from the fact that the double engines are complete in themselves with air columns, pressure gauges, air valves, and other fittings, which in the case of the singles engines are detached from the engine, and fixed to a bulkhead or other convenient support. The double and triple engines are regulated by a peculiar chain governor, which we may describe on an early occasion.

ON THE APPLICATION OF HYDRAULIC MACHINERY TO THE LOADING, DISCHARGING, STEERING, AND WORKING OF STEAMSHIPS.*

By Mr. A. Betts Brown.

(*Continued from page* 264.)

Hydraulic hoist.—The hydraulic machinery for discharging cargo may be of two kinds, namely, hoists, the motive parts of which reciprocate only, and those which have a continuous rotary motion. The first is the simplest, most durable, and least expensive, and is shown in Fig. 27, a side elevation, Fig. 28, a plan, and Fig. 29, front elevation. It consists of a hydraulic cylinder A, which is carried on the upper deck by a foundation plate B, and at its lower end is secured to the main deck. The casting B is made in the form of a shallow tank, and has three pulleys mounted, C C C. The cylinder is fitted with a ram D, carrying a crosshead with three similar pulleys, C′ C′ C′. A chain or wire rope passes to and fro round the two sets of pulleys in the order of "block and tackle," one end being fixed to the cylinder, while the other passes over the derrick and into the hold. The valve for admitting water to the hoist is shown at E, and is of the usual two-ported slide variety, shown in enlarged section, Fig. 30. For high speeds it is necessarily of large area, and with the pressure employed is much too heavy to be conveniently handled direct. A subsidiary miniature valve is worked on the back of the main slide, which, by alternately exhausting small cylinders forming part of the latter and working upon rams attached to the casing, causes it to move in either direction in perfect obedience to the small valve, both as to speed and position. With such a "hydraulic relay" there is almost no limit to speed and power in hydraulic lifts, as in this case while the main valve is large and too stiff to work, the small one—about the size of half a walnut—may be moved by the fingers applied at the end of the lever. With these provisions for speed it is necessary to prevent the hoists from running away, and this is accomplished by the lever F, while its extreme end engages the spindle of the miniature valve at G, shown in Fig. 29. It

FIG. 13

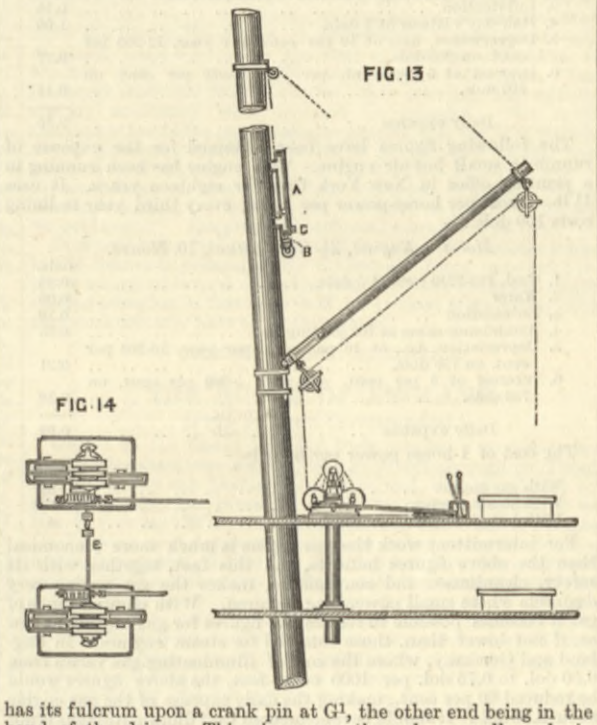


FIG. 14

has its fulcrum upon a crank pin at G¹, the other end being in the hand of the driver. This pin moves through a small angle in obedience to the motion of the lifting ram to which it is connected by a shaft H—shown in dot lines, Fig. 28—with its levers H¹ jointed to the nut I, which in turn receives its motion from the spiral bar running through the coarser screwed nut J. In this way the hoist is self-stopping in any position corresponding to that of the lever in its quadrant. The second system we come to, while not so simple, possesses many advantages for whipping light cargo and warping purposes over the first system.

Hydraulic derrick gear.—In connection with the foregoing hoists when the derrick or jib requires to have its radius altered to suit the variable positions of hatch and overside craft, the arrangement shown in Figs. 13 and 14 is adopted on board the Quetta. Fig. 13 shows the derrick and gear in side elevation, in which a hydraulic cylinder A is attached to the mast, having a ram B, with one pulley, carried at its end, and working downwards, so that its weight may tend to balance the weight of the derrick. The fast end of the chain is held by the clip at C, passes round the pulley on the ram B, thence over the swivel pulley D on the mast, and lays hold of the derrick at its point. A small slide valve is placed close to the hoist and hatch, the admission port of which is connected to the cylinder A by a small pipe up the mast. The movement of the derrick is thus easily controlled; by admitting water it rises; exhausting, it falls; and when the valve is in mid-position it is held fast. Fig. 14 shows the hoists, arranged in pairs, where there are two derricks with the communicating pipe and valve E, which, when both lifts are to work on one load, is opened, and one set of valve gear used for both.

Hydraulic swinging gear for jibs.—In connection with either of these hoists, the arrangement shown in Fig. 15 is used for swinging the jibs that are suspended from the mast for putting cargo over the side of a vessel. A pair of small hydraulic cylinders and rams A are attached, one on each side of the mast B on deck, each ram carrying a pulley C, round which a chain is passed, and its end fastened to the cylinder with provision for tightening at D. This chain passes round, and is fixed to a pulley E upon the base of the swinging jib F, and serves to move the jib round by the action of either cylinder alternately. The slide valve G admits water to either cylinder, and is moved by a lever H, which is centred at the bottom of the joint pin of the jib. The valve is thus opened by the attendant moving the lever to any position in its quadrant, while the actual swinging of the jib shuts it again. By having adjustable stops in the quadrant, the jib can always be swung by power exactly plumb over the centre of the hold of any craft alongside. The lever for operating this, although shown close to the mast, is usually brought alongside the lifting lever of the hoist.

Hydraulic crane.—This is shown in Figs. 16 to 18, Fig. 16 being in side elevation, Fig. 17 plan, and Fig. 18 detail of automatic swinging valve gear. The post of the crane forms the hydraulic cylinder, and is secured by a strong bed-plate A to the upper deck, and similarly fastened to the main deck at B. The post or cylinder is turned at its middle and top to receive the revolving castings C and D, the former carrying the foot of the jib, while the latter supports the jib, and at the same time provides the stuffing-box, through which lifting ram E works. At its lower part another stuffing-box F allows the crane to swing on the fixed hydraulic cylinder. Two pulleys are carried on the ram crosshead, one on the casting D, and one at right angles on the lower casting C. The chain is fast at G, passes over one top pulley, down to the lower one, over another top one, under front pulley, and thence over the point of jib. The whole of this arrangement is swung round by the swing cylinder H H′ and their rams I I′, which carry chain wheels at their extremities. Round these being a strong chain, one end fastened at J, passes round the nearest ram pulley I, thence round a chain-grooved wheel forming the lower part of casting C, laying hold of half its circumference, and, finally, round pulley on ram I′, it is made fast at J′. The lifting valve, which is of the "hydraulic relay" description, similar to that used in the hoists, is shown with its lever at K, K in Fig. 16 being in dot lines. The admission port of this valve is connected by a pipe to the post or cylinder, while its exhaust is connected by the return mains to the tank in engine-room. The swinging valve gear has the same property as that of the steering and reversing gear hereinafter described, only that the movement of the jib must be controlled throughout a complete circle. It is shown in Fig. 17 at L, a side elevation of the same being at Fig. 18. The slide valve is of the usual three-ported description, each end port being connected to the cylinders H and H¹, while the centre port is open to exhaust, and is moved direct by the swing lever, which lays hold of a nut, through which the valve spindle works at M. This spindle is connected to a spiral rod N, free to revolve through the valve, chest, and lever nut. A corresponding spiral nut is fixed to the ram I at N¹, and as it travels in its stroke it lengthens or shortens the distance between the slide valve and the lower joint of the swing lever. Thus this lever, assuming the slide valve to remain shut, or in mid-position, will take up different positions in its quadrant, equivalent to the positions of the swing ram in its stroke. The effect of this is, therefore, if the driver, either by setting his quadrant stops, or by marking the quadrant for different craft alongside, and either hatch, once ascertains by trial the various positions he wants to stop at, he has only to put his swing lever at these marks, and without further attention the jib will plumb the exact spot required.

Hydraulic reversing gear.—At Figs. 3 to 7 is shown the hydraulic reversing gear, which has been applied to the steamship Mikado, of 3000 tons, and is similar to that in use in the Cheshire and the Birkenhead ferry boats at Liverpool; these latter boats have each two pairs of engines, which are easily reversed by one man by means of this hydraulic gear. The apparatus consists of two hydraulic single-acting cylinders A A, Figs. 3 and 4, having rams 4½in. diameter, and 19in. stroke, coupled together and working in opposite directions, and connected by side rods B from the boss C to the weight shaft lever D. In the working of the apparatus, water from the accumulator is admitted to either of the cylinders as required, by opening the slide valve E by means of the reversing handle F, which is centred at G, and has a detent rod and quadrant H. The other end of the reversing handle F is connected to one end of the short double lever K, the other end of which is moved by a connecting rod from a stud joint J on the back of the weigh shaft of the main engines. The slide valve spindle is attached to the double lever K, at an intermediate point I, as shown also in the plan Fig. 7. The effect of this arrangement is that when water is admitted into the lower cylinder by a downward movement of the reversing handle raising the slide valve, as shown in Fig. 4, the hydraulic rams are then moved in an upward direction, carrying with them the weight shaft lever D, as shown in Fig. 4, and reversing the engines accordingly; and by the same movement the stud joint J upon the weight shaft is lowered, and closes the valve again, so that the two hydraulic rams are then held fast in whatever position they may be placed in. This counteracting cut-off enables the engineer at once to place the reversing links of the main engines at any degree of expansion and hold them there, by simply moving the reversing lever into the desired position in its quadrant, when the rams will follow at once into that position and stop there.

Combined steam and hydraulic starting engine.—This engine is shown in side elevation at Fig. 31, while Fig. 32 is a vertical sect : : Such an arrangement is necessary where it is the practice—a very good one—to shut off the hydraulic steering during the day, and so keeping the hand steering in good working order, only using the power gear at night, and in fogs when on a straight course. The engine oscillates on a centre A at the lower end of the steam cylinder, held by a casting A¹ bolted to the bed-plate of the marine engine. The cylinder is fitted with a piston B and rod C, to which is attached an hydraulic piston D, working in the hydraulic cylinder E. The rod C passes through a stuffing-box F on the steam cylinder, thence through another G on the hydraulic cylinder, and terminating at the point H on the weigh shaft lever. This lever is produced to K, and from that joint depends a rod and rack L, geared into the pinion M. Upon its shaft a worm wheel N is keyed, which is actuated by the worm O and the hand wheel P. This worm and wheel can be disengaged from the weigh shaft and link motion by the excentric bearing Q, turned by the handle R. This hand gear answers a similar purpose to that of hand-steering gear in case of derangement to the engine, and forms no integral part thereof. The arrangement of variable and automatic cut off gear in this engine is precisely similar to that of the swinging arrangement described under the subject of hydraulic crane. The steam side valve 1 is opened in either direction by the hand lever 2 acting on the nut 3. The piston B and rod C then move the lever I and reversing links at the same time, causing the valve rod to rotate by the fixed nut 4 attached to the rod by the arm 5. By this means the slide valve is brought to its central position, and the engine brought to a state of rest. Thus if the lever 2 is placed in any notch in its quadrant 6, the reversing links will follow and stop in a similar position. The water in the cylinder E is used in a passive capacity, and is kept up under pressure from the boiler by the pipe 7, which communicates between the lower end of the cylinder and that of the valve chest, so that only condensed water finds its way to the former. (*To be continued.*)

* Read before the Institution of Naval Architects.

A YEAR'S RAILWAY ACCIDENTS

The following summary of accidents and casualties which have been reported to the Board of Trade as having occurred upon the railways in the United Kingdom during the year ending December 31st, 1883, was issued on Tuesday:—

Accidents to train, rolling stock, permanent way, &c., caused the death of 22 persons, and injury to 749, viz.: Passengers killed, 11; ditto injured, 662; servants of companies killed, 11; ditto injured, 87; total—killed, 22; ditto injured, 749. Total for the corresponding period in 1882: Passengers killed, 18; ditto injured, 803; servants of companies killed, 21; ditto injured, 153; total—killed, 39; ditto injured, 957.

During the year there were reported 36 collisions between passenger trains or parts of passenger trains, by which 6 passengers and 1 servant were killed and 239 passengers and 19 servants injured; 51 collisions between passenger trains and goods or mineral trains, &c., by which 5 passengers and 2 servants were killed and 238 passengers and 21 servants injured; 15 collisions between goods trains or parts of goods trains, by which 2 servants were killed and 4 passengers and 12 servants injured; 2 cases of trains coming in contact with a projection from other trains travelling on parallel lines, causing the death of 1 servant; 57 cases of passenger trains or parts of passenger trains leaving the rails, by which 2 servants were killed and 22 passengers and 7 servants injured; 11 cases of goods trains or parts of goods trains leaving the rails, by which 2 servants were killed and 2 injured; 21 cases of trains travelling in the wrong direction through points, by which 17 passengers and 8 servants were injured; 25 cases of trains running into stations or sidings at too high a speed, by which 1 servant was killed and 111 passengers and 3 servants were injured; 154 cases of trains running over cattle and other obstructions on the line, by which 4 passengers were injured; 42 cases of trains running through gates at level crossings, in one of which a servant was injured; 1 case of the bursting of a tube in an engine, by which 1 servant was injured; 7 failures of machinery, springs, &c., of engines, by which 4 servants were injured; 14 failures of couplings, by which 26 passengers and 2 servants were injured; 13 slips in cuttings or embankments, involving

injury to 4 servants; and 2 other accidents, by which 1 passenger and 3 servants were injured.

The following cases were also reported, but they involved no personal injury:—1247 failures of tires; 3 failures of wheels, 450 of axles, 1 of brake apparatus, 2 of ropes used in working inclines, and 3 of tunnels, bridges, &c.; 398 broken rails; 27 floodings of the permanent way; 4 fires in trains, and 4 at stations.

Of the 1247 tires which failed, 53 were engine tires, 16 were tender tires, 5 were carriage tires, 30 were van tires, and 1143 were wagon tires; of the wagons, 830 belonged to owners other than the railway companies; 1100 tires were made of iron, and 147 of steel; 39 of the tires were fastened to their wheels by Gibson's patent method, 9 by Beattie's patent, 14 by Mansell's, and 6 by Drummond's patent, none of which left their seats when they failed; 1167 by bolts or rivets, 3 of which left their wheels when they failed, and 14 by various other methods; 51 tires broke at rivet-holes, 149 in the solid, 21 at the weld, and 1026 split longitudinally or bulged.

Of the 450 axles which failed, 275 were engine axles, viz., 247 crank or driving, and 28 leading or trailing; 21 were tender axles, 2 were carriage axles, 141 were wagon axles, and 11 were axles of salt vans. 57 wagons, including the salt vans, belonged to owners other than the railway companies. Of the 247 crank or driving axles, 173 were made of iron and 74 of steel. The average mileage of 171 iron axles was 213,719 miles, and of 72 steel axles 199,471 miles.

Of the 398 rails which broke, 260 were double-headed, 131 were single-headed, 6 were of the bridge pattern, and 1 was of Vignoles' pattern; of the double-headed rails, 178 had been turned; 157 rails were made of iron and 241 of steel.

Of the 602 persons killed and 1065 injured in this division, 114 of the killed and 754 of the injured were passengers. Of the latter, 36 were killed and 48 injured by falling between carriages and platforms, viz., 22 killed and 26 injured when getting into, and 14 killed and 22 injured when alighting from, trains; 10 were killed and 494 injured by falling on to platforms, ballast, &c., viz., 3 killed and 43 injured when getting into, and 7 killed and 451 injured when alighting from, trains; 38 were killed and 14 injured whilst passing over the line at stations; 60 were injured by the closing of carriage doors; 7 were killed and 37 injured by falling out of carriages during the travelling of trains; and 23 were killed and 101 injured from other causes; 78 persons were killed and 51 injured whilst passing over railways at level-crossings, viz., 36 killed and 38 injured at public level-crossings, 23 killed and 7 injured at occupation crossings, and 19 killed and 6 injured at foot crossings. There were 293 persons killed and 165 injured when trespassing on the railways, 61 persons committed suicide on railways, and of other persons not specifically classed, but mostly private people having business on the companies' premises, 56 were killed and 95 injured.

During the year there were 543 servants of companies or contractors reported as having been killed and 2373 injured, in addition to those included in Division 1. Of these 45 were killed and 395 injured whilst coupling or uncoupling vehicles; 4 were killed and 47 injured by coming in contact, whilst riding on vehicles during shunting, with other vehicles, &c., standing on adjacent lines; 1 was killed and 44 were injured whilst passing over or standing on buffers during shunting; 46 were killed and 314 injured in getting on or off, or by falling off, engines, wagons, &c., during shunting; 7 were killed and 161 injured whilst breaking, spragging, or chocking wheels; 8 were killed and 36 injured whilst attending to ground points, marshalling trains, &c.; 1 was killed and 134 were injured whilst moving vehicles by capstans, turntables, props, &c., during shunting, and 18 were killed and 318 injured by various other accidents during shunting operations; 13 were killed and 41 injured by falling off engines, &c., during the travelling of trains; 6 were killed and 39 injured by coming in contact with over-bridges or erections on the sides of the line during the travelling of trains; 5 were killed and 47 injured whilst getting on or off engines, vans, &c., during the travelling of trains; 2 were killed and 108 injured whilst attending to, or by the failure of, machinery, &c., of engines in steam; 116 were killed and 132 injured whilst working on the permanent way, sidings, &c.; 3 were killed and 6 injured whilst attending to gates at level crossings; 147 were killed and 246 injured whilst walking, crossing, or standing on the line on duty; 46 were killed and 156 injured by being caught between vehicles; 24 were killed and 92 injured by falling or being caught between trains and platforms, walls, &c.; 47 were killed and 19 injured whilst walking, &c., on the line on the way home or to work; and 4 were killed and 38 injured from various other causes.

Altogether, the number of persons killed and injured on railways in the United Kingdom in the course of public traffic during the year ending 31st December, 1883, as reported to the Board of Trade, was as follows:—

Passengers: From accidents to trains, rolling stock, permanent way, &c., killed 11, injured 662; total 1882, killed 18, injured 803. By accidents from other causes, killed 114, injured 754; total 1882, killed 109, injured 936. Servants of companies or contractors: From accidents to trains, rolling stock, and permanent way, &c., killed 11, injured 87; total 1882, killed 21, injured 153. By accidents from other causes, killed 543, injured 2373; total 1882, killed 532, injured 2423. Persons passing over railways at level crossings, killed 78, injured 51; total 1882, killed 72, injured 40. Trespassers—including suicides—killed 354, injured 165; total 1882, killed 306, injured 155. Other persons not coming in above classification, killed 56, injured 95; total 1882, killed 63, injured 91. Total, killed 1167, injured 4187. Total 1882, killed 1121, injured 4601.

In addition to the above, the railway companies have reported to the Board of Trade, in pursuance to sec. 6 of the Regulation of Railways Acts, 1871, the following accidents which occurred upon their premises, in which the movement of vehicles used exclusively upon railways are not concerned, namely:—1 passenger killed and 117 injured whilst ascending or descending steps at stations; 45 injured by being struck by barrows, falling over packages, &c., on station platforms; 37 injured by falling off platforms; and 52 injured from other causes. Of servants of companies or contractors, 7 were killed and 873 injured whilst loading, unloading, or sheeting wagons; 1 was killed and 286 were injured whilst moving or carrying goods in warehouses, &c.; 7 were killed and 147 injured whilst working at cranes or capstans; 3 were killed and 347 injured by the falling of wagon-doors, lamps, bales of goods, &c.; 4 were killed and 506 injured by falling off, or when getting on or off, stationary engines or vehicles; 12 were killed and 251 injured by falling off platforms, ladders, scaffolds, &c.; 1 was killed and 265 were injured by stumbling whilst walking on the line or platforms; 1 was killed and 174 were injured whilst attending to stationary engines in sheds; 59 were injured by being trampled on or kicked by horses; 9 were killed and 510 injured whilst working on the line or in sidings; and 3 were killed and 159 injured from various other causes. Fourteen persons who were transacting business on the companies' premises were also killed, and 109 were injured—making a total in this class of accidents of 63 persons killed, and 3936 injured.

Thus the total number of personal accidents reported to the Board of Trade by the several railway companies during the year amount to 1230 persons killed, and 8123 injured.

THE RELATIVE ECONOMY OF GAS, STEAM, AND HOT-AIR ENGINES.

In a paper entitled "Some Experiments upon the Otto Gas Engine," Messrs. Morgan Brooks and J. E. Steward, graduates of the Stevens Institute of Technology, Hoboken, N.J., arrived at the following figures on the commercial efficiency of the gas engine as compared with steam and hot-air engines:—

In making a comparison of this kind it is necessary to consider—(1) The cost of gas or coal consumed; (2) the cost of water used; (3) lubrication; (4) the cost of attendance; (5) depreciation and repairs; (6) interest on capital invested.

1. The average consumption of gas in a gas engine per effective horse-power per hour, including igniting flames, is about 30 cubic feet. The consumption of coal per effective horse-power per hour by small steam engines is about 7 lb.

2. The water used in the water jacket of a gas engine will not enter into the estimate, since by the use of tanks the same water may be used continuously. The water supplied to the boiler of the steam engine here considered amounts to $\frac{2}{3}$ cubic feet per horse-power per hour.

4. A gas engine requires little or no attendance. A man can accomplish five-sixths of a day's work and still take full charge. Steam engines of this size require from one-half to a day's attention, depending upon the proximity of the engine and boiler.

5. As regards depreciation, it is safe to say that gas and steam engines have about equal terms of life; for while gas engines have less complication of working parts than steam engines, yet they are subject to more severe and abrupt strains.

6. The interest will necessarily be directly proportional to the amount of capital invested.

The following summary shows the relative cost of a day's running:—

Gas Engine, 8-H.P. actual, 10 Hours.

	dols.
1. 2400 cubic feet gas at 2.50 dols. per 1000	6.00
2. Water	0.00
3. Lubrication	0.20
4. One-sixth day's labour at 2 dols.	0.33
5. Depreciation, &c., at 12 per cent. per year, 12-360 on 1075 dols.	0.36
6. Interest at 5 per cent. per year, 5-360 per cent. on 1075 dols.	0.15
Daily expense	7.04

Steam Engine, 8-H.P. actual, 10 Hours.

	dols.
1. Coal, 560-2240 tons at 5 dols.	1.25
2. Feed-water, 65 cubic feet at 1.25 dols. per 1000	0.08
3. Lubrication	0.15
4. Half-day's labour at 2 dols.	1.00
5. Depreciation, &c., at 12 per cent. per year, 12-360 per cent. on 800 dols.	0.27
6. Interest at 5 per cent. per year, 5-360 per cent. on 800 dols.	0.11
Daily expense	2.86

The following figures have been obtained for the expense of running a small hot-air engine. This engine has been running in a printing office in New York City for eighteen years. It uses 4½ lb. of coal per horse-power per hour; every third year re-lining costs 100 dols.:—

Hot-air Engine, 2½-H.P. actual, 10 Hours.

	dols.
1. Coal, 115-2240 tons at 5 dols.	0.25
2. Water	0.00
3. Lubrication	0.10
4. Attendance same as for gas engine	0.33
5. Depreciation, &c., at 10 per cent. per year, 10-360 per cent. on 750 dols.	0.21
6. Interest at 5 per cent. per year, 5-360 per cent. on 750 dols.	0.10
Daily expense	0.99

The cost of 1-horse power per hour is—

	cents.
With gas engine	8¾
With steam engine	3½
With hot-air engine	4

For intermittent work the gas engine is much more economical than the above figures indicate, and this fact, together with its safety, cleanliness, and convenience, makes the gas engine very desirable where small powers are required. With cheaper kinds of gas it becomes possible to reduce the figures for gas engines as low as, if not lower than, those obtained for steam engines. In England and Germany, where the cost of illuminating gas varies from 0.50 dol. to 0.75 dol. per 1000 cubic feet, the above figures would be reduced 60 per cent., making the daily expense of the gas engine about 2.75 dols. It should be remembered that illuminating gas is not required for the gas engine. The manufacture and distribution in cities of some cheap gas especially adapted for use in gas engines may soon become a prominent industry; and, with economy added to its other merits, the gas engine may largely supplant steam for manufacturing and other purposes.

It will be seen that the gas engine comes out well in these trials, as the price of the gas used is about 10s. per 1000 cubic feet.

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

(*From our own Correspondent.*)

This has been only a half week as regards business at the iron-works. A few mills and forges re-started on Tuesday, but the resumption of operations was not at all general until last night or to-day—Thursday. At a considerable number of the works nothing will be done until next week, masters availing themselves of the interval to carry out repairs. More works would have gone on this week had not some of the men turned stupid over the wages question. When on Wednesday the puddling furnaces were got clean and in an altogether excellent condition for a re-start, the puddlers at certain places refused to begin. Their excuse was that they did not understand what wages they are to receive between now and the date when the President of the Wages Board gives his decision concerning the reduction claimed by the masters. On Tuesday the Wages Board at Wolverhampton had resolved: "That the works be kept in operation, according to Rule 18, pending the decision of the President." This is what the puddlers professed not to understand; and the masters concerned have, therefore, no alternative but to prolong the holidays. Happily, the difficulty should not be of much duration.

On 'Change in Wolverhampton yesterday, and in Birmingham to-day, the prices declared at the quarterly meeting were confirmed. As is often the case at the markets which immediately follow the quarterly gatherings, the new business transacted was small. Yet negotiations which last week were set on foot between buyers and sellers were this afternoon, in numbers of instances, satisfactorily concluded; and the effect upon the order books will be decidedly tangible.

Thin sheet makers reported that such is the inquiry for early consumption, that they are almost "pulled out of the place for prompt deliveries." They are, therefore, firm in price, and speak of the probabilities of an advance rather than a decline in the not very distant future. The orders are well distributed over alike home and foreign buyers, though the latter are ordering in the largest quantities.

John Knight and Co., Kidderminster, quote working-up sheets: Singles, £9 10s.; doubles, £11; and lattens, £12 10s. Stamping sheets to 24 b.g. are £13, and lattens £14. These last prices apply to sheets of either steel or iron as buyers prefer. The firm find that steel sheets are increasingly demanded, and they are rolling them down from blooms obtained from the steel making districts.

Notwithstanding the competition of steel, charcoal sheets are still required by customers who are rather conservative in their views, and who are not easily persuaded to adopt a new metal. Messrs. Knight are doing well in charcoal sheets, which they quote: Singles, £19 10s.; doubles, £21; and lattens, £22 10s.

Plate and angle makers still complain of the competition from the North of England firms. Indeed this competition is becoming more severe; and the bar makers have to contend against competition from South Wales in particular. Australia and India are the best export customers at present for good bars, but even with the help which these export orders afford, the marked bar makers are only able to find irregular employment for their workmen. Best bars are £7 10s. to £7 per ton; medium qualities, £6 10s.; and common bars can this week be got for £5 15s. per ton.

Prices of other merchant irons are easy, and to get orders, makers have to coax buyers. Hoops for export are abundant at £6 7s. 6d., and gas tube strip may be had at £5 12s. 6d.

The Staffordshire Steel Company, which is erecting works at Bilston upon the basic principle, informs me that it is expected to make a start in June. When it has got well under weigh it hopes to produce 1000 tons a week. It is laying down rolling power sufficient for an output of some 2000 tons a week if such a make should eventually become necessary by the demands of the district. The molten metal will be supplied to the converters from blast furnaces upon the adjoining premises of Messrs. A. Hickman and Sons. This firm will blow in two new furnaces—bringing their plant up to six—for the purpose. The better to superintend the new steel works, Mr. Percy C. Gilchrist, one of the patentees, and who is understood to have also an important interest in the new company, is about to take up his residence permanently in Wolverhampton.

The Patent Shaft and Axletree Company, Wednesbury, which a while ago was manufacturing part of its output of steel upon the basic process, has ceased to employ it, and is now again producing only upon the Bessemer principle. The chief reason which has led to the suspension, for at any rate the present, of the Thomas-Gilchrist process at these works is that the steel could not be sold at a profit in competition with the same product offered from other districts.

The Earl of Dudley's all-mine pigs were quoted to-day in Birmingham at 85s. for cold blast and 65s. for hot blast. The other leading makers quoted 80s. for cold blast and 60s. for hot blast. The demand for pigs of this quality continues very limited. It is not by any means an easy matter for producers to find a market for all their output. Yet the Lilleshall Company continues blowing four furnaces, three of them being upon hot blast and one upon cold blast pigs. Its total output is between 900 and 1000 tons a week. The number of makers of cold blast pigs is getting smaller and smaller. The manufacture is now confined to some four or, at the most, five firms.

Part-mine and cinder pigs are in larger sale than best qualities, and at the Spring Vale Works of Messrs. Hickman four furnaces are kept going. The firm quote:—Hydrates, 57s. 6d.; mine iron, 50s.; and common, 40s. per ton. Messrs. Bradley Brothers also quote their part-mines at 50s., while some other makers quote 47s. 6d. One or two new brands of native part-mines have lately been put upon the market, and to secure a foothold prices are at present being accepted which it would be scarcely fair to quote.

Foreign pigs were this afternoon in rather limited sale, and competition among vendors is sharp. The Northampton makers who, up till recently, have by a combination kept the minimum for their pigs at 44s. delivered into this district, are now understood to have consented to abate that figure by 1s. a ton, making 43s. their standard. West Cumberland hematites are to be had at from 57s. 6d. to 56s.; but for best hematites of other districts vendors ask 58s.

The East Worcestershire tin-plate makers are fairly active. They are much better off in the matter of price than their Welsh brethren. In this district, as in Wales, steel blooms and billets are being increasingly used up at the tin-plate mills. The present quotations of such local firms as John Knight and Co., for steel tin-plates of I.C. quality is 23s. per box. "Cookley" coke tin-plates are 21s. per box, and "Cookley" K charcoal 25s. per box I.C. The quotations which the Welsh makers are, through their sellers, naming to merchants hereabouts are 15s. 6d. for ordinary cokes, and 19s. for charcoals. But merchants will not generally give out orders except at a reduction of something like 6d. per box upon these prices.

The coal trade is unsettled by the uncertainties of the wages question. The Coal Trade Wages Board has been summoned to meet in Wolverhampton next Wednesday.

The heavy ironfounders report new work rather difficult to secure, as competition is keen. Especially is this the case in the big pipe department. Constructive engineers, however, are getting some good orders. A large contract has just been placed with the Horsely Engineering Company, of Tipton. It is for iron work to widen a railway bridge across the Thames, and for an additional bridge to span the Medway at Rochester. Both orders are for the South-Eastern Railway Company. They will absorb together upwards of 7000 tons of iron. As I noted in my report of two or three weeks ago, there is also being built in this district a bridge which is to span the Thames at Putney, the firm who have that order being Messrs. Simpson and Wood, of Darlaston.

Colonial orders for hardwares continue below the average, but manufacturers in certain leading branches are still sending out considerable consignments in the hope of their finding a market upon arrival. Such a course must tend to keep down rates. So America is taking a very fair quantity of common hardwares, and India is buying pretty steadily.

Increasing success is attending the production at Walsall and Willenhall of light ornamental iron castings. Great perfection has been attained at Willenhall.

On Wednesday at a meeting of chain makers held at Cradley Heath it was determined to cease work to-morrow—Saturday—if the employers refused to pay the 4s. 6d. list.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The past week has been so much of a broken character, owing to the holidays, that there is very little to report, so far as business is concerned, in either the iron or the coal branches of industry in this district. Generally, there has practically been a stoppage of the ordinary operations at the iron and engineering works and the collieries for about three days, and at the usual Manchester weekly markets on Tuesday there was only a partial resumption of business operations, both the iron and the coal exchanges being only thinly attended, with very little inquiry stirring in either branch of trade. The very limited weight of transactions which have taken place since the holidays scarcely afford any sound basis as to the actual condition of trade, but generally there appears to be a weaker tone in the market; and although both ironmasters and colliery proprietors are in the position that they can scarcely come lower in price without some corresponding reduction in wages, there is a good deal of very low selling to secure orders, and for anything like quantities there is to a large extent an absence of anything like fixed rates.

As I have already intimated, the business doing on the Manchester iron market on Tuesday was extremely small. Consumers of pig iron, in view of the want of firmness shown in the market, are, as a rule, very indifferent about buying beyond their hand-to-mouth requirements, except at a reduction upon current rates; and in not a few instances the deliveries they have to come in on account of contracts entered into a few months back are more than sufficient to cover the work they have now in hand. Here and there, where contracts are running out, makers are open to accept offers at under current rates; but generally there is no disposition to give way to any very material extent. For Lancashire pig iron delivered equal to Manchester 43s. 6d. to 44s. less 2½ is still quoted as the minimum for forge and foundry qualities, and for district brands quotations remain on the basis of 43s. 10d. to 44s. 4d. less 2½ for forge and foundry Lincolnshire delivered; but there is very little being done at these figures.

In the manufactured iron trade business continues very quiet, and although there has been no announced alteration in the quoted list rates since the quarterly meetings, there is an easier tone in the market. For good Lancashire and North Staffordshire bars, delivered into the Manchester district, £5 17s. 6d. is still the basis for the average quoted prices, but for anything like good specifica

tions £5 15s. would be readily taken in many cases, and good local made hoops are to be bought without difficulty at £6 5s. per ton.

Although there is a continued absence of any great weight of work ahead in the engineering branches of industry, and as a rule new orders are only to be got by cutting down prices to the lowest possible point, a fair amount of activity is still being generally maintained, locomotive builders, tool makers, and machinists being, as a rule, kept steadily employed.

The returns for the past month issued by the Amalgamated Society of Engineers show, if anything, a slight improvement in the general engineering branches of trade throughout the country, the only important branch in which any real slackness is reported being the iron shipbuilding trade. In the Lancashire districts, with the exception of the shipbuilding centres on the Mersey and at Barrow, trade is returned as slightly better, and in the Manchester and Salford district the number of members on the books in receipt of out-of-work support does not average more than about 3 per cent., which is also about the average for the country generally.

In the coal trade business continues only very dull, and for both house-fire and manufacturing classes of fuel there has been only a very limited demand during the past week owing to the holidays. The stoppage of the pits from the same cause has prevented any accumulation of stocks, and quoted prices are without change from last week; but so far as round coals are concerned the tendency is downwards. At the pit mouth the average prices are about 9s. to 9s. 6d. for best coals, 7s. to 7s. 6d. for seconds, 5s. 6d. to 6s. per ton for common round coals, but the minimum figures represent more nearly the basis of the average selling prices, and for quantities to clear away stocks under load sellers in many cases are open to take very low prices, the result being that for anything like large sales prices are very irregular. Engine classes of fuel continue in fairly good demand, and so far as slack is concerned, late rates are maintained without difficulty. At the pit mouth burgy averages about 4s. 6d. to 5s.; best slack, 4s. to 4s. 3d.; and ordinary qualities from 3s. to 3s. 6d. per ton.

For shipment there has been a moderate demand, and with the stoppage of pits during the past week this has enabled colliery proprietors in some cases to clear away the stocks they had under load, but the prices at which orders have to be taken continue extremely low, and good Lancashire steam coal delivered at the high level, Liverpool, or the Garston Docks averaging about 7s. 3d. to 7s. 6d. per ton, with seconds house coal about 1s. per ton more.

The question of a reduction in wages has recently been several times under consideration at the meetings of the West Lancashire colliery proprietors, but although the feeling is very strong that the present low prices do not warrant the rate of wages now being paid, there is some hesitation in initiating any movement in the direction of a reduction which might not be fully supported in other districts, and so far no definite action has been decided upon. It is, however, almost certain that should the continued depression in trade force on any further announced reduction in prices, this would be accompanied by some corresponding reduction in wages.

Barrow.—I have little or nothing to report in connection with the hematite pig iron trade of this district. The market is unchanged, and at present there are no signs of a revival taking place. Business in all departments has been completely at a standstill during the past week owing to the Easter holidays. I hear of no improvement in the demand, and the orders at present in the hands of makers are anything but sufficient to keep works steadily employed, and unless a change for the better takes place very soon we shall hear of the output being further reduced all round. The business to hand from home consumers is restricted to supply more immediate wants, whilst the contracts received on foreign, American, and continental account are practically *nil*. Prices are nearly nominal, No. 1 Bessemer samples being offered at 47s. per ton net, No. 2 at 46s., and No. 3 at 45s. per ton, while inferior samples are selling very slowly at 44s. 6d. per ton net at works. Stocks are gradually increasing, and are likely to do so, as the present deliveries by sea and rail do not by any means represent the amount of the output, which is pretty well maintained. The steel trade does not improve, and makers are following in the steps of the ironmakers—at least, that is, so far as restricting the output. The orders from all quarters are limited. Rails are in poor demand at from 90s. per ton net at works, prompt delivery. Shipbuilders are badly off for orders, and a crisis appears imminent in the trade. Very few men are employed at local yards. Boilermakers, engineers, and the other minor departments of the steel and iron trades are but indifferently employed. Large stocks of ore are now banked at mines. Coal and coke easier. Shipping freights dull.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The Easter holidays have been unusually prolonged in many quarters this season, mainly on account of there being so little pressure, that once the machinery was permitted to stand, the employers were not particular to a day or two about resuming business. This remark applies more particularly to the lighter departments of business; indeed, at some of the larger establishments—notably Messrs. Vickers, Sons, and Co., River Don Works—work has never ceased, through pressure of orders for their large castings, and similar specialities. With the exception of Easter Monday and Tuesday, which were wet and cold, pleasure-seekers had favourable weather, which the Sheffield workman and his wife enjoyed mainly in the adjoining county of Derbyshire.

Ironworkers in this district are ruled by South Staffordshire. If the workmen there persist in resisting the readjustment of puddlers' wages, the Sheffield ironworks will be affected. It is expected, however, that the Wages Board will decide on arbitration, and the result, when arrived at, will affect the whole of England, except Northumberland and the other northern districts. The colliers are stated to be even more determined upon resisting the drop which the masters claim. At the present the Coal Trade Wages Board is without a president, and therefore cannot meet.

A threatened strike at the Barrow collieries has been averted by the men engaged in the Thorncliffe seam having concluded to accept the terms offered by the masters, "to see how they answer." Up to the present the men have been accustomed to send out the whole of the coal, and to be paid 1s. 7d. per ton for it. The company, with a view to improve the quality of the coke manufactured, have required the men to send out "tops" only, leaving the "bottoms," which are equal to about two-fifths of the whole. With that left in the pit, the price offered for the coal sent out is 2s. per ton. Though the men eye the new terms somewhat askance, they have been advised by the Union to try the new scale of pay, and see how it works. The men in the Silkstone seam will also return to work.

At the Alma Colliery, North Wingfield—not very far from Clay Cross—the whole of the miners employed by Mr. Thomas Holdsworth went out on strike on the 9th. The rate of wages paid at Alma Colliery, as well as others owned by Mr. Holdsworth, is ruled by those paid by the Clay Cross Company. It having been reported that the Clay Cross colliers had received fourteen days' notice of a reduction, the men at the Alma Colliery were required to accept a reduction of 2d. per ton. They declined to submit to a reduction, and are now on strike, the datal men being also thrown idle in consequence. The number out in North Derbyshire, which reached 600 last week, is now, therefore, increased to 900. The singular incident of the affair is, that no reduction had been intimated at Clay Cross. Mr. James Haslam, secretary to the Derbyshire Miners' Association, writes that the letter from the managers of the Dronfield and Unstone Collieries, part of which he read at a meeting of the men, does not ask the secretary of the Union to use his influence to induce the men to go in at the reduction, but reiterates certain statements made to the deputation and the secretary as to the disastrous consequences that would ensue to the population of the district if either of the collieries should be closed, as it would be impossible for either of them, singly, to cope with the volume of water that would be thrown upon their pumping power.

Good Friday was mainly spent by the South Yorkshire miners in holding meetings, at which they passed several resolutions supporting the County Franchise and other prominent measures of her Majesty's Government, and one resolution dealing with their own affairs. The latter was to the effect, "That this meeting is of opinion that all miners, whether working coal or iron, should join the Yorkshire Miners' Association in order to secure all the benefits secured by law—both social, political, and protection of life—and all the benefits unsecured by law which are rightly their due, and that unless the miners do so unite they cannot hope the present or any future Parliament will grant more than they have already done, or that colliery owners or managers will be more lenient or generous in the future than in the past; we, therefore, pledge ourselves to join the Yorkshire Miners' Association, and assist in preserving what we have, and make ourselves strong to secure those things we considers ours by right in the future."

A vigorous effort is at present being made to secure the extension of the benefits of a thorough scheme of technical education to Sheffield. An influential meeting has been held, at which it was resolved to take steps to secure an income of at least £1200 a-year for the departments of metallurgy and engineering, and the resolution urged the necessity of increasing the donations to £10,000. The Master-Cutler, in a letter to the newspapers, states:—"In metallurgy we shall establish a school, which, Dr. Sorby informs me, will be the only one in Great Britain. Is there not scope for inventions in steel, iron, silver, nickel, and other metals used in the Sheffield trades? The 'rule of thumb' mixture will to a great extent be superseded by the thorough knowledge of the scientific mixture of metals. We have been rather slow in Sheffield in taking up new things, but I have noticed of late that we have been waking up; not before it was time. We have allowed other countries to take the lead. We have followed, and then complained. I would rather we should be the leaders, and let other people complain. See how slow we have been in the matter of inventions in the steel trade. Since the time of Huntsman, of Attercliffe, I suppose about eighty or ninety years ago, up to the time of Bessemer, Siemens, and Mushet, steel was practically made on the old lines. Those inventors were not Sheffield men. Saw grinding, axe and fork making machinery were invented in America. File cutting machinery has taken many years to perfect, and the best machine, in my opinion, was invented by a Frenchman. Many other machines that are now used in the Sheffield staple trades were not invented here. I once heard our respected ex-mayor—Michael Hunter—remark, 'Confound it! we have it in us. Why don't we get it out?' The proposed technical school will do that."

Dronfield is doomed to suffer still further. The colliery interest in the district is collapsing, the timbers are being removed out of the workings of several collieries, and it is feared that the result of ceasing pumping in these pits will be to flood other mines, which may consequently have to be abandoned.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

Owing to the Easter holidays, there was but a poor attendance at the Cleveland iron market, held at Middlesbrough on Tuesday last. Scarcely any business was done, and, in fact, almost complete inactivity has prevailed since the returns for March were issued, showing 5207 tons less in stock than at the end of February. On Tuesday most merchants and some makers were offering No. 3 g.m.b. for prompt delivery at 37s. per ton, but the combination makers asked a little more. The price of forge iron is now 35s. 6d. per ton, and the demand less than it was a short time since. Makers are not pressing their iron on the market either for prompt or forward delivery, and as prices have nevertheless receded somewhat, consumers appear to be indifferent about buying. Altogether the market is at present in a lifeless condition.

There is still little inquiry for warrants, and the price remains at 37s. per ton.

Shipments from the Tees are, on the whole, satisfactory, but have suffered somewhat through the holidays. During the first twelve days of April 32,379 tons of pig iron and 11,649 tons of manufactured iron and steel were exported.

Most of the finished ironworks are closed this week, and business is exceedingly dull. Consumers are waiting for the arbitrators' award, and hope to be able to buy more favourably when it is issued. Meanwhile prices remain about the same, viz.:—Ship-plates, £5 to £5 5s.; shipbuilding angles, £4 15s. to £4 17s. 6d.; and common bars, £5 2s. 6d. to £5 5s.; all free on trucks at makers' works, cash 10th, less 2½ per cent. discount. Puddled bars are £3 5s. per ton net at manufacturers' works.

The depression in the shipbuilding trade still continues. Messrs. Raylton Dixon and Co., of Middlesbrough, paid off about thirty workmen on the 9th inst., and others will be discharged as the work in hand is completed. No fresh orders are being booked. Messrs. Cragg and Sons also paid off twenty-five men last week. They have now nothing in hand except repairing work.

An idea was prevalent some years since among civil engineers that the manufactured iron of the Cleveland district was inferior in quality to that produced in Staffordshire, and was unsuitable for high-class bridge work. The Tay Bridge disaster naturally tended to strengthen this idea, notwithstanding that the Court of Inquiry into that famous disaster stated emphatically in its judgment that the material used was of exceptionally good quality. The old proverb runs, however, thus: "Give a lie twenty-four hours' start, and you will have a difficulty in catching it up." And so the prejudice still remains in the minds of some. Recently the engineer of a northern railway company, being not altogether unbiassed, employed Mr. Kirkcaldy to test ten strips of iron which he had had cut from plates sent by a Middlesbrough firm to a Lancashire bridge-builder for use in a high-class railway bridge. The average tensile strain withstood by five of the pieces cut in the direction of the fibre was 24·4 tons per square inch, with 9 per cent. extension; and the average tensile strain withstood by the other five pieces cut across the grain was 20·4 tons per square inch, with 3 per cent. extension. With such results as these it is idle to talk of Middlesbrough iron being unfitted for use in any structure whatever.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The iron market was closed from Thursday of last to Tuesday of this week in consequence of the Easter holidays. By this abridgement of the week's business, the transactions have, of course, been more limited than usual. There is an almost entire absence of animation from the warrant market. Of late the stocks of pig iron in the warrant stores have been on the decrease, but this can scarcely be due to any large improvement in the consumption of g.m.b., seeing that our makers are employing such a large proportion of Cleveland iron. Up till date, the imports of this iron since Christmas amount to 72,660 tons. Although the tendency of prices has been downward, the smallness of the actual decline over a series of weeks is very remarkable. The exports and coastwise shipments of Scotch pig iron to date are 11,000 tons behind what they were at the corresponding date in 1883.

Business was done in the warrant market on Tuesday forenoon at 42s. 2½d. to 42s. 3½d. cash, and 42s. 4½d. one month, the tone in the afternoon being firmer, at 42s. 3½d. to 42s. 4d. cash. Business took place on Wednesday at 42s. 4d. to 42s. 5½d. cash, and 42s. 7d. one month. To-day—Thursday—the market was quiet, 42s. 3½d. to 42s. 4d. cash, and 42s. 5½d. to 42s. 6d. one month.

The values of makers' iron, which exhibit little alteration, are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 52s. 9d.; No. 3, 51s.; Coltness, 58s. and 51s.; Langloan, 54s. and 51s.; Summerlee, 52s. and 48s.; Calder, 53s. 6d. and 47s. 6d.; Carnbroe, 52s. and 48s.; Clyde, 48s. and 45s. 6d.; Monkland, 44s. 3d. and 41s. 3d.; Quarter, 44s. and 41s.; Govan, at Broomielaw, 44s. and 41s. 3d.; Shotts, at Leith, 53s. and 52s.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s.) and 47s. 6d.; Kinneil, at Bo'ness, 46s. and 45s. 6d.; Glengarnock, at Ardrossan, 52s. and 45s. 6d.; Eglinton, 46s. and 42s. 6d.; Dalmellington, 48s. 6d. and 44s. 6d.

The malleable iron department continues quiet, with merchants quotations as follow:—Bars, flats, rounds, and squares, £5 12s. 6d. per ton; nail rods, £6; angles, £5 7s. 6d.; sheets, £7 7s. 6d.; ship plates, £6 2s. 6d.; boiler plates, £6 17s. 6d. to £8 17s. 6d.; ditto, for boiler bottoms, £9 5s. About 100 men have been dismissed by Messrs. Ure and Co., at their Bonnybridge Ironfoundry, the reason stated being that the castings for the Singer Manufacturing Company, hitherto executed by them, will now be done at the company's new factory in Glasgow.

The past week's iron manufactures reported from the Clyde, in addition to pig iron, were comparatively small, being valued at £34,000, of which £12,100 represented machinery of different kinds, £4500 steel goods, £16,000 general iron goods, and £1700 sewing machines.

The steel industry is less prosperous than it was last year, through the slackness in the shipbuilding trade, but there is a probability of a constant increase in the foreign orders for goods of a miscellaneous nature. The Steel Company of Scotland have in hand most of the steel required for the construction of the Forth Bridge. Progress is being made with the new steel works of Messrs. Merry and Cuninghame, and of the Glasgow Iron Company, both of whom have contracted for large sets of steel boilers to supply the new works with steam. Messrs. William Wilson and Co., of the Lilybank Works, Glasgow, supply the former, while the order for the latter is entrusted to Messrs. Penman and Co., of the Caledonian Works, Glasgow.

The coal trade of the West of Scotland is gradually improving, at least in the shipping department.

At a conference of delegates of the Lanarkshire miners held in Hamilton a few days ago, it was agreed to solicit an advance of 6d. a day on the wages, to come into force on the 1st May. In the present condition of trade, it may be remarked, there is little probability of the employers feeling themselves at liberty to make such a concession by the time mentioned. The Executive Board of the Fife and Clackmannan Miners' Association have also resolved that an application be made for an increase of 15 per cent.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

I was quite right in stating that the Barry promoters did not intend relinquishing their scheme, even if they purchased the Bute Docks. In fact, as then stated by me, the Barry Docks would be one of the guarantees tendered to the Marquis of Bute. After long waiting a decisive settlement has been brought about as regards the purchase of the docks by the Barry promoters. His lordship finds two fatal objections in the proposals of the promoters. The first, that the transfer should be made to a company composed of only a limited number of freighters; and the second, that the Barry Dock should be constructed. His lordship thinks that if a sale of the docks took place it should be to a public trust established upon a broad basis, in which all the various interests of Cardiff and district—including, of course, the whole mineral range of which Cardiff is the natural port—should be well represented. Then with respect to the second point, his lordship considers that the construction of the Barry Dock would be most prejudicial to the interest of Cardiff and district, and that if additional dock accommodation should be required, there was a suitable place near at hand. The argument of his lordship is well reasoned out, and reflects highly on the clear good sense and far-sightedness which has actuated him and his advisers. He finally points to the Roath Dock, and the increased appliances in course of arrangement at the dock for tipping, and submits that the present time is an unfavourable one for any transfer of the property.

This should give consolation to all concerned, and a harbour trust in the future would form a pleasant gathering camp for all conflicting parties, wherein every difference and antagonism might be smoothed away. They have only to wait, and it would be wise in the meantime not to burden the future with difficulties by dividing the interests of Cardiff.

I went over a great tract of coal country in the Monmouthshire district last week—the Rhondda of the next generation. Much of this may be utilised for the good of Cardiff docks by wise railway schemes, and to those all attention should be turned, and capital and energy not cast heedlessly away upon making the pilot harbour of Barry into docks.

The deep measures of the Monmouthshire valleys will come into play soon, and the Great Western, Brecon, Rhymney, Risca, and Cardiff lines will aid greatly. In the meanwhile old properties of the upper veins are running out sharply. The Bargoed Company's present collieries will not last much longer. It is now in treaty for new fields of similar excellent coal. A capital coalfield near Crumlin is in the market. The great expense has been incurred by Mr. Powell, and a comparatively small outlay would give large results.

There is anticipation that Crumlin Bridge Works will soon be going again. I have rarely seen a place so full of good machinery. They have turned out good work there. At one time 600 hands were employed. It was there, too, that the materials for Blackfriars Bridge were made; and the bridge overhead for strength and beauty is a standing proof of the capacity of the place in good hands.

The ironworks all round have been very quiet this week, and prospects are not improving. The outlook is bad. Probably more than in reality, for the buyers now hanging back must come forward shortly. With more settled weather important railway work will have to be done, and the sooner orders are on books the better.

In coal the same condition remains as I have so repeatedly noticed. Best steam is in strong demand, house coal dull, and little demand for small steam. Ground will shortly be broken for various new collieries.

Smoke Abatement.—At a meeting of the managing committee of the National Smoke Abatement Institution, Sir Frederick Pollock, Bart., presiding, it was resolved to conclude an arrangement with the Parkes Museum for space to be provided in the museum for a collection of heating, cooking, and smoke abating apparatus of various kinds and intended for either domestic or industrial purposes. Ventilating apparatus combined with heating apparatus, or otherwise, as well as fuel and gas burners, will be included in the collection. The heating apparatus will be selected with the special view of showing typical kinds of apparatus and illustrating systems of economising fuel and abating smoke. No charge will be made to the persons whose articles are exhibited. The public are admitted to the museum free during a portion of every day. The library of the museum, to which the public are admitted by a member's order, contains the illustrated and descriptive report of the tests of grates, stoves, and furnaces made by the Smoke Abatement Committee, as well as a large and valuable collection of medical and sanitary reports, and other works of reference. Persons having specimens of apparatus, diagrams, models, statistical matter, or other articles suited to the collection—or new inventions which they desire to bring to the notice of the Council—are requested to communicate with Mr. E. White Wallis, secretary to the National Smoke Abatement Institution, at the offices of the Institution, which are now to be removed to the Parkes Museum, Margaret-street, Regent-street, W.

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.

8th April, 1884.

6073. Soldering Irons, G. W. Wilkinson, London.
6074. Calculating Cards, J. J. Raggett, Aston.
6075. Bending Shuttle Springs, D. Bradbury, Blackburn.
6076. Drawing Off the Water from Steam Cylinders, G. Petrie, London.
6077. Mills for Rolling Metals, D. Stewart, Glasgow.
6078. Spinning Machinery, G. Keighley, Burnley, and F. Rosskothen, Accrington.
6079. Movable Joint, W. Bow, Old Brompton.
6080. Compound Surface Condensing Engines, D. A. Cormack, Leith.
6081. Poplin Cloth, J. Watson, Dublin.
6082. Treating Iron and Steel, &c., T. Williamson, Pollockshields.
6083. Dinner Wagon & Hot Plate, E. Bray, Halifax.
6084. Spindles, A. Nicholson and J. Hall, Leek.
6085. Indicating Apparatus for Sunken Vessels, C. Sutton, Salford.
6086. Mowing and Reaping Machines, J. Fennell, near Stockport.
6087. Method of Printing for Potting Purposes, J. T. Armstrong, Hanley.
6'88. Cranks, H. Bleasdale, Liverpool.
6089. Couplings, F. T. S. Hamilton, Liverpool.
6090. Purifying Grain, H. Dietz, Berlin.
6091. Electric Telephone Transmitters, J. H. Johnson.—(*J. A. Maloney, Washington.*)
6092. Receiving Telephones, J. H. Johnson.—(*J. A. Maloney, Washington.*)
6093. Thermometry, G. T. Beilby, Midcalder.
6094. Distilling Mineral Oil, W. Young, Priorsford, and G. T. Beilby, Midcalder.
6095. Boiling Size, J., W. T., and J. G. Briggs, Over Darwen.
6096. Telephone Receivers, E. H. M. Andreoli.—(*J. Boisselot, Paris.*)
6097. Cabinet, J. P. Wood, London.
6098. Gas Governors, W. Key, Glasgow.
6099. Removing Submarine Obstruction, R. Stone, New York.
6100. Grinding Mills, E. A. Brydges.—(*J. Bouillier, fils, Viriville, France.*)
6101. Disinfecting Sewer Cistern, H. Hughes, London.
6102. Purifying Water Supplied to Houses, &c., H. Hughes, London.
6103. Applying Buffers, &c., to Vehicles Travelling on Ordinary Roads, G. B. Richards and A. Spencer, London.
6104. Discharging or Delivering Coal, &c., W. H. Kershaw, London.
6105. Tramway Joints, &c., J. W. Hartley, Stoke-on-Trent.
6106. Damping Apparatus for Lithographic Printing Machines, G. Cliff, Holbeck.
6107. Ventilating Apparatus, G. Greig, Harvieston.
6108. Couplings for Rope-transmissions, H. Pataky.—(*A. Engelmann, Hanover.*)
6109. Preserving Dead, &c., Bodies, H. Pataky.—(*R. Strauss, Germany.*)
6110. Cotton-gins, A. J. Boult.—(*S. D. Webb, Washington, U.S.*)
6111. Pendulum Levels, C. J. Parkhurst, North Adams, Massachusetts, U.S.
6112. Lenses, &c., W. W. Lavarack, Liverpool.
6113. Car Couplings, the Excelsior Life-Saving Car Coupling Company, New York, U.S.
6114. Purifying Air, J. Cottrell and R. Oakley, London.
6115. Machine Guns, T. Nordenfelt, London.
6116. Reducing Metals by Electrolysis, A. J. Rogers, J. Koebig, and H. Mann, Milwaukee, U.S.
6117. Gulley for Drains, &c., S. S. Phillips and H. F. Green, London.
6118. Traps for Intercepting Sewer Gas in Drains, S. S. Phillips and H. F. Green, London.
6119. Locking Screw Nuts, J. W. Boulton, Ashton-under-Lyne.
6120. Circular Magnetic Weaver's Loom, E. Winckler, Guebwiller, Alsace-Lorraine.
6121. Baths, &c., J. Tomkins and S. Napper, London.
6122. Fastenings for Corsets, &c., S. Pearce, Handsworth.
6123. Railroad Car Brakes, H. J. Haddan.—(*H. Flad, St. Louis, U.S.*)
6124. Ticketing Fabrics, G. W. McGill, Riverdale, New York, U.S.
6125. Hot-air Engines, W. Eimecke, Germany.
6126. Cricket Bats, C. Malings, Woolwich.
6127. Water-closets, T. Durrans, London.
6128. Electrical Conductors, M. Sugar, London.
6129. Playing a New Game, A. G. Brookes.—(*E. I. Horsman, New York, U.S.*)
6130. Fire-escapes, J. C. Hudson, London.
6131. Steering Tricycles, R. Green, Birmingham.
6132. Fire-arms, W. S. Riley, Birmingham.
6133. Rifles, &c., T. Nordenfelt, London.
6134. Roller Mills, A. W. L. Reddie.—(*La Société Anonyme pour les Procédés Brevetés de Farinerie, Saint-Requier, Paris.*)
6135. Reeling Silk, H. E. Newton.—(*Atwood Machine Company (Incorporated), Stonington, U.S.*)
6136. Flocking Paper, &c., H. E. Newton.—(*J. McMillén and J. McAdams, New York, U.S.*)
6137. Extracting Deleterious, &c., Gases from Mines, J. Heath, Burslem.
6138. Safety Pins, H. H. Lake.—(*J. Jenkins, Montclair, New Jersey, U.S.*)
6139. Coating the Surface of Iron, &c., A. Gutensohn, London.
6140. Couplings for Railway Vehicles, H. H. Lake.—(*C. E. Mark, Flint, Michigan, U.S.*)
6141. Skipping Ropes, A. Stanley, Walsall.
6142. Obtaining Motive Power, A. C. Engert, Bromley-by-Bow.
6143. Production of Neutral Sulphate of Alumina, A. Myall.—(*F. Lienau, Germany.*)
6144. Gelatine Capsules, H. H. Lake.—(*J. Krehbiel, Detroit, U.S.*)
6145. Hot-air, &c., Engines, F. Knoeferel, London.

9th April, 1884.

6146. Water-cisterns, G. E. Newton, London.
6147. Forging Tackle, J. Water, Glasgow.
6148. Spinning and Doubling Cotton, &c., W. Leach and J. Pearson, Accrington.
6149. Ornamental Trimmings, R. H. Plummer, Nottingham.
6150. Drawing Frames, R. Andrews, Armagh.
6151. Cinder Shovel and Screen, W. C. Owston, Pontefract.
6152. Gas Engines, T. Morrall, Birmingham.
6153. Wringing, &c., Machines, E. Dutton, Hulme.
6154. Preventing Collisions of Ships, W. Bevan, London.
6155. Folding Screens, F. McIlvenna, Manchester.
6156. Shafts of Two-wheel Vehicles, E. H. Julian, Cork.
6157. Cooking Ranges, J. McI. Shaw, Glasgow.
6158. Springs for Shuttle Pegs, J. Haydock, Blackburn.
6159. Cutting, &c., Wood, W. Morrison and J. Hayes, London.
6160. Joining Lead Pipes, J. Hayes and W. Morrison, London.
6161. Metallic Doors, J. G. Stidder, London.
6162. Opening Lids of Jelly Frames, &c., T. and T. T. Prime, Birmingham.
6163. Tricycles, &c., W. R. Wills, Birmingham, and T. Jefferiss and C. H. Treglown, Handsworth.
6164. Supplying Nails to Nailing Machines, A. Schneider.—(*W. Eredenhagen, Germany.*)
6165. Plaited Frilling, &c., E. S. B. Tombs, London.
6166. Cutting Corks, &c., J. Liston, Glasgow.
6167. Taps, W. A. Todd, Stamford.
6168. Tube for Artists' Colours, G. Cook, Hounslow.
6169. Governors of Steam, &c., Engines, H. W. Pendred, Streatham.
6170. Ovens, W. A. F. Wieghorst, Hamburg.
6171. Painting Glass, C. W. Lee, London.
6172. Metallic Alloys, G. A. Dick, London.
6173. Drying Closets for Laundry, &c., Purposes, T. Fletcher, Warrington.
6174. Gas Ovens, T. Fletcher, Warrington.
6175. Ornamental Designs, C. Moseley, Manchester.
6176. Obtaining Solutions Containing free Phosphoric Acid, E. Packard, Bramford.
6177. Fog Signalling, W. S. B. Kempe and W. F. Rowell, Wimbledon.
6178. Chimney Cowls, &c., T. Brown, Penicuik.
6179. Carbonic Acid Gas, J. Mangnall, Manchester, and R. S. Lloyd, London.
6180. Water-closets, F. P. and E. J. Preston and J. T. Prestige, London, and E. W. De Rusett, Croydon.
6181. Prismatic Compass, &c., W. Green, London.
6182. Bakers' Ovens, G. E. Bailey, London.
6183. Closing Apparatus, G. and R. Marley, Newcastle-upon-Tyne.
6184. Locks, A. M. Clark.—(*W. McM. Brooke, New York.*)
6185. Supplying Air to Furnaces, J. G. Galley, Essex.
6186. Mounting, &c., Spindles, A. M. Clark.—(*J. J. Bourcart, Switzerland.*)
6187. Saddles, C. T. C. James, Langley.
6188. Chaff Machines, S. Burlingham and G. H. Innes, Hitchin, and J. W. Lee, Cambridge.
6189. Dining Tables, J. Clegg, London.
6190. Spinning Cotton, &c., W. Gibson and W. N. Nilson, Sweden.
6191. Electrical Indicators, W. H. Baughan, London.
6192. Ploughs, G. Grieg, Harvieston.
6193. Everlasting Candle, F. W. Bach, London.
6194. Metallic Money-boxes, E. A. Jahncke and H. W. Herbst, London.

10th April, 1884.

6195. Galvanic Batteries, J. A. Fleming, London.
6196. Supplying, &c., Compressed Air, B. J. Bing, France.
6197. Odometers, E. and T. Underwood, Birmingham.
6198. Castors, W. Aitken, Edinburgh.
6199. Regulating Inequalities in Laps of Scutchers and other Machines, S. Lord, Rochdale.
6200. Carts and Wagons, W. Billing, Wolverhampton.
6201. Producing Pleated or Goffered Frilling and Trimming, W. Lowe, Nottingham.
6202. Shoots or Spouts and Valves, J. J. Harrington, Tralee.
6203. Attachment of Knitting Apparatus to Weaving Looms, C. J. Appleton, Lower Broughton, Manchester.
6204. Carriage Lamps, G. P. Hockley, Birmingham.
6205. High-pressure Double-gland Equilibrium Cock, E. Davie and R. F. Clark, Exeter.
6206. Apparatus whereby any Required Variable Velocity Ratio between Two or more Discs, &c., may either be Obtained or its Magnitude be Determined, H. S. H. Shaw, Bristol.
6207. Securing, &c., Railway Carriages, &c., T. Veitch, Edinburgh,
6208. Filtering Water, &c., G. Weddell, Newcastle-on-Tyne.
6209. Pen and Pencil Cases, A. H. Woodward, Birmingham.
6210. Gas-burners, T Redmayne, Sheffield.
6211. Packing, T. C. Bell, Newcastle-upon-Tyne.
6212. Topograph, W. C. Keith, Dundee.
6213. Purification of Water, W. Wyatt, Ellesmere.
6214. Reversing Gear, W. C. Keith, Dundee.
6215. Purifying Sulphuric Acid, W. P. Thompson.—(*G. Thomson, Canada, and W. Kemp, Jarrow-on-Tyne.*)
6216. Frames of Writing and School Slates, O. J. Owen, Blaenau.
6217. "C" Spring Carriages, J. A. Lawton, Liverpool.
6218. Collecting Night Soil, &c., W. Makin, Liverpool.
6219. Sewing Machines, A. Louden, Ceres by Cupar.
6220. Metallic Shields for Field Artillery, W. de Rohan, London.
6221. Self-acting Dampers, W. D. Priestman and S. Priestman, Hull.
6222. Ligroin Gas, H. W. Senthe, Vienna.
6223. Padlocks, W. Sturmey, Willenhall.
6224. Wheels for Carriages, &c., W. S. Lockhart, London.
6225. Ledger and Reference Book, E W. Monington, London.
6226. Economic Working of Gas Producers, D. Rylands, Barnsley.
6227. Steam Windlasses, W. Clarke, Gateshead-on-Tyne.
6228. Secondary Batteries, J. S. Sellon, London.
6229. Gas Retorts, W. T. Walker, London.
6230. Lamp, E. Préda, London.
6231. Compound Material for Covering Steps, &c., E. G. Capon and H. Heaton, jun., King's Norton.
6232. Electro-motors, T. Cuttriss.—(*C. Cuttriss, Duxbury, U.S.*)
6233. Electric Signalling Apparatus, E. P. Timmins, Cardiff.
6234. Pendulum Indicator, E. P. Timmins, Cardiff.
6235. Constructing the Bases of Electric Bells, E. P. Timmins, Cardiff.
6236. Chronographic Checking Apparatus, W. P. Horne, London.
6237. Pencil Cases, E. H. Schmidt, London.
6238. Peat Fire-lighter, R. Whittome, Ramsey.
6239. Attachments to Wagons, W. Whieldon and J. W. Haynes, London.
6240. Removing Debris from Tram Rails, A. E. Westhorp, London.
6241. Bicycles, W. Travers, London.
6242. Obtaining Photographic Images on Porcelain, J. Wetter.—(*J. A. C. Burel, Nevers, France.*)
6243. Tuyeres, R. Duncan, Partick.
6244. Moulding Objects by Pressure, P. Jensen.—(*Kjöbenhavns Hesteskofabrik, Copenhagen.*)
6245. Trouser Suspenders, A. C. Henderson.—(*J. B. Fournier and J. B. Thoully, France.*)
6246. Continuous Spinning Machines, L. A. Groth.—(*W. Lüpke, Berlin.*)
6247. Signalling the Rise and Fall of Temperatures, &c., L. A. Groth.—(*C. Raab, Munich.*)
6248. Preparing Grains for Feeding, &c., Cattle, L. Lederer, London.
6249. Food for Invalids, W. R. Barker, A. L. Savory, and C. Ekin, London.
6250. Food for Invalids, W. R. Barker, A. L. Savory, and C. Ekin, London.
6251. Controlling Steam, W. Pepper, Stockton-on-Tees.
6252. Drying China Clay, &c., J. Lovering and J. Bell, Cornwall.
6253. Measuring Liquids, R. H. Twigg, Tooting, and J. Gibb, London.
6254. Measuring Liquids, J. B. Stoner and T. Beddoe, London
6255. Lifeboat, H. Hargreaves, Stratford.
6256. Drapers' Costume Stands, &c., F. McIlvenna, London.
6257. Effecting Hem Stitch by a Sewing Machine, J. B. Robertson, Lurgan.
6258. Nippers, S. Lee.—(*G. W. Hubbard, Windsor, U.S.*)
6259. Yeast, G. F. Powell, Bristol.
6260. Electrical Distribution, W. H. Scott, Nottingham, and E. A. Paris, London.
6261. Dynamo-electric Machines, W. H. Scott, Nottingham, and E. A. Paris, London.
6262. Mechanical Excavators, A. J. Boult.—(*G. Kervern, France.*)
6263. Attaching Shoes to the Hoofs of Horses, &c., R. Young, London.
6264. Bridges, &c., H. H. Lake.—(*C. T. S. de D. Brochocki, Paris.*)
6265. Knitting Yarn, F. Wirth.—(*A. Bielefeld, jun., Germany.*)
6266. Portable Steam Engines, J. Gwynne, Hammersmith.

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6267. Legs of Chairs, Tables, &c., G. W. von Nawrocki.—(*G. Ladisch, Stettin, Germany.*)
6268. Roofing Plates, J. Halley, Hazlebank.
6269. Fixing in Fronts of Seed Drills, W. Gilbert, Shippon, Abingdon.
6270. Sailing into Head Winds, C. Macgowan, Ireland.
6271. Soaps, &c., E. Sonstadt, Cheshunt.
6272. Tape Frames for Sizing, J. Mercer, Blackburn.
6273. Dip Pipes, A. Wilson and R. Porter, London.
6274. Window-blind Racks, J. Hartill, Dudley.
6275. Propulsion of Tram-cars, &c., A. Reckenzaun, London.
6276. Tube Vices, W. Devoll, near Birmingham.
6277. Revolving Spindles, G. Hall and S. Hulme, near Oldham.
6278. Straightening Rails for Railways, R. Marsden, Sheffield.
6279. Receptacles for Umbrellas in Railway, &c., Carriages, R. Marsden, Sheffield.
6280. Sheep Shears, R. Marsden, Sheffield.
6281. Covering Roofs, V. Brown, Denton, and J. Marshall, Haughton Denton.
6282. Wedging or Getting Coal, F. Robinson, Wigan.
6283. Retaining Valves, C. S. Madan, Manchester.
6284. Doffing the Spindles of Spinning Machinery, D. Maitland and H. Greenhalgh, near Rochdale.
6285. Holders for Ever-pointed Pencils, &c., J. Appleby, Birmingham.
6286. Drawing Water from Wells, A. Texier, France.
6287. Spinning, &c , Yarns, J. Knowles, R. C. Pilling, and J. Mercer, Blackburn.
6288. Adjustments of the Mariners' Compass, F. M. Moore, Belfast.
6289. Manipulating Wet Spun Yarns after Reeling, W. H. Lawlor and J. Esdale, Balnamore, Antrim.
6290. Alumina, &c., G. Rosenthal, London.
6291. Pickers and Stoppers employed in Looms for Weaving, T. Bromley, Bolton.
6292. Walking, &c., Sticks, J. Holding, Farnworth.
6293. Stands for Umbrellas, M. H. Smith, Halifax.
6294. Increasing the Driving Power of Tricycles, C. H. R. Holdcroft, Wolverhampton, and R. Taylor, Leeds.
6295. Horseshoes, G. G. Belcher, Manchester.
6296. Automatic Expansion Apparatus for Steam Engines, J. Coogan, Manchester.
6297. Atmospheric Buffers for Railway Trains, T. Williams, London.
6298. Gas Stoves, J. Aldersley, New York.
6299. Breech-loading Guns or Small-arms, S., R., and W. Trulock, Dublin.
6300. Detecting Leakages of Gas, A. C. Henderson.—(*M. Lambert, Paris.*)
6301. Chimney Top or Ventilator, J. Bonner, Newcastle-on-Tyne.
6302. Gut Cast Lines, Leaders, or Collars, M. Carswell, Glasgow.
6303. Bags for Holding Wool, St. J. V. Day.—(*P. S. Swan, Calcutta.*)
6304. Preparing Salt, &c., for Preserving Food, E. Sonstadt, Cheshunt.
6305. Gauge Glass Fittings, E. A. Brydges.—(*V. Agnès, France.*)
6306. Grease Intercepting Gulley Trap, E. Page, London.
6307. Bags for Holding Wool, St. J. V. Day.—(*P. S. Swan, Calcutta.*)
6308. Bags for Holding Wool, St. J. V. Day.—(*P. S. Swan, Calcutta.*)
6309. Sugar Mills, G. Halliday, London.
6310. Treating Locust Beans, J. A. Meylers, Hendon.
6311. Violet Colouring Matter, C. D. Abel.—(*Farbwerke vormals Meister, Lucius, and Brüning, Hoechst-am-Main, Germany.*)
6312. Photometers, W. H. Preece, Wimbledon, and A. P. Trotter, London.
6313. Artificial Fuel, S. Butler, London.
6314. Rabbit Hutches, G. F. Morant, Blackerton.
6315. Stern Posts of Ships, &c., A. Reichwald, Newcastle-upon-Tyne.
6316. Triangular Rest Indicating Distances, G. Shepheard, Ivy Bridge.—*4th March*, 1884.
6317. Eyelets, &c., G. Capewell, Aston.
6318. Type-setting and Distributing Machines, H. Springmann.—(*G. Fischer and A. von Langen, Bielefeld, Prussia.*)
6319. Holders for Incandescent Electric Lamps, A. Swan, Gateshead-on-Tyne.
6320. Backing Artificial Teeth, C. J. Brooksbank, Matlock Bank.
6321. Jewellery, N. Macphail, Glasgow.
6322. Preventing Incrustation in Steam Boilers, &c., E. Przibilla, Cologne.
6323. Picture Frames, H. H. Hund.—(*A. Brüning, Berlin.*)
6324. Preserving Compressible Organic Substances, E. G. Brewer.—(*G. Comperghi, Trieste.*)
6325. Reeds for Musical Instruments, J. B. Hamilton, Boston, U.S.
6326. Drying Bodies containing Water, E. Passburg, Moscow.
6327. Spring Side Boots, C. W. Meiter, London, and W. Watson, Retford.
6328. Ringing Alarm Bells on Velocipedes, H. J. Eck and D. J. Callow, London.
6329. Tram Rails, &c., J. Bidder, London, and W. R. Lodge, Croydon.
6330. Buttons, G. W. von Nawrocki.—(*Dinklage and Franze, Austria.*)
6331. Capsuling Machines, F. Wirth.—(*F. Fehr, Wiesbaden, Germany.*)
6332. Alarm Apparatus, &c., J. Wetter.—(*L. Loicq, Bruxelles.*)
6333. Water Waste Preventers, W. Smeaton, sen., London.
6334. Shafting of Picks, A. E. Stayner, Sheffield.
6335. Combing Machines, A. M. Clark.—(*Heilmann-Ducommun and Steinlein, Mulhouse.*)
6336. Fastenings for Lace-up Boots, &c., J. Hinks, Birmingham.
6337. Propelling Vessels, H. Smith, Titchfield.
6338. Railway Signalling, H. H. Lake.—(*M. F. Parrish and S. J. Munn, Niles, U.S.*)

ABSTRACTS OF SPECIFICATIONS.

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

3775. Construction of Roofs, *T. W. Wingfield, Kellyville Athy, Ireland.*—1st *August*, 1883. 6d.
Relates to the means of securing glass, slate, &c., between strips of metal supported by rafters.

4035. Construction of Boats and Equipment of, and Attachments to the same, *H. F. Coombs, Charlottetown, Canada.*—21st *August*, 1883.—(*Not proceeded with.*) 2d.
Relates to constructing a metallic boat having a double hull.

4037. Electric Secondary or Storage Batteries, *R. H. Courtenay, London.*—21st *August*, 1883.—(*Not proceeded with.*) 2d.
Relates to means for preventing leakage when not in use, to charging the cells with oxygen, and to the making of the electrodes.

4041. Grooming Brushes, *A. Harvey, Ottaway.*—21st *August*, 1883. —(*A communication from R. W. Thompson, East Rockport, U.S.*)—(*Not proceeded with.*) 2d.
Consists in the construction of an implement for grooming purposes, being a flexible brush surface conforming to the outline of the human hand and provided with means of attachment to the hand.

4075. Looms for Weaving Double Pile Fabrics, *A. M. Clark, London.*—22nd *August*, 1883.—(*A communication from F. Charcot, Patterson, U.S.*)—(*Not proceeded with.*) 2d.
Consists in delivering mechanism constructed with clamping bars and clamping roller between which the pile warps are passed, said bars and rollers being mounted upon a frame and provided with means operated from the hooks of a jacquard mechanism, whereby the said bars and rollers are caused to clamp and carry forward the pile threads.

4100. Steam Traction Locomotive Cranes, *T. Aveling, Rochester, and W. D. and S. Priestman, Kingston-upon-Hull.*—24th *August*, 1883. 6d.
This consists in providing steam traction locomotive cranes with appliances for working self-acting grabs, buckets, and similar tools. The locomotive is provided with a slewing jib crane fitted with duplex sheaves at the head of the jib, on top of the crane pillar. One sheave is used for the lifting chain of a self-acting grab and one for the discharging chain.

4102. Machinery for Measuring or Marking Cloth, *J. Farmer, Salford.*—24th *August*, 1883. 6d.
The object is to indicate the length of cloth at intervals on such length, and it consists in applying to a creasing and measuring machine a toothed wheel on the shaft of the measuring drum, and causing it to actuate a suitable marking or printing apparatus.

4105. Harvesting Machinery, *J. Hornsby and J. Innocent, Grantham.*—24th *August*, 1883. 6d.
This relates, First, to the means for giving motion to the reel of such machines; Secondly, in raising the cut crop between two endless bands, which convey it over the top of the driving wheel and deliver it on to a table inclined downwards on the outer side of the wheel; and Thirdly, to the means for giving motion to the packers, the endless band platform, and the elevator bands of such machines.

4106. Packing Case, Box, or Receptacle, *J. Pearson and W. F. Orriss, London.*—24th *August*, 1883. —(*Not proceeded with.*) 2d.
Relates to the construction of packing cases, &c., in two parts, one sliding within the other.

4110. Electro-telegraphic System, particularly Applicable for Long Cables, *A. Guattari, London.*—24th *August*, 1883.—(*Not proceeded with.*) 4d.
Relates to means for effecting a mechanical movement sufficient to operate a printing instrument, however feeble the line current may be.

4111. Construction of Lawn Tennis Bats, Racket Bats, &c., *W. Cole, London.*—25th *August*, 1883.—(*Not proceeded with.*) 2d.
Relates to the construction of a metallic frame and to the means of tightening the strings.

4114. Casting Boxes for Producing Stereotype Plates for Rotary Printing Machines, *A. Sauvée, Westminster.*—25th *August*, 1883. 10d.
This relates to stereotype casting boxes consisting of an open shell and a centre core pivotted together on a horizontal axis parallel to their own, the stereotype plate being cast in the space between the shell and core. The improvement consists in inserting a bar in a longitudinal groove formed in the core, and causing such bar to recede within the groove as the core is turned on its pivot to remove it from the shell, whereby the point at which the "jet" or runner of the plate cast round the core is required to be separated therefrom, has a clearance left beneath it to enable a circular saw to readily cut through it.

4116. Bullets, *W. F. Bayliss and C. Brown, Birmingham.*—25th *August*, 1883.—(*Not proceeded with.*) 2d.
The bullet is formed with a series of longitudinal ribs upon its surface, which ribs give the bullet the requisite diameter to suit the bore of the barrel, and thus the friction is upon these ribs only instead of upon the whole circumference of the bullet.

4117. Machinery or Apparatus for Washing Plates, *H. Fletcher and F. J. Clarke, London.*—25th *August*, 1883.—(*Not proceeded with.*) 2d.
The plates are carried in guides, and are automatically fed forward to brushes.

4118. Brake, *H. Pilkington, Bury.*—25th *August*, 1883. —(*Void.*) 2d.
Relates to means for brakeing on the rail or road.

4119. Files, &c., *J. Heap, Ashton-under-Lyne.*—25th *August*, 1883.—(*Not proceeded with.*) 2d.
Relates to round and half-round files, and generally to files having curved cut faces. The lines of cuts commence at one edge of the file and extend spirally to the other edge, so that the whole surface is covered with spiral lines of cuts instead of with straight or nearly straight lines.

4120. Automatic Electric Signals for Railways, *L. Piskorski, London.*—25th *August*, 1883.—(*Not proceeded with.*) 2d.
Relates to means for signalling to each of two trains should they approach each other either on the same line of rails or on lines which converge and unite, or cross.

4124. Tricycles, *C. Pollok, London.*—27th *August*, 1883.—(*Not proceeded with.*) 2d.
Relates to means to diminish the dead points in working tricycles with cranks.

4129. Wardrobe Safety Lock for Securing Suspended Wearing Apparel, *A. T. Martens, Germany.*—27th *August*, 1883.—(*Not proceeded with.*) 2d.
A button is secured to the garment, and can be inserted in the shell of a lock, formed with a hook at top and provided with suitable mechanism operated by a key to secure or release the button on the garment.

4130. Steam Generators, *W. A. G. Schönheyder, London.*—27th *August*, 1883.—(*Not proceeded with.*) 2d.
Caustic soda is used to generate steam for working engines, the exhaust steam from which is delivered to a vessel containing a strong solution of the material, which absorbs the steam and gives out heat, which can be utilised to generate fresh steam.

4132. Stop-watches or Chronographs, *A. Huguenin, Switzerland.*—27th *August*, 1883.—(*Not proceeded with.*) 2d.
This relates to stop-watches or chronographs, and the object being to avoid the recoil usually accompanying the starting of the quarter second hand and moving forward after each revolution of the latter a separate minute wheel and hand. The dial is arranged with a separate small minute dial divided into thirty parts, with a small hour and minute dial, and with a circumferential quarter second subdivision.

4134. Machine for Sorting and Separating Grain and Seeds, *T. Stevens, Kingston-on-Thames.*—27th *August*, 1883.—(*Not proceeded with.*) 2d.
A wheel or drum is constructed with a number of vanes or blades fixed at a suitable angle to the periphery thereof; the vanes or blades are full of indentations or perforations of suitable form, the wheel or drum being mounted upon a shaft and in a suitable frame. Below the said wheel or drum are placed shoots or spouts for delivering the grain and seeds as they fall from the wheel or drum, and between these shoots or spouts is jointed to the frame of the machine a division board or plate to regulate the delivery of the grain or seeds, a suitable hopper being fixed over the

machine, from which the grain or seed passes on to the wheel or drum.

4135. CONSTRUCTION OF FITTED DRESSING BAGS, &c., *O. Leefels, London.*—28*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to an arrangement of springs to the framework.

4138. APPARATUS FOR THE MANUFACTURE OR PRODUCTION AND DISTRIBUTION OF GASES AND VAPOURS FOR HEATING, ILLUMINATING, &c., *W. Arthur, Isle of Wight.*—28*th August*, 1883.—(*A communication from J. P. Gill, New York.*) 2*s.*

Relates partly to a pair of cupolas with closed fire chambers and grates above the fire chambers, connecting pipes above and below, and suitable valves, valved smoke flues, and hydrocarbon and other necessary liquid, vapour, gas and air supply pipes entering the upper parts of the cupolas, and of chambers the same for each cupola.

4142. ELASTIC TRIMMING FOR ORNAMENTING ARTICLES OF DRESS, &c., *G. Dean, Derby.*—28*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The inventor produces a trimming or fabric made with its elastic threads running in a curved course in the completed fabric, and which will accommodate itself to a rounded surface or contour on which it is placed instead of having to be kilted or goffered to shape, and thereby injuring the appearance of the trimming when placed on the dress.

4143. CARDING MACHINES, *W. Gawthorp, J. Redduhaugh, and S. Wade, Bradford.*—28*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The inventors dispense with the two doffers and workers over the cylinders, also the workers under and over the lickers-in, and substitute endless carding sheets each passed round two rollers with a stripper over the cylinders and lickers-in.

4148. ELECTROLYTIC TREATMENT OF SACCHARINE SOLUTIONS, *L. H. Despeissis, Paris.*—28*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the separation and removal of the saline and earthy constituents.

4156. APPARATUS FOR HOLDING LUCIFER MATCHES AND FOR WITHDRAWING SUCH MATCHES SINGLY AS REQUIRED, *E. Edwards, London.*—28*th August*, 1883.—(*A communication from P. Gillant, Morialmé, Belgium.*)—(*Not proceeded with.*) 2*d.*

Relates to the employment of a pivotted lever in the shape of a bird, provided with points, which are caused to enter a slit in a box and grip one match.

4164. JACQUARD MACHINERY AND APPARATUS APPLICABLE THERETO, *R. Scott, Nottingham.* — 29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Consists of a longitudinal frame, the vertical sides of which are capable of sliding vertically and horizontally in slots in brackets attached to the framing of the machine to which it may be applied or in slots in standards secured to the floor. One or more indexes are provided to show the vertical rise or fall of the frame, to which one or more indexes are secured to show the right or left traverse of the frame which is held to a stop at one end by a spring.

4166. MANUFACTURE OF ARTIFICIAL MANURE, *F. W. Martino, Sheffield.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the employment of crushed basic slag obtained in the dephosphorising of pig or cast iron by the use in the converter of a lining of quick lime, which slag is treated with sewage.

4167. SECURING RAILS FOR PERMANENT WAY, *T. Reading, Barrow-in-Furness.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Consists in supporting and at the same time securing the joints of rails by means of suitably shaped metal chairs and their connections (cast or otherwise); the joint chairs are cast with a jaw on one side, corresponding in outline with the side of the rail, thus forming a groove to receive the bottom head or projection of the rail, clearance being allowed between the bottom of the rail and the chair, to prevent wear of or indentations being formed on the bottom of the rail, by its coming in contact with the chair.

4168. SCREW PRESSES, *J. Cadbury, Birmingham.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Refers principally to working or operating screw presses by foot, instead of by hand as heretofore.

4169. BICYCLES, *J. Watkins, Birmingham.* — 29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Consists in procuring additional brake power upon the axles or spindles of bicycles in conjunction with the hubs or wheels, which are mounted thereon to revolve freely in lieu of being firmly secured to the axle.

4170. APPARATUS FOR DRYING PROVISIONS, &c., *J. Wetter, London.*—29*th August*, 1883.—(*A communication from E. Passburg, Moscow.*—(*Not proceeded with.*) 2*d.*

The substances are introduced into a hermetically closed vessel, kept at a temperature not exceeding 100 deg. Cent., and a high vacuum is produced in the vessel by means of an air pump, so as to evaporate the greatest part of the water contained in the organic substances thus treated.

4171. ELECTRICAL INSULATORS, *J. H. Johnson, London.* —29*th August*, 1883.—(*A communication from G. Westinghouse, jun., Pittsburg, Penn., U.S.*)—(*Not proceeded with.*) 2*d.*

These are preferably made of gypsum, and after submission to a process of dehydration, are immersed in a solution which will have a hardening effect.

4172. APPARATUS FOR FEEDING YOUNG DOGS AND OTHER YOUNG ANIMALS, *J. Cunningham, Bristol.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the construction of a box for heating the liquid food, and a pipe connected with the box is supplied with a perforated nipple.

4174. SHUTTLES OF LOOMS FOR WEAVING, *J. Wilkinson, Bradford.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to apparatus for preventing waste of weft by the cop or cop and tube being shaken off or shaken loose upon the peg or pike of the shuttle, and which is caused by action and reaction of the picker upon the tip of the shuttle, and by reason of the shuttle striking the picker or entering the shuttle box.

4176. CONSTRUCTION OF TOOL FOR SPOKE-SHAVING, &c., *J. Matthews, Sheffield.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to means for adjusting the cutting part of a spoke-shave so as to regulate the depth or width of the cut.

4178. APPLIANCES FOR PROMOTING CIRCULATION OF WATER IN STEAM BOILERS, *J. Rankine, North Shields.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Pipes in the form of syphons are arranged in the water space of the boiler so that the longer legs reach down into the lower portion of the boiler, while the shorter legs are brought over those parts which are first affected by the action of the heat. The lower ends of the pipes may be of inverted dish-form to gather the heated water in them and form an upward current.

4180. APPARATUS FOR AUTOMATICALLY OPENING, CLOSING, AND CONTROLLING OR DIRECTING ELECTRIC CIRCUITS, *F. C. Phillips, London.*—29*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The varying weight of the plate of a secondary or other battery is caused to operate suitable mechanism.

4182. APPARATUS FOR TAPPING AND FOR PREVENTING THE FOULING OF BEER BARRELS, &c., *J. Walker, Birmingham, and A. Howell, Aston.*—30*th August*, 1883.—(*Not proceeded with.*) 2*d.*

A tubular socket is fitted in the tap-hole, and in it is arranged a valve which is opened when the ordinary beer tap is inserted, and closed when the tap is withdrawn.

4183. STEAM GENERATORS, AND APPARATUS CONNECTED THEREWITH, *L. Hill, Glasgow.*—30*th August*, 1883. —(*Not proceeded with.*) 2*d.*

This relates especially to generators in which the steam is generated in a coil of pipes arranged preferably spirally within an outer shell, and it consists in the use of a gas producer, from which a pipe leads the gas to the lower part of the generator, such pipe being provided with a deflecting valve to regulate the supply. A fan supplies air to the gas producer.

4185. RAILS FOR THE PERMANENT WAY OF RAILWAYS, AND MEANS OF LOCKING NUTS UPON BOLTS EMPLOYED IN FIXING RAILS, &c., *R. Howard, Wolverhampton.* —30*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The web of rails is formed with vertical corrugations joining the top and bottom parts of the rails. The chairs are formed with a nose to fit the corrugations, and a packing piece fits the same on the other side, a wedge being inserted between it and the horn of the chair. The invention further relates to a spring washer to lock the nuts in position on the bolts.

4186. SEPARATING AND EXTRACTING METALS FROM MINERALS, TAILINGS, REFUSE, &c., *J. Bell and G. J. Davis, London.*—30*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The minerals are roasted in crucibles or furnaces with common rock salt and carbon, and then pulverised and mixed with fluxes, such as carbonate of soda or carbonate of potash, lime, fluor spar, and salt, and heated to a white heat in crucibles.

4191. APPARATUS ADAPTED FOR PUMPING AND OTHER HYDRAULIC PURPOSES, &c., *J. A. Wade and J. Cherry, Hornsea, Yorks.*—30*th August*, 1883.—(*Void.*) 2*d.*

This consists in a screw or screws caused to revolve in a tube, and impel water through pipes.

4194. PIPES FOR SMOKING TOBACCO, *J. Hoppel, Leytonstone.*—30*th August*, 1883.—(*Not proceeded with.*) 2*d.*

The pipe is provided with an opening or openings at a point between the bowl and mouthpiece, such openings having a cover or plug, which when removed admits air, and prevents excessive accumulation of nicotine.

4197. SECONDARY BATTERIES, *D. G. Fitz-Gerald and T. J. Jones, London.*—30*th August*, 1883.—(*Not proceeded with.*) 2*d.*

Certain portions of the anode elements are constructed of an alloy of platinum and lead, so as to resist the effects of local action.

4205. PIPE COUPLINGS FOR RAILWAY BRAKE APPARATUS WORKED BY FLUID PRESSURE OR VACUUM, *J. Imray, London.*—31*st August*, 1883.—(*A communication from L. B. Regray, Paris.*) 6*d.*

Flexible hose is replaced by lengths of metal tubing, either straight or curved, which are respectively connected at one end by a ball-and-socket joint with the train pipe of each carriage, and are connected together at the other end either by another ball-and-socket joint or preferably by a coupling, generally similar in construction to the coupling used for the pipes of the Westinghouse brake apparatus.

4206. JOINTING FOR THE COUPLING PIPES OF RAILWAY BRAKE APPARATUS WORKED BY FLUID PRESSURE, *J. Imray, London.*—31*st August*, 1883.—(*A communication from A. C. Benoit-Duportail, Paris.*) 6*d.*

The inventor claims connecting the flexible hose pipe to the upright metallic pipe at the end of a carriage by a joint allowing lateral oscillation.

4208. CHEQUE AND APPARATUS FOR COUNTING AND INDICATING THE VALUE OF CHECKS GIVEN OUT, *J. Auty, Liversedge.*—31*st August*, 1883.—(*Not proceeded with.*) 2*d.*

A series of tubes pass through holes in the checks, and an arrangement of dials, acted upon by ratchets, indicate the value of the checks extracted.

4209. MEANS OR APPARATUS FOR BREAKING-UP ROADS, *A. A. Dixon, London.*—31*st August*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a machine in which a series of picks are connected to pistons working in cylinders, so as to be caused to reciprocate and act upon and break up the roads when the machine is caused to travel along the same.

4210. BOTTLES APPLICABLE ESPECIALLY FOR CONTAINING PERFUMERY, COSMETICS, &c., *J. Thompson, London.*—31*st August*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to bottles which upon being compressed will expel a portion of their contents, and it consists in forming the body of such bottles of vulcanised india-rubber, and the head of metal.

4212. SHIPS' LOGS, *A. M. Clark, London.* — 31*st August*, 1883.—(*A communication from L. M. Garland, Havre.*) 8*d.*

Relates to several improvements in ships' logs of the kind in which the rotation of a helical-vaned rotator is transmitted by the line by which it is towed to registering mechanism placed on the vessel.

4213. TILE HEARTHS AND FENDERS FOR FIREPLACES, *S. B. Sutcliffe, Manchester.*—1*st September*, 1883. 6*d.*

Relates to the general construction and arrangement of the parts forming fenders for tile hearths.

4215. BAKING OVENS, *W. A. F. Wieghorst, Hamburg.* —1*st September*, 1883. 8*d.*

Relates to improvements in baking ovens which are heated by pipes that are advantageously entirely closed and partly filled with water, and the objects are, First, to heat two or more baking chambers arranged one above the other by the same fireplace; Secondly, to obtain throughout an equal heat in all the chambers; Thirdly, to facilitate the charging of the oven.

4216. MACHINERY FOR THE MANUFACTURE OF METAL HEELS FOR BOOTS AND SHOES, *J. W. Jones and E. K. Bridger, London.*—1*st September*, 1883. 6*d.*

Relates to machinery for manufacturing hollow revolving metal heels by first cutting suitable lengths from tubular metal, and then stamping or pressing them in suitably shaped dies to form the hollow heels, a bottom plate being fixed thereto by brazing.

4219. VOLTAIC PILES, *E. Edwards, London.*—1*st September*, 1883.—(*A communication from A. Schroeder, Stettin.*)—(*Not proceeded with.*) 2*d.*

Relates to a pile so constructed that a current distributed over a large area may be imparted to any object on simply making contact with it.

4220. TRANSMITTING SIGNALS BY MEANS OF ELECTRICITY, *A. F. St. George and C. A. McEvoy, London.* —1*st September*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to employing, as a conducting medium, water, fog, or clouds in place of wire.

4222. VELOCIPEDES OF THE BICYCLE TYPE, *S. J. Tucker, Liverpool.*—1*st September*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to prevent the rider being thrown over the handle, and it consists in forming the driving wheel with a double or two tires a few inches apart, but connected together, and driving this wheel from a chain wheel driven by pedals and carried by a bracket secured to the fork.

4224. APPARATUS FOR GRINDING VALVES TO THEIR SEATS, *A. M. Clark, London.*—1*st September*, 1883.—(*A communication from A. W. Case, South Manchester, U.S.*) 4*d.*

Consists in the combination with the valve stock and the valve head, having a square recess in its face, of a sliding rod, having square inner end, a stuffing-box, and a screw plug, whereby the said valve head can be ground to its seat without being removed from the valve stock.

4226. APPARATUS FOR THE CONSUMPTION OF SMOKE, *J. Newsome and B. Hustler, Bradford.*—3*rd September*, 1883.—(*Not proceeded with.*) 2*d.*

A valve is fixed in the furnace at the end of the grate bars in front of the bridge, and the consumption of smoke is effected by regulating the opening of the valve.

4227. MANUFACTURE OF DECORATIVE MATERIAL FOR WALLS AND OTHER DECORATIVE PURPOSES, &c., *T. J. Palmer, Carshalton.*—3*rd September*, 1883. 6*d.*

Relates to the treatment of paper pulp or paper material.

4229. MACHINERY FOR THE MANUFACTURE OF CERTAIN PARTS OF STEAM BOILERS, &c., *S. Fox, Leeds.*—3*rd September*, 1883. 6*d.*

Relates to means for flanging the end plates of steam boilers.

4230. CONSTRUCTION OF SPINDLES USED IN BRAIDING MACHINES, *W. Ashton, Manchester.*—3*rd September*, 1883. 6*d.*

The object is to prevent the weight from falling down the spindle when not required to do so and forming a slack end, and it consists in forming a deep slot in the spindle, so that the drop lever never leaves the slot, even when the weight is at its highest point and the bobbin free of the drop lever, whereby the possibility of the bobbin not being locked is prevented.

4231. MACHINERY FOR DRESSING HEMP, *L. Gooder, near Wakefield, and H. W. Whitehead, Leeds.*—3*rd September*, 1883. 6*d.*

A roller, with its periphery covered with slightly curved pins, is mounted in a frame between the slow and fast sheets of a "Good's double-sheet preparer for Manilla and other hemps;" and while such machine is working the roller is caused to revolve, thereby hackling or combing out a large quantity of lumps usually in hemp preparation, and the material being taken on to the fast travelling sheet.

4232. ROTARY PUMP AND ENGINE, *H. J. Haddan, London.*—3*rd September*, 1883.—(*A communication from V. H. T. von Swaine, Wiesbaden.*) 6*d.*

Relates to a rotary engine or pump, comprising in its construction two encased bevel wheels, having either enlarged teeth, the flanks of which are shaped like ordinary teeth along a small part of their length only, or two sets of teeth, one of which serves as ordinary tooth gearing, while the other set forms extended wings.

4233. MANUFACTURE OF SANITARY BLUE COLOURING MATTER, *J. Ellis, Hull.*—3*rd September*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a blue colouring matter for the use of laundresses and others, and which will also act as a disinfectant; and it consists in adding to ultramarine carbolic acid, borax, and bi-carbonate of soda, together with any or all of the following substances:—Sugar, treacle, glucos, and gum arabic.

4234. STAMPING CORRUGATED IRON AND STEEL PLATES, *R. Baillie, London.*—3*rd September*, 1883. 6*d.*

Relates to the stamping of corrugated iron and steel plates with deepened corrugations by forming first the central corrugations in the plates, and afterwards forming the outer corrugations therein.

4236. DRIVING GEAR APPLICABLE TO VELOCIPEDES, &c., *D. Carter, Stratford-on-Avon.*—3*rd September*, 1883. 4*d.*

Relates to a means of permitting compensating differential rotation when a pair of wheels is traversing a curve, to provide an alternative fast and slow driving gear, and to obviate any side shake of the wheels.

4238. MANUFACTURE OF "NECKS" FOR CANS OR CHURNS FOR THE TRANSPORT OF MILK, &c., *R. Stroud, Wolverhampton.*—3*rd September*, 1883. 6*d.*

Relates to a means of stamping the necks from sheet iron, steel, or like metal.

4239. COKE OVENS, *H. Simon, Manchester.*—3*rd September*, 1883.—(*A communication from F. Carves, St. Etienne, France.*) 6*d.*

Relates partly to effecting the communication between the gas ascension pipe of coke ovens and the shut-off valve on the gas main by means of a horizontal extension having a vertical branch leading at top into the valve-box, and at bottom into the hydraulic main, so that the gas, in passing through such horizontal and vertical pipes on its way to the gas valve, shall deposit the greater or colder part of its tar in such pipes, whence it flows into the hydraulic main.

4240. CHRONOGRAPH WATCHES, *A. Aubert, Switzerland.*—3*rd September*, 1883.—(*Not proceeded with.*) 4*d.*

This relates to simple mechanism for obtaining a minute meter working with absolute and unfailing exactness; and it consists in applying to the chronograph with minute meter an intermediate movement similar to the minute works which regulate in common watches the step of the hour and minute hands, the use of which is to regulate the motion of the hand of the minute meter in relation to the hand of the chronograph.

4241. MACHINE FOR ELEVATING WATER, *F. O'C. Prince, Brighton.*—3*rd September*, 1883.—(*Not proceeded with.*) 4*d.*

This consists in the employment of two nearly equal volumes of water suspended from a beam working on an axle in a frame so as to alternately raise them and cause water from one to overflow from the top of one, while a corresponding amount of water is caused to come into the bottom of the other volume.

4242. GAS ENGINES, *J. H. Ladd, London.*—3*rd September*, 1883.—(*A communication from J. A. Serrell, New York.*) 8*d.*

Consists partly in igniting a charge of compressed gas and air in a cylinder by the explosion of a smaller separate charge not under compression; also in admitting the charge to the cylinder through a passage arranged tangentially to the periphery of the said cylinder; also in avoiding the compression of the ignited charge, and in enriching it with gas during the compression of the charge in the cylinder.

4244. PREVENTING OR LESSENING DAMAGE TO SHIPS FROM COLLISIONS, *J. H. Grell, Germany.*—3*rd September*, 1883. 4*d.*

Two or more ropes of wire, hemp, or other suitable material are secured to the hull of the ship, so as to protect the same should another vessel come in contact therewith.

4245. APPARATUS FOR OBTAINING MOTIVE POWER, *J. H. Johnson, London.*—3*rd September*, 1883.—(*A communication from E. J. Delaurier, Paris.*)—(*Not proceeded with.*) 4*d.*

This relates to apparatus which is caused to be propelled by the action of a jet of steam issuing from an orifice which can be regulated, and is so controlled that the issue of such jet is intermittent.

4246. MORTISE AND OTHER LATCH LOCKS, *A. M. Clark, London.*—3*rd September*, 1883.—(*A communication from Messrs. Gollot freres, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to locks in which a spring latch is operated by a follower on the spindle of the handles, the chief object being to increase the bearing surfaces of the spindle follower, and thus prevent it wearing loose, and it consists in forming a deep groove in each end face of the cylindrical boss of the follower concentric with the axis of the spindle hole, and providing each of the side covers of the lock case with an inwardly turned flange around the hole in which the follower turns, these flanges fitting into the grooves.

4247. TELEPHONE TRANSMITTERS, *C. A. Allison, London.*—4*th September*, 1883.—(*A communication from D. Drawbaugh, Eberly's Mills, Penn., U.S.*) 8*d.*

A series of blocks of low conducting material are used in combination with the diaphragm. The box is so constructed as to form a sound chamber, and is provided with a "reflector" so as to concentrate the sound waves upon the diaphragm. The vibrations cause induced currents and also modifications in a local circuit, and these are united upon the line.

4248. CRUCIBLES, MUFFLES, &c., *H. E. Newton, London.*—4*th September*, 1883.—(*A communication from T. Egleston, New York.*) 6*d.*

The object is to form a vessel with an interior surface which will not be chemically or mechanically affected by the contents, and an exterior surface which will not be materially injured by heat. The interior surface is made essentially of basic refractory material and the exterior surface essentially of acid refractory material, or its two surfaces may be made of differently constituted basic materials, or of different basic material.

4249. HAIR COMBS AND APPARATUS FOR THE MANUFACTURE OF THE SAME, *P. Borck, Liverpool.*—4*th September*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to form combs so as to effectually remove dandriff and other matter from the hair, and it consists in forming the teeth with channels or grooves in them, a suitable apparatus being described in which cutters are arranged to form the spaces between the teeth and others to form the channels or grooves in the teeth.

4250. CONSTRUCTION OF VELOCIPEDES, *J. Ferguson, Bowdon.*—4*th September*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to enable the driving wheel to be driven at a greater speed than the crank shaft without the aid of stud pulleys and chains, and without the use of more than two toothed wheels, and it consists in mounting in one branch of the fork an axle driven by cranks and carrying an internal toothed wheel, while a wheel carried by an axle mounted in the other branch of the fork gears with the first wheel, and on the same axle the driving wheel is secured.

4251. MANUFACTURE OF GLUCOSE, *B. Moiske, Germany.* —4*th September*, 1883. 2*d.*

This relates to the manufacture of crystallised and of liquid glucose from rice starch by subjecting it with water to the action of sulphuric acid and steam under pressure, the free acid contained in the liquor produced being neutralised, and the solution condensed to 30 deg. Beaumé, passed through a filter press and condensed to about 40 deg. Beaumé and cooled.

4256. ROLLER MILL AND MIXING APPARATUS APPLICABLE FOR THE MANUFACTURE OF STARCH, &c., *H. J. Haddan, London.*—4*th September*, 1883.—(*A communication from W. H. Uhland, Germany.*—(*Not proceeded with.*) 2*d.*

The object is to convert washed starch-material, such as rice, maize, and wheat, into a homogeneous starch liquid, and to effect an intimate mixture of the latter with lyes or diluted acids, and it consists in the employment of a combination of crushing or grinding rollers, with mixing apparatus.

4257. FLYER'S THROSTLE FRAMES, *G. E. Vaughan, London.*—4*th September*, 1883.—(*A communication from S. N. Wadia, Bombay.*) 4*d.*

This consists in the employment of an antifrictional ring between the bobbins and collars or bolsters of the throstle frames of spinning machines.

4259. CONSTRUCTION OF TOOTHED RACKS FOR OPENING AND CLOSING FANLIGHTS, WINDOWS, &c., *R. Adams, London.*—4*th September*, 1883. 6*d.*

This consists essentially in forming toothed racks so that they are flexible, and using them for opening and closing fanlights, windows, &c.

4260. GAS ENGINES, *A. M. Clark, London.*—4*th September*, 1883.—(*A communication from the Economic Motor Company, New York.*) 6*d.*

This relates to gas engines in which an explosive mixture is drawn into the cylinder during the early part of the piston stroke and subsequently exploded, the expansion of the gases propelling the piston during the remainder of the stroke, and it consists of an igniter formed of a disc of platinum supported at its edges by a non-conductor of heat, and maintained in a state of incandescence by a blow-pipe flame; in an air pump driven by the engine, and serving both as a governor to the gas supply of the engine and to supply the ignited blow-pipe with air; in a slide valve formed of two independently adjustable pistons admitting of regulating the admission of gas and the exhaust of the products of combustion independently of each other; in a valve motion which ensures a quick opening and closing of the gas and air supply valves while allowing them to remain wide open during the period of supply and the period of exhaust; in a regulator for the air check valve, by means of which the lift of the valve may be regulated from the outside of the valve without the necessity of opening it for the purpose; in the combination of a check valve with the gas and air supply for preventing the heat resulting from the explosion in the cylinder from reaching the gas and air check valves, and in an automatic cut-off which shuts off the gas supply as soon as the engine stops.

4261. HOE, &c., *B. S. Harrison, Dronfield.* — 4*t September*, 1883. 6*d.*

The object is to permit the use of various sized hoe blades with one handle, and at the same time to fix the blades securely thereto. The hoe holder is in the form of a bow or fork of elastic cast steel, and its two prongs are formed with a slit to admit the hoe blade, each slit being provided with a pin, which passes through the prongs and across the slits. The blade is formed with two angular slots, into which the pins of the holder are forced, and springing outwards in the horizontal branch of the slots, secure the blade in position.

4264. SEPARATION OF GLYCERINE FROM FATTY SUBSTANCES, *C. Rumble and F. Sear, Battersea.*—5*th September*, 1883. 4*d.*

This consists principally in the employment of zinc or magnesium salt, or salts of a fatty acid, to decompose neutral fats into glycerine and fatty acids.

4265. APPARATUS TO BE APPLIED TO CHILDREN'S COTS AND BEDSTEADS FOR PREVENTING ACCIDENTS, *W. T. and W. H. Keep, London.*—5*th September*, 1883. 6*d.*

This consists in fitting over a child's cot a hinged frame resting on a spring block, which upon being depressed by a child trying to get out of the cot, completes an electric circuit, and so causes a bell or other alarm to be sounded,

4266. ROLLERS EMPLOYED IN MACHINERY AND APPARATUS FOR PREPARING, DRAWING, DOUBLING, AND SPINNING COTTON, &c., *J. T. Chadwick, Salford, and J. Crossley, Bury.*—5*th September*, 1883. 2*d.*

This consists in coating these rollers with thick roller cloth, and then coating it with a mixture of linseed oil, rock ultramarine blue, lamp-black, and prepared albumen, and placing it in an oven to dry, after which it receives a second coat of the composition, is again dried, and a final coating applied consisting of linseed oil, ivory black, and Prussian blue.

4268. EXCAVATORS, *W. F. Batho, Westminster.*—5*th September*, 1883. 8*d.*

The inventor claims, First, excavators provided with lever arm blades pivotted to a boss in pairs; Secondly, apparatus for giving motion to four-bladed lever arm excavators; and Thirdly, two-bladed excavators with lever arms, links, crossheads, and frame. Each blade is provided with lever arms connected to the means for actuating the skip or bucket, which consist of a chain and trip gear, or two chains, one connected to the crosshead operating to open and the other to the crosshead acting to close the blades.

4269. ELECTRIC LAMPS, *A. W. Richardson, Chorlton-on-Medlock.*—5*th September*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to an arc lamp provided with a cage carrying a train of wheels, the cage being lifted by an electro-magnet to establish the arc, the feed being controlled by a shunt magnet, brake, and friction wheel.

4271. MANUFACTURE OF UMBRELLAS, *T. Wrench, Waterloo.*—5*th September*, 1883. 4*d.*

Relates to the manufacture of umbrellas with a cap of india-rubber between the cover and the metal portion.

4273 PUMPING ENGINES, *H. Davey, Leeds.*—5*th September*, 1883. 6*d.*

Refers partly to the construction of vertical pumping engines, whereby these are enabled to be erected

at the side of a shaft or pit, while the end of the beam thereof projects over the side of the pit, so as to leave the greater part of the pit free for the raising and lowering gear.

4272. Apparatus for Removing Dirt, Snow, or other Impediments from the Rails of Tramways or Railways, *R. D. Jones, Liverpool.—5th September*, 1883. 6*d*.

Relates to an apparatus consisting of a scraper pivotted preferably in front of the wheels and kept in position by a counterbalance weight or its equivalent.

4274. Apparatus for Training and Testing Coursing Dogs, *W. E. Hind, Goole.—5th September*, 1883. 4*d*.

Consists in arranging at the end of the course of a model animal, mechanism whereby the model is made to disappear and a real animal is propelled into view of the dogs.

4275. Sight-feed Lubricators, *W. A. G. Schönheyder, London.—5th September*, 1883. 6*d*.

Relates to the construction of sight-feed lubricators, wherein the several passages are governed by a single plug that can be turned by hand to various positions indicated on a hand wheel.

4276. Electrical Switches, Chiefly Designed for Use with Telephonic Apparatus, *H. H. Lake, London.—5th September*, 1883.—(*A communication from C. W. Holden, Boston, Mass., U.S.*) 1*s*. 2*d*.

The receiver is carried by a lever, the movements of which make and break the necessary circuits as required, a similarly arranged lever serving the same purpose for the transmitter. Means for signalling to the central office are also described and illustrated.

4277. Machinery Used in the Preparation of Textile Materials, *S. Johnson, Rochdale.—5th September*, 1883. 6*d*.

Relates to the cones and connected parts of machinery used in the preparation of cotton and fibrous materials for spinning, as, for example, to slubbing, intermediate, and roving frames.

4278. Machinery for Felting or Stamping Hat Bodies, &c., *G. Atherton, Stockport.—5th September*, 1883.—(*Partly a communication from G. Yule, Newark, U.S.*) 8*d*.

Relates partly to the employment of two felting rollers of small diameter provided with rings in combination with a third plain roller which is movable for the insertion of the work, the whole proportioned to act upon one or two hat bodies at once.

4280. Hoes for Tilling Land, &c., *F. Kinder, Cottenham.—6th September*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to provide a hoe which can be used either for the purposes of an ordinary hoe, or for drilling, and which can be set for different widths and otherwise adjusted.

4281. Electric Lamps, *J. R. P. Wallace, Distington, and F. Cherry, London.—5th September*, 1883. 6*d*.

The "feed carbon" is fed by a counterweight, the motion of which is controlled by a trigger carried by the armature of an electro-magnet, and acting on the escapement wheel of a train of wheels. The arc is established by the second carbon being drawn into contact by an electro-magnet with the "feed carbon," and then repelled from it by a spring.

4282. Asbestos Packed Casks and the Process of Packing the Same, *J. Deverance, London.—6th September*, 1883. 6*d*.

Consists in coating the fibres of asbestos with india-rubber mixed with material for vulcanising, so that when the asbestos is caulked into the grooves of cocks, the influence of heat shall vulcanise the rubber, and cement the fibres of the asbestos, and prevent them being blown out by the current of steam or other fluid passing through the cock.

4283. Construction of the Saloons of Steamships, *J. R. Thompson, Clydebank.—6th September*, 1883. 6*d*.

Relates principally to the means of admitting light and to the ventilation.

4284. Gas Burners for Boiling, Grilling, &c., *T. Fletcher, Warrington.—6th September*, 1883. 4*d*.

Relates to the combination of a deflector plate or plates, with a reversible gas burner or burners.

4285. Kilns and Drying Apparatus, *W. Lawrence, London.—6th September*, 1883. 6*d*.

Consists of kiln plates which admit the heated gases laterally, and which may be applied to present kilns; also in making the plates in the form of channels or troughs, or made so as to admit the heated gases above the level of the ordinary kiln plates.

4286. Strainers, *W. Lawrence, London.—6th September*, 1883. 6*d*.

Consists in the mode of perforating metal surfaces either flat, circular, or conoidal or otherwise.

4287. Cotton Gins, *H. J. Haddan, London.—6th September*, 1883.—(*A communication from D. S. Chapin, Massachusetts, U.S.*) 6*d*.

Relates partly to an elastic or spring plate, a bar and its series of screws over such plate, in combination with a rotary cylinder and beater, and with the curved plate or seed arrester extending and provided with a bearing shoulder to rest against such spring plate.

4288. Middlings Purifiers and other Separating Machines, *W. P. Thompson, London.—6th September*, 1883.—(*A communication from F. A. Price, Victoria, Australia.*) 6*d*.

Consists of a screen for agitating the middlings or other pulverulent matter to be operated upon, a fan below the screen arranged with special contrivance for distributing the air currents equally over the screen bottom, and an arrangement of travelling brush to keep the sieve clean.

4289. Lamps for Railways, &c., *A. E. Ragg, Chester.—6th September*, 1883. 8*d*.

Relates to a lamp that will give a strong light unaffected by surrounding currents of air, or those caused in the lamp itself by violent swinging or jolting; also a lamp more convenient in construction than those at present in use.

4290. Rotary Engines, *H. C. Bull, Liverpool.—6th September*, 1883. 6*d*.

This relates to the construction of rotary engines and to the compounding of the same, and means for reversing the engine. In a vessel with flat sides, and a semi-cylindrical top and bottom, work four barrels, each provided with four or more pistons connected in pairs through the barrels, which are mounted on shafts passing through the ends of the vessel. The vessel is divided by a diaphragm, one part forming a high-pressure and the other a low-pressure chamber, the steam expanding from the former into the latter. The shafts are geared together and run in opposite directions, each having transmitting devices. The steam and exhaust ports are five in number, and are side by side in the engine valve face. The valve which serves as the communicating valve between the two chambers and as the reversing valve is placed and works on the engine valve face, and is provided with four ports. Over it works the admission valve, consisting of a flat plate with a central opening.

4291. Gas Engines, *C. H. Andrew, Stockport.—6th September*, 1883. 6*d*.

This relates to engines in which the charge is exploded when under considerable pressure, and the object is to relieve the slide valve of the pressure due to the compression and explosion of the charge. A check valve is arranged in the passage between the combustion chamber and the slide valve, under which the charge passes to enter the combustion chamber. Directly the charge is compressed the check valve severs connection between the main charge and a portion of the charge left in the passage at atmospheric pressure. When the light is introduced by the slide valve the portion of the charge in the passage is ignited, and the expansion caused by the explosion raises the check valve, and the main charge is fired, the check valve being instantly reclosed.

4293. Operating Corliss Valves of Motive Power Engines, *J. Musgrave, Bolton.—6th September*, 1883. 8*d*.

The object is to give a traversing motion to a Corliss valve during the time that it is oscillating to open and close the port. The spindle of the valve passes through a stuffing-box at each end, and the ordinary levers to actuate the valve are secured to one end, and at the other end is a loose collar with an excentric ring on its periphery, which rests against a fixed collar on the valve spindle. The excentric ring lies in a recess cut in a stationary bracket, which supports the bearing of the valve spindle and collar. A ratchet wheel is cast with the collar, and the valve spindle projects through the collar and has a lever with a pawl, which acts on the ratchet teeth. When the valve is operated the lever and pawl cause the ratchet wheel to make part of a revolution, and the excentric ring gives the valve spindle and valve a traversing motion lengthways of the port.

4294. Barrels of Fire-arms, *P. A. Bayle, Paris.—6th September*, 1883. 4*d*

Consists in the application of a contraction formed by two truncated cones joined at their truncated summits.

4296. Steam Boilers, *P. A. Bayle, Paris.—6th September*, 1883. 6*d*.

The furnace is formed of three concentric cylinders. The fire-bars and fuel are placed between the first or innermost cylinder and the second or middle cylinder. These cylinders are both open at top and bottom. The third, or outermost cylinder, is also open at the bottom, and is surmounted by a truncated cone. The first, or innermost cylinder, acts as an automatic injector of atmospheric air into the upper part of the furnace, and, moreover, by impulsion causes a current of air to rise up through the other two cylinders.

4297. Supports or Holders for Telephonic Instruments, &c., *H. H. Lake, London.—6th September*, 1883.—(*A communication from C. W. Holden, Boston, Mass., U.S.*) 10*d*.

Relates to supports so constructed as to permit of the instruments held by them being swung and adjusted both vertically and horizontally. The telescopic arms and the various joints are so constructed as to prevent the conducting wires becoming twisted or entangled.

4301. Machinery for "Splicing" or Preparing Pieces of Leather for "Splicing," *S. Haley, Leeds.—7th September*, 1883. 6*d*.

Relates partly to the employment of a divided roller or a roller composed of a series of brass or other metal rings, mounted side by side upon an axis of smaller diameter. It also relates to the employment of mechanism for holding the leather and drawing it through the rollers against the edge of the knife.

4303. Pneumatic Hammers or Stamp Mills for Crushing Ores, &c., *C. Sholl, London.—7th September*, 1883. 6*d*.

This relates to stamp mills in which atmospheric air is employed to form a cushion for the hammer or stamp. The pneumatic cylinder and stamp are made separately and connected by flanges, and the cylinder may be in one piece or in two pieces connected by flanges at the centre. The cylinder has a lining of a metallic alloy to counteract the effect of the heat evolved by the compression of air in the cylinder. Two long slots are formed in the cylinder, and through them passes a pin, on which is pivotted a "plug" pneumatic piston furnished with rings of a metallic alloy. The piston is reciprocated by a bifurcated connecting rod, or by two connecting rods, coupled at one end to the pin and at the other to a crank on the main driving shaft. The slots are long enough to admit air beneath the piston when at top of its stroke, and above it when at bottom. A perforated pipe is used in connection with apparatus for supplying water to keep the cylinder cool, two perforated branch pipes from the main pipe being arranged in recesses in the guides of the cylinders. As a substitute for the cushion of air in the cylinder, a helical spring can be fixed to the top of the piston, and also, if desired, at the bottom of same.

4306. Treadle Mechanism of Sewing and other Machines, *J. Pasfield, Sedgley.—7th September*, 1883. 6*d*.

The object is to provide a treadle motion which, while retaining the ordinary heel-and-toe motion of the foot, will avoid all dead points, and render the action less constrained and tiring than hitherto. The tread-plate is mounted on a reeling, sliding, or rolling axis, or is capable of sliding upon a fixed centre, so that, in addition to the heel-and-toe motion, the operator also exerts the pressure of the foot to produce a reciprocating horizontal motion of the tread-plate.

4308. Manufacture of Bricks, Tiles, Slabs, and Blocks of Building Material, *J. C. Bloomfield, London.—7th September*, 1883. 2*d*.

Consists in moulding a molten mixture of gas pitch, powdered chalk, and other material.

4314. Valved Dip-pipe for Hydraulic Mains in Gas Works, &c., *J. H. Lyon, Cosham.—8th September*, 1883. 6*d*.

Relates to the method of and apparatus for actuating a valved dip-pipe without the use of a gland or stuffing box, the said method and apparatus consisting of the use of a rod or rods secured to the lower end of the said dip-pipe or to a bracket or to feet thereon, which rod or rods actuate the said dip-pipe and move freely in a tube or tubes, which tube or tubes is or are tightly secured to the flange or cap of the branch pipe or to the cover of the hydraulic main or elsewhere, while the lower end or ends of the said tube or tubes is or are deeply sealed in the liquid.

4315. Attachments for Sharpening "Solid Ink" Pencils, *J. Darling, Glasgow.—8th September*, 1883.—(*Not proceeded with.*) 2*d*.

This consists of an open-ended tube capable of being placed over the end of the pencil to be sharpened, and provided with an internal elastic knife or cutter, which, upon rotating the tube, forms the point to the pencil. Two or more cutters may be provided.

4316. Lamps, *F. R. Baker, Birmingham.—8th September*, 1883. 6*d*.

This consists in connecting the gallery to the burner by means of jointed arms, which allow the gallery with the globe, chimney, and burner dome to be removed from above the wicks without disconnecting them from the lamp.

4317. Rails and Sleepers for Railways, *J. A. R. Main and J. Dick, Glasgow.—8th September*, 1883. 6*d*.

Transverse iron or steel sleepers of an inverted trough form have depressions at top to receive the bottom of the rails, which are secured thereon by means of special fastening devices.

4318. Burner for Combustion of Liquid Hydrocarbons, *M. F. Perry, West Hartlepool.—8th September*, 1883. 4*d*.

A steam pipe terminates in an adjustable annular nozzle, and around it is a pipe enclosing an annular passage, through which liquid fuel passes to an annular nozzle surrounding the steam nozzle.

4319. Electrical Generators, *F. C. Glaser, Berlin.—8th September*, 1883.—(*A communication from A. J. Gravier and Kukss, Luedtke, and Grether, Warsaw.*)—(*Not proceeded with.*) 2*d*.

This relates to a mode of construction so as to obtain a truly cylindrical and balanced armature.

4321. Hydraulic and other Pumps, *W. H. Watson, near Leeds.—8th September*, 1883. 6*d*.

The object is to dispense with the stuffing-boxes or packing glands employed for preserving the pump rods tight in the ends of the pump cylinder, and it consists in the use of split rings having a conical form outside, and acted upon so as to cause them to bear firmly against the rods which pass through them.

4322. Apparatus for Stamping Letters, &c., *H. J. Haddan, London.—8th September*, 1883.—(*A communication from R. Hinrichsen, Germany.*) 6*d*.

This consists in an apparatus for stamping letters, in which a carriage is actuated by a spring barrel, so as to convey the letters in succession to the stamping block, whence they are transported by an endless strap to a receptacle for the stamped letters.

4325. Making Tubes of Paper, &c., *G. A. E. and R. Ashworth, Manchester.—8th September*, 1883. 6*d*.

The tubes are made from two to three strips of paper cemented together, and arranged to break joint, the strips being taken from continuous coils, so that the tube is produced by a continuous process. The strips are led through tubular formers.

4326. Taps, &c., *W. A. Todd, Stamford.—8th September*, 1883. 6*d*.

This consists in securing a bush in the tap hole, and inserting a plug which can turn therein, so as to bring holes, formed both in the bush and plug, opposite to each other. The tap is made to fit into the plug, and a partial turn thereof shifts the plug into the required position to allow the contents of the vessel to flow through the tap.

4327. Surgical Belt and Bed Stay, *E. M. Moore, London.—8th September*, 1883. 6*d*.

This relates to a belt made adjustable to the waist of the wearer, and with or without extensions to be secured to the lower limbs.

4328. Treadle Looms, *C. D. Abel, London.—10th September*, 1883.—(*A communication from L. Laeserson and H. Wilke, Russia.*) 1*s*. 8*d*.

The loom is constructed so as to be worked by the weaver exerting but slight pressure on the treadle, and among the advantages claimed are:—The regulations of the speed partly according to the material, partly according to the construction of the fabric. The heald frames being made to operate without cords, can be readily removed or changed. In cases where several healds operate together both for upward and downward motion, the friction of the warp threads can be reduced by putting them in motion at different moments. Both the simplest as also the most complicated construction of fabrics, as also all changes thereof, can be executed with ease by the shifting of cams. Every description of fabric with different forms of selvage can be woven, and the latter can be shifted in width without altering the harness. The tension of the warp is kept uniform by a falling weight with pulleys having double action.

4332. Manufacture of Boots or Shoes and Apparatus therefor, *A. Hannibal, London.—10th September*, 1883. 6*d*.

The object is to construct boots and shoes so that they shall be more pliable and give more to the movements of the feet, and it consists principally in the use of paste or cement for securing the inner sole to the upper and lining.

4334. Permanent Way of Tramways, *J. H. Johnson, London.—10th September*, 1883.—(*A communication from H. L. Geveke, Amsterdam.*) 6*d*.

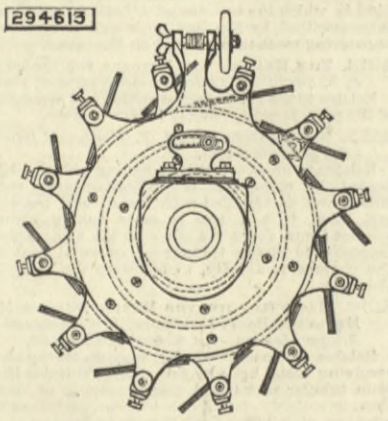
The rail is flat on the underside and rests on a longitudinal trough sleeper to which it is secured by cramps or dogs and bolts, the heads of which take over a ridge or projection running along the side of the rail, while the bottom ends curve inwards and enter recesses in the sleepers. Two opposite cramps are secured together by bolts. Flat bars or plates connect the longitudinal sleepers together at suitable intervals.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

294,613. Commutator for Magneto or Dynamo-electric Machines, *Zénobe Théophile Gramme, Paris, France.—Filed December 18th*, 1883.

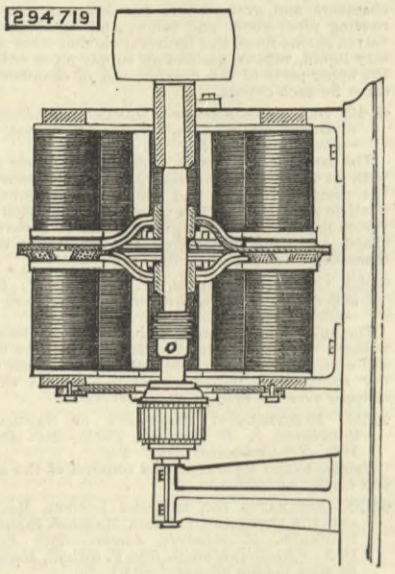
Claim.—(1) The combination, with the brush sockets or carriers and the common support therefor, of the devices for shifting the said sockets or carriers and the common support for said devices, substantially as described. (2) The combination, with two or more pairs of commutator brushes, of mechanism, substantially as described, for simultaneously moving said brushes into and out of contact, with the commutator disc, as set forth. (3) The combination, with brush sockets or carriers, movable to bring the commutator brushes into and out of contact with the commutator disc, of a ring or plate movable around the axis of the disc, and connected with said sockets or carriers to shift the same, substantially as described. (4) In combination with the brush sockets or carriers, plates fastened together but insulated from each other, and connected, respectively, with sockets or carriers or unlike sign, substantially as described. (5) The



combination, with the brush sockets or carriers, of the two supports connected with said sockets or carriers, said supports being movable with respect to each other to move the brushes toward and away from the commutator disc, and movable together to adjust the position of the brushes with respect to the neutral and maximum points on the commutator disc, substantially as described. (6) The combination, with the commutator disc and brushes of an electrical machine, of means, substantially as described, for simultaneously moving the said brushes toward and away from the commutator discs, and for simultaneously adjusting the position of the brushes with respect to the neutral and maximum points on the commutator disc, substantially as described.

294,719. Dynamo-electric Machine, *Clinton M. Ball, Troy.—Filed May 29th*, 1883.

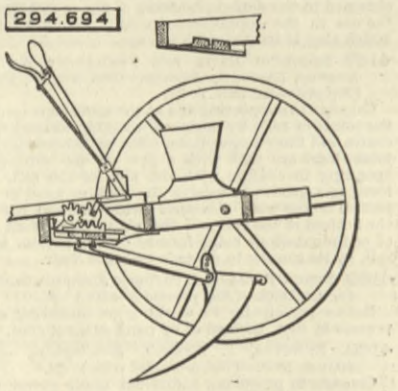
Claim.—(1) The combination, in an armature wheel, of two flat rings or discs with conical or tapered openings, ranges of coils or helices introduced into the openings, and screws or rivets for clamping the rings together and holding the helices into the discs, substantially as set forth. (2) The combination, in an armature wheel, of two flat rings or discs having conical or tapered openings, and two separate ranges of coils introduced into the openings in such discs, substantially as set forth. (3) The combination, in an armature wheel, of two flat rings or discs having openings, helices or coils within such openings, and a layer of insulating material between the respective discs and their coils, substantially as set forth. (4) The combination, with the helices, of an armature wheel or ring of metal recessed to receive the coils or helices, and having separations in the metal between the alternate helices at 4, for the purposes and substantially as set forth. (5) The combination, with the armature wheel, of helices or coils wound with an exterior conical form to slip into the similarly-shaped openings in the armature wheel, substantially as set forth. (6) The combination, with the commutator plates and intervening insulating material, forming a cylinder, of collectors or rubbers, each composed of a range of plates with concave ends fitting the surface of the commutator cylinder, boxes for holding such plates, and springs to press upon the rubbers, substantially as set forth. (7) The combination, with the rubbers, of the boxes l^2, for holding the same, the spring p^2, the covers n^2 for the boxes, and the screws for adjusting the springs, substantially as set forth. (8) The combination, with the ranges of armature



coils each having free ends, of the rings $+a+b-c-d$, the commutator plates and collectors, and the circuit connections, arranged substantially as set forth. (9) The combination, with the circular range of field magnet poles, separate ranges of induction elements in the armature, and the commutator plates and collectors, of the branched connections between the free ends of the armature elements and their respective commutator plates, arranged substantially as and for the purposes set forth.

294,694. Seeding Machine, *Harrison D. Spangler, Rushville, Ind.—Filed November 15th*, 1883.

Claim.—(1) In a grain drill, the combination, substantially as set forth, of the machine framing, a pair of shifting draft bars, hoes and drag bars attached to the draft bars, in the manner specified, means for shifting the draft bars, and angularly-arranged guides for the draft bars, as specified. (2) In a grain drill,



the combination, substantially as set forth, of the machine framing, a pair of shifting draft bars, having drag bars and hoes attached, a hand lever, guides for the draft bars, a pair of racks, as set forth, secured to each draft bar, pinions engaging each other in pairs and engaging the racks, and a shaft uniting the pairs of pinions.

CONTENTS.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Richard F. Callaway, chief engineer, to the Flirt, complement incomplete; and William Hall, engineer, to the Shannon, for the Forester, temporarily, vice Keast.