## THE MANIPULATION OF SHIP STEEL.

The difficulties and uncertainties which once attended the use of steel in ship construction are become matters of somewhat ancient history, and yet a history which is so familiar to the majority of our readers that it is scarcely necessary to now relate it. It may, perhaps, be sufficient to mention, that the steel supplied for shipbuilding previous to the year 1875 could be used only to a very limited extent, and with extreme caution. Not only was the element of price a formidable obstacle to its general use in mercantile shipping, but the variability and uncertainty of its quality constituted a still more cogent deterrent to the employment of steel in all descriptions of vessels, even when built for wealthy Governments, with whom cost of material was a minor consideration. It was about the time we have named that the memorable discussion upon the steel question took place at the Institution of Naval Architects, when, in response to the challenge of Sir Nathaniel Barnaby, Mr. James Riley, of Landore, promised that within twelve months a quality of steel would be produced fully to satisfy the requirements of the Admiralty and the private shipbuilding trade. As will be remembered, that promise was abundantly fulfilled; so that, at once, the Admiralty laid down two corvettes—the Iris and Mercury—to be built of the new "mild steel" at Pembroke. Lloyd's and the Board of Trade gave immediate attention to the subject, and the former especially instituted such an exhaustive series of experiments as satisfied them that at last they would be able to accord their highest classification to ships built of steel without any qualifying notation against their names in the Register Book. During the twelve years which have elapsed the popularity of mild steel has been continuously upon the increase, until at the present time it is found that upwards of 90 per cent. of the ships under construction in this country are being built of that material.

But, although it was early seen that the steel difficulty had been overcome, evidences were speedily forthcoming which indicated that the safe employment of mild steel necessitated certain precautionary measures not needed in the manipulation of wrought iron. In the first place, it was found necessary to institute tests of the tenacity and ductility of the material, in order to insure that only steel within certain safe and well-defined limits of hardness should be employed. These tests, which were at first made by Lloyd's surveyors upon the premises of the shipbuilders, are now conducted at the steel works, and only approved and duly certified plates and bars are allowed to leave the manufacturer's premises when intended for classed vessels. It may be, and indeed has been, urged that this course of procedure is equally necessary in the case of ship iron. No doubt there is much force in the representation, but whatever may be said in favour of testing wrought iron on the manufacturer's works will apply with far greater force in regard to a material having such a wide range of tenacity, ductility, and other qualities as steel. Now that nearly all the ship tonnage on the stocks is of steel, the question of testing at the iron works the small quantity of iron entering into ship construction is of little or no moment, and what is required in that way is doubtless sufficiently done at the shipyards. But with steel the case is widely different; and so keenly is this fact appreciated by Lloyd's Committee, that in such districts as the Clyde the surveyors employed upon testing steel at the manufactories exceed in number those engaged in surveying the construction of ships. It is to the former class of officials that some of our correspondents appear to refer in several of their communications which have recently appeared in The Engineer. So thorough and satisfactory has been the testing system, not only of Lloyd's but also of the Admiralty and Board of Trade, that the failures experienced in the use of mild steel at the Royal and private shipyards have been very few indeed: and cases of failure have in most instances been traceable to the neglect of those precautionary measures to which allusion has already been made.

A consideration of the properties of mild steel which render it necessary to manipulate it differently from ordinary wrought iron, and of the measures which the most recent experience shows should be taken to avoid failure when working it into a ship, may perhaps be of interest and value, both to those shipowners who still view the material with some amount of suspicion, and to the shipbuilders who have so far had the good fortune to escape the pitfalls into which others have stumbled. Some of these sources of failure are more frequently experienced than others, and a few are familiar to all who have had anything to do with the manipulation of mild steel. Others, however, are not so generally known, and, unfortunately, scarcely yet understood.

The simplest and best known among the properties peculiar to mild steel, or rather, which distinguish it from ordinary wrought iron, is the great loss of tenacity and ductility which the material suffers after punching. This was an early-discovered difficulty in the use of steel for shipbuilding, and for a time it seemed probable that the objectionable quality would seriously interfere with the extended employment of an otherwise most desirable material. It was observed that the loss of ductility and tenacity through punching was comparatively trifling when the steel was under ½in. in thickness, and diminished with the thickness. But when more than ½in. thick, the loss of strength and deterioration of quality was so considerable, that at first it was believed punching would have to be dispensed with in favour of drilling in the larger steel ships; a change which would, of course, involve a serious addition to the cost of construction. Experiments made under the direction of Lloyd's Committee showed, however, that there were two ways of getting over the difficulty. It appeared that the apparent deterioration in the quality of the material after punching was due to a molecular disturbance of the material which extended only very slightly beyond the side of the punched hole. This disturbance induced a ready initial tendency to rupture, and when once a tear commences in a material such as steel it rapidly extends. So thin, however, is the film of material in the disturbed condition, that a very slight rimering, or even the ordinary countersinking, was found sufficient to remove it. Hence the remedy was at once reduced from drilling to rimering, or countersinking; and as the latter process is inevitably necessary in many parts of a ship, and rimering is not expensive, the possibility of building large ships of steel at a moderate cost seemed to be again restored. This was improved upon the further discovery being made, that without any rimering at all the simple act of annealing set the whole matter right, by restoring the original qualities of the punched material.

This difficulty once past, there appeared every prospect of perfectly plain-sailing in the future; and, indeed, that prospect has been fully realised by most shipbuilders, and might with prudence and care be experienced by all. So skilfully is the manufacture of Siemens-Martin steel now conducted at the recognised steel works in England and Scotland, and so carefully is it tested after manufacture, both by the makers and the surveyors to the Admiralty, Lloyd's, and the Board of Trade, that we question very much if one ton in ten thousand which find their way into the shipyards is of improper quality. Surface defects and lamination are, it is true, not uncommon; but these are mechanical faults, originating in the rolling mills, and have no reference to the quality of the steel. But despite the uniform excellence of the steel sent into the shipyards of Great Britain, failures in its employment have not been infrequent, and especially so of late at certain shipyards wherein modes of manipulation have been resorted to which will be further alluded to presently.

In considering the causes which lead to the fracture of mild steel, or to the impairment of its quality, under the hands of the shipyard workman, it will be found that they may be classified under three distinct heads. First, we have the failures due to overheating the steel, or "burning it," as it is termed; second, those due to manipulating heated steel when below the temperature at which such manipulation should cease; and thirdly, those which attend the bending of steel when in a cold, or rather, perhaps, we should say, unheated condition. The failure of steel through overheating when first noticed by the workmen seemed to be of a paradoxical character. Accustomed as they were to working upon hot wrought iron, which, the hotter it is made the more plastic it becomes, they were surprised to find that after a certain temperature was passed the steel lost all its ductility and tore asunder like hot cast iron. Although this discovery was made many years ago, and the property of mild steel in this respect is well known, yet through carelessly overheating angle bars and plates in the furnaces of the shipyard, a large quantity of material is still destroyed. This occurs much more frequently in some establishments than upon others, and at certain well-conducted shipyards this description of failure is almost unknown. Fortunately the mischief always declares itself when done, for as the material is in every case heated in order that it may be the more easily bent, the bending which follows overheating invariably discloses what has been done by the fracture of the plate or bar. One could fain wish that the damage done to steel by working upon it when at a "black heat" were so clearly apparent as that which results from "burning" it. It is to be feared that many steel plates in ships now afloat are brittle and in a state of molecular tension bordering upon rupture through having been heated and afterwards hammered or otherwise manipulated after redness had disappeared, and the material had arrived at a "black heat." This, too, is a singular property of steel which is not shared by wrought iron, or, at all events, to an appreciable degree. It is, unfortunately, the most serious of the differences between the two metals: because, as already remarked, mischief may have been done to a plate when no evidence of the same is to be seen. Very often indeed are boss, oxter, and other plates in the shell of a ship, which must be heated in order to be bent to form, damaged in this way without the brittleness of the plates being manifested until they have been rivetted into place; and in many instances it is to be feared, it is never discovered at all. A fine hair-like line upon the plate indicates a crack in it to the experienced eye, when the simple stresses induced by rivetting the plates in place have been more than it could endure. But how about the cases when the "hair-like line" has not been seen, and its existence is hidden with paint? And how about the cases wherein the stresses due to rivetting have not been quite enough to crack the plate, but the stresses of the sea have? It is to be hoped that most of these failures are detected in the shipyard, for certainly they are not cheerful things to contemplate, and would be far worse were it not that, after all, a crack will not admit very much water into a ship, and that very few plates require to be heated at all when working them to form. Indeed, the disposition just now is to heat none at all, but to do every species of bending by powerful hydraulic machinery operating upon unheated plates. Considering the highly ductile qualities of mild steel, it is matter for surprise that this disposition was not earlier manifested; and now that a start has been made in the cold bending and flanging of the material, there is no saying how far or in what directions it will proceed. Already machine makers are competing with each other in the production and perfection of appliances for safely and economically shaping cold steel to the various forms required in ship construction. No difficulty has so far been experienced in the bending and flanging of plates up to ½in. in thickness, and even plates of ⅝in. have been satisfactorily turned through an angle of 90 deg., so as to shape them for garboards and plate keels throughout the entire length of a vessel. Success in the manipulation of such thicknesses has not apparently been so uniform as to warrant shipbuilders generally in placing entire confidence in the system, so that at the present time garboard plates above ½in. thick are being bent to form in a heated condition in shipyards where cold flanging is very generally applied to thinner plates. Other shipbuilders are, however, persevering in their efforts to dispense with heating altogether; and judging by the expensive machinery they are fitting up for the purpose, it would appear that they are sanguine of ultimate success. Before considering the nature of the failures hitherto encountered in the cold bending of steel, and investigating their causes, it will perhaps be desirable to indicate the portions of the structure wherein it has been found advantageous to apply the system. Reference has already been made to the garboards, and as the material for these plates is at least as thick as any other part of the hull requiring excessive bending, it is with the garboards that, so far, the greater number of failures have occurred in cold bending. A very simple and ordinary instance of the advantage of cold flanging is, however, seen in the case of bulkhead plates when wrought vertically; for by flanging one edge of each plate, or flanging both edges of alternate plates the use of vertical stiffening angle bars has been avoided The flange is, of course, at least the breadth of the stiffening bar which would otherwise be required, and the breadths of the bulkhead plates are arranged so that the vertical stiffening flanges are not more than the usual 30in. apart. Not only does a great saving in weight of material result from the adoption of this device, but a saving is also effected in the rivetting. Whether or not the stiffening afforded is an equivalent to that of the angle bars is, of course, quite another matter, but, nevertheless, one worthy of serious consideration. Indeed, this aspect of the question seems to have been largely lost sight of in the efforts made to effect economies of weight and cost. Bulkhead plates are always much thinner than their vertical stiffening angles, and consequently the flange cannot contribute the same stiffness as the angle bar it supersedes; besides which the angle bar has a "root," while the flange has none, but only a more or less open curvature where a "root" should be.

Another common application of the flanging system is at the upper edges of floor plates and intercostal longitudinals of cellular double bottoms, and quite recently the vertical edges of intercostal plates have also been treated in the same way. The purpose in each case is, obviously, to dispense with the short angle-bar attachments to the inner bottom plating in the former instances and to the floor plates in the latter. The objection common to every case is the same, viz., the want of stiffness, such as is provided by the root of the ordinary angle bar; and no cold flanging, however sharp may be the turn, can possibly produce an equivalent to the angle bar connection. This is especially seen to be the case when the vertical edges of intercostal girders or longitudinals are flanged in order to connect them by rivetting to the transverse floor plates.

But whatever may be the structural disadvantages of flanging, as compared with the arrangement it supersedes, no difficulty has been found so far in the cold manipulation of the material, which is rarely more than eight-twentieths of an inch in thickness. But in dealing with the stouter plates for the garboards, the results have not been so encouraging. Thicknesses of twelve-twentieths of an inch and upwards have not been found to bend cold through an angle of 90 deg. with that invariable measure of success which is necessary in order to establish confidence in the system. A great deal, of course, depends on the machine employed for bending the plates, and upon the care exercised by the workmen in its use. Some machines have been found to yield a smaller proportion of failures than others; but, so far as we are aware, absolute freedom from failure has not been experienced with any of the appliances for cold-bending thick steel plates which are at present in use. No fault can be found with the quality of the steel, which had all been tested and found within the proper limits of tenacity and possessed of the required amount of ductility. Re-tests of broken plates have served only to confirm those originally made upon them before they were issued from the steelworks. The blame for failure must therefore fall either upon the methods employed in bending the plates, or upon the system of cold-bending when applied to such considerable thicknesses. The principle upon which these machines act is identical with that of the ordinary machine for bending hot plates in use at every shipyard, the force being applied by means of a long cast iron or steel roller free to revolve at the extremities of a pair of levers. But while in the common bending machine for hot plates the power is due to manual labour, in these cold-bending machines the motive force is hydraulic pressure. This can, however, scarcely affect the result, except inasmuch as the power is so considerable that the plate must either bend or break. But as a great force is absolutely necessary in order to bend a stout steel plate, the use of the hydraulic press is essential to the system. Some experiments recently made in cold-bending by hydraulic pressure have yielded interesting and encouraging results. It has been found that by simply annealing a stout plate, the angle through which it can be safely bent is considerably increased. Plates which broke when being bent through less than 90 deg. have been satisfactorily turned cold through even a greater angle after being annealed; and very recently a steel plate of no less than 1in. in thickness, which was repeatedly broken in a plate-bending apparatus before 90 deg. were attained, was, after annealing, safely bent beyond the 90 deg. without any increase in the hydraulic pressure. In neither of these instances was there any grounds for attributing failure either to hardness in the material or a want of the proper ductility for ship steel; but it is quite clear that the operation of annealing communicated to the plates a condition of molecular equilibrium which was previously wanting, or, at all events, which was essential to their enduring the stresses set up in the bending machine.

Hence there appears to be good grounds for believing that the difficulties which have hitherto been encountered in the cold-bending of thick steel ship plates will soon be entirely overcome. In view of the economies in cost of

construction which may be effected by the cold manipulation of steel in shipbuilding, such a consummation is much to be desired.

## ON THE LAWS OF STEAMSHIP PROPULSION.

By Robert Mansel, Whiteinch, Glasgow.

In continuation of my note in The Engineer of July 5th, 1889, re-stated in its concrete form, I have endeavoured to show: in the direct movement of a steam vessel, at a trial speed, say, at rate of V nautical miles per hour. If, as in common logarithms, we adopt the Briggs or decimal base, the number 10, raised to a power proportional to V, as exponent, will give a number equal to the numerical ratio $\frac{E}{W}$, where E denotes the gross power developed by the machinery, to propel this particular vessel, at the speed V, and W the portion of this power absorbed, as it were, by the machinery in developing the gross power. Or again, also, equal to $\frac{P + rp}{f}$; that is to say, the ratio of the gross piston pressures during this speed—assuming the engines to be compound—to the pressure $f$, at which, under the same external conditions, the engines would begin to move. I have in my letters fully explained how this quantity $f$—known in mechanics as Morin's constant—is to be determined, and further, that this *constancy* must be understood as subject to conditions which may cause changes in its value, for adjacent ranges of speeds. To express this in definite symbols, we may write:—

$$(1) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad 10^{cV} = \frac{E}{W} = \frac{P + rp}{f}.$$

Or, by taking the common logarithms of the members,

$$(2) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad cV = \log. \frac{E}{W} = \log. \frac{P + rp}{f}.$$

Again, from the definition of *power*—at one time named *vis viva*, and now-a-days generally termed *energy*—it necessarily follows: N being the number of revolutions, per minute, of direct-acting engines, and $d$, $s$, and $r$ the diameter and stroke of the high-pressure piston and ratio of the areas of the two pistons respectively; also, P and $p$ the respective mean diagram pressures upon them, we must have:

$$(3) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad E = \frac{d^2 s}{21{,}010} (P + rp) N.$$

In the Watt conventional horse-power units; and, as a necessary consequence:

$$(4) \quad . \quad Log. E. = \log. \frac{d^2 s}{21{,}010} + \log. (P + rp) + \log. N.$$

Again, Morin's constant $f$, viewed as a resisting pressure upon the same pistons at their rate of travel, necessarily gives:

$$(5) \quad . \quad . \quad . \quad Log. W. = \log. \frac{d^2 s}{21{,}010} + \log. f + \log. N.$$

And, by taking the differences of (4) and (5),

$$Log. \frac{E}{W} = \log. \frac{P + rp}{f} = cV; \text{ by (2).}$$

Hence, (5) on writing $\log. \frac{d^2 s}{21{,}010} f = C$, we have:

$$Log. W = C + \log. N, \text{ and } \log. \frac{E}{W} = \log. \frac{E}{N} - C.$$

That is to say:

$$Log. \frac{E}{N} = C + cV \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6);$$

also, the explicit value of V:

$$V = \frac{1}{c} \left\{ Log. \frac{E}{N} - C \right\} \quad . \quad . \quad . \quad . \quad . \quad (7).$$

Either of the two latter forms, I characterise as the most accurate, simple, and direct application of the involved principle, and capable of a direct test by their application to any, reasonably, accurate set of progressive trial data.

In this important equation, $\log. \frac{E}{N} = C + cV$. The term C has the value, $\log. \frac{d^2 s}{21{,}010} f$, or proportional to the value of Morin's constant. The explanation of the other term $cV$, is to be looked for in the direction: that it is a quantity proportional to the velocity of "Poncelet's current." That is to say, the retrograde flow, past the vessel, of the quantity $mV$ of fluid displaced by a vessel of $m$ immerged mid section moving with the velocity V. Obviously, this will vary inversely as the section of the current, and experience shows that this is much greater than the section of the vessel. Hence, since current $= \frac{\text{quantity}}{\text{section}} = \frac{mV}{\text{section}} = cV$, suppose? $c$ is, necessarily, a small quantity, and the experiments on prisms by Dubuat and Duchemin yielded Poncelet deduced values from $\frac{1}{6{\cdot}46}$ to $\frac{1}{12}$. In steam vessels, from the position of the propeller, whether paddle or screw, the slip, and other circumstances, we might expect, and do find, a greater range of values. As explained—Poncelet's "Mécanique Industrielles. Des Resistance," page 434, &c.—this current has a variable velocity in its section, extending from its greatest value, near the vessel, to a point outwards, at which the current is insensible. Poncelet there imagined an enclosing boundary—*parois fictive*—and that the displaced water is forced through this imaginary pipe, of which the hull of the vessel forms the upper side.

I have long maintained the *rationale* of this to be the only correct view of the problem of fluid resistances which has ever been offered. The assumption with which I have set out involves that the indicated horse-power, for a given speed of vessel *does not vary as the cube, or other power of the speed;* the law being: *the speed itself is involved, as the exponent or power of a constant quantity.* The subject, admittedly, presents many difficulties; but anyone who will take the trouble to examine, carefully, a few cases, will, I think, arrive at the conclusion: this *theory* agrees *exactly* with experimental facts.

Although I may, already, have furnished sufficient illustrations, by the analysis of many published sets of trial data; on the face of them, complete and honest, and by competent parties, another case or two—out of hundreds at my disposal—may neither be misplaced nor valueless. In *Industries* of March 16th, 1888, I noted the published trial data of Mr. Donaldson's steam yacht Thetis, as follows:—

Steam Yacht Thetis.

*Triple-cylinder Compound Engines, by Messrs. Muir and Houston, Glasgow.*

| Obs'd. speeds. | Revs. | Ind. powers. | | |
|---|---|---|---|---|
| 7·31 | 73 | 123 | These figures indicate, $f = 14{\cdot}85$ | Log. = 1·1716 |
| 9·605 | 94·5 | 278·8 | In this vessel, we have, $\log. \frac{d^2 s}{21{,}010}$ | = −2·3020 |
| 10 99 | 100 | 403·7 | | |
| 12·25 | 127 | 690·3 | Therefore, C | = −1·4736 |
| | | | Also, $c$ | = ·103 |

Hence (7) $V = \frac{1}{\cdot 103} \left\{ \log. \frac{E}{N} - (-1{\cdot}4736) \right\}$. And the test—

| | | | | | |
|---|---|---|---|---|---|
| Values log. E | = | 2·0899 | 2·4336 | 2·6061 | 2·8390 |
| ,, log. N | = | 1·8633 | 1·9752 | 2 0000 | 2·1038 |
| ,, log. $\frac{E}{N}$ | = | ·2 ·66 | ·4504 | ·6061 | ·7352 |
| Subtract C .. | = | −1·4736 | −1·4736 | −1·4736 | −1·4736 |
| Differences .. | = | ·7530 | ·9448 | 1·1325 | 1·2616 |
| Log. differences | = | − 1·8768 | − 1·9933 | ·0542 | ·1010 |
| Log. ·103 | = | − 2·0128 | − 2·0128 | − 1·0128 | − 1·0128 |
| Log. V | = | ·8640 | ·9805 | 1·0414 | 1·0882 |
| ∴ V | = | 7·312 | 9·561 | 11·00 | 12·25 |
| By observation | = | 7·31 | 9·685 | 10·99 | 12·25 |

Here the differences are very small. Highly probable, there has been a slight error of observation, or uncorrected variation of tidal drift, on the second speed, which slightly mars the otherwise perfect agreement between the formula and the trial data.

As a second example, take the much larger and more powerful merchant screw vessel "Caridad," built by Messrs. McMillan, Dumbarton, and engined by Messrs. D. Rowan and Son, Glasgow. Tried on 27th June, 1883; this vessel furnished the following trial data:—

S.S. Caridad.

*Double-cylinder Compound Engines.*

| Obs'd speeds. | Revs. | Ind. powers. | | |
|---|---|---|---|---|
| 7·772 | 41·95 | 264· | These figures indicate, $f = 5{\cdot}435$ | Log. $f$ = ·7352 |
| 9·250 | 49·65 | 411·23 | and in this vessel log. $\frac{d^2 s}{21{,}010}$ | = −1·4393 |
| 12·676 | 68·65 | 1051·4 | Therefore, C | = ·1745 |
| 14·042 | 76·25 | 1595·3 | also, $c$ | = ·0804 |
| 15·740 | 87·53 | 2411·8 | | |

Hence, by (7), $V = \frac{1}{\cdot 0804} \left\{ \log. \frac{E}{N} - \cdot 1745 \right\}$. and the test, as follows:—

| | | | | | |
|---|---|---|---|---|---|
| Log. E | = | 2·4216 | 2·6141 | 3·0207 | 3·2028 | 3·3823 |
| Log. N | = | 1·6227 | 1·6959 | 1·8366 | 1·8822 | 1·9422 |
| Log. $\frac{E}{N}$ | = | ·7989 | ·9182 | 1·1851 | 1·3206 | 1·4401 |
| Subtract C | = | ·1745 | ·1745 | ·1745 | ·1745 | ·1745 |
| Differences | = | ·6244 | ·7437 | 1·0106 | 1·1461 | 1·2656 |
| Log. differences | = | −1·7955 | −1·8714 | ·0045 | ·0592 | ·1024 |
| Log. ·0804 | = | −2·9053 | −2·9053 | −2·9053 | −2·9053 | −2·9053 |
| Log. V | = | ·8902 | ·9661 | 1·0992 | 1·1539 | 1·1971 |
| ∴ V | = | 7·766 | 9·25 | 12·57 | 14·25 | 15·74 |
| By data, V | = | 7·772 | 9·25 | 12·676 | 14·042 | 15·74 |
| Differences | = | −·006 | ·00 | −·106 | +·208 | ·00 |

Again, I repeat, the observed speeds obtained by a system of means of runs, with and against the tidal drift, are affected by small residual errors, due to variations in the rate of drift, in the time occupied by the trials. Were the experiments distributed over the entire time of the ebb and flow of one tide, and indeed, very generally, the algebraic sum of such errors will be found to vanish. From the foregoing cause, speeds obtained with very low powers are, generally, very erroneous; and in many cases, have served to mask the true relation of the data.

In further proof of the perfectly general and consistent results yielded by these formulæ, I will, further, add the application to two vessels from the Admiralty trial data tables, as follows:—

H.M.S.S. Serapis, *27th September*, 1880.

| Observed speeds. | Revolutions. | Powers. |
|---|---|---|
| 13·746 | 63·89 | 4032 |
| 11·677 | 53·51 | 2127 |
| 9·258 | 41·33 | 982 |

Dimensions, 360 × 49-1½ × Draughts. 17-11 forward / 23-2½ aft. Mid area, 880 square ft. Displacement, 6439 tons.

Hence, by formula, $V = \frac{1}{\cdot 0945} \left\{ \text{Log.} \frac{E}{N} - \cdot 5010 \right\}$.

| | | | |
|---|---|---|---|
| Applied to data, we have V | = | 13 747 | 11·626 | 9·258 |
| By data | = | 13·746 | 11·677 | 9·258 |
| Differences | = | −·001 | −·051 | ·000 |

H.M.S.S. Mutine, *1st June*, 1881.

| Observed Speeds. | Revolutions. | Powers. |
|---|---|---|
| 12 085 | 110 3 | 1176 |
| 10·913 | 103·8 | 786 |
| 8·874 | 81·6 | 388 |

Dimensions, 170 × 36 × Draughts. 12-10 forward / 16-4 aft. Mid area, 392 square feet. Displacement, 1136 tons.

Hence, by formula, $V = \frac{1}{\cdot 10} \left\{ \text{Log.} \frac{E}{N} - (-1{\cdot}7888) \right\}$.

| | | | | |
|---|---|---|---|---|
| Applied to data, we have, V | = | 12·086 | 10·904 | 8·883 |
| By data | = | 12·085 | 10·913 | 8·874 |
| Differences | = | +·001 | −·009 | +·009 |

I omit the calculations as unnecessary, and any one interested in the question can, easily, follow out the very simple process of finding, for any set of trial data, the values of the quantities $\text{Log.} \frac{E}{N}$. Further, on drawing by scale the values of these, as *ordinates*, to the corresponding observed speeds, as *abscissæ*, it will be found the upper ends will lie in, either, *one straight line*—example, the foregoing Caridad—or, in *two straight lines*—example, the Italian warship Lepanto, see The Engineer, September 7th, 1888, and communication of "W.S." in The Engineer, October 5th, 1888. Or, it may even be, in *three straight lines*, an example of which is given by the analysis of Mons. De Bussy's trial data of torpedo boat—The Engineer, April 9th, 1887. According to the elementary principles of co-ordinate geometry, these lines cut the axis of ordinates, at distances from the origin, equal to the values of the quantity C, while the respective corresponding values of $c$, are the natural tangents of the angle, which these lines make with the axis of abscissæ.

July 22nd. Robert Mansel.

## THE CROSSNESS OUTFALL WORKS.

### VISIT OF THE SOCIETY OF ENGINEERS.

On Tuesday, July 30th, the Society of Engineers paid a visit to the sewage outfall and precipitation works at Crossness. These works were begun by the Metropolitan Board of Works, and are being completed by the London County Council. This latter body seems to think that it has a social mission as well as an administrative one to perform, and refuses to accept coal from collieries at which piecework is done. The result is that whereas formerly the authorities at Crossness paid fourteen shillings per ton, they now have to pay as much as twenty-three. The works at Crossness are highly interesting, and although an official of the Board of Trade, has violently attacked them and stigmatised them as representing flagrantly bad masonry work, and has even stated that the bricks have been put up without the use of the trowel, yet, for all that, we doubt whether better work could be found. The works form the outfall into the river Thames of the whole of the sewage of the south of London, and with what has already been spent and what will still have to be expended, it is expected that the total cost of these stupendous works will amount to £650,000. We are often reproached with building only for the present, and our ephemeral structures are sometimes contrasted with those of the Egyptians and the Romans, who built for all time, but the monumental works at Crossness would bear favourable comparison even with the *cloaca maxima*. There is an existing reservoir occupying about seven acres, divided into four compartments and capable of holding some 4,000,000 cubic feet of sewage, which can stand for about eight hours per tide, and is discharged at high water. The sewage reaches Crossness by an 11ft. 6in. barrel sewer, at a deep level, and is then pumped into the reservoir. The existing works are about to be supplemented by the precipitation works now in progress, the contract of which has been let to Mr. Wm. Webster for the sum of £258,166; these comprise the adaptation of the four compartments of the old reservoir, and the addition of a new reservoir, in area about two and three-quarter acres, in two compartments, affording together 1,000,000 cubic feet additional capacity. All the six compartments are to be used as precipitation tanks, and are arranged in successive and progressive order; they provide altogether for fully 12,000,000 cubic feet of effluent per day, the discharge of which will be distributed throughout all the hours of the twenty-four, except when the tide is above the flow level, when the effluent will pass into an effluent store underneath the new reservoir, which store will be emptied into the river when the level of the tide permits. The sewage before entering the precipitation tanks will be treated with lime water and iron water, and will remain quiescent in these tanks for about two hours, during which time the solids will be precipitated, after which the effluent will be run over the tips of weirs as quietly as possible, so as not to disturb the precipitated sludge at the bottom. When comparatively perfectly pure the effluent will be finally discharged into the river.

The "wet" sludge will be mechanically swept off the floors and passed into a sweep or well, and from thence it will be pumped into another reservoir, divided into compartments known as sludge settling channels. Then it will undergo a second settling, by which its bulk will be further reduced; the second effluent, or "liquor," will then be gently allowed to flow over weirs, and will be used for making the lime water. The "settled" sludge will be passed into a receiver beneath the sludge settling channels, and thence be pumped through pipes extending along a jetty into the sludge steamboats, which will convey and discharge it into the German Ocean. The "liquor," or second effluent, being insufficient in quantity for making the lime water, will be supplemented by river water admitted at high water into the adjacent settling ponds. The "liquor" and water will be pumped up to the liming station, to be erected on the top of the sludge settling channels, where the slaking and mixing will be effected; and thence the lime water will be run through pipes into the low-level sewer, which brings the sewage to the main sewage pumps, and will be supplied in such quantities as to furnish about four grains of lime to each gallon of sewage. On the top of the sludge settling channels, and next the liming station, there will also be an iron water station for grinding and dissolving proto-sulphate of iron, and supplying the solution in such quantities as to furnish about one grain of iron to each gallon of sewage, the lime and iron being both added to the sewage before it is allowed to enter the precipitation channels. Mr. Houghton is the engineer.

Mr. Webster's experimental station, where he is trying his electrolytic process of purification, is in full working order, and is giving results from which it is possible to make calculations of cost. He claims to obtain 40 per cent. of purification by his process, and estimates the net cost per million gallons at 15s. The precipitation is effected by oxide of iron, two grains of which are required per gallon. This is obtained by means of sets of three strips of iron, of which two represent negative poles and one a positive pole. These pieces of iron are in connection with a dynamo, driven by a 50-horse power engine, worked at one-third its power, and the effluent is run past these strips of iron through several settling troughs, until it becomes so clear that it is fit for drinking; indeed, Mr. Webster's faith in his process is so great that he did not shrink from subjecting himself to the severe test of drinking some of the effluent himself.

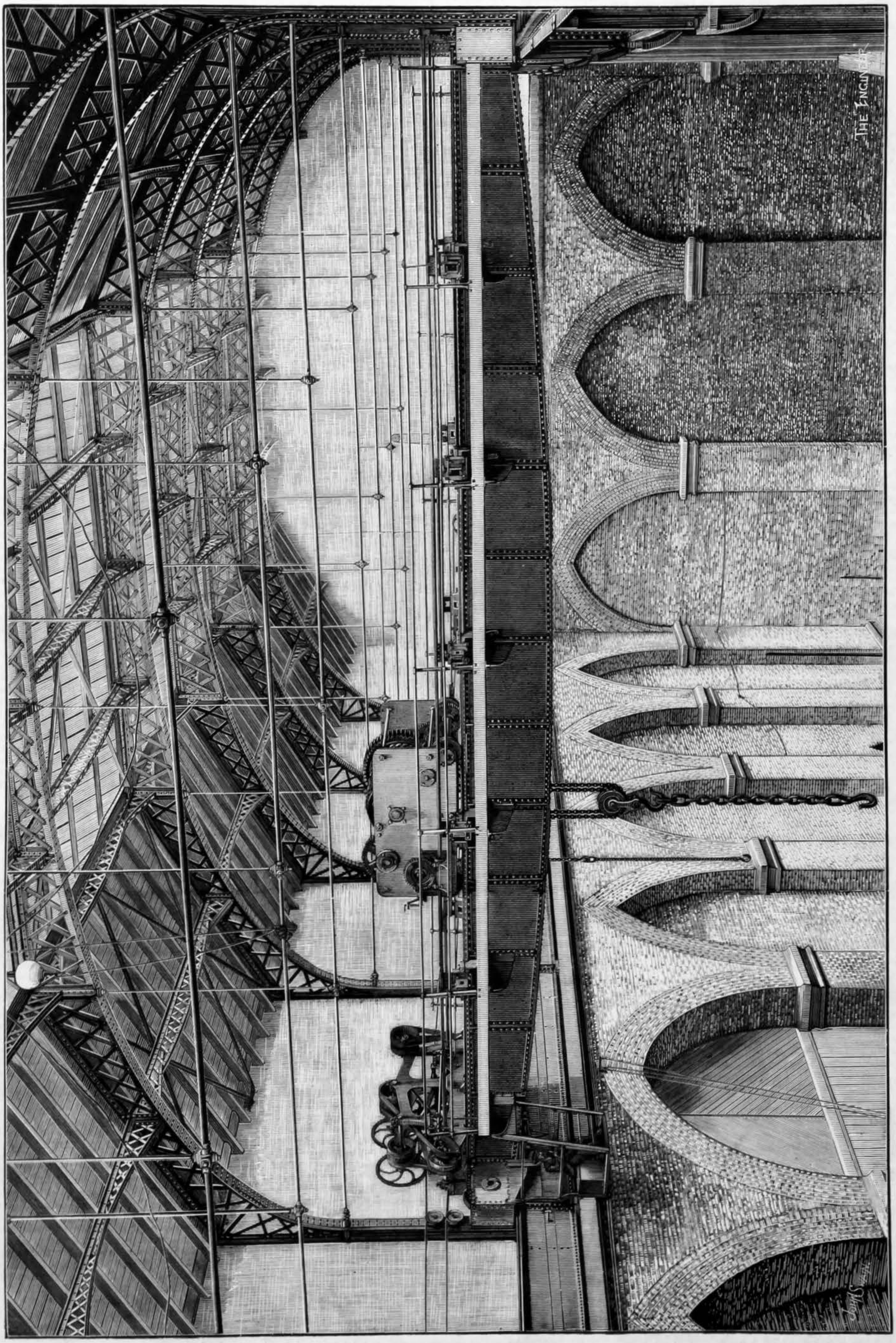
The company were entertained at luncheon by Mr. Webster, and there were present, amongst others, Mr. Jonathan R. Baillie, president; Mr. Henry Adams, vice-president; Mr. Jabez Church and Professor Henry Robinson, past presidents; Mr. J. H. Cunningham, member of council; Mr. G. A. Pryce Cuxson, secretary; and Messrs. W. J. Botterill, W. F. Broadberry, J. L. Chapman, J. Etherington, E. A. Glover, F. Hovenden, A. Lund, H. R. Newton, H. C. Petter, H. A. Roechling, J. S. Tamburini and E. H. Toulmin.

University College, London.—At the Session of Council on July 6th, the title of Emeritus Professor of Engineering and Mechanical Technology was conferred on Professor A. B. W. Kennedy, F.R.S.

TRAVELLING CRANE, DEPTFORD STATION OF THE LONDON ELECTRIC SUPPLY CORPORATION.

MESSRS. VAUGHAN AND SON, MANCHESTER, ENGINEERS

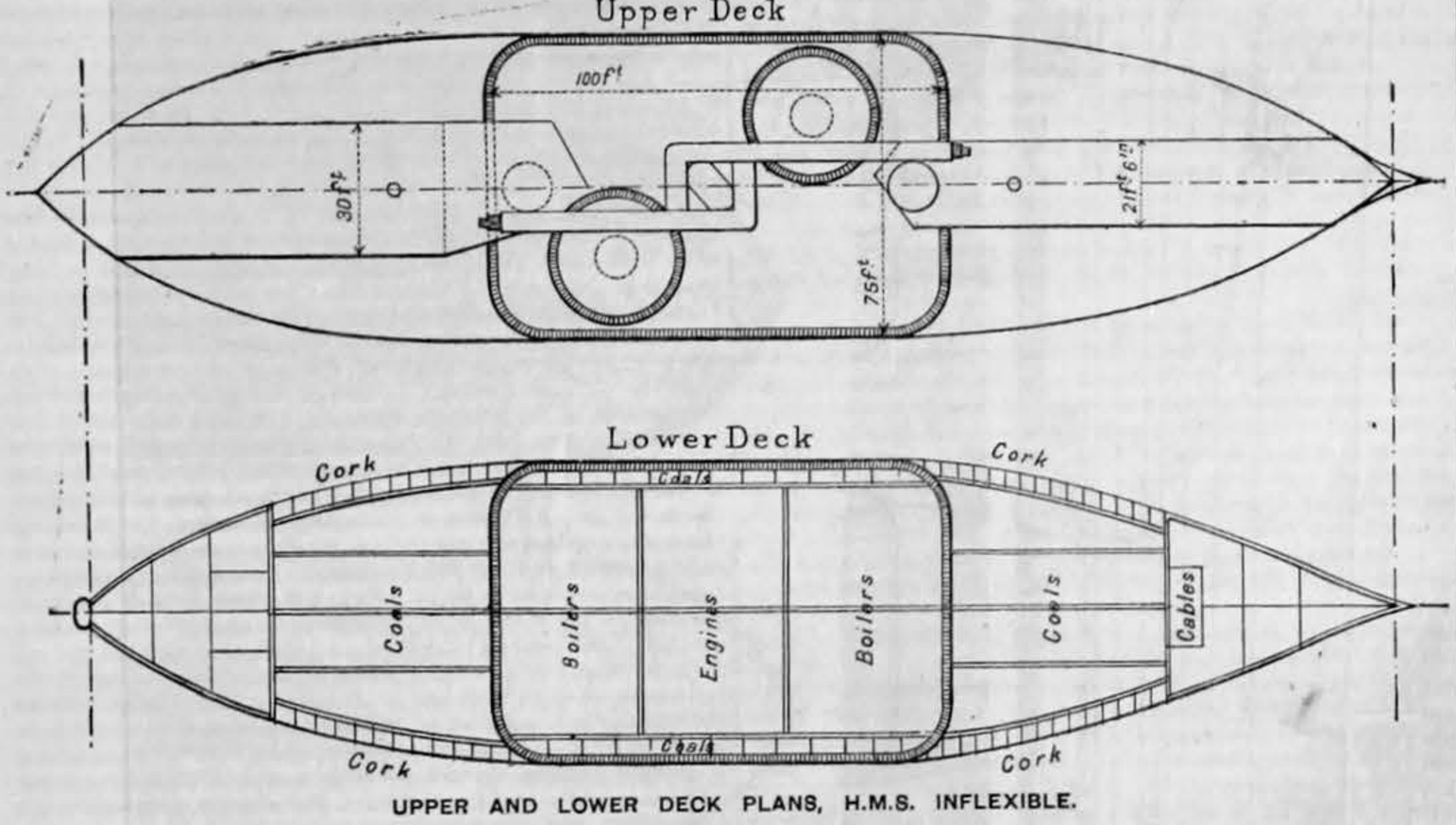
(For description see page 102.)



## H.M.S. INFLEXIBLE.

We publish this week the fifth of our series of views descriptive of the various types of vessels included in the British Navy. It is taken from a photograph by Messrs. Symonds, High-street, Portsmouth. The Inflexible is an armoured turret battleship of the first class. It is described by Mr. W. H. White, Director of Naval Construction, as a "central citadel ship with turrets placed *en echelon*." It was built at Portsmouth and launched in 1876, but not actually completed till 1881, just in time to take part in the bombardment of the forts at Alexandria a year afterwards. The engines were made by Elder and Co., of 8010 indicated horse-power. The principal dimensions, &c., are as follows:—Length, 320ft.; beam, 75ft.; extreme draught, 26ft. 4in.; displacement, 11,880 tons; speed, 13·80 knots; coal capacity, 1300 tons. The leading characteristic in the structure of this vessel, which is quite a typical example of its class, is a huge central citadel protected by a belt and bulkheads of iron armour plates, 16ft. high and 110ft. in length, placed immediately over the engines and boilers, the turrets being superimposed upon a thin armoured deck covering the whole. This armour is 24in. thick in the centre, thinning to 20in. at the top and 16in. at the bottom. Practically it is not so strong as the sides of the Trafalgar's "womb," which has 18in. of compound steel-faced armour upon it. The Inflexible has a raft body at either end, entirely unprotected with plating, and with shallow light plating over the sides, the Inflexible would still be one of the most powerful of our battleships. The cost was £648,811 for hull, £146,457 for machinery. To this must be added the cost of the armament, bringing up the whole to about £900,000.

It is unlikely that any more of the Inflexible class will ever be built. They were the outcome of an idea which has been exploded, more particularly since the introduction of high-explosive shells. The unprotected raft-bodies would be rendered mere shambles by the use of these last-mentioned projectiles, and one single shot penetrating the citadel might wreck its interior. Divided gun positions, with powerful protected auxiliary batteries, are the outcome of a better principle. But, as we said before, the Inflexible is well worth modification.




UPPER AND LOWER DECK PLANS, H.M.S. INFLEXIBLE.

except that a thick iron deck extends from the citadel to stem and stern, at a considerable depth below the surface of the water, which covers the magazines. These "raft-body" ends are made—presumably (?)—buoyant by a series of thick compartments filled with cork, and stretching over half of the unprotected ends. The unprotected ends of the ship have an actual freeboard of the same weight as the top of the armour plates, and are necessarily low, so as to admit of the firing of the heavy turret guns along their surfaces; but the superstructure gives an erroneous impression of the height of the Inflexible, and makes it appear as though she has a high bow. As a matter of fact, owing to her short length and considerable beam, the fore-deck outside the cabins is all a-wash in heavy weather. The central citadel has further protection, behind the armour plates and teak backing, of large coal bunkers disposed within its whole length. There is a spar deck over the superstructure at both ends, upon which boats are housed and light armament mounted. The turrets are covered with 17in. composite armour, and each pair of guns on either side can train through an arc of 180 deg., so as to fire ahead, astern, or abeam. The arrangement of the guns for loading is execrable. The hydraulic machinery is so arranged that the muzzles of the guns are depressed to an opening in the deck below, immediately over the centre of the vessel, and whilst in this loading position they point directly into the main magazines. A "premature" discharge under these circumstances would absolutely imperil the security of the ship. This was a fatal oversight in the construction of the Inflexible. The danger attaching to such badly protected ends as she possesses was also strikingly exemplified at Alexandria, where an officer was killed just outside the citadel, although below at the time, and where the ship was hulled effectively several times, though it is needless to say the citadel was not penetrated.

The armament of the Inflexible consists of four 16in. 80-ton muzzle-loading guns in the two turrets, and eight 4in. breech-loading steel guns and twenty-one G.F. and machine guns within and upon the superstructure. The 4in. guns are an afterthought. They do not form a properly constituted auxiliary battery, as they are not contained in protected stations of any sort. Moreover, there is no proper room for them, and in some cases they would interfere with the fighting of the turret guns, if rapid fire were being carried on in the heat of action. Most ingenious arrangements have been made in the designs of the new battleships, submitted by Mr. White to the naval architects, to avoid these complications. The guns are so disposed, in separate and remote positions, on several decks, as not to interfere with each other's line of fire in any way. Some of the existing cruisers will probably aim point blank at an adjoining sponson gun during rapid fire in action, unless great caution is exercised. The 80-ton guns, although not of the most recent pattern, are most formidable weapons. They fire a projectile of 1700 lb. weight, with a charge of 450 lb. prismatic brown powder, and their penetration into armour plate at 1000 yards is 23·3in. The effect of some of these projectiles striking the forts at Alexandria was appalling. At Fort Ras-el-tin whole gun positions were wrecked in a moment by a single shot; and had the huge common shell which hurtled over the houses in the town been fitted with more sensitive fuzes, whole districts would have been laid bare by their explosion. The Inflexible's guns are a little "scored" from ill-usage in the early days of pebble powder; but, even without re-tubing, they are good for many a long series of firings, should their services be required. The roller paths of the turrets are worn out, but this is a small matter. They should originally have been constructed of steel, not wrought iron. Re-engined,

## FRENCH PATENT LAW.

French patent law has many peculiar features, viewed from the standpoint of the English lawyer and the English patentee, and as it is in some of its most peculiar provisions that it may, at some time or another, be of importance to our English readers, and as the International Exhibition now being held at Paris has naturally directed considerable attention to French industrial questions, it may not be out of place to set before inventors and manufacturers the broad outlines of French law in relation to patents for inventions, dealing more particularly with the features which are of special interest to Englishmen. The rights and liabilities of patentees are in the main summed up in the law of July 5th, 1844. Under this law any person, be he Frenchman or foreigner, who alleges that he is the inventor of any industrial product, or the inventor of any new means, or any new appliance of means already known for obtaining an industrial result, is entitled, on depositing a specification and paying certain fees, to demand a *brevet d'invention*, or patent from the Government, entitling him to the exclusive right of working the invention for his own benefit during the term of the grant. This term may, at the election of the patentee, be for five, ten, or fifteen years, at a cost respectively of 500f., 1000f., or 1500f., payable in each case by yearly instalments of 100f. The Government refuses to grant any patent for pharmaceutical compounds or remedies of any kind, or for financial plans or schemes.

In America and Germany, and to a certain extent in England, an examination is made by Government officials as to the novelty of the invention for which protection is desired, and a patent is only granted if the officials are satisfied that the invention is new. In France no such examination is made, and provided the formalities prescribed by law are observed, a patent will be granted to each applicant. Though no official examination is made, novelty is as essential in France to the validity of the grant as it is in England, and in order that the public may not be deceived by the apparent official protection given to articles by the use of the word *breveté*—patented—stamped or written upon them, the Government compels every patentee to use after the word *breveté* the phrase *sans guarantie du Gouvernement* usually written in an abbreviated form S.G.D.G. This provision is strictly enforced, and the use of the word *breveté* alone renders the offender liable to a fine varying from 50f. to 1000f., and for a second offence to a fine of double that amount.

When a patent is taken out in England it frequently happens that the original inventor is robbed of many of the benefits which he ought to obtain from his patent. It may be he has in his specification contented himself with enumerating some new principle, and has also set out the most simple of its applications, but has not fully worked out all that is capable of being developed from his original idea. No sooner is his specification published than applications are made by other persons for patents for various alterations or improvements in or additions to the original invention, and the inventor is robbed of much that is rightly his due. In France means are taken to prevent this injustice to the inventor. Every patentee has the sole right during the year immediately following the grant of the patent to protect alterations or improvements in or additions to his invention; the inventor can, if he so desires it, obtain a separate and independent patent for the alterations, improvements, or additions, or he may, at a much smaller cost, obtain what is known as a certificate of addition of even date with his patent and expiring with it, which will protect all the alterations, additions, or improvements which he has made.

During the year immediately succeeding the grant of a patent, no person other than the patentee, or those entitled through him, can obtain a valid patent for any improvement or alteration in or addition to the patent; but if any other person makes an application, his application will not be rejected, but will be kept under seal until the original patent has been in force a year. If within the year neither the patentee nor those entitled through him have made any application for a new patent, or for a certificate of addition, a patent will be sealed to the other applicant.

The conditions of validity, in so far as they relate to the sufficiency of the specification and to subject matter, are somewhat similarly treated both by French and English law. On the question of novelty, the inquiry in England is whether or not the invention has been published in the United Kingdom prior to the date of the patent. In France the scope of the inquiry is much wider, and apart from the benefits conferred upon Englishmen and the subjects of the other States who have joined the Industrial Property Convention of 1883, the law is tersely summed up in the 31st Article of the Act of 1844, which says, "No discovery, invention, or application to which in France or abroad, and before the date of the deposit of the application, sufficient publicity has been given to enable it to be worked, shall be reputed new." Under the law as it stood prior to the promulgation on July 8th, 1884, of the International Convention of 1883, the publicity given to an invention even a few days before, by deposit at the London Patent-office of the specification and drawings, was enough to invalidate a patent taken out in France; but by Article 4 of the Convention, any person belonging to a State forming part of the union who has duly made application for a patent in one of the contracting States, enjoys as regards registration in the other States of the union a right of priority during six months.

Fiscal considerations in France enter largely into every branch of the law, and one finds that the patentee who has not paid his yearly instalments before the beginning of each year of the term of his patent forfeits all his rights. Closely connected with fiscal and protective considerations are two other grounds of forfeiture. The first of these is that a patentee who has not worked his discovery or invention in France within two years from the date of the patent, or who has ceased to work it for two consecutive years—unless he can in either case show good cause for not working it—forfeits all his rights. This provision remains untouched by the International Convention of 1883, and subjects of foreign States, even though members of the Union, must still work their invention in France if they desire to retain their patent rights.

Prior to the International Convention, a French patent in all cases became void if the Patentee imported into France articles made abroad similar to those protected by the French patent, but so far as regards Englishmen and the subjects of other countries who have joined the Union, Article 5 of the Convention has provided "That the introduction by the patentee into the country where the patent has been granted, of objects manufactured in any of the States of the Union, shall not entail forfeiture of the patent."

It is on the question of infringement that the greatest difference exists between French and English law. In England infringement gives rise only to civil rights; in France, infringement is a misdemeanour, entitling the patentee to put in motion the procureur-général, and to proceed before the correctional courts for fines, which for the first offence vary from 100f. to 2000f., whilst for the second offence imprisonment from one to six months is to be awarded in addition to the fines, and in all cases where the infringer is a workman, or has been employed in the workshop or factory of the patentee, the courts may imprison the infringer from one to six months. Summary means are also provided under which a public process server may draw up a detailed description of the articles alleged to be infringements, and may, if necessary, seize the articles complained of. It is, of course, open to the alleged infringer in France, as in England, to attack the validity of the patent, and the correctional courts have jurisdiction to try issues of that character. They may also award such damages, if any, as the patentee has sustained, but the infringer is also liable to be sued for damages by the owner of the patent before a civil tribunal. As with all other misdemeanours, the right of action is barred after three years from the date of the commission of the offence unless proceedings have meanwhile been taken. It will thus be seen that though a French patent is—to use the words of Article 11 of the law of 1844—"granted without guarantee to either the reality, novelty, or merit of the invention, or the accuracy of the description in the specification," a large measure of protection is afforded to any inventor who, having obtained a patent, is able to support before the courts the patentable character of his invention.

## THE IRON TRADES EMPLOYERS' ASSOCIATION.

Several important labour questions which have recently come to the front in the various branches of the iron and engineering industries, and which are certain before very long to occupy serious attention, are dealt with in the report of the Iron Trades Employers' Association, which was submitted to the members at their annual meeting this week. The report, after briefly alluding to revival of the engineering industries, which now seem to have reached a point at which an improvement in prices may be looked for, and trade again be made profitable to the capitalists, points out that the past twelve months have been characterised by movements in the labour market, which in many instances, have been disadvantageous to the employers who have had to complete large contracts upon greatly advanced rates of wages to the workmen. In the chief engineering and shipbuilding centres the wages had been advanced in various degrees from 5 to 10 per cent., and demands for further advances were coming to the front, which were an indication that the wages question was still very much disturbed in many of the industrial districts. Amongst the foremost movements in connection with the labour market that are just now largely occupying attention, the report deals specially with the eight hours' agitation, and the overtime question. With regard to the eight hours' movement, this had of late not only been made a prominent topic for public debate in many ways, but it had become a constant subject for discussion in every trades union and amongst workmen in all the leading industries of the country. Except, however, in the form of legislative enactment for fixing the hours of labour in all trades, and declaring eight hours as the measure of the day's work, there has been no definite plan formulated for giving effect to this proposed limitation of working time. Whilst, however, the leading trades unions were adverse to State intervention in the regulation of working hours for adult male labour, the report points out that they looked hopefully for a speedy limitation of working hours to be brought about by the voluntary cohesion of trades unionists. That view was distinctly put forward by the Council of the Amalgamated Society of Engineers, in their annual report issued in April last, when they proposed to agitate for the abolition of overtime, coupled with higher wages rates, as a means for securing the desired objects of the society. The Steam Enginemakers' Society, in its last annual report issued in February last, also very vigorously opposed all attempts to fix the measure of a working day by legislative means, and relied upon the co-operation of trades unions for the accomplishment of the object in view. Upon the overtime question "the men," adds the report, "do not accept silently the orders of their leaders for its abolition, and will not in many cases consent to abandon its practice, because

able and industrious workmen are quick to see in it the means of increasing their weekly incomes. Hence they rebel against the mandates of their committees, and are glad to work overtime under the advanced rates of pay which accompany it." This statement is true, generally speaking, of all branches of the iron trades. It is, however, emphatically true of the members of the Amalgamated Society of Engineers. In the society's latest annual report it is declared that when the council had ordered the suspension of overtime, protests were sent in against the order which had been given, and workmen from high-rated districts asked for the edict to be removed, "so that they could work unlimited overtime." In this case, therefore, as in all others where the overtime question had been raised, the highest paid and steadiest going workmen are not opposed to overtime and piecework, because they recognise in them the means by which they may raise their social condition, and thus add to the comfort and prosperity of their families. After showing by quotations from the official publications of the workmen's organisations that the trade unions in the engineering industries are making unusual efforts to draw within their influence every skilled workman in their respective trades, the report deals with the hostile attitude recently assumed by some of the trades organisations towards employers of skilled labour. Under repeated threats of expulsion from their unions and the forfeiture of their monetary rights in their funds, the men had been ordered by their leaders to take steps in regard to individual employers, the injustice and immorality of which were of the most glaring type. Amongst other matters, the apprentice question was still attended with friction in many districts, especially in the iron shipbuilding and boilermaking industries, where it might suddenly be forced upon employers under disadvantageous conditions; and as proof of this, it is pointed out that in the annual report issued by the council of the Boilermakers' and Iron Shipbuilders' Trades Union in March last it was dealt with in a manner which showed the adverse feeling of the union to any step which took into the trade a higher number of apprentices than the rules of their society allowed, viz., one apprentice to every five journeymen. Touching upon other matters closely affecting the interests of the engineering and the iron trades, the report reviews the various steps which have been taken during the past twelve months with a view of securing an alteration of the law with regard to the rating of machinery and an amendment of the Employers' Liability Act. By a recent decision it was clear that, according to the law as it now stood, all the spinning machinery in Lancashire, Yorkshire, and other counties was liable to assessment for the relief of the poor; and although the Bill brought in during the session of 1889 dealing with the question of the rating of machinery had been abandoned, it was only fair to conclude that in the Parliamentary session of 1890 the matter would again be brought before the Legislature, and the threatened industries of the country would make common cause in the support of some such measure as that which had for several years been promoted by the Iron Trades' Employers' Association. Another important matter dealt with in the report is the proposed revised schedule of railway rates and charges, and with regard to this matter, it is stated that from different parts of the country during the past few weeks information had reached the Association which showed that their members were alarmed at the new classification of merchandise traffic, and the revised table of rates and terminal charges which had been issued by the railway companies in connection with the Railway Canal Traffic Act. It was feared that new and very onerous conditions were about to be enforced upon them, and at a special meeting of the executive committee it was resolved to engage an expert who should analyse the new tables and state the objections which it might be found desirable to offer on behalf of the members of that Association. The resolution of the executive committee had been carried into effect, a carefully drawn schedule of objections had been officially signed by the secretary, and presented to the Board of Trade. At the present moment it was not possible to add more to this statement, as the matter was now under discussion between the Government officials and the managers of the several railway companies, and would again at an early date be before the general committee of the Association.

## ABSTRACTS OF CONSULAR AND DIPLOMATIC REPORTS.

*France: Trade of Cherbourg in* 1888.—The trade of Cherbourg has not recovered from the check caused by the stoppage of the nightly line of steamers to Weymouth. The iron mine at Diolette has been worked with energy in the past two years, and the results are encouraging. The quality of the ore has improved; and the traces of sulphur, which prevented it from being made into steel, are disappearing. The chief difficulty is the position of the mine under the sea, necessitating heavy expense for pumping to keep it drained. As a result of the activity of the mine, the port of Diolette is more frequented by small British vessels. The deepening of the outer port of Cherbourg has been completed as far as is for the present intended. The times when vessels of large draught can enter or leave are lengthened each tide by nearly two hours; the inner basin is available for vessels of deeper draught than formerly, so that there is not so much occasion for lightening in the roads. Additional steam service between this port and England would probably be successful. The last venture by night failed from discernible causes extraneous to the capacities of the trade, all obviously remediable. The steamers were too expensive and large, intended for more passengers than could at first be expected, and business was checked by their having to meet the competition of the steamers to Southampton, running five nights a week. A smaller class of well engined steamers, conveniently arranged for both goods and passengers, making the voyages both ways by day, and leaving ample time for discharging and loading, are required for this trade. The passenger service ought to be prosperous, there being many persons coming to or going from this locality, Avranches, Cherbourg, Dinan, Dinard, Granville, St. Malo, &c., who would prefer the voyage by this port if it could be made conveniently; but they are deterred by the night passage, and usually go round by Boulogne or Calais.

*Greece: Public works of the Morea.*—The railway from Patras to Pirgos is making good progress, and has been opened as far as Achaia. A railway across the Morea from Argos to Calamatta has been commenced; the breakwater at Patras has been carried out by a French company, and is now a fair protection against winds from north-west and west, and the harbour works will soon be commenced. The managing committee of the Corinth Canal has deferred payment of interest due to the shareholders, the canal was to be completed by 1888 at a cost of £120,000, but this cannot be done before 1891 at double the cost. The canal was to be nearly four miles long, and it was estimated that there would be 10,480,000 cubic yards of excavation. A committee was appointed by the Government to inquire into the difficulties which had arisen, who reported that the time for completing the work should be extended, that the gradients of the sides should be reduced, that the sides should be protected from slips of earth by retaining structures, that the amount of excavation would be increased to 13,100,000 cubic yards, and the cost be increased to £240,000. The time for completion has accordingly been extended to November, 1891. The price of labour continues cheap—about 1s. 6d. per day; many peasants from Bulgaria, Montenegro, and even Asia Minor having found their way to Greece.

*Roumania: Trade of Galatz in* 1888.—British shipping increased by 38,542 tons, or 15 per cent. over 1887, and its proportion of the total tonnage at Sulina from 66 to 71 per cent. The commercial relations between Roumania and Austria-Hungary are still unsatisfactory, negotiations for a new commercial treaty not having made any progress. This has had a serious effect on the imports from that country, which in 1887 decreased by 55 per cent. in volume, and 42·9 per cent. in value under the previous year. The trade thus lost has for the most part gone to Great Britain and Germany, the heavier goods coming from the former by sea and from the latter by rail. The values of the imports were:—

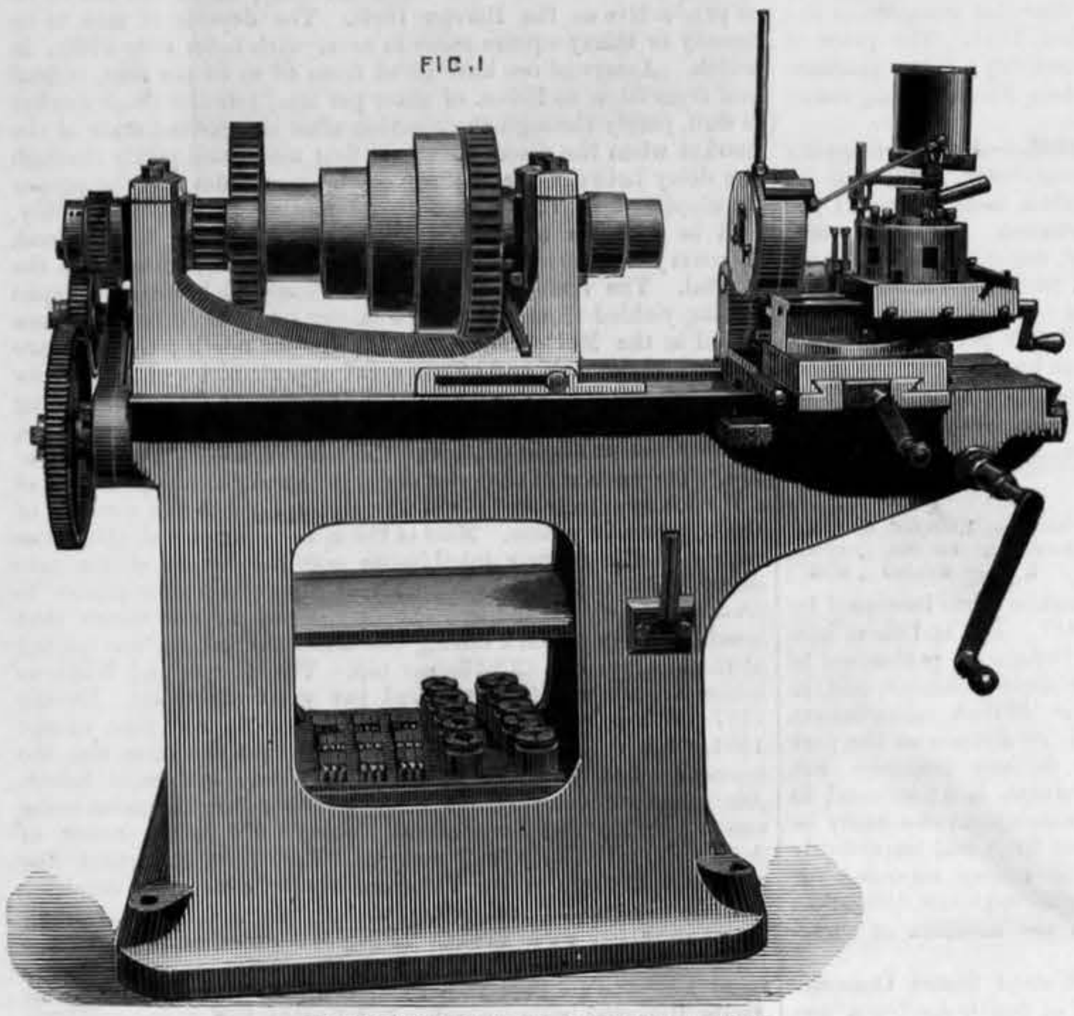
| | 1886. £ | 1887. £ | | £ | Per cent. |
|---|---|---|---|---|---|
| Austria-Hungary | 3,740,000 .. | 2,137,000 .. | decrease, | 1,603,000, or | 42·9 |
| Germany .. .. | 2,933,000 .. | 3,600,000 .. | increase, | 667,000, ,, | 22·8 |
| Great Britain .. | 2,856,000 .. | 3,471,000 .. | ,, | 615,000 ,, | 21·5 |

Coal from Great Britain through the Danube ports increased by 31,000 tons, or 21·25 per cent. over 1887. Bar and sheet iron continue to be imported from Great Britain in preference to other countries, although the price is slightly higher, and in many of the shops there are articles of British manufacture formerly coming from Austria. There is reluctance on the part of some British firms to correspond in any language but English. In most cases French or German is understood in this country, and in cases of difficulty translations can easily be obtained, but English is for the most part little and imperfectly known. There have been instances of orders intended for England having been placed elsewhere through the difficulties connected with the use of English as the medium of correspondence.

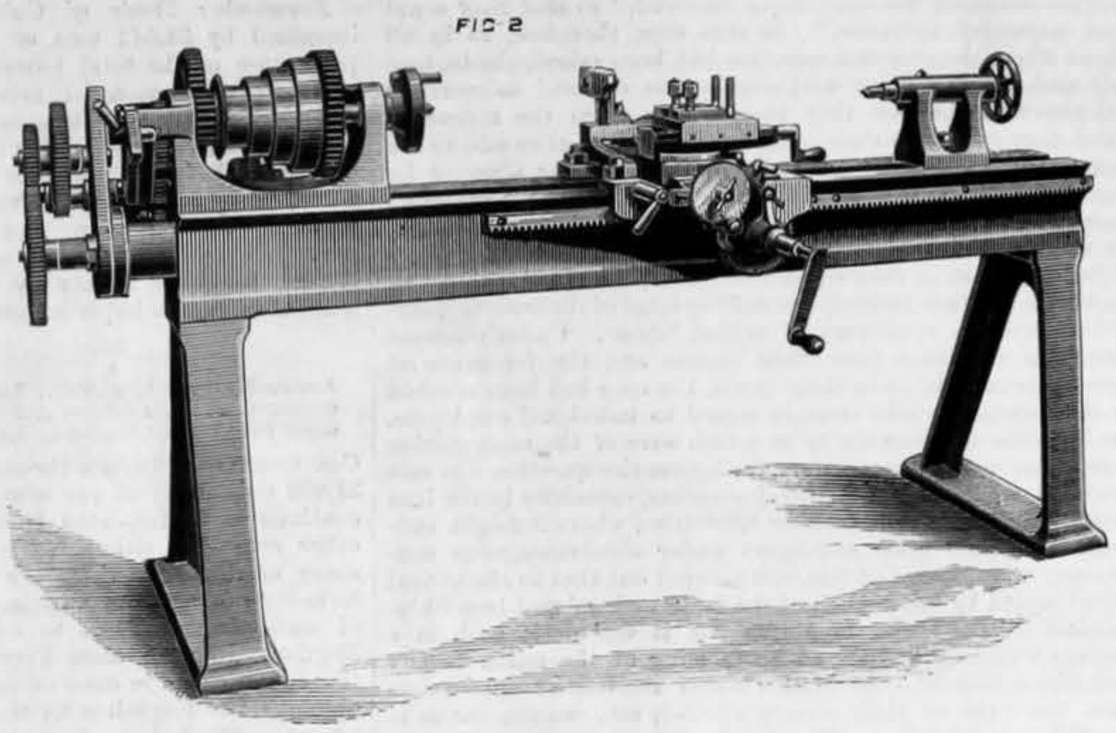
*South Australia, progress of.*—The United States Consular Agent at Adelaide reports:—The colony of South Australia has made rapid strides in civilisation and material progress, in spite of numerous checks from dry seasons, and their inevitable results. At the end of 1887 the population amounted to 317,446, an increase of 68,651, or 27·7 per cent. over 1878. The resources of the country have been better developed, copper, gold, silver, and tin mining are flourishing industries. Agricultural implements, jams, oil, and wine are largely produced, the manufacture of flour has improved and increased largely in the last few years, the introduction of the roller system having given it a great impetus; so the prosperity of the country does not depend so much upon one wheat crop as formerly. The shipping trade shows a large increase both in cargo and passenger steamers, but the sailing vessel trade is gradually decreasing. Shipping entering the port in 1887 increased by 70,500 tons, or 9·15 per cent. over 1886. Though this was a decrease 67,912 tons, or 7·45 per cent. under 1884, the highest year reached, it was an increase of 388,684 tons, or 85·8 per cent. over 1878. The average size of the vessels arriving was 927·7 tons. The tonnage owned and registered in the colony was 34,868 tons, and the average size of the vessels but 113·6 tons. There are two lines of British mail steamers, the Orient and Peninsular and Oriental Companies. In addition the Messageries Maritime Company's boats, and those of the Nord Deutscher Lloyd's Steamship Company call every month, and a company has been organised at Hamburg for running a line of steamers from thence to Australia. There are several lines of British cargo steamers calling; the British India Steam Navigation Company's boats call occasionally, but there are no steamers from the United States, though there is a splendid opening for them. The import trade of the colony in 1887 amounted to £5,274,663, an increase of £283,117, or 5·7 per cent. over 1886; but this amount was slightly less than in 1885, and less by £1,190,250, or 22·4 per cent., than in 1882. English imports fell off between 1885 and 1886 by £815,580, and in 1887 further decreased by £25,875. For this decrease the increasing trade between this colony and New South Wales is mainly responsible. In 1886 the trade between here and Sydney increased over 1885 by nearly £1,035,000, and in 1887 by about £258,750 over 1886. Imports from Queensland have grown 100 per cent. since 1885, when they were valued at £76,590. Trade between this and the remaining colonies during the last three years has had a downward tendency. Imports from the United States declined from £189,377 in 1885 to £176,472 in 1886, and to £118,243 in 1887, a clear indication that this trade, which might be developed to an unlimited extent, is gradually falling away, though there is a wide field here for American enterprise. Among the goods imported in 1887 were:—Coal to the amount of £81,765; agricultural implements, £37,260; hardware, £37,260; iron, bar and rod, £28,980; galvanised, £46,570; machinery, £76,510; oil in bulk, £56,925; wire, £28,989. Great Britain supplied ironmongery, machinery, and every variety of manufactured articles to the extent of 44·1 per cent. of the entire imports. The imports from the United States, 2·25 per cent. of the whole, consisted chiefly of kerosene and other mineral oils, the bulk of American manufactures being comparatively unrepresented. The other colonies furnished 45·1 per cent. of the imports. The recent protective tariff will probably have a deterrent effect upon the import trade, and this will be more marked as time goes on and native manufactures increase; but the tariff is not prohibitive, and the free list is the most extensive of all, consisting chiefly of articles which the Colony has no facilities to produce. The annual value of the exports in a great measure depends upon the crops; but the highest figure ever reached was £5,477,450 in 1884, when there was only a medium harvest. The exports for 1887, owing to the failure of the harvest of 1886 and the dulness of the times, only reached £3,465,761. Of this amount, £1,812,132, or 52·3 per cent., consisting of everything the Colony produced, went to Great Britain, and only £29,090, or ·85 per cent., to the United States. Of the total exports, agricultural implements amounted to £25,667, copper and copper ore to £248,745, iron columns and girders to £6570, manganese ore to £5324, and vehicles to £11,039. The mining industry has received great impetus by the discovery of the Broken Hill and other mines in the Barrier district of New South Wales, about nine miles from the South Australian border. The Broken Hill proprietary mine is one of the richest silver mines ever discovered, and is said to rival even the great Comstock mine. The lode is several miles in length, and varies from 60ft. to 100ft. in breadth. The weekly output of ore varies from 1200 to 1500 tons, which yields from 40oz. to 45oz. of silver per ton. There are numerous other mines in the district which are not doing as well as they might, owing to the difficulty in obtaining machinery to concentrate ores which are easily obtainable from extensive lodes that are not of a rich description. There is a wide field here for the ingenuity of American machinists, who might create an immense trade with this Colony by manufacturing machinery of the nature indicated. Some silver mines of great promise are being developed about 250 miles from Adelaide, which bid fair to be as productive as the Barrier reefs. The deposit is said to be twenty or thirty square miles in area, with lodes over 100ft. in width. Assays of ore have given from 40 to 60 per cent. of lead and from 60oz. to 100oz. of silver per ton; but the share market is dull, partly through the reaction after the excited state of the market when the discoveries were first made, and partly through the delay between the floating of the companies and the proper development of the mines. Gold mining progresses steadily, and in addition to the Teetulka and Woodside finds a fresh discovery is reported beyond Terowie, about 180 miles from the capital. The reefs seem to be exceedingly rich, quartz assayed having yielded from 6oz. to 14 oz. per ton. Gold has also been found in the McDonnel ranges in the far north; the reefs are extensive and rich, and afford great opportunities of fortune for thorough miners. The whole of the machinery for gold crushing and concentrating comes from England and the other colonies, while America might command the whole trade by a little pushing. The revival of the price of copper through the operations of a French syndicate has given a fresh impetus to the working of the copper mines here. Most of the mines were closed, the towns deprived of half their inhabitants and the houses fallen into decay. The rise in price stimulated the mining companies to fresh exertions and induced the opening up of new mines that would not pay to work during the time that copper was quoted at the low figure of £32 10s. per ton. The Moonta and Wallaroo mines are again in full work and pay good dividends. During 1887 the copper exported was the largest in any year except 1884, when the amount was 4572 tons, but the value was the lowest reached except in 1886. The railway system of South Australia extends over 1500 miles, and there are 273 miles being constructed. The lines extend nearly 690 miles north of Adelaide and nearly 200 south. The most important line opened is the one to the Victorian border connecting Adelaide with Melbourne, 510 miles, and with Sydney. There is railway communication with Broken Hills, 310 miles, tapping all the trade from the Barrier district. The trans-continental line from Adelaide to Port Darwin is completed nearly as far as Angle Pole, 690 miles north of Adelaide, but there are 1000 miles to be constructed. A line is being constructed from Palmerston, in the northern territory, to Pine Creek, 146 miles. It is proposed to push this line inland and connect with the trans-continental, but there is considerable difference of opinion here about completing that line. Many are averse to the colony increasing its public debt to the extent necessary for finishing the work, and there seems to be a growing disposition to have it finished on the land grant system. American capitalists of experience in this kind of work will find here a splendid opening. The line will traverse some of the richest grazing and mineral country in Australia, and open up a route that would with efficient steam service bring these colonies several days closer to England. The railway returns show that the total cost of railway construction in the colony was £10,045,955, and the revenue in 1887 £839,715. Deducting working expenses, the net revenue was £451,260, or 4·5 per cent. on the cost of construction. The average interest on the money borrowed was 4 per cent., so that the money invested in railways has, after paying interest on money borrowed, contributed ·5 per cent. profit to the general revenue. This is the best return the railways of the colony have made, for in no previous year have the net receipts been sufficient to pay interest on the cost of construction. The railways have recently been placed under a board of three Commissioners, who are not subject to Parliamentary control. It is hoped that under this management the railways will be considerably more profitable than hitherto. The great cry of the land is for water, of which it is mostly impossible to get too much. The Government has realised this, and is carrying out large schemes for water conservation, such as the construction of large dams and reservoirs where the rainfall is good and the conformation of the country affords facilities for such operations. In drier districts recourse is had to boring. Artesian wells are fairly numerous in the arid bush country, and promise to be a great source of benefit. The rainfall in 1887—25·701in.—has been only exceeded twice in the last twenty-five years. Between 1875 and 1887 the lowest rainfall was 13·434in., in 1876; the average, 20·600in.; the highest, 28·964in., in 1875. With the gradual subsidence of the depression in this colony the glut in the labour market became less pronounced, and there is a fair demand for all kinds of labour, especially artisans and tradesmen, who can always find employment at remunerative rates. The ruling rates of wages are:—Blacksmiths and bricklayers per day, 8s. 4d. to 9s. 4½d.; brickmakers, 12s. 6d. to 13s. 6½d. per thousand; engineers and ironfounders, 8s. 4d. to 11s. 5½d. per day; masons, 10s. 5d. per day; miners, 6s. 3d. to 7s. 3½d. per day; quarrymen, 6s. 3d. per day; sawyers, 8s. 4d. per day; shoeing smiths, 7s. 3½d. to 9s. 4½d. per day; wheelwrights, 9s. 4½d. to 10s. 5d. per day. The question of the admission of Chinese into the colonies is the burning question through all Australia. As far as this colony is concerned the influx of Chinamen has been very small, and in none of the colonies is the Chinese population large enough to cause any alarm. The greatest outcry is from the labouring classes, who fear the competition of the Chinese; and as members of Parliament are largely dependent upon the working classes for their seats, they cry down the Chinamen right or wrong, and endeavour to hide the real cause of the agitation behind the reason that the Chinese are not desirable colonists. The most degraded representatives of that nation are held up as a sample of all. The consequence is that almost the whole land cries out, "Exclude them." There are two classes of Chinamen who emigrate to these colonies—the loafing criminal and the trader. The former class are guilty of those crimes and offences for which both classes are blamed, the latter are law-abiding, steady, thrifty people, whose commercial integrity is beyond cavil, and whose presence is a direct gain to the country. The proper course of legislation should be not to exclude all, but a class, and in this the Chinese Government would co-operate. Increased trade, the development of the mineral resources, and retrenchment in all Government departments, show for the present financial year an estimated surplus of income over expenditure of £179,055, whereas from 1882 to 1887 there has been an annual deficit averaging £243,965 a year. The public debt of the Colony amounts to £21,048,867, averaging £63 2s. 8½d. per head of the population. The interest on this is £877,016, or 4·11 per cent., varying in rate from 4 to 6 per cent., and absorbs nearly one-fifth of the yearly revenue; but as most of the principal was expended upon reproductive works, such as jetties, railways, reservoirs, wharves, &c., it is looked upon as a good investment, and in time will be the backbone of the Colony, which, in all probability, will make far greater progress during the next fifty years of its existence than in the half century just passed.

# THE PARIS EXHIBITION—MACHINE TOOLS.

MESSRS. HULSE AND CO., MANCHESTER, MAKERS.




MPROVED HOLLOW SPINDLE LATHE.




IMPROVED DOUBLE-GEARED SCREW-CUTTING LATHE.

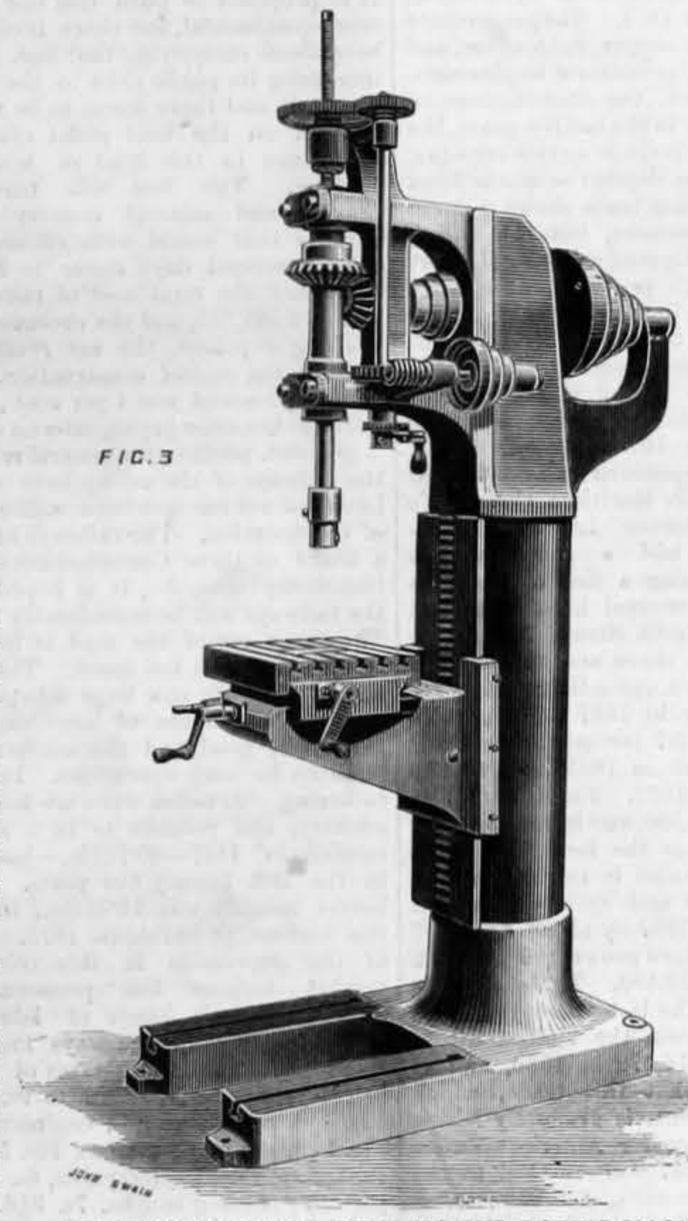
## PARIS EXHIBITION—MACHINE TOOLS.

Messrs. Hulse and Co., Ordsal Works, Manchester, make a fine display of admirable machine tools at the Paris Exhibition, a few of which we illustrate.

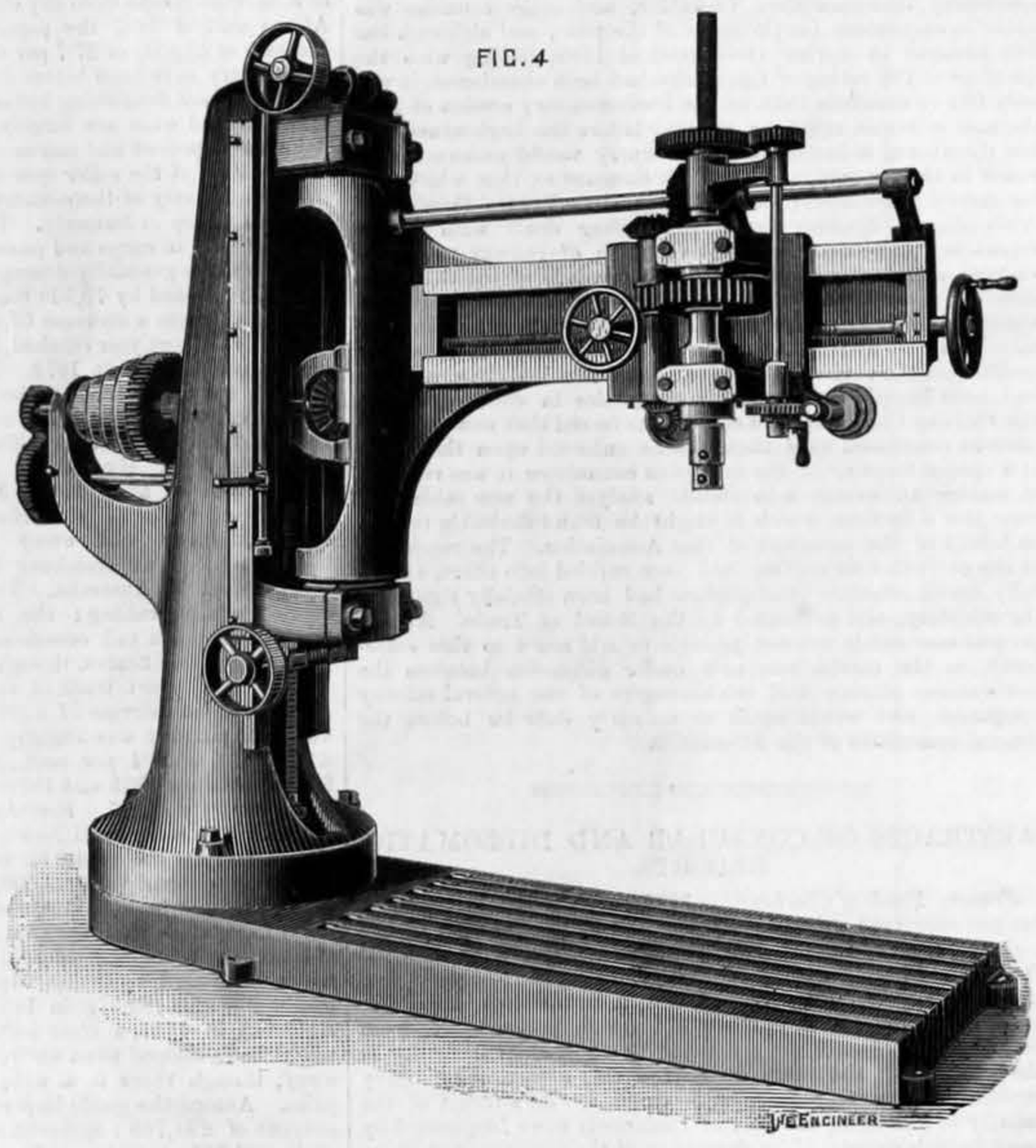
Fig. 2 is an improved double-geared screw-cutting lathe, with independent action for sliding and surfacing. The sliding and surfacing actions are operated by a side shaft driven from the lathe spindle through an independent arrangement of change-wheels, giving three different speeds; and friction clutches, operated at the front of the sliding carriage, are provided for putting the actions in or out of gear instantaneously. The guide screw for screw-cutting is inside the bed, where it is well protected and acts more nearly in the line of the cutting resistance than it would if arranged outside, reversing mechanism acting on both the back shaft, and the guide screw is applied on the fast headstock, and the slide rest has an action for rapidly drawing the cutting tool back from the work and advancing it again. The lathe has 6in. centres, and the bed is 5ft. long.

Fig. 1 is an improved hollow spindle lathe for turning, screwing, and finishing studs, pins, &c., up to 1½in. diameter out of long bars. The bars are passed through the spindle, which is fitted with a concentric chuck for gripping them while being operated on. Immediately each article is completed and cut off, the bar is released and fed forward so as to present a fresh portion to the action of the cutting tools. Much time and expense is saved by this system as compared with the old plan of cutting the bars into lengths and then centreing each length before putting it into the lathe. The lathe has only one headstock, which is double-geared, and is carried upon a bed formed with a trough, for catching the lubricant, and with shelves for holding the cutting tools, &c., not in use. The sliding carriage, movable along the bed either by guide screw or rack and pinion mechanism, at option, holds a capstan rest for six cutters and a screwing apparatus. The several cutters for sliding, ending, chamfering, &c., and the screwing apparatus can be rapidly put in or out of position for operating on the work; and adjustable stops are provided for insuring exact repetition of diameters and length.

Fig. 4 is a 5ft. patent radial drilling and boring machine. It stands on a base-plate, tee-grooved throughout its upper surface. The radial arm is carried by a vertical slide, which is raised and lowered on the upright frame automatically by a screw, 5ft. being admitted under the spindle when in its highest position. The spindle slide is traversed along the arm in either direction by a quick-threaded screw and hand wheels, one upon the slide itself and the other at the end of the arm, for convenience in working. The spindle is rotated by a long revolving tube, with hard gun-metal adjustable bearings above and below, and has a variable self-acting feed motion by a screw, with adjustable nut for taking up end play. Single gearing is provided for drilling, and treble for boring; and these, in conjunction with a four-speeded cone pulley, give eight changes of speed.



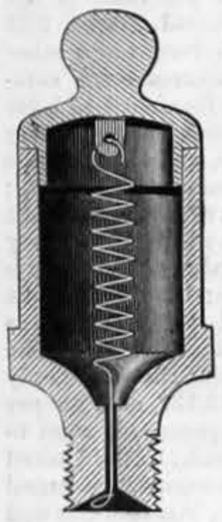

"COLUMN" VERTICAL DRILLING AND BORING MACHINE.




RADIAL DRILLING AND BORING MACHINE.

Girard's Hydraulic Slide Railway.—The invention of Girard, who was killed during the Franco-German war has been again brought forward, and as the *Chemin de Fer Glissant* is now to be seen at work in the Paris Exhibition.

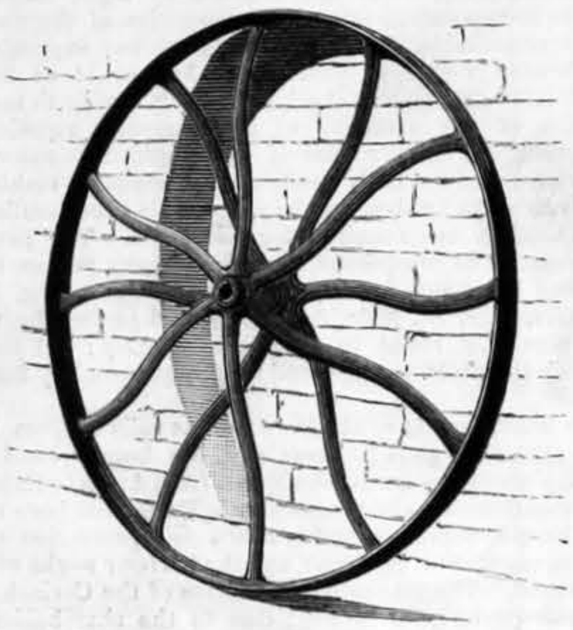
## A SPRING COVER OILER.



The illustration herewith represents an oiler, the cover of which is self-closing, without the screwing on of a cap, as is common with the ordinary oiler. It is manufactured by the Penberthy Injector Company, of Detroit, Michigan. As will be seen by this sectional diagram, the cover is held in place by a spring of fine wire, which passes down through the oil way and is fastened in its concave, threaded base. The filling of the oil cup is readily effected by lifting the cover against the slight tension of the spring, which of course is always sufficient to keep the cover in place in ordinary use, or even against any considerable jar of machinery, while a cover so attached cannot be lost.—*Scientific American.*

## HANSELL'S STEEL WHEELS FOR COLONIAL TRANSPORT WAGONS.

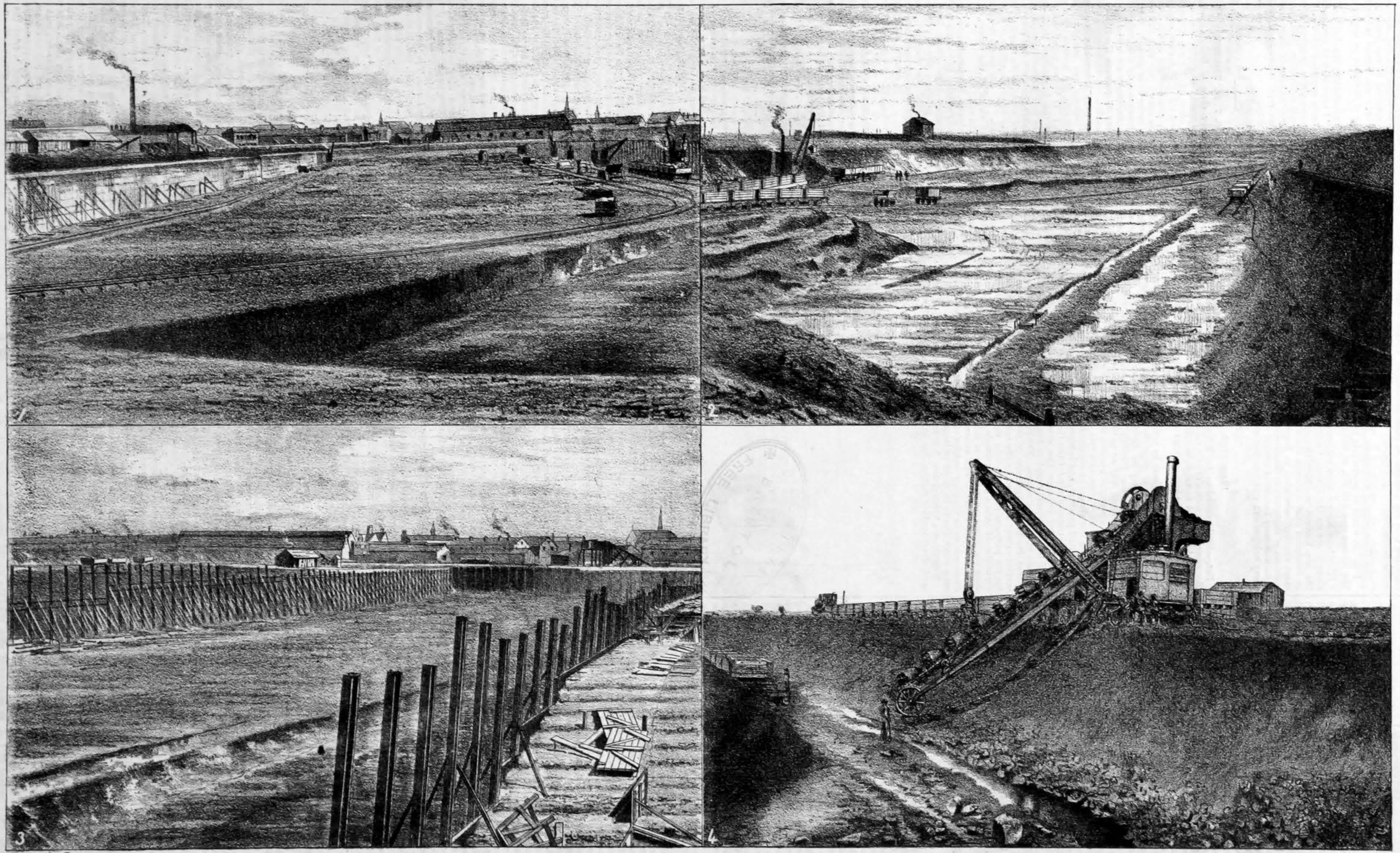
Messrs. Hansell and Co., of Sheffield, may be said to have been one of the pioneers of the steel wheel and steel casting trade, and amongst their many specialities in this line are the above, which were introduced by them as long ago as 1884, and they are particularly busy in this line at present. These wheels are for travelling on rough roads in the colonies, Spain, America, and in hot climates generally in place of built-up wheels, which are so constantly giving way in consequence of the variation of temperature, Hansell's improved wheels being without fastenings or joints, and entirely in one piece. We hear that a large user reports having twenty-five transport wagons now in use, and these wheels have been running under



these upwards of five years, and great satisfaction has resulted. They are now practically as good as new, and the many drawbacks of wood and iron wheels formerly used are now entirely removed through their adoption. The annexed engraving illustrates the article.

# THE MANCHESTER SHIP CANAL.—MANCHESTER DOCKS SECTION.

(*For description see page* 100.)




J. Swain Eng.

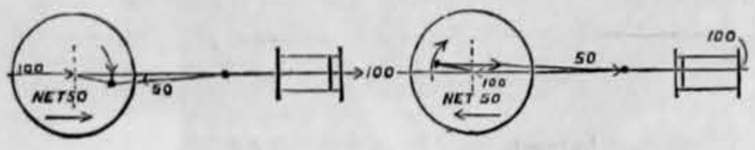
The Engineer

## LETTERS TO THE EDITOR.

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

### UNEXPLAINED DERAILMENTS.

Sir,—When I wrote last week under this head, I referred to the steam acting in one cylinder as causing vibration laterally, in spite of a rigid connection between cylinders, but perceive that I am liable to be misunderstood from having omitted what I had intended further to have written. Those who urge that steam action cannot cause lateral vibration, do so on the claimed fact that owing to rigid frames the power is so distributed that the cylinder acts on each rail with equal effect, and as the steam pressure on the cylinder end has its opposite equal at the axle-box, there can be no tendency to cause lateral movement. Admitting this to be so for argument, it is then perfectly clear that in order to secure perfect equality at the rails the two wheels on the axle must be absolutely rigid; the axle itself must be equally rigid against bending and torsion, and there must be no play whatever in the bearings or axle-box guides. Unless those conditions are observed, it is obvious that the off-wheel cannot take up its share of the work, which consists in rolling forward on the rail and pressing its axle against the forward side of the box. If the forward side of the box is not there to be pressed forward the whole of the work will be done by the near wheel, which will press forward its own side until the frame is so much twisted that the off side has got to the rear sufficiently to encounter the off-side axle, which then urges it forward, but it will be to the rear all the same by the amount of the yielding of wheels and axle and the lost motion. This action constantly changing over from one cylinder to the other cannot fail to cause swaying, and does so, as anyone can see, especially in outside cylinder engines. Inside cylinders are steadier because the cylinder power does not pass through a wheel, an axle, and another wheel to get at the off rail, but has to pass to each rail through an almost equal length of axle and one wheel. It is all very well in half theory to imagine an engine as a self-contained machine giving off power equally at two wheel rims, but this will not answer in practice. Anyone who has watched an American




locomotive move from rest may have observed occasionally that when the axle-boxes have been loose and steam has come between the piston and front cover, the top of the wheel has moved back, under the influence of the pressure, turning as a lever upon the rail as a fulcrum. I say an American engine, because in these the wheel is wholly exposed, and the peculiarity becomes visible. The wheel rolls back, in fact, until the axle-box presses against the rear side of the guides, and then the wheel rolls forward, not under the action of the crank pin, for this rolls it backwards, but under the pressure of the frame on the axle as the frame is forced forward by the steam on the front cover. Thus in a 4ft. wheel with a 2ft. stroke a pressure of one ton in the cylinder pushes the axle-box back with a pressure of half a ton. The cylinder cover advances with one ton pressure. There is thus a net forward action of half a ton. As this is the true action of the steam, it cannot be good practice to assume an engine as self-contained.

Further, when it is argued that steam acting on the frame in one direction through the cylinder cover exactly counterbalances itself by transmitting an opposite pressure through the piston to the axle guides, and therefore the frame side does not tend to move forward, it is quite overlooked that this action only takes place on the assumption that the moving parts have no weight. Actually, the steam pressure on, say, the forward cylinder cover is not resisted by an equal pressure on the axle guides, but by the piston. This, on the dead point, is moving forward over the rail at the same velocity as the cover. Steam is admitted between them, and urges one forward but checks the other. The cylinder cover thus moves forward under steam pressure, which is literally pumped against it by the inertia of the piston, &c. The whole side of the engine moves forward without a corresponding back action. Take the engine when the crank pin is just off the centres, and assume one-half the pressure taken up by inertia. Then for 100 lb. transferred from the cylinder covers to the axle-box we have only 50 lb. opposing pressure. This leaves for the two positions of the crank chosen a net result in one case of 50 lb. forward, and in the other case 50 lb. backward. The engine does not move back simply because of its own inertia, which carries it forward to a position where it can utilise the energy stored in the moving parts; but the activity is there and must have its effect, and this must be on one side only. In fact, while the off-side of the engine is free to continue unimpeded in a forward direction, the working side is for the moment being forced back by steam on the back cover, which acts on the cover with full power when the crank is at a position of least moment and cannot exert forward turning effort. Inertia may thus exert a great influence on the distribution of power which no amount of frame or axle rigidity can conceal, and such influence is probably most severe at high speeds, because of the increase of the inertia action being more rapid than the increase in the rapidity of the alternation. This shows the importance of good axle-box fits, and seems to indicate that inside connected engines will be the steadier.

W. H. Booth.

4, Fenchurch-avenue, July 27th.

### THE LOA VIADUCT.

Sir,—I have just read with great interest the account of the above viaduct in your issues of April 19th and April 26th, and would, with your permission, offer a few comments upon it. The first point that strikes me is its remarkable resemblance to the Kinzua Viaduct on the New York, Erie, and Western Railway in America. The height is about the same, the arrangement of alternate long and short spans very similar, and the construction of the trestles and the mode of bracing them almost identical, with the same features in the Kinzua Viaduct as illustrated in *Engineering* of December 22nd, 1882.

It is very pleasing to see the good points of American engineering being thus adopted by English engineers. There are, however, certain points in which the Loa Viaduct differs from its prototype, and for which I have a difficulty in discovering a justification. The first is the quantity of metal used. At Kinzua a viaduct 2052ft. long, with a maximum height of 301ft. and an average height of 176ft., carrying a 4ft. 8½in. railway, with the heaviest locomotives in use anywhere, was constructed with 1562 tons of iron. At Loa a viaduct 800ft. long, 314ft. maximum height and 170ft. average height, carrying a 2ft. 6in. gauge railway, required 1115 tons of iron. In other words, the Kinzua Viaduct, with a broad gauge and heavy locomotives, contains ·76 of a ton of iron per foot in length, while the Loa, with a narrow gauge railway, with small locomotives, and a rather smaller average height, requires 1·39 tons per foot, or nearly twice as much.

It cannot be urged that the Kinzua is a flimsy or dangerous structure, for all the sizes and strains have been published, and in common with others I have checked considerable portions by calculation, and find the stresses to be by no means excessive. Where, then, is the immense excess of metal at Loa used, and what is its justification? A second point that comes out on inspection is the complicated nature of the girders at Loa, as contrasted with the simple type at Kinzua. I have endeavoured to count the rivets in each of these girders as illustrated, and find only 900 rivets in a 60ft. girder at Kinzua, as against 1500 rivets in an 80ft. girder at Loa. Surely this must mean greater cost, while what advantage is obtained I cannot discover.

These lofty viaducts are of such importance in mountainous countries that the question of their economical design is one well worth discussing.

W. C. Kernot,
Professor of Engineering.

The University of Melbourne, June 17th.

P.S.—It would be interesting to know the cost of the Loa viaduct. The Kinzua cost £49,375, or £24 per foot.—W. C. K.

[Professor Kernot must not suppose that English engineers are likely to set up the Kinzua Viaduct as their model, or to recognise the Loa Viaduct as embodying American practice. He must also be reminded that although the stresses in a structure may be the same whether calculated in England, America, or Australia, the opinions of engineers in the several countries may vary very much as to necessary factors of safety. A larger factor might have saved many bridges and viaducts that we know of.—Ed.]

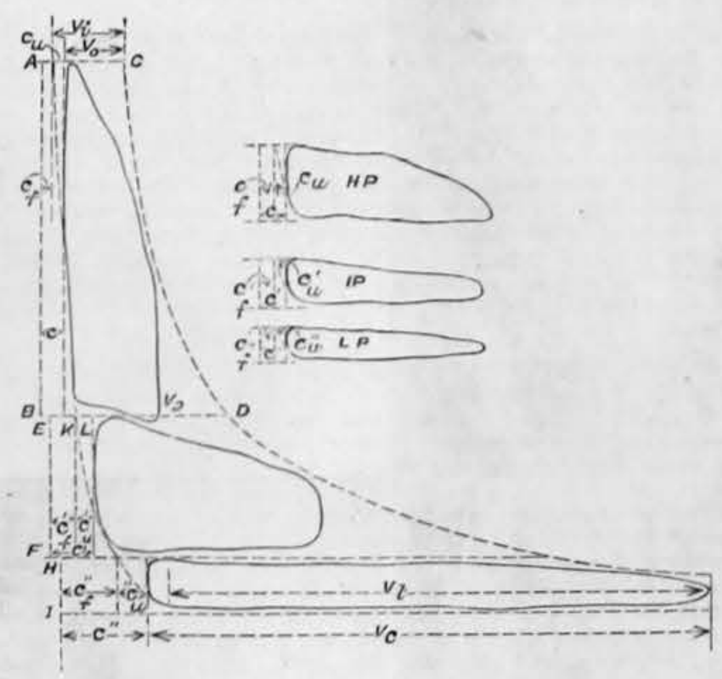
### INDICATOR DIAGRAMS.

Sir,—With regard to Mr. Willett's inquiry concerning indicator diagrams, there seems to be a neglect by text-book writers of that care which should be taken in their combination if the expansion curve obtained is to be compared with any standard curve of expansion.

In the special case given by your correspondent, and also in most compound engines, it is clear that the steam of which the card shows the diagram may be divided into two portions, viz., the working steam passing through the cylinders, and the cushion steam or the amount shut up in the cylinder for compression.

The first is a constant amount for the three cylinder, the second, or cushion steam varies, as a rule, in each cylinder. The amount of the second can always be obtained by producing the compression up to the initial pressure, and is represented in the diagrams by $c_f$, $c'_f$, and $c''_f$ respectively for the H.P., I.P., and L.P. diagrams, and the difference between this amount and the clearance volume added to the volume swept by the piston before cutting off is the amount of working steam. The curve shown by the indicator card is that due to the expansion of these two volumes, and it is to a certain extent distorted by the varying character of the second, and for the purposes of comparison it is necessary that the standard curve should have a proportionate distortion. To obtain this, produce the compression curves of each diagram up to the initial pressure as in the figure. The volume $c_f$ represents the part of the clearance space filled by cushion steam and $c_u$ the portion of clearance which has to be filled by incoming steam.

Now draw a vertical line A B to represent zero volume of H.P. card, draw another vertical line at a distance to the right of this




representing the clearance space, and lay down the H.P. diagram to the scale of combination diagram, then draw the standard curve C D to touch this.

Produce the compression curve down to cut a horizontal line at the initial pressure of the I.P. diagram in the point K. From this point measure off a distance K L corresponding to the volume $c_u$ 1, and lay down the I.P. diagram touching a vertical line through L; draw another vertical line E F at a distance E L representing the clearance volume, then E F will be the line of zero volume for the I.P. cylinder. The same method may be adopted for the L.P. cylinder, and our diagram will be complete, care being taken to form each portion of the standard curve from its own zero line. The standard curve will then show the expansion if the steam remained in the form of steam throughout the cylinders, and the variation of the indicator diagrams from it will give a clue to the actual behaviour of the working fluid.

Moreover, the true ratio of expansion will be seen to be $\frac{v_t}{v_i}$, the volume of the working steam at the point of release divided by its initial volume, not as usually taken, the ratio of volumes swept by the piston $\frac{v_c}{v_o}$, which often bears no closer relation to real ratio than nominal to actual horse-power.

T. P. Rennoldson.

Garfield Chambers, 44, Royal Avenue,
Belfast, July 24th.

### THE REPAIR OF ROADS.

Sir,—I have read with interest your correspondent, "A Ratepayer's," letter, in your issue of the 19th inst., and venture to send you a set of the pamphlets published and distributed gratuitously by this Association, from which you will see that the views expressed by your correspondent are almost identical with the programme laid down by the Roads Improvement Association for securing better roads at a saving to the ratepayers. If he will forward me his address I shall be pleased to send him some of the pamphlets, in the hope that a distribution of them among the members of the local board and surveyor responsible for the road in question may be the means of bringing about the adoption of a better, cheaper, and more efficient system of repair than at present obtains.

John Phillips, Hon. Sec.

The Roads Improvement Association of Great Britain,
57, Basinghall-street, E.C., July 25th.

### HISTORY OF WIRE ROPE CONSTRUCTION.

Sir,—In your issue of June 7th there is a reference to the invention of wire rope. The accompanying statement is taken from a catalogue of the California Wire Works of this city, and I have had occasion to verify its truth:—

"The adaptation of iron wire to the manufacture of ropes is due to Mr. Andrew Smith, a civil engineer by profession, and a native of Dumfriesshire, in the south of Scotland. His first experiments were made in 1828. As a substitute for raw hide ropes, he employed wire counterbalance ropes for shutters and elevators; and the partial success he met with was encouraged by the great advance in the price of Russian hemp. His first patent was dated January 12th, 1835; his second patent was dated March 26th, 1836. A third patent was granted him on December 21st, 1836, and a fourth patent was granted him March 20th, 1839; and at subsequent dates other patents were issued him for improvements in wire ropes and wire rope machinery. Since then wire rope has become an important industry, and has added much to the wealth of the country in helping to develope the iron interests."

Mr. Andrew Smith there referred to was born November 30th, 1798, and died May 17th, 1861; was buried in Dryfesdale churchyard, Lockerbie, in the south of Scotland—a tombstone marks the burial spot.

Mr. Andrew Smith was undoubtedly the original patentee and manufacturer of wire rope. I have been to some pains to hunt up the facts, and find his patents recorded in the "Repertory of Patent Inventions." He was an active member of the Society of Arts, lectured there as far back as 1845 or 1846; had a long lawsuit with Robert Sterling Newall—lately deceased—in regard to wire rope patents; had wire rope works at Great Grimsby, and later at the Isle of Dogs.

A. S. Hallidie.

San Francisco, California,
July 8th.

### WATER-TUBE BOILERS.

Sir,—As makers of every class of boilers, you will scarcely think we have any "axe to grind" in expressing our astonishment at the article in this week's issue on "Water Tube Boilers." Will you kindly inform us who are the "high-class engineering world" who are exchanging the Lancashire for either the Galloway or water-tube boilers? We can assure you that there were never so many Lancashire boilers on order as at present; and, further, that nearly every boilermaker of any repute is making them to work at 100 lb. and 150 lb. pressure, and there are some on order to work at 185 lb. Pray what is there to prevent Lancashire boilers being made to carry these pressures?

You will admit that there were Lancashire boilermakers who in the early seventies were making the present official standard boilers of the official material also, and some in the sixties. Do you think they have gone back? If so, we would recommend you to come and have a look round the Lancashire boiler works, and we will be most happy to give you introductions to go through a number of them; and we believe you will find it extremely difficult to find an equal number of works in the marine, locomotive, and water-tube boiler makers to come alongside of them, either for first-class work or equipment. We can assure you if the Lancashire boilermakers are not as far ahead of the others as they were in seventies, they are still in the van.

What would be very valuable information to us is, where has forced blast been successfully applied to water-tube boilers? Our experience is, that they cannot stand firing equal to ordinary Lancashire boiler every-day practice, namely, 20 lb. of coal per square foot of grate. We shall be glad to know where the water-tube boilers can be seen working satisfactorily doing even this.

Joseph Adamson and Co.

Hyde, July 29th.

### FIRE HOSE CONNECTION FOR LOCOMOTIVES.

Sir,—Noticing a letter in your correspondence column of July 26th upon the above subject, we beg to say that we have, for a number of years, made locomotive injectors with a fire hose branch for the purposes mentioned by your correspondent, Mr. William Warren.

Gresham and Craven, Limited.

Craven Ironworks, Ordsall-lane, Manchester, July 30th.

## THE WHITE STAR LINER TEUTONIC.

The new steamship Teutonic, of the White Star Line, arrived at Liverpool on Monday after her first trial cruise. She is the first merchant vessel built to comply with the conditions of an Admiralty subsidy. As she is to take part in the review of the fleet at Spithead on Saturday, she is fitted with four of her complement of twelve 5in. guns. The guns are to be placed six on either side upon the promenade deck, and those at present in position are fixed at the extremities of the ship.

The vessel has been built by Messrs. Harland and Wolff for Messrs. Ismay, Imrie, and Co., and may be regarded as absolutely the safest ship afloat. She is fitted with twin screws; and the whole of the machinery, engines, boilers, and coal for working either screw independent completely from its neighbour by a fore-and-aft bulkhead, which extends from the after end of the engine-room to the forward end of the foremost coal bunker, and, in fact, intersects the six largest of the twelve watertight compartments made by the eleven ordinary transverse bulkheads. This fore-and-aft bulkhead is pierced by only one locked door, the key of which is held by the chief engineer. The doors between the engine-rooms and the stokeholes are in every instance duplicated, and the duplicate door is in every case under the control of the captain on deck. When liberated they close by their own weight, but they are fitted with glycerine cataracts to ease their descent. In the event of water flowing into the ship the doors will close automatically. As the water rises in the bilge it will buoy up a hollow piston attached to a rod. This rod on being pushed up about 1ft. removes the catch that holds the door.

The engines are triple expansion, with three cylinders of 43in., 68in., and 110in. in diameter, and they have been constructed to develope 17,000-horse power. The pistons have a 5ft. stroke, and the machinery, in accordance with Admiralty requirements, has all been placed below the water line. The boilers are twelve in number. Some are 12ft. and some 12ft. 6in. in diameter and 17ft. long, with six furnaces in each, and a grate area of 1163ft. The furnaces are fed with forced air to a moderate extent above the fuel and under the grate, and the boilers are designed to work up to 180 lb. The initial pressure in the intermediate cylinder is 80 lb., and in the low about 16 lb., with a vacuum of 27in. The full pressure was not reached during the experimental cruise; indeed, some of the furnaces were not lighted, nor has there been, as yet, any trials of the maximum speed. The actual trial will be made in the Atlantic, starting on the Wednesday after the review.

The propellers, which are 21ft. 6in. diameter, with a pitch of 28ft. 6in. and a superficial area of 128ft., form a subject of special interest in this ship on account of the unusual manner in which they are placed. They overlap each other to the extent of 5ft. 6in., or, in other words, they each extend over the centre line 2ft. 9in. The centres of their axles are 16ft. apart, and the port side propeller is 6ft. forward of the starboard, measuring from boss to boss. The port propeller is a left-handed screw and the starboard a right-handed; thus both work away from the ship; and the port propeller working in the loose water of the after screw makes two revolutions a minute more than its twin. The propeller shafts are 199ft. and 205ft. long respectively, and are entirely encased to the boss of the screw. The hull is very much cut away under the stern, and a large space has been cut in the frames to admit of the massive casting that carries the screw shafts. The stern-post is connected with the rudder-post by a bar on the line of the keel in the ordinary way, the scheme of allowing the rudder to be suspended without support below having been abandoned as dangerous.

The vessel herself is 582ft. long—the longest ship afloat—57ft. 6in. broad, 39ft. 4in. deep, and has a gross tonnage of 9685 tons. She has a cutter stem, and, relying wholly on her two sets of engines, the masts are little more than three bare poles without yards. 30ft. up the foremast is a sort of crow's nest for the look-out. Accommodation is provided for 300 first-class, 150 second, and 750 steerage passengers. She has a promenade deck 245ft. long, with a clear way of 18ft. on each side of the deck-houses. Some portion of this promenade is covered by an awning deck, which is used for stowing the boats. For the fittings and decorations throughout the boat, it must suffice to say that they are unusually lavish, even in these days of sumptuous ocean travelling.

## RAILWAY MATTERS.

The convention for the construction of the Athens-Larissa Railway was signed on the 27th ult.

To the close of the past financial year the total amount expended on railways in New Zealand was £14,875,187.

It is stated in the *Colonies and India* that the Tasmanian Government intend commencing the construction of railway rolling stock at Launceston on an extensive scale, having now all the necessary appliances.

It is reported that the New South Wales Government intend to almost immediately proceed with the duplication of the railway from Granville to Liverpool and the Newcastle line between Adamstown and Taralba.

The South Australian Railway Commissioners have, Colonial papers say, decided to adopt the Westinghouse automatic brake on the broad gauge, and the automatic vacuum brake on the narrow gauge lines in the Colony.

The earnings of the St. Gothard Railway are now steadily increasing. Thus, last year they amounted to 2,309,081f., as against 2,172,556f. in the preceding year. It is also said that there is a good increase this year.

The Montreal tubular bridge, according to a current rumour, is threatened with removal and the erection of a modern truss bridge upon its piers by the officials of the Grand Trunk Railway. The estimated cost of the change is set down at about 1,000,000 dols. The American *Engineering News*, however, says the rumour is without substantial grounds.

An interesting lecture was delivered on the 23rd ult. at Simla, by Colonel Le Messurier, on the "Russians in Central Asia," and was based on his personal experience. Dealing with the question of steam transport on the Caspian, he stated that the Russians, even with their present steamers, were able to convey 47,000 men from Batoum to Uzun Ada, the starting point of the Transcaspian Railway, in twelve days. The railway, he said, had been pushed forward 2½ miles daily, and would now be carried northwards to join the great Siberian-Pacific Railway. When that line had been completed, twelve days only would be required to go from St. Petersburg to Vladivostock, and fifteen days to Pekin.

A German contemporary gives some interesting comparisons between the earnings of railways and tramways in Berlin. For instance, the average diurnal earnings of Prussian railways last year amounted to 27 marks, whereas the earnings of the Great Berlin Tramway Company reached 40·3 marks a day per car. If the number of seats in the two kinds of conveyances be compared whilst they are running, it appears that a seat in a railway carriage only yielded 63 pfennigge in twenty-four hours, as against 2 marks by a seat in a tram car in eighteen hours. Although the contemporary quoted by the *Railway News* says the two means of traffic are difficult to compare, these figures should certainly have attention in the fixing of railway rates.

Professor Milne, of the Seismological Society of Japan, has invented what the *Railway News* thinks a very interesting self-recording instrument for railway trains. "It shows when a train stops, for how long, and whether at a station, signal, or siding. It indicates also the upward and downward vibrations due to the condition of permanent way, and points out the defects in bridges, sleepers, and ballast, as well as vibrations due to oscillation of the train. The mechanism has, it is stated, worked satisfactorily in Japan, and on a journey across the American continent, and arrangements are being made for having it tried on some of the English and Scotch lines." It would be pleasant to think that some useful purpose had been found for these much-talked-of jog instruments, but the above-mentioned seems to be as useless as those for the continuous record of earth tremours. Such an instrument would, for instance, register a good many miles while the train stood at the ticket platform on Battersea Bridge.

The Bill recently signed by the Governor of New York State, allowing the street railroad companies to substitute mechanical motive power for horses, is, the *Electrical World* observes, an important one. We hope in time to see it lead to a general use of electric motors on the roads in this city, but we apprehend that its first effect will be to encourage cable traction, for the reason that for some years past one or two roads have had their minds fixed on cables, and will not be satisfied till they have given them a trial. The difficulty about the destruction of old and new street paving is, however, a serious one, and it may stand in the way of cable work on an extensive scale. The situation, in fact, is not an unfavourable one for electricity, and we expect to see it availed of for the introduction of one or other of the systems of electric traction. Boston has been setting New York a brilliant example in this respect, but it is still open to New York to bring itself abreast of the improvements of the day and hour in urban passenger traffic.

The last quarterly return of railway accidents and casualties in the United Kingdom shows that the three months ended March 31st last cannot on the whole be compared favourably with the corresponding period of 1888. In one respect, indeed, passengers were more fortunate, inasmuch as only eighteen were killed this year, a decrease of five; but of injured passengers there were 400 instead of 344. One hundred servants of companies or contractors were killed, instead of 88, and the injured were 688 in number, showing the large increase of 137. Sixteen persons were killed and nine injured, while passing over railway crossings, instead of twelve and nine; 87 trespassers—this includes suicides, of whom there were 21—were killed and 25 injured, instead of 71 and 22 respectively; and of other persons not classified four were killed and seventeen injured. Altogether the list for the first quarter of the year shows 225 killed and 1139 injured, in place of 209 killed and 934 injured in the corresponding period of 1888. Several accidents, however, occur at railway stations or on railway premises besides what are caused by the movement of railway vehicles. If these are included, the total number of personal accidents reported to the Board of Trade by the several companies amounts to 239 persons killed and 2660 injured.

The Delagoa Bay railroad war, says the *Railroad Gazette*, is not a large one, but it presents several interesting features, which our American contemporary presents characteristically in the following:—"Some four years ago Portugal granted a charter to an Anglo-American company authorising it to build a railroad fifty-eight miles long, connecting Delagoa, in Portuguese Africa, with the Transvaal gold fields. Fifty-four miles were completed more than a year ago, and have been open for traffic ever since; but the remaining four miles lay in an extremely difficult country, and could not be finished within the time limit contemplated by the charter. On this account the Portuguese Government declared the concession forfeited, and apparently attempted to take possession of the road without regard for the rights of the company. But this was not so easy. England took the matter seriously, and promptly arranged to send a gunboat to the point threatened. We seemed to be on the eve of a railroad war between England and Portugal. But more peaceful counsels prevailed. The gunboat frightened the Portuguese more effectively than a general freight agent could have done. This is not because a gunboat is in itself more dangerous than a general freight agent. On the contrary, we are convinced that more property has been destroyed in the last ten years by general freight agents than by gunboats. But a gunboat, armed with modern weapons of precision, usually hits what it aims at, while a general freight agent, armed with irresponsible authority, does not. We commend the study of this distinction to presidents who think of engaging in railroad wars."

## NOTES AND MEMORANDA.

It is said that Chicago has now a population of more than a million.

In London last week 2376 births and 1553 deaths were registered. Allowing for increase of population, the births were 411, and the deaths 275, below the average numbers in the corresponding weeks of the last ten years.

The cost of the working of the electric light in Leeds is given by Mr. Hewson, M.I.C.E., the borough engineer, as about 1d. per hour for four 16-candle lamps, and he thinks that the cost of eight 10-candle lamps would also be about 1d. per hour; that is to say, the cost inside the works.

According to an American paper, the cost of distribution of food in American towns is very great. The distribution of bread, after it is baked, now costs the average workman in a city as much as it does to grow the wheat, mill it, barrel it, move it 1500 miles, and convert it into bread, all put together.

The annual death-rate in London per 1000 from all causes, which had been 19·3 and 18·7 in the two preceding weeks, further declined last week to 18·6. During the first four weeks of the current quarter the mean death-rate was 18·2 per 1000, and was 2·5 below the mean rate in the corresponding periods of the ten years 1879-1888.

An incandescent lamp known as the Backstrom lamp has a filament of carbonised silk; the filament is of high resistance and is run at three watts per candle, the 16 candle-power lamp absorbing 49 watts, so that 15 may be said to go to an electric horse-power. In the interior of the globe the filament passes through an eyelet, so that vibrations of a sufficient amplitude to break the filament are prevented.

Last year the United States production of lead increased to 180,555 short tons from 160,700 tons in 1887. The increase was due principally to the heavier receipts of lead in Mexican silver-lead ores from 15,000 tons in 1887 to over 27,000 tons in 1888. The average price in New York was 4·41 cents per pound. The production of white lead, chiefly from pig lead, was 89,000 short tons, valued at 10,680,000 dols.

A new artificial leather is described in an English patent of 1888 by N. F. E. Rapeand as follows:—"Leather refuse or cuttings are ground and made into a fibrous paste, with which is mixed a glue or gelatinous compound containing fatty matter and glycerine. The paste may be spread and formed into plates by machinery, to be afterwards rolled and calendered. As exemplifying the composition, the following proportions may be taken:—Leather refuse, 78—90 parts; gelatine, 4—8 parts; tallow, 1—2 parts; glycerine, 5—12 parts."

A paper on "A Flow of Molten Glass occasioned by the Accidental Piercing of a Glass Furnace," was recently read before the Paris Academy of Sciences by M. F. Fouqué. An account is given of the sudden escape of about 4000 kilos. of molten glass from the Clichy-la-Garenne Works, and a comparison is drawn between the action of the discharge and that of volcanic lavas. The absence of bubbles near the surface of the former, and the other differences noticed between the two streams, are attributed mainly to the different chemical composition of the initial magma of each substance. The wollastonite peculiar to the vitreous flow solidifies under very different conditions from those of the feldspars and ferro-magnesian bisilicates occurring in the molten lavas.

In their report on the water supplied to London during June, Mr. William Crookes, F.R.S., Dr. William Odling, and Dr. C. Meymott Tidy, say, during the past month the progressive increase in degree of freedom from organic matter, manifested by the water supply during the first five months of the year successively, was not found to be sustained. Taking the Thames derived water for comparison, the mean proportion of organic carbon present in 100,000 parts of the water, during each of the first six months of the year respectively, was found to be as set forth below—the mean proportion of ·144 grain of organic carbon observed during the month of May, corresponding as nearly as may be to about a quarter of a grain of organic matter per gallon:—January, ·170; February, ·161; March, ·161; April, ·154; May, ·144; June ·157.

In the neighbourhood of Ekaterinburg, in the Province of Perm, an apple-green clay containing nickel was long ago discovered. The *Journal of the Society of Chemical Industry* says:—"It contains a very pure hydrated nickel and magnesium silicate, and is free from cobalt, sulphur, and arsenic. 330,000 puds—1 pud = 40 lb.—of this ore have of late years been treated. By the metallurgical process a nickel containing 97 per cent. of the pure metal may be obtained. Large quantities of this ore occur in a quartz vein which, it is calculated, will certainly yield 200,000 puds of metallic nickel. Recent analyses by Huntingdon prove that the ore from the quartz vein contains about 7 per cent., and the soft ore 14—19 per cent. of nickelous oxide. It is proposed to prepare the pure metal electrolytically. Samples of the latter have given an excellent alloy with steel and aluminium. The alloy contains 60 per cent. of iron, 20 per cent. of nickel, and 20 per cent. of aluminium."

A method of making grained negatives for zinc etching without a screen is described by W. T. Wilkinson in the *Photographic News*. This is done by coating the plates with an emulsion containing sulphate of baryta in very fine powder, and well shaken up before coating. Pictures are taken upon these plates, and developed and fixed in the usual way; but the image, instead of being smooth and nice, will be covered with myriads of fine pinholes. These negatives are used for printing on the zinc in bitumen, then etched in relief for type blocks. Instead of sulphate of baryta, carbonate of soda, &c., may be used in the emulsion, and, after fixing, immersion in weak acid will develope the pinholes. The bromo-chloride emulsion may be used upon collotype plates, followed by drying them in the oven at a high temperature, exposing under a reversed negative. Develope and ink up as for the paper; pull the transfers upon ordinary lithograph transfer paper. To obtain a coarser grain, soaking in warm water will develope the reticulation.

Mr. H. P. Woodward, Government Geologist for Western Australia, sends *Nature* some interesting particulars of both coal and tin discoveries in that colony. He writes:—"On the south coast, where a small stream flows out, called Fly Brook, coal has been found of a very good quality, but there is no port nearer than Albany or Vasse, and this latter is not a good one. There seems to be a line of coal-bearing country between the coast range, which runs north and south from Cape Leeuwin to Cape Naturalist and the main highlands; much of it covered with sand and swamps at the surface, but under which, I believe, we shall find coal-measures which may extend west beneath Perth to the Irwin river. There is one 5ft. seam and several smaller, averaging 17ft. of coal in 200ft. of rock. There are two or three outcrops in the bed of the Creek of a much-weathered but good coal, some of which is highly bituminous. In the Fitzgerald coalfield is only brown coal or lignite of no value, but there is some good-looking gold-bearing country near it. At a place called Bridgetown tin has been found. Little work has been done yet, but, as far as I am able to judge, it seems to indicate the biggest thing of the kind that has ever been found. One shaft, 18ft. deep, will wash all the way down at about 4 lb. or 5 lb. to the pan, and they have not got to the bottom of it yet. The richest works in other colonies are rarely more than 2ft. or 3ft. deep. Tin has been found at the surface, in the sand, over an area of about 100 square miles, but no sinking, except the one shaft, has yet been made; and as the surface is covered, either with sand or clay ironstone, the formation cannot be seen at all."

## MISCELLANEA.

Messrs. Wheatley Kirk, Price, and Goulty have issued a catalogue with particulars and plan of the Britannia Works, Birkenhead, and of the plant and machinery, &c., which they are instructed to sell by auction on the 7th, 8th, and 9th of this month.

There appears to be some truth in the rumours from Baku, to the effect that a permanent decrease is showing itself in the production of naphtha in that region. Many new borings have been made, but the results by no means realise the hopes or expectations of the speculators.

The effects of a terrible storm, which swept over Szegedin on the 24th and 25th ult., are reported. A *Times* correspondent says, the gale blew down the circus in the town, carried away twenty-one windmills out of twenty-four in the environs, and caused the deaths of nine persons.

We have received a copy of a report of the Electric Lighting Committee of the Town Council of Leeds, which contains a review of the proceedings of the Committee since its formation and the particulars of a scheme for lighting the town from a central station. The report also refers to the recent proposals and accepted suggestions of the Committee, and shows that the subject is under serious consideration, and that Leeds means to move, but not too quickly.

The Union Steamship Company's Royal Mail Steamer Tartar, which arrived at Southampton at 4.15 a.m., on Sunday, 28th July, has made a very rapid passage from Cape Town. She left that port at 5.43 p.m. on the 10th July, and the distance run, 5986 miles, *vid* Madeira, was accomplished in 17 days 10 hours 32 minutes, gross time, the net steaming time being 17 days 6 hours 11 minutes, giving an average speed over the whole distance of 14·5 knots per hour.

Messrs. C. Isler and Co., London, have recently completed some noteworthy artesian wells, amongst them one at Messrs. C. Vaux and Sons' brewery, Sunderland, a 7¼in. internal diameter tube well, 221ft. deep, through magnesian limestone. The supply obtained exceeds 3000 gallons per hour, and is pronounced of excellent quality. At the Friary and Holroyd's Brewery Company, Guildford, a supply has recently been obtained from a 350ft. tube well. Several others are in course of sinking.

We hear that one of the largest firms of manufacturers of traction engines in Great Britain are considering the manufacture of Proctor's steam diggers, and that an arrangement is being negotiated with Messrs. C. Burrell, and Sons, the present sole manufacturers, whereby a sub-licence will be granted to the firm in question. Should this arrangement be carried out, the opposition to the improved system of digging land will in a very great measure be done away with, and a strong impetus will be given to the manufacture of steam diggers.

The Government Geologist of New South Wales has prepared a map showing the areas within which artesian water-supplies may be bored for with good prospects of success. Water-bearing formations extend for 60,000 square miles in the arid parts of the colony, where permanent supplies are most needed; and the system of artesian wells is being widely adopted throughout Australia with the most satisfactory results. Large tracts of good pastoral country, which have hitherto been totally valueless through the want of a regular water supply all the year round, are now, it is said, capable of supporting flocks and herds.

The "Journal" of the British Society of Mining Students for June shows that this Society is well supported by active members, some of whom contribute excellent papers. The journal is well printed, and the June number contains a larger number of illustrations than usual, and many are inserted in the text, which is carefully edited. The papers include "Coal Cutting by Electricity," by H. W. Hughes; "Hydraulic Pumping," by W. Walker, jun.; "Description of Seams and some Methods of Working in the Forest of Dean Coalfield," by J. J. Joynes; and "Historical Notes on Underground Haulage," by H. F. Bulman.

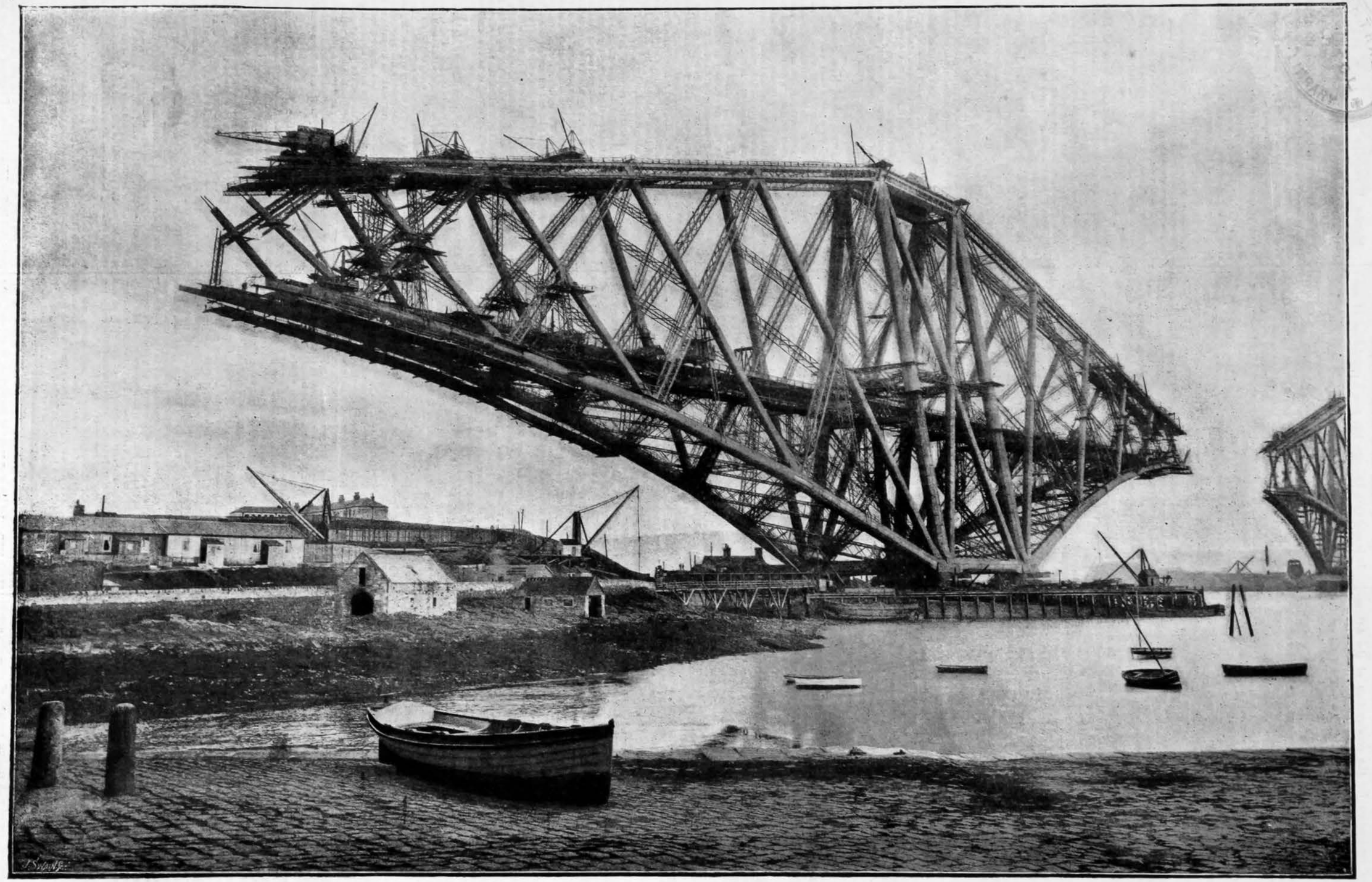
The Sims-Edison electric torpedo is described as follows in the *Scientific American*:—"The torpedo consists of a submerged portion attached to a float having the form of a boat. The submerged portion is a spindle-shaped copper shell containing the propelling machinery, a cable by which the current is conveyed to the electric motor and steering apparatus, and a charge of dynamite or other explosive. The spindle-shaped shell is connected with the float at the bow by means of a triangular steel frame, and at the stern by a post and an angled bar. The float, which is of copper, is made air-tight and filled with buoyant material, so that if it should be perforated it will still be able to sustain the submerged part. The triangular frame which connects the two parts at the bow extends up over the top of the float, and serves to either lift obstacles with which the torpedo comes in contact or to depress the torpedo, enabling it to run underneath the obstruction."

The monthly report of the Steam Engine Makers' Society just issued is very much a repetition of the preceding one. The reports from various districts are to the effect that there is continued activity in all branches of trade, with employers frequently requiring men who cannot in all cases be supplied. There is certainly no indication in the reports of any approaching slackening off in the activity prevailing throughout the industrial centres. Most of the works have sufficient work to keep them fully employed all through the present year, and in some instances well into the ensuing year. The returns as to employment show a slight but almost inperceptible decrease, the percentage of out-of-work members being in fact now so small that it can scarcely undergo further reduction. It remains at a little under 2½ per cent. of the total membership on actual donation, and this is the lowest percentage of unemployed that has been recorded for a number of years past.

The following information respecting the river and canal traffic of Germany in 1887 relates to vessels and rafts navigating the rivers and canals mentioned, and whose arrival or departure has been notified at the places specified:—On the Nieman, at Schmaleningken; the Vistula, at Thorn; the Canal of Bromberg, at the second lock; the Oder, at Ohlau; the Spree, at Berlin; the Elbe, at Hamburg; the Weser, at Bremen; the Ems, at Nieppen; the Rhine, at Emmerich and Mannheim; the Sarre, at Gudingue; and the canal from the Rhine to the Marne, at Altkirch—frontier of Alsace. The total traffic, ascending and descending, reported at the above places, attained the following proportions in 1887:—132,863 boats with cargoes, and 35,989 without cargoes, amounting in all to a total of 168,852 boats, with a tonnage of 28,577,000 tons against 157,722 boats with a tonnage of 26,210,000 in 1886; and 146,378 boats, with a tonnage of 22,951,000, for the average of the years 1881 to 1885. M. Hewin Belle, the French Consul-General at Franfort-on-the-Marne, from whose report these particulars are taken, states that previous to the year 1881 there were no complete returns relating to German river and canal traffic. The weight of goods shipped on these boats amounted in 1887 to 17,568,000 tons, in 1886 to 16,002,009 tons, and for the average of the years 1881 to 1885 to 14,318,000 tons. The increase in the general movement at the places mentioned above, in the year 1887, as compared with the average of the preceding years, was, for the number of boats, 15·4 per cent.; for the capacity of the vessels, 24·5 per cent.; and for the quantity of goods shipped, 22·7 per cent. The tonnage of the rafts passing the localities in question amounted in 1887 to 2,217,000 tons, in 1886 to 2,061,000 tons, and for the average of the years 1881-1885 to 2,313,000 tons. Compared with the last figure the falling off in 1886 was at the rate of 11·1 per cent., and in 1887 4·4 per cent. Berlin, Hamburg, and Emmerich are the most important centres of German river and canal navigation.

THE FORTH BRIDGE.—FIFE CANTILEVERS, MAY 24TH, 1889.

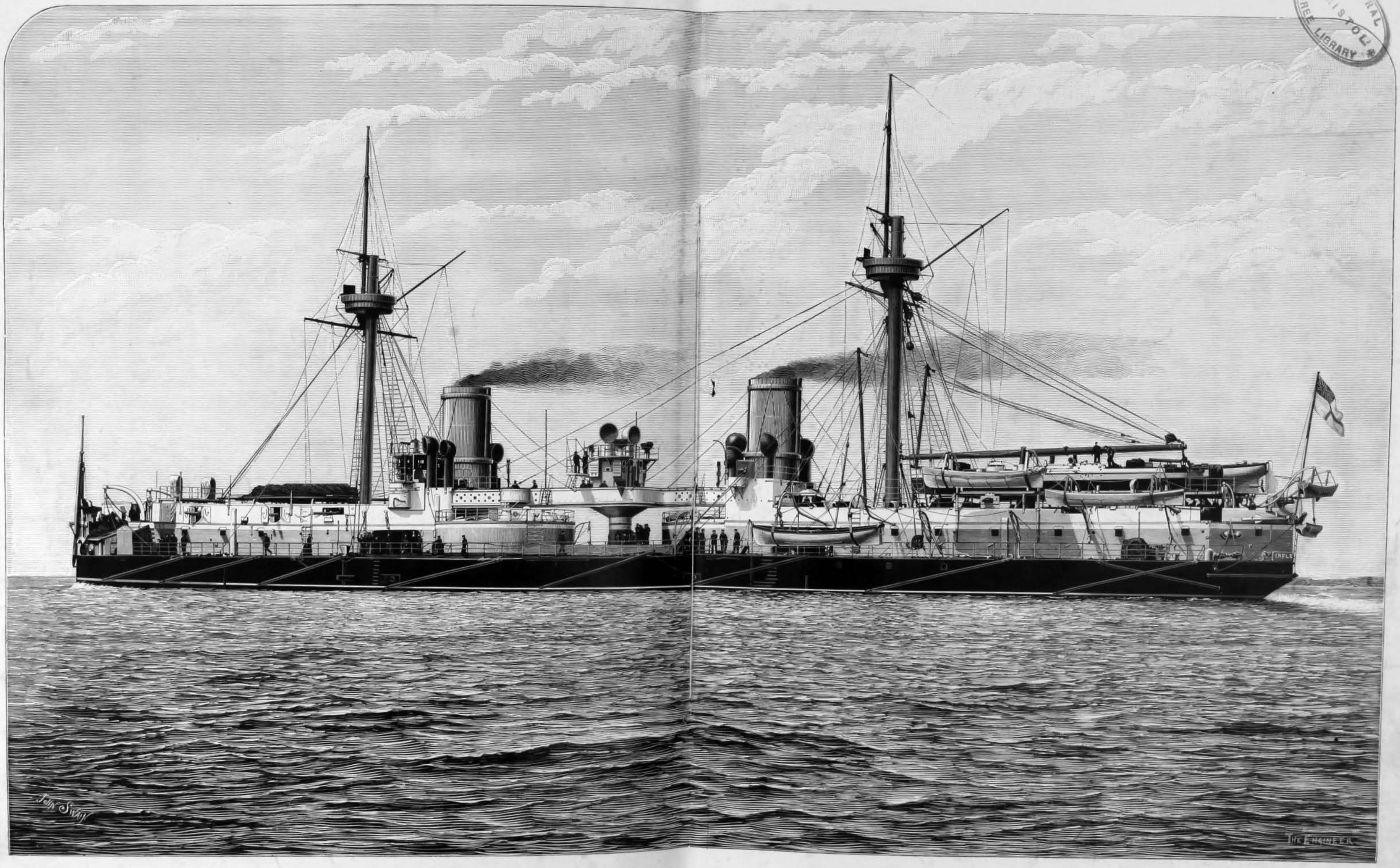
(*For description see page* 102.)



[Supplement to THE ENGINEER, August 2, 1889.

# HER MAJESTY'S FIRST-CLASS BATTLE-SHIP INFLEXIBLE, 11,800 TONS.

CONSTRUCTED AT PORTSMOUTH DOCKYARD.



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## TO CORRESPONDENTS.

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JUVENIS.—*We fail to understand your question. What Government appointment have you in your mind? We know of nothing outside the Navy and the Indian Service which seems likely to meet your ideas.*

J. L.—*The best book on cranes and lifting machinery is in German—"Die Hebezeuge, theorie and kritik ausgeführter konstruktionen," by Rd. Ernst, published in Berlin by Julius Springer, two vols. A book on cranes of the fully-descriptive and well-illustrated catalogue kind, by H. R. Towne, is published by Spon. Cranes of the kind you mention have been illustrated in the "Annales Industrielles," the "Portefeuille Economique des Machines," and also in* THE ENGINEER. *Most of these can be seen in the Patent-office Library. The pump book depends on what sort of pumps and machinery you refer to. A useful little book by P. R. Björling on pump making is published by E. and F. N. Spon. There is also a book on pumps, "Hydraulic Power and Hydraulic Machinery," by Henry Robinson, M.I.C.E., and published by Chas. Griffin and Co.*

### MACHINE FOR CLEANING WASTE.

*(To the Editor of The Engineer.)*

SIR,—We have an inquiry for a machine for cleaning waste, and shall be much obliged if your readers can let us know who make such a thing.

July 31st. S. A.

### SCANTLINGS IN ROOF STRUCTURES.

*(To the Editor of The Engineer.)*

SIR,—Will any of your readers kindly tell me the readiest mode of ascertaining the sizes of T or ⊐ iron for rafters in trussed rafter and queen rod iron roofs up to 100ft. span; also any formulæ that there may be for the struts and braces? I find no difficulty in ascertaining the "strains." There are innumerable books on the subject, but having found the strains and tested my work by the proportions given in Hurst, it appears to me that the sizes given there are amply strong enough in the case of small spans, but too close to the breaking weight for large spans. This is discouraging. What I want is—knowing the span, and having found the weight per foot super, to be able to find the necessary scantlings in an examination room, without being able to look up. I shall be glad to know of any book that will help me.

July 31st. ARCHITECTURAL STUDENT.

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# THE ENGINEER.

*AUGUST* 2, 1889.

### UNEXPLAINED DERAILMENTS.

THE useful feature in Mr. Wiseman's paper published in our impression for June 28th, was that it called attention to a subject of some importance. It is not to be supposed that we are prepared to accept all the author's conclusions as correct. The discussion now going on in our pages unfortunately only goes over very old ground. For example, all that Mr. Booth has to say in his letter appeared in very nearly the same form about twenty-eight years ago in the pages of the *Mechanics' Magazine*. No one will dispute that his conclusions are in the main sound as far as they go, but they are practically of no moment in this connection, and have really little or nothing to do with derailments. The idea that an outside-cylinder engine is more likely to leave the rails than an inside-cylinder engine, because of the lateral action of the pistons, will not be readily accepted by anyone who has had much experience with both classes of engine. All those who have hitherto taken part in the discussion have curiously enough failed to see the way in which an outside-cylinder engine is worse than one with the cylinders inside. It is the variable lifting action on the guide bars that does harm, if any is really done. We may very readily have a pressure of about ten tons on a piston, and in certain positions of the crank as much as one-fifth of this may be exerted on the top guide bar. As the piston approaches the end of its stroke, this vertical effort dies away to nothing. It is at a maximum and at a minimum twice in each revolution. We have one leading corner first lifted with a force of two tons, and then the other leading corner of the engine raised with a similar force. Now, furthermore, it is known that when an engine lurches, the load on the wheels is altered. Experiments made in France have gone to show that a rocking engine—which must not be confounded with a "boxer"—may put no load at all for an appreciable period on first one leading spring and then on the other. The consequences entailed should the up thrust on the guide bars synchronise with a lurch will be readily understood. It is this upheaving effort that is to be avoided, and it is notorious that engines with outside inclined cylinders are unsteady, other things being equal, in about the ratio of the square of the angle of inclination.

So much being said about the oscillation of locomotives, we may endeavour to draw our readers back to the question really at issue. Are there really any such things as inexplicable derailments? And if there are, do they invariably take place under conditions which leave no doubt that the cause must be sought for in the engine? Our reply to the first question is that, when the truth is told by railway employés, a derailment is seldom, if ever, inexplicable. Some puzzles are presented, however, at very long intervals. It has fallen to our lot to see two curious derailments, and we give the particulars, because they show how small a bearing what has been written hitherto in our pages has on the subject. In the first case, a four-wheeled goods van was being shunted at a roadside station. The engine pushed it at a moderate pace and then left it to itself. The van had no brake. It crossed the switch and entered a long straight siding, and when running at about five miles an hour the trailing wheels left the road. A most careful examination of the road failed to give any explanation. The wheel mounted the rail, and the mark of the flange was on the rail. The rail was of iron, in very fair condition. There was no drop in the road, which was well ballasted. Measurement showed that the gauge was about $\frac{1}{8}$in. tight. The van was empty. A ramp was extemporised, a tow rope attached to the engine, and the van, apparently none the worse, was pulled on the rails again in less than ten minutes, and safely lodged against the stop block. In the second case, a goods train, drawn by a six-coupled engine, ran with steam off at a very slow pace through a junction. The line was gently curved and in beautiful order. The engine passed over a crossing all right, and ran about twenty yards along the main up line, when, without any preliminary notice or lurch, its leading wheels left the rails, and it ran for a couple of yards, bumping over the sleepers. Then the driving wheels left the rails, and the whole came to a stand. Not the smallest clue could be got as to why the engine got off. Our own opinion formed at the time was, that the super-elevation of the outer rail was too great for the slow speed. The engine ran off inside. No one was hurt, nor was there any damage done, save a few leaves broken in one leading spring. It is obvious that in these cases none of the causes so fully described by our correspondents could have operated.

Many years ago Mr. D. K. Clark carried out numerous experiments on locomotives. He found that lateral oscillation could be almost wholly prevented by careful balancing. But there is reason to think that Mr. Clark drew certain deductions which are not strictly consonant with the facts. He had to do with engines very imperfectly balanced, and these he greatly improved by working on proper principles. He may be said to have done all that balancing could do; but he did not think enough of the circumstance that there are disturbing forces at work which no balancing can affect. He mentioned these forces, indeed, but he does not appear to us to have attached, at the time of which we speak—1856—sufficient importance to them. A great many engineers have worked at the problem since, and it is doubtful if anything remains to be effected in this direction. The best modern engines, whether inside or outside cylinder, run with remarkable steadiness at any attainable speed; and a rough running engine is the result of faulty design or bad workmanship. When all has been said and explained, however, there remain some curiosities of locomotive practice which need clearing up. Some years ago, a number of tank engines with outside cylinders, all alike, were found to wear their flanges on one side more than the other. They were employed in working passenger trains. The line is crooked enough, but the curves balance each other. It was assumed that the fault must lie in some way with the engines, which ran chimney first one trip, and foot-plate first on the return trip. They were run for a fortnight chimney first on the down trip of about fifteen miles. The wear of the tires was carefully taken by template. They were then turned round, and run bunker first on the down trip. At the end of a fortnight, it was found that the excessive wear had been transferred to the opposite side of the engine. In other words, it was not the engine, but the road which was to blame. The cause was, so far as we are aware, never cleared up. Everyone who has ridden much on a foot-plate knows that on straight roads some engines are liable to swing. The rough lateral jerk of an engine running at speed is rapidly changed to a smooth swinging motion to-and-fro across the rails, and the head of the engine will be seen to deviate right and left in a very alarming fashion. This swinging motion can be stopped by shutting off steam for two or three seconds. More frequently it is terminated by the engine entering a curve. This motion of which we speak has nothing in common with lurching, or pitching, or "boxing." It partakes in its nature of the swing of a pendulum, and we have no doubt but that if it were to continue the amplitude of the swing would go on increasing until the engine climbed one rail or the other or burst the road. It is possible that derailments have been thus brought about, but it can scarcely be said in such a case that the cause was obscure. In almost every conceivable case of derailment the fault is in the road, if it cannot be found in a moment in the engine. Thus, for example, a case of derailment presents itself. Nothing about the road is to be found wrong, save perhaps a joint a fraction of an inch too low. We come to look at the engine, and find a leading axle-box set fast in the horn plates, or one spring a couple of tons weaker than its fellow on the other side. We met with a case once in which a passenger engine, single, with 16in. cylinders, 22in. stroke, ran off the road on its first trip. Very little harm was done, and it was put in regular work, and in a month it was off the road again without apparent cause. It was sent in for repairs, and it was then found that the horn plates would not square across the engine. The leading axle-box was nearly three quarters of an inch further from the driving axle at one side than the other. The cause of derailment was manifest in a moment.

There are good engines and bad engines; engines so much out of order that they should not be permitted to run; but the badly made and badly kept engines are very exceptional in this country. This is the reason why derailment is so seldom due to the engine. It is to the road, as a rule, we must look for defects. At the same time, we must not forget that a badly running train may pull a tender, and with it the engine, off the road. The tail will sometimes wag the dog.

### STREET WATERING WITH SEA WATER.

THE consumption of water differs from that of most commodities, in that the demand is the greatest when the available supply is generally the least, particularly as regards street watering, washing, garden watering, &c., and in sea-side towns there is a further increase in the consumption of water, inasmuch as the population is often doubled during the summer season by visitors, and this is precisely the class that uses the most water per head. Of the water thus consumed during the summer months, only a small proportion is used for potable purposes, and it is only this small proportion which must be fresh. It will, therefore, be seen at once what an enormous saving in water would be effected if sea water were used in all cases where fresh water is not absolutely indispensable, and especially for such purposes as the flushing of sewers and the watering of streets. The advantages to be derived from sea water for such municipal purposes as the above have frequently struck engineers, and are set forth in a paper read by Mr. S. H. Terry before the Civil and Mechanical Engineers' Society. There have not been wanting schemes for supplying sea water even to inland towns, but hitherto it has been objected that sea water, though so abundant, was an expensive commodity to supply to towns, and it has even been asserted that the effect of sea water on the pavements, for instance, was anything but beneficial. These ideas, however, have now been exploded. The majority of the municipal engineers of our large sea-side towns have made experiments with sea water for street watering, and they have found

it answer beyond their expectations. They find that sea water not only does no injury to the pavement, but, on the contrary, has rather the effect of perserving it, inasmuch as it covers the metal with a thin filmy moisture, which forms a sort of coating and binds down the dust for a long period. Indeed, it is proved that sea water is not absorbed by the atmosphere as soon as fresh, and that whereas in cases where it has been found necessary to water the streets several times in the course of the day when fresh water was used, one watering was found to be quite sufficient when sea water was employed.

According to Bloxam's "Chemistry—Organic and Inorganic," sea water contains in every thousand parts 29·0 parts of chloride of sodium, besides 0·5 of chloride of potassium, 3·0 chloride of magnesium, 2·5 sulphate of magnesia, and 1·5 sulphate of lime, or rather more than 3½ per cent. of solid matter. A gallon of sea water contains about 2500 grains of saline matter, of which about 1890 grains are common salt—chloride of sodium—the remaining 610 grains being composed of the salts enumerated above, and it is due to the deliquescent character of one of these salts —chloride of magnesium—that any material having once been moistened by sea water remains moist for a considerable period. But after storms there is also present in sea water taken from near the shore—in the vicinity of weed-covered rocks—a considerable amount of organic matter from the destruction of sea-weed and the consequent mixture of its glutinous sap with the water. It is believed that it is to this glutinous material that the formation and endurance of the bubbles of sea scum, which occasionally in gales are driven some distance inland, is due. As, roughly speaking, about 80lb. weight of various salts are present in every water-cart containing 224 gallons —one ton—of sea water, it will be seen that much material, which may or may not be injurious, is, in the course of a few weeks, spread over the streets of a town by the water-cart. This fact had created a feeling that the use of sea water for streets might not be without its dangers, and Mr. E. Buckham, M. Inst. C.E., Borough Engineer of Ipswich, was so much impressed with it that he instituted inquiries on the subject, and requested information from the engineers of thirty-five coast towns who had used sea water for watering the streets. The result of this inquiry is of the greatest interest. Twenty-three of the engineers written to replied that they were no longer using sea water, as they had no works for the purpose; twelve stated that they were using sea water, some with suitable works and some by merely filling the carts by hand; and two that they were about to have works.

The engineers of two towns—Ramsgate and Folkestone —spoke adversely of sea water, and stated that it destroyed all kinds of road material except wood. Some advised its use for sewer flushing if a sufficient volume was employed; others, again, were of opinion that sea water tended to produce gas when brought into contact with sewage, and should not be used for sewer flushing except in large volumes. But it is probable that sea water only produces objectionable effects in sewers when these are particularly foul, and the influx of sea water stirs up the decomposing matter deposited in them. With regard to the efficiency of sea water as a means of preventing dust on roads formed of flint, gravel, or granite, the testimony of those who have used it is almost entirely in its favour. Indeed, the borough engineer of Berwick-on-Tweed goes so far as to say that all persons having control of street watering should use sea water, where it can be had, for reasons of economy as well as for the comfort of the inhabitants. In his district he finds that one cart of sea water is equal to two carts of fresh water, and gives more lasting and beneficial results. He states that the macadamised roads that are watered with salt water are a pleasure to drive upon in the summer season as compared with those watered with fresh water, and they never seem to have a loose stone upon them.

In answer to Mr. Buckham's question, whether sea water occasions any offensive decay of street refuse, and if so, whether this is greater than that which would be occasioned by rain or fresh water, the pithy reply was: "No, when the scavenging of the towns is regularly attended to." Without enumerating all the favourable answers that were received, it will suffice to state that the following important seaside resorts reported in favour of sea water—Portsmouth, Tynemouth, Great Grimsby, Great Yarmouth, Hastings, and Littlehampton. Hastings, which has a population of 42,258, and a rateable value of £309,219, has erected very extensive works at the cost of £9000 for sea watering, which means a charge of about 3d. per head of the population, or ½d. on the rateable value. Great Yarmouth, with a population of 46,159, and a rateable value of £133,658, has completed works of salt water supply for street watering at a cost of £4500. Here an 8-horse power Otto Crossley gas engine has been erected, with a 12in. pump, engine-house, tower, and tank, containing 22,000 gallons, settling tank, and suction pipe, fixed to the jetty. There are about 9000 yards of main, ranging from 8ft. to 3in. cast iron socketted pipes, lead jointed, forty stand posts, twelve automatic flushing syphons—Field's—each connected to tanks holding 2000 gallons of sewer flushing. The total expenses, including interest and capital, repayment of loan in twenty years, depreciation of wages, gas, oil, &c., are under £500 per annum. For this amount some 30,000,000 gallons are raised 44ft., at a cost of 4d. per 1000 gallons. Of this volume about 5,000,000 gallons are used for street watering and 25,000,000 gallons for sewer flushing. Before these works were constructed the cost of water for street watering alone was £404, on an average of each seven years, ending 1883. In 1885 it was as much as £552. To keep the automatic trucks of the size mentioned properly going the cost would have been £700 per annum. The charge for water at Yarmouth was at that time 1s. per 1000 gallons. The cost of watering for street watering and sewer flushing, including all items mentioned above, is less than 3d. per head per annum, and something under 1d. in the pound. At Gosport a similar experiment has been made, with highly satisfactory results. These facts speak eloquently for themselves, and require no further comment. In some cases, however, the water companies offer a very strenuous opposition to the introduction of sea water, and Mr. Terry instanced the case of Kirkhallerton, near Redcar, on the Yorkshire coast, where a very neat scheme was got out for the supply of sea water for street watering, and it was also intended to supply sea water for bathers to the houses, and but for this intention the scheme would probably have been carried. The law, however, with that far-seeing interest in the human race which characterises it, here stepped in, and showed that, inasmuch as the district was within the limits of supply of the Stockton and Middlesbrough Waterworks, a loan for such works of proposed supply would be illegal. The logic of this kind of argument will strike everyone when it is pointed out that the water company only proposes to supply fresh water. It seems rather a bad chain of reasoning which insists that the inhabitants of Kirkhallerton shall not have sea water because a company has a monopoly of supplying fresh. It amounts almost to saying that because people have milk they shall not have beer. But, nevertheless, the law had its way. Here we are brought face to face with the impotence of the Local Government Board, on which we have had occasion to comment in the columns of The Engineer on more than one occasion. The discussion which followed Mr. Terry's paper was nearly all in favour of sea water, Messrs. Boulnois, Houghton, Cockrill, Matthew Hall, Elford, and Newton giving the results of their experience. As Mr. R. E. Middleton, the chairman, pointed out, it was much to be regretted that some of the objectors to the use of sea water for street watering had not come forward. Their silence, however, gives all the more *éclat* to its merits.

From the very brief and rapid survey that we have given of the main arguments in favour of sea water, it will be seen that its employment for the watering of streets at any rate is a perfectly practicable idea, and one that can be adopted with economy and success. It remains, however, to be seen whether it could be introduced into inland towns as well. If this could be effected at no unreasonable cost, a very great saving of fresh water would be the result, and a great service to the community would consequently be rendered. For, apart altogether from the great scarcity of water which is now vexing the minds of our municipal engineers, the increasing size of our towns makes an adequate supply of water annually a question of greater and greater difficulty, especially when we remember that with the spread of the scientific spirit of the age cleanliness may be said to be advancing at quite an alarming ratio, and that the demands made on our water supply for municipal purposes are growing almost daily. In London, indeed, this is felt very appreciably, and it would be interesting to see an experiment tried on a large scale of flushing our enormous sewers and watering our interminable streets with sea water. For this purpose London is more favourably situated than any other capital in Europe almost, Constantinople and Lisbon perhaps alone excepted. At any rate, there is a strong feeling that something must be done, and that speedily; and Mr. Terry's paper may therefore be received as containing what—at least appears to be—a very practical suggestion, and possessing, moreover, the merit of being, as far as we know, the first attempt to bring together in an accessible form all the pros and cons, and experience and practice, connected with the subject. The moderate cost of the pipes necessary for supplying even a large town places the proposal very easily within reach of realisation.

## THE NORTHERN COAL TRADE.

The difference in the position of the two branches of the northern coal trade is exemplified just now. In Northumberland there is settled work, and contentment with the wages; but in Durham the sliding scale arrangement is at an end, and no systematic method of determining the method of adjusting wages has been agreed upon, so that labour difficulties are imminent. The middle of the year, and up to the end of autumn is, however, with the Durham coal trade a period of low demand, whilst in Northumberland, owing to the largeness of the exports, it is the period of the briskest sale. Northumbrian steam coals are mostly in demand for export, but in Durham there is a large production of both gas and household coal, which find their period of fullest consumption in the wintry days. This year the demand for steam coal has shown a sharp increase—attributable in part to the growth of the steamship, and to the fact that all our steamships now are finding full employment, and are, of course, consuming much more coal than when a large proportion of the merchant navy was idle. This change of the mercantile navy from sail to steam is one of the factors which affect the coal trade to a very considerable extent. For instance, in the last month officially reported on, we increased our steamers registered in the United Kingdom by thirty-two—an increase that must have its effect on the consumption of coals. From time to time the number and the tonnage of the sailing vessels we own decreases; or, in other words, we are changing our shipping rapidly from wind-impelled to steam-impelled —in short to coal consumers. We do not see the exact results of this, because part only of the coal consumed is bought at our own ports, a large part being sent to other countries and to coaling stations, so that it figures in the exports of coal, though in reality it is merely shipped for a time to other countries to be used by steamships, largely British, which take their supplies there. Northumberland sends out a not inconsiderable proportion of that steam coal, and thus it is benefitting by the increased prosperity of the shipping trade. On the other hand, Durham has decidedly benefitted by that advance in the iron trade's prosperity which has allowed the increase in the price of coke to be marked, and it is also benefitting by the higher prices now paid for the gas coal it produces in such quantities. But the contracts are, on the whole, longer in Durham than in the more northern county, so that the coalowners are a little later in reaping the benefit, and this is in great degree the cause of the uncertainty that has prevailed as to the wages question in the more southern section of the coal trade of the North. The Northumberland coal contracts are more generally for the shipping season, whilst in the case of the gas coal of Durham there are contracts that are made for one or two years at a time. There is a benefit in a falling market from these long arrangements of sale, but, on the other hand, there is a counterbalance to that gain in the times such as the present, when the price of coal has risen, and seems likely to advance still more in the course of a few months. The issue of the difficulty in Durham has been looked for with some anxiety, because that county is the largest of the coal-producing counties, and because in a considerable degree the iron trade of the North is dependent on it.

## MACHINE MINING IN ILLINOIS.

The reports of the Inspectors of Mines for the five districts of the State of Illinois give special prominence to the subject of "machine mining," and some of the figures and comparisons are of interest. In the State named there are reported to be the comparatively large number of 272 mining machines at work; and they, with 3088 men, produced 2,243,210 "tons of lump coal"—the ton being the American net ton. In a few instances the machines have been employed in "experimental work," or in "driving;" but, deducting these, it is stated in a summary that 251 machines, operated by 2915 men, produced on the average 8795 tons of coal per machine—though the output varies considerably in the different districts of the State, according to the thickness of the coal. The reports of the inspectors speak at some length of the advantages of the system of coal-getting by the machines, most of which are of the Harrison type. The machines give a greater subdivision of labour, and it is claimed that, generally speaking, the use of machines leads to greater skill on the part of the men who operate them, or who prepare the way for the work or follow them. It tends to make the users of the explosives, the blasters, and others expert in their work, lightens the hardest of the labour, and increases the output of the coal. Elaborate statistics are given of some thirty-nine mines in which machines of one kind or other are at work, of the classes of men employed in connection with them, and of the wages earned on the average by many of them. The mean of the whole may be given thus:—The daily wages of the cutters is 2·33 dols.; that of the helpers is 1·70 dols.; the blasters earn on the average 2·07 dols. per day; and the loaders, 1·79 dols. The "timberers" earn 2·02 dols. daily, and the labourers 1·43 dols. In one or two mines there is a little variation between the summer and winter prices; but this general average must be looked upon as a satisfactory proof that at least good wages are generally earned by the companions of the machines. If the yield of the machines is a large one, it is to be remembered that the first cost of supplying the machines for a mine is heavy, and that the wages are also large; but there is claimed the advantage of coal which has a larger proportion of lump, and also the use of a smaller quantity of powder for the blasting of a given quantity of coal. These are no small advantages; and the largeness of the number of three kinds of machines would seem to point to the belief that they are proved to exist. Several of the Inspectors of Mines acknowledge that there are advantages which more than compensate for the cost, and for the disadvantages which must also be admitted. It is a rather singular fact that in this distant State—not the largest contribution to the coal production of America—we should find so frequent a use of machinery in the coal mines, whilst with us it is so rare comparatively. As it is, however, the facts officially stated by the Inspectors of Mines give authenticity to what must be looked on as an interesting feature in the production of minerals. There may be differences in the depth or thickness of the coal seams in the United States which are not stated, and which foster the use we have named, but the fact in itself is one that is worth referring to here.

## OUR UNITED STATES TRADE IN PLATES.

Welsh and English makers of tin-plates have long been accustomed to announcements that preparations were being made in the United States for the manufacture of tin-plates there on a scale large enough to render the importation of the British-made goods unnecessary. As every tin-plate manufacturer knows, there are considerable obstacles in the way of the realisation of this idea, and these hitherto have not been found surmountable. A fresh attempt, however, is now being made which calls for notice. It is a project to lay down an experimental tin-plate plant at Pittsburg, at a cost of about £1000, to demonstrate that the tin-plates can be made with American materials. The next step would, of course, be to try again for an American tin-plate import duty—the agitation for which is, in fact, a resumption. The plant is proposed to be shown in working order at the forthcoming Exhibition of the Pittsburg Exhibition Society. It is, after all, only an exhibit; but the reasons for establishing it are of interest. Why, it is urged, should America send 20,000,000 dols. a year abroad for tin-plates which might give employment to 100,000 hands? It appears that in 1888 there were imported into the United States—mainly from Wales and England—over 333,615 tons of tin-plate. This, it is estimated, meant 900,000 tons of ore, 500,000 tons of coke for furnace use, 450,000 tons of pig iron, 1,250,000 tons of coal or other fuel in the sheet or tin mills, and about 3,000,000 dols. of earnings. Naturally, American importers would like to save all this, if they could only get an import duty to protect them. A fund towards the plant has been opened at the office of the *American Manufacturer*, Pittsburg, and American iron and steel firms are subscribing to it. We do not think the desired import duty will be gained for some time to come. Similar attempts have been made in the past. At the same time, the matter is worth keeping an eye upon, for our tin-plate exports to the United States are growing. In 1873, 2,153,477 boxes of tin-plate were exported from Great Britain to all countries; in 1879, 3,534,169 boxes; and last year, 6,953,128. America absorbs every year the giant's share of our tin-plate shipments, and it is to the increase in the American custom that those satisfactory enlargements are mainly due.

## ENGINE FOR ELECTRIC LIGHTING INSTALLATIONS.

One of the most important considerations in establishing an electric lighting plant is the choice of a good motor. This is a matter of special importance in the installation of the large central stations which it is at present the custom to establish for the lighting of large towns. It is no longer customary to multiply the number of engines; on the contrary, one must have recourse to large and more important and more perfect motors; economy of combustible, the cost of the ground, &c., are expenses which it is absolutely essential should be taken account of. Moreover, high speed engines have always given rise to unpleasant surprises in installations of this kind, in which the engine, like a race-horse, must, once set in motion, run uninterruptedly until its work is done. It is for these reasons that we now see all those who have the most experience in these matters have recourse to powerful engines running at ordinary speeds, built with the utmost care and solidity, with a view to avoid accidents. This has led all

those interested in this branch of engineering to seek out the best builders they can find in the various countries. Thus we now see the firm of Hick, Hargreaves, and Co., entrusted with the building of the engines for the important central station at Deptford, and another firm of whom we had occasion to speak some time ago in our journal—*vide* The Engineer, vol. lx., pages 341-349—P. Van den Kerchove, favoured with important orders for the city of Berlin, which is the highest eulogy these firms could receive. Seeing the importance of these installations, we are happy to say that we have obtained particulars of these engines, and hope soon to be able to publish a description and illustration of the second of them.

## LITERATURE.

*Practical Gold Mining.* By G. C. Warnford Lock. 8vo., pp. 778. E. F. and N. Spon, London and New York, 1889.

"Want of success in working a gold mine is generally due to one cause, viz., *ignorance how to extract the gold;* and to convey information that will help to dissipate that ignorance this volume has been written. The superficial reader will probably see in this book a family likeness to its predecessor, 'Gold, its Occurrence and Extraction,' produced by the present author and his father in 1882, and now out of print." The above extract from the preface explains the relation of the present work to the laborious compilation of the late Mr. A. G. Lock, published in 1882, and of which Mr. G. C. W. Lock claims to be co author, although in the preface to the earlier volume he is credited with having edited and seen the work through the press, no doubt a most essential service, but scarcely sufficient to constitute authorship as it is usually understood. However this may be, the new book is substantially the old one limited and reduced. By the omission of the chapter on geographical distribution, covering 745 pages, space has been found for considerable additions to the sections devoted to working and reduction processes, so that as a final result 1229 pages are brought down to the more manageable quantity of 778. The book is mainly made up of extracts from former publications—the Transactions of the American Institute of Mining Engineers, the reports of King Hague, Raymond, and other similar well-known sources of information having been largely laid under contribution. Unfortunately, however, the plan of composition dispenses with references and dates, so that it is not always easy to determine whether information said to be new, is so or not. In one case a machine, by an inventor who has been dead for some time, is described as recently introduced; but on referring to the earlier volume, we find that the recent introduction was in 1882, and we are left without information whether anybody has used the machine, and with what result, during the intermediate years. The system of arrangement adopted is alphabetical, which gives the text a very patchy character. This is especially apparent in the chapter on complete mills and reduction works, where the descriptions jump about from the A mine in California to the B in Australia, the C in Colorado or New Zealand, and so on, the diversity being heightened by interpolating woodcuts of stamp batteries and other machines, also in the order of the makers' names. Among these latter we find at p. 530 a cut of six drum sieves in cascade series, given among methods for the treatment of quartz mill tailings, for which purpose they would be about as useful as rabbit netting would be for whitebait fishing. Very little care has been taken in correcting quoted statements when the originals are manifestly wrong, and American blunders in spelling common European names are reproduced in a very annoying fashion. The Boss process of continuous pan amalgamation is said to have been introduced in 1887, whereas it certainly was in use on a considerable scale in 1881, and most likely was well known at an earlier date. The Linkenbach buddle is figured and described at some length, but the inventor's name is not mentioned. It is not easy to see a reason for this omission, as the machine is perfectly well known, and has been described by the inventor and several other persons. In contrast with this reticence we are presented in a supplemental chapter with a somewhat effusive notice of two machines and a stone-breaker which "comprise a process" which cannot be described in detail, as the whole of the patents are not fully secured; but the advantages over every other process, in the inventor's opinion, are set forth at length, as they also are, in a more concise style, but in posting bill form, on the page fronting the preface. As a matter of literary propriety, these notices would have found a more fitting place in the advertising pages at the end of the book. There is a tolerably voluminous index, which, however, is a somewhat delusive guide as to the actual contents. For example, not having noticed the Stetefeld furnace in turning over the pages, we consulted the index, and found three references which yielded the following results:—Page 598, "It is more easily transported, but more expensive to build than a reverberatory furnace;" page 614, "It is a superior furnace, and would probably work well with a large supply of ore;" and finally, page 639, "It reduces loss of gold to a minimum by instantaneous roasting." These items, though, no doubt, interesting, will scarcely satisfy anyone wishing to know something about the construction and working details of a not unimportant appliance in the extraction of gold, and which might fairly have been looked for in a practical treatise of 778 pages. Taken as a whole, we fear that the author's help towards dissipating ignorance how to extract the gold is not likely to be very effective, owing to the uncritical way in which he has used his materials.

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*A Course of Instruction in Machine Drawing and Design, for Technical Schools and Engineer Students.* By William Ripper. Sheffield: Published by the Author. 1889. 4to.

Numerous as are the books for instruction in machine drawing and design, we do not know of one which, preceding this, has anticipated it. The system upon which the author proceeds is to imitate the sequence of operations which would be followed by a competent draughtsman in his work in the drawing-office. With a given subject to be dealt with, the type of design for the article being chosen, the calculations necessary to determine dimensions and strength are made, and the design finished accordingly. The examples chosen are all of the actual working drawing type representing modern practice, so that the student learns, not only the application of usual calculations in designing, but a knowledge of the proper form of parts and complete engines, boilers, and lathes, as made in practice. He learns nothing that will have to be unlearned. The set of exercises on the steam engine, for instance, is arranged so as to encourage the student to make working drawings of details to as large a scale as possible, and afterwards, from their own drawings, to build up and complete the general drawing. This system Mr. Ripper, who is the assistant professor of mechanical engineering in the Technical School, Sheffield, found to work very successfully, the students becoming really interested in what is very like making parts and putting together a real thing. The same system is followed out with the lathe. The student is led to make those calculations which are necessary to enable him to do the thing in hand; he learns to make a calculation for its immediate practical application, and to find out the reasons for things instead of merely drawing things from a copy. Drawing is thus made a really valuable training. The book is illustrated with a large number of excellent plates, but besides these a large number of explanatory sketches are given in the text. Besides the subjects we have mentioned, there are many others, including instructions in drawing, drawing instruments, sketching, &c., calculations of stress and strain, strength of materials, as far as necessary to the proper understanding of the work referred to. Examples are given of the methods of setting out spur, bevel, helical, and other kinds of gearing, propellers, &c. The plates are well drawn, some are coloured, and the whole of the work of the book does credit to author and printer. We can strongly recommend it.

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*The Chemical Analysis of Iron.* By Andrew Alexander Blair. 8vo., pp. 282. London: Whittaker and Co. Philadelphia: J. B. Lippincott. 1888.

The multiplication of special analytical processes and methods for the examination of iron and steel and the various materials required for their production, has given rise to a very voluminous literature, which for the most part is scattered through the journals of societies and other periodical publications; and although these have been reproduced in systematic form by different writers, as, for instance, in the successive editions of Mr. Crookes' "Select Methods in Analysis," the want of a really good modern book of a reasonable size confined to the details of iron analysis must have been felt by many chemists. This want is likely to be very fully supplied by the present volume, which is the work of a distinguished American specialist, the author having acted as chief chemist to the United States Testing Board for Iron, Steel, and other Metals in 1875, and in the same position to the Census Board, and Geological Survey in 1880. The more important methods used in ironwork laboratories are clearly described, and what is of more importance, the precautions necessary in manipulation are very fully treated. Several new processes, including one for rapid determination of silicon in pig iron, by Mr. A. Ford, are especially noticeable. The methods of examining fluxes, fuel, firebricks, furnace and producer-gases are also fully described. The illustrations are especially good as representing the best modern appliances. These, we believe, are those that were used in the investigation of American iron ores made for the Tenth Census of the United States; and although in many instances they may be beyond the means of private laboratories, still are useful as indicating a standard to be worked up to. There are many interesting novelties in the apparatus described, particularly in those for pulverising minerals, and for filtering under pressure on asbestos, and in the determination of carbon by combustion. A new form of burette, by Mr. T. H. Garrett, of Philadelphia, appears to be a very considerable advance upon that by Mohr, which is generally used. In describing earlier processes the author has endeavoured to give the credit of originality to the proper person, but, as he points out, this is not always easy to do, and therefore he hopes that he may be assisted by his readers in correcting any mistakes that he may have made in this particular.

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### *BOOKS RECEIVED.*

*The Handy Book of the Law of Joint Stock Companies under the Companies Acts, 1862 to 1886; with Directions for Forming a Company.* By Jas. Walter Smith, LL.D. Nineteenth thousand. New and revised edition. London: Effingham, Wilson, and Co. 1889.

*Gaseous Fuel, including Water-gas; its Production and Application.* A lecture delivered at the Association Hall, Peter-street, Manchester, on March 29th, 1889. By B. H. Thwaite, C.E. London: Whittaker and Co. 1889.

*Hydraulic Motors, Turbines and Pressure Engines, for the Use of Engineers, Manufacturers, and Students.* By G. R. Bodmer, A.M. Inst. C.E. With numerous illustrations. London: Whittaker and Co. 1889.

*The Practical Manager's Slide Rule Companion; being a Treatise on the Engineer's Slide Rule, adapted to Mill and Factory Calculations, &c.* By Joseph Howell, Dundee. Second edition, revised and enlarged. London: Simpkin, Marshall, and Co.

*Construzione ed Esercizio delle Strade Ferrate e delle Tramire.* Vol. v., Part II., Nos. 26 (Fonderia delle ghisa e del bronzo) and 27 (Considerazioni generale sulle Ferroire secondarie and econonnche). 1889. Unione Tipografico-editrice, Torinese, 33, Via Carlo Alberto.

*Ministero di Agricoltura, industria e commercio—Direzione generale dell' agricultura.* Annali di Agricultura, 1889. Revista del Servizio Minerario nel 1887. Firenze tipografia di G. Barbèra. 1889.

*Useful Rules and Tables relating to Mensuration, Engineering, Structures, and Machines.* By Wm. John Macquorn Rankine. Seventh edition, thoroughly revised by W. J. Millar, C.E.; with Electrical Engineering Tables, Tests, and Formulæ for the use of Engineers, by Andrew Jamieson, M. Inst. C.E. London: Charles Griffin and Co. 1889.

*Theoretisch-praktisches Handbuch der Gas-Installation.* Von D. Coglievina. Vienna: A. Hartleben.

## THE PARIS EXHIBITION. — MISCELLANEOUS EXHIBITS.

Quitting the Machinery Hall for awhile, and making a tour of some of the "galeries" devoted to the various industries of different nationalities, we find examples of processes and products of manufacture worthy of some attention. In the court devoted to glasswork on the eastern side of the Central Dome, we find some sheets of plain and silvered plate glass of extraordinary dimensions. The glassworks of St. Gobain have placed vertically in this court a sheet of plate glass no less than 25ft. high and 13ft. 5in. wide. The weight of this plate is given as 938 kilos., or 2060 lb. The area of the plate is given as 31·28 square metres, or it is 336 square feet; the weight per square foot is thus 6·13 lb.; the thickness of the glass is given as ·012 m. To the left of this are three huge mirrors placed vertically side by side so as to form half of a room. These are all approximately the same size, the largest being 19ft. high by 11ft. 11in. wide, which is the largest size ever silvered. These latter are the manufacture of the Compagnie Française de la Chapelle, who have works at Aniche, Recquignies, and Jeumont, in the north. Sheets of plate glass over 1in. thick for aquariums, &c., are shown, and a variety of specimens of thick block glass for use as skylights. In this court are good specimens of glass tubes, ranging from the boiler gauge glass type up to the enormous size of 5in. diameter and 18ft. long. Passing from this court through the Japanese section, which is replete with manufactures of great merit, we enter the Russian Court.

Here, as one would naturally expect, furs predominate, a fine show being made by the Grunwaldt house of every possible application to which bruin's skin can be put. Not the least profitable and interesting of Russia's industries are her mines. These are well represented in this section by specimens of raw material, models, photographs and plans of the mines and machinery. We notice first of all a large artistic trophy built of blocks of anthracite from the Koschkine mines of Rostov-on-the-Don. Some 345,000 tons of this fuel have been brought to the surface from an average depth of nearly 500ft. during the eight years the mines have been worked. As no smoke is evolved in the combustion of this substance, it is eminently suitable for war ships, and is already in exclusive use as fuel in the vessels of the Black Sea flotilla and the Central Russian Railways. An analysis by Professor Tchirikoff shows small percentages of oxygen, nitrogen, hydrogen and sulphur, and 93 per cent. of carbon, its calorific property being cited as 7·9

Further on, the Auerbach mercury mines show specimens of the ore obtained from their mines at Bakmouth, Central Russia, with photographs of the mines and machinery, and samples of wrought iron jars used for the transport of mercury to the market. It appears that the annual production of mercury from these mines is now 358 tons, the yield being 150 lb. per ton of mineral. The seam of cinnabar was discovered in a coal formation in the year 1879 by Mons. Minenkoff, but the mine has only been in operation for three years. The ore, which is crushed and sifted by machinery, is afterwards heated in furnaces, enclosed in hermetically sealed iron cases, the mercury vapour thence passing over to the condensers. The copper mines of Verchotor are also represented by a very interesting display of ore specimens and samples of pieces of finished copper which have been subjected to torsion and elongation tests. These mines are the property of Colonel W. Paschkoff, and are situated near the river Belaia on the Ural range. The new central Laboratory of Electricity, lately started in Paris, has apparently been at work here, for we notice a conductivity certificate made out as recently as the 25th of June last, on a sample of wire drawn from copper from these mines. The results of the tests are worth noting. The wire was ·083 millimetre diameter, and measured 3128 ohms per kilometre at 25 deg. Centigrade, giving, therefore, a conductivity of 103·6 per cent. as compared with Matthiesen's results. The annual production of these mines is about 240 tons. In the same section we find an extensive exhibit of the Metallurgical Company of Central Russia, who have large works at Kamenskoie, and exhibit ores containing iron, aluminium, silicium, sulphur, phosphorus, &c. A system of manufacture from clay of artificial granite and marble is shown in this section. The system is the invention of Paul de Kristoforovitch, and comes in chiefly for use in paving streets, the cost being about one-tenth that of natural granite. The stones are of a bronze tint and susceptible of a high polish, and the substance itself, which the inventor terms "pyrogranite," possesses the property of impermeability, and greater mechanical resistance than natural granite. Blocks used for paving are about 4in. thick, a square yard being laid with fifty or sixty bricks on a 2in. sand bed, and costing about one franc. Any form can be given to the raw material, the inventor having also used the process in the manufacture of containing vessels for electrical storage batteries.

Leaving this section, we enter a wide court, which gives access to the Norwegian, United States, and Swiss sections. Exhibited in this court are some very choice pieces of work in enamelled ware, and in stones and crystals. From the mines worked by M. Alibert in Siberia, are shown specimens of a beautifully-grained green stone, called "Nephoite," which lends itself to the manufacture of various articles of *vertu*. Blocks of graphite, cut and polished, are also shown as the product of these mines. A notice is put up that specimens of these minerals will be given to those who apply in writing to M. Alibert, in French, the same being delivered to applicants between the 15th and 31st of October, in the Vestibule des Sections Etrangères Côté Suffren, on presentation of the acknowledgment to their letter of application.

Passing now through to the Galérie Desaix, which contains an extensive exhibit of musical instruments, we find a very good demonstration of the working of organs

electrically. The two large organs installed at either end of this spacious hall are controlled from a three-manual key-board and set of pedals placed in the centre of the hall on the ground floor.

The system is electro-pneumatic, and is the invention of Messrs. Schmoele and Mols, who use compressed air in conjunction with electrical action. Messrs. Merklin and Co., organ architects and builders in Paris, to whom is due the demonstration of the system in the Exhibition, have already introduced it into a number of churches and cathedrals on the Continent. From the keyboard one or other of the organs can be controlled, and judging from the recital which we heard in the evening, the effects produced are very pleasing. We say in the evening advisedly, this being the time when well-conducted recitals are given, in contradistinction to the earlier part of the day, when instruments are being tuned up and muscular musical machines of the "World's-fair" type are in full blast.

The western end of this hall contains some exceptional exhibits of various kinds, chiefly Russian. For instance, we come across an electrical measuring instrument of portable dimension, which is called an avomètre, that is, the one instrument measures ampères, volts, and ohms. The instrument is the invention of Mr. Tichkoff, a captain in the Russian artillery. There is no explanation of its action. Adjoining this is a so-called constant primary battery, invented by Mons. T. Kornfeld, Electrical Engineer of Odessa, and introduced into France by the Société Centrale de Produits Chimique. The main idea seems to be to take up as little space as possible. To effect this each element is composed of a zinc plate immersed in a narrow rectangular vessel of carbon constituting the other electrode. No porous partition appears to be used to prevent polarisation, as there is extremely little clearance. The zinc plates have lugs at either end, which are screwed to a wooden frame capable of being raised and lowered, while the carbon cells have emptying tubes fitted to them, running into one main horizontal pipe. Some figures are given with reference to the performance of the battery. It consists of forty cells occupying only 2ft. by 1ft. 8in., the zincs weighing 220 lb., with an active surface of 32 square feet. The total energy of the battery is said to be 1000 watts, of which 750 are available, and the expense of maintenance is said to be proportional only to the energy utilised. When we inspected the battery only half of it was there; probably its better half.

Close to it is a case of integraphs, the design of these interesting pieces of apparatus being due to Mr. Abdank-Abakanowicz, and their construction to G. Conradi, of Zurich. A Warsaw firm, by name Rejchman, also has an exhibit of magneto call and bell apparatus, and the continuous current Kechniewski dynamos for which they are the concessionaires.

The continuation of the Decauville narrow gauge to the Machinery Hall, places that end of the Exhibition within only fifteen minutes of the most remote end in the Place des Invalides, including stoppages. This is the time occupied in *transit*, and does not include the time spent in getting past the ticket office. If this latter time was plotted as a function of the hours of the day, there would be little or no rise before noon on week-days, but a maximum in the afternoon between four and seven. It is just as well to avoid the "peak," and make the tour early, if the visitor wishes to closely inspect apparatus. In the Place des Invalides there is a building specially devoted to posts and telegraphs, in which are assembled a most varied and interesting display of telegraph instruments and appliances. Here are the Hughes and Baudot type printing telegraphs in operation, the Wheatstone automatic transmitter, and numberless forms of transmitting and receiving instruments. The recent invention of M. J. Munier, by means of which he works "multiplex" with Hughes' type printing instruments, is especially worthy of note. The system is as yet quite new, the instruments here exhibited being the identical ones used between Paris and Dijon. Only two currents in opposite directions are used, instead of five as in the Baudot system, the method being to utilise these currents for each transmitter, and its corresponding receiver at the distant end for a given interval of time. To demonstrate the system four instruments are connected at one end and four at the other, in series with one another, although the same principle could be applied to a greater number. Professor Hughes himself saw this new adaptation of his ingenious instruments for the first time yesterday, when he visited this portion of the Exhibition, and expressed considerable admiration at its performance.

Nothing can be more original than the bamboo cane combined posts and insulators used in Annam and Tonkin. Nothing is simpler than to cut a niche in the top of the post, drop the wire in, and follow it up with a peg or wedge. The cane being hollow, and possibly its natural properties, probably keep up a fair insulation.

A case containing samples of a system of compound aërial telephone or telegraph conductors is shown by A. Fortin Herrmann, near the entrance. The bare wires appear to be kept separate by wooden beads slipped over them, the same being kept closely in contact by fixtures at the ends. A lead pipe encloses the wires thus covered and separated.

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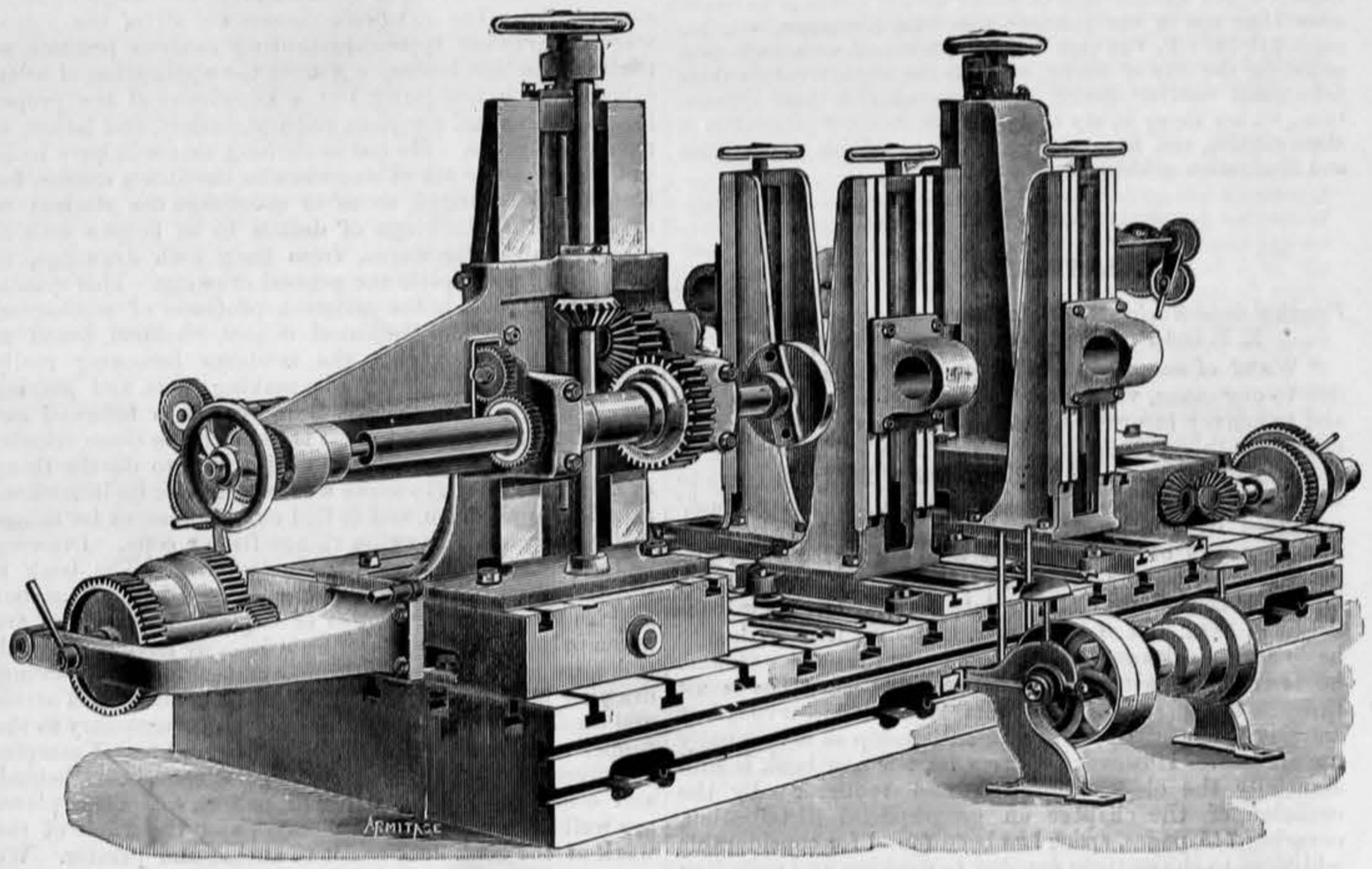
Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Frederick A. Hillyer, engineer, to the Firebrand; Frederick T. W. Curtis, engineer, to the President, additional, for service at Woolwich; Samuel Aston, engineer to the Black Prince; William R. Parsons, assistant-engineer, to the Hero, all to date July 19th. Francis H. Lister, assistant engineer, to the President, additional, for service in Comptroller's Department.

The Gold Mining Exhibition.—In consequence of certain unfortunate circumstances in connection with the Alexandra Palace, a meeting of the Exhibitors at the forthcoming Gold Mining Exhibition was held at the Cannon-street Hotel, E.C., on Wednesday. A resolution was proposed to the effect that owing to the position of the Alexandra Palace Co., the site for the Gold Mining Exhibition should be removed from the Palace to the Spanish Exhibition at Earl's Court. This motion was carried unanimously.

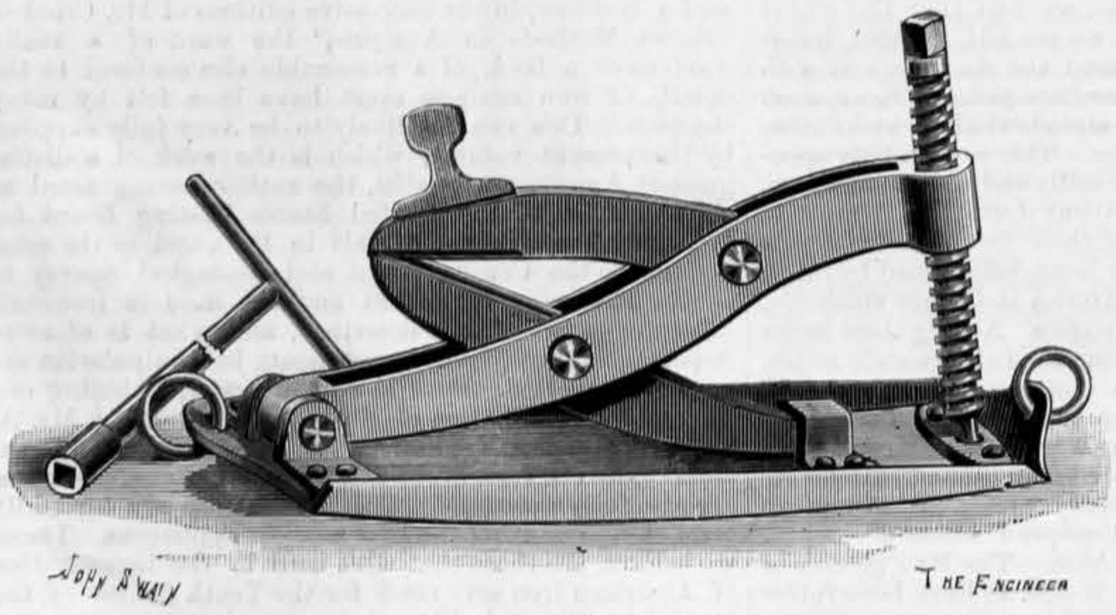
# HORIZONTAL BORING, DRILLING, AND SURFACING MACHINE.

THE BRITANNIA COMPANY, COLCHESTER, ENGINEERS.



## HORIZONTAL BORING, DRILLING, AND SURFACING MACHINE.

The machine which we illustrate is constructed with powerfully geared boring heads, having steel spindles, driven by strong spur and mitre gearing, with variable feed, self-acting in either direction or stationary for surfacing; the heads are mounted on upright heavy and rigidly constructed slides, with a vertical adjustment by a screw and hand-wheel and a traverse adjustment by rack and pinion. The upright bar rests are made with socket heads to carry the boring bar and bushes, one bar rest at each side of the work, and are also adjustable vertically by screws and hand-wheels. The driving cone pulleys have four speeds, and double gearing is fitted, giving eight changes of speeds. The whole is mounted on a machine-planed heavy foundation bed-plate with T slots for bolting work to. The machine illustrated above has steel spindles 3¼in. diameter, and is capable of boring holes up to 24in. diameter by 42in. long, and has a double set of boring heads and bar rests, the foundation plate being 12ft. by 5ft. The total weight is about 7½ tons; but the machines are made of all sizes to suit purchasers' requirements.



BOHLER'S RAIL RAISER.

## THE PROGRESS OF THE MANCHESTER SHIP CANAL.—THE MANCHESTER DOCKS SECTION.

There is probably no portion of the Manchester Ship Canal on which greater progress has been made since the work was commenced than in the No. 9 section, or what is known as the docks section at Manchester and Salford, and we give a series of illustrations, page 93, from photographs taken in May last, showing the state of the works on that date in several branches of the Salford docks, together with one of the new types of steam excavators which has done very excellent work in the main cutting leading out of the docks. The docks section includes 110 acres of docks, five miles of quay wall with two locks—one 600ft. by 65ft., and the other 350ft. by 45ft.—having intermediate gates, a weir of four openings, each 30ft. wide, and the requisite approaches. The contractors' agent on this section is Mr. L. P. Knott; the sub-agent, Mr. J. H. Dutton; and the engineer, Mr. A. H. Owles; whilst Mr. J. Kyle is the company's resident engineer; and Mr. J. Dean, the chief assistant. About 1900 men are employed on this section, and the work includes 5,300,000 cubic yards of excavation, 450,000 cubic yards of concrete, and 30,000 cubic yards of masonry and brickwork. Of this, 1,700,000 cubic yards of excavation had been completed on the date the photographs were taken, and the work is progressing at the rate of 180,000 cubic yards per month. Of the concrete work, 80,000 cubic yards had been completed, and this is progressing at the rate of 17,000 cubic yards per month, whilst some 5000 cubic yards of masonry have been erected, chiefly, however, in boundary walls on the De Trafford estate, which abuts on to the docks section. Mr. Knott, the contractors' resident agent, we may add, has also charge of the No. 8 section, where 1100 men are employed, and which includes 3½ miles of canal with locks, swing aqueduct, swing road bridge, and two hydraulic lifts at Barton, of which we hope to give illustrations when the work has made further progress.

Our illustration No. 1 is taken from a photograph of the north branch of the Salford docks, which is 1350ft. long by 250ft. wide, and this is the most advanced portion of the works. Here the excavation was first taken out to within 10ft. of the bottom. Trenches were then dug out for the walls, which are all built up to the water level, and on the north wall the fender course is now on. The remaining 10ft. of excavation is now being taken out, as shown in the illustration.

The main dock cutting, at present 2000ft. long by 250ft. wide, but which will eventually be 6000ft. by 300ft., widening out into three branches, is shown in our illustration No. 2. In the foreground the excavation is seen to the finished bottom, and the dock wall is now being built, where an excavator is shown at work on the left of the view.

Illustration No. 3 is from a photograph of the middle branch of the Salford docks, and this is 1200ft. long by 225ft. wide. Here the excavation was taken out to within 4ft. of the bottom, and trenches were then dug for the walls, which have now been built up to the water level for the greater part of the length. The method of building the dock walls is very clearly shown in this illustration. Uprights 11ft. by 4in. are fixed in the exact line of the dock walls to be erected, and battens and shutters 9ft. long are arranged to slide between these uprights, following the work as it is built upwards, the inside face of the shutters being coated with soft soap, so that they leave a smooth face on the concrete surface of the wall. This branch is also now being bottomed up.

Our illustration No. 4 shows one of the numerous types of excavators which are being employed on various portions of the Ship Canal works. This is termed a French excavator—L. Buette's patent—and it was manufactured by J. Boulet and Co., of Paris. This machine, which cuts 18ft. deep, fills 700 wagons per day of ten hours, each wagon holding four cubic yards of earth, and under favourable conditions would excavate and load up as much as 3500 cubic yards in ten hours. There are on the ladder twenty-four buckets of about nine cubic feet capacity each; these empty into a shoot at the back as they turn over the top tumbler, and there is a plough-shaped tool which loosens the earth in the bucket. The machine weighs about seventy tons, and travels on three 80 lb. rails, the gauge of the outside pair of rails being 6ft. 7in., the middle rail making a 4ft. 8½in. gauge with that furthest from the cutting, and these two rails answer for the road and for getting water and coals to the machine.

Amongst other excavating plant employed on the Salford docks section are three of Ruston and Proctor's well-known steam navvies and three of Whitaker's excavators. In the adjoining Manchester docks, of which we propose giving illustrations in a subsequent notice, the work is being carried out on an entirely different system to that which has been adopted in the Salford docks. In the Manchester docks a trench is being taken down from the surface—all on rock—as there is not convenience for getting machines down for excavating, and the dock walls are being built to the water level in these trenches, after which the dock excavations will be taken out by cranes on the dock wall.

## IMPROVED RAIL RAISER.

The engraving given above illustrates Bohler's rail raiser now being introduced by Mr. J. Melling, of Dashwood House, London. It is designed to do the work usually requiring from four to six men by aid of two men, and to take the place of the long lever. With Bohler's apparatus two men can easily raise sleepers and rails. The lift is directly vertical, steady, and certain, in all of which particulars it is very superior to the lever, and in addition to this it will raise the rail 5in. to 6in. in one minute. It is 2ft. long by 7in. wide, so that the platelayer can proceed with similar work on the adjoining pair of rails. During repacking of the sleepers it does not interfere with the passage of trains, as it acts as a sleeper in position.

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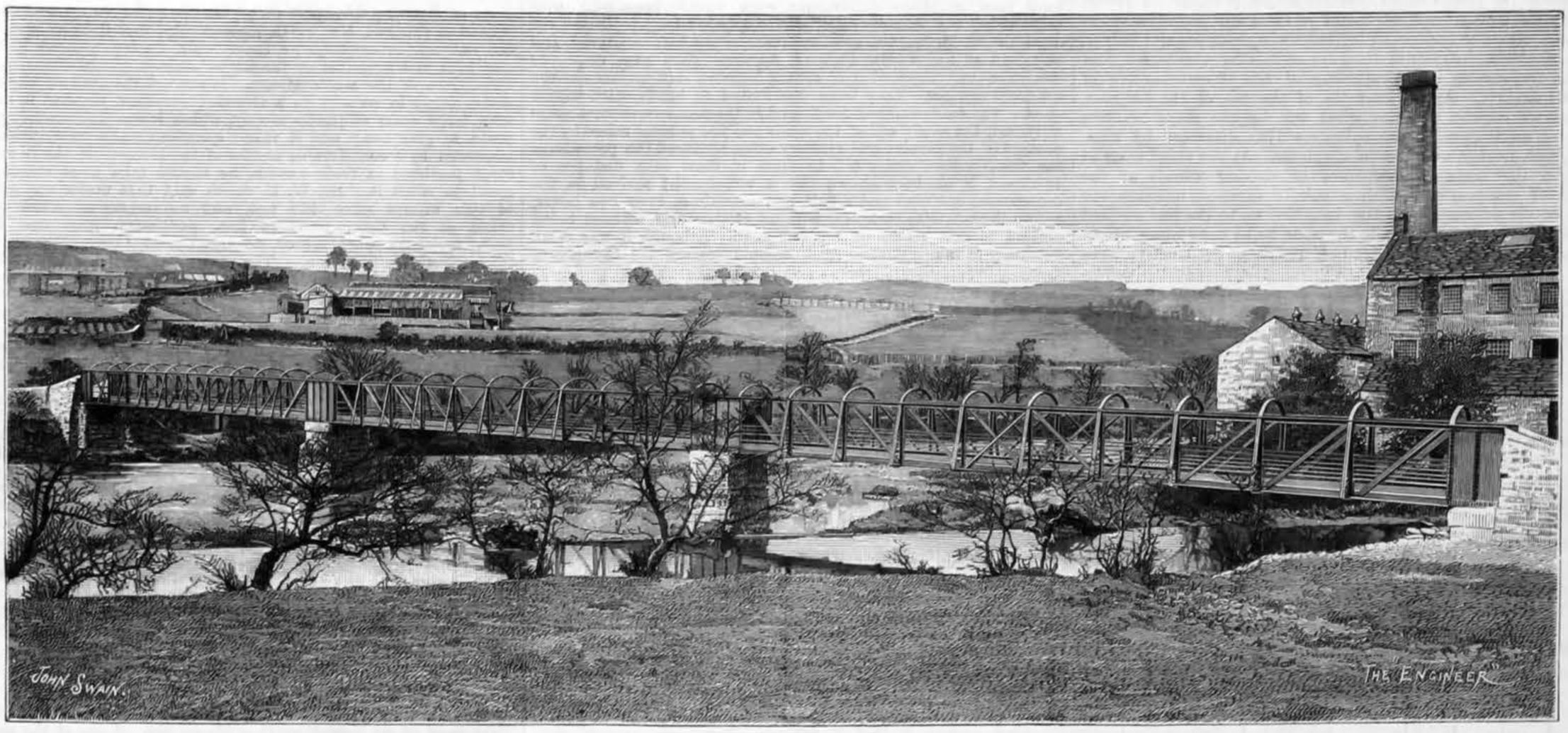
The death is announced of Mr. Henry Dean Denison, of the firm of Samuel Denison and Son, Leeds. The business of the firm will henceforward be carried on under the same style by the surviving partners, Messrs. Samuel and George Henry Denison.

## FOOT BRIDGE ACROSS THE AIRE AT BUCK MILL.



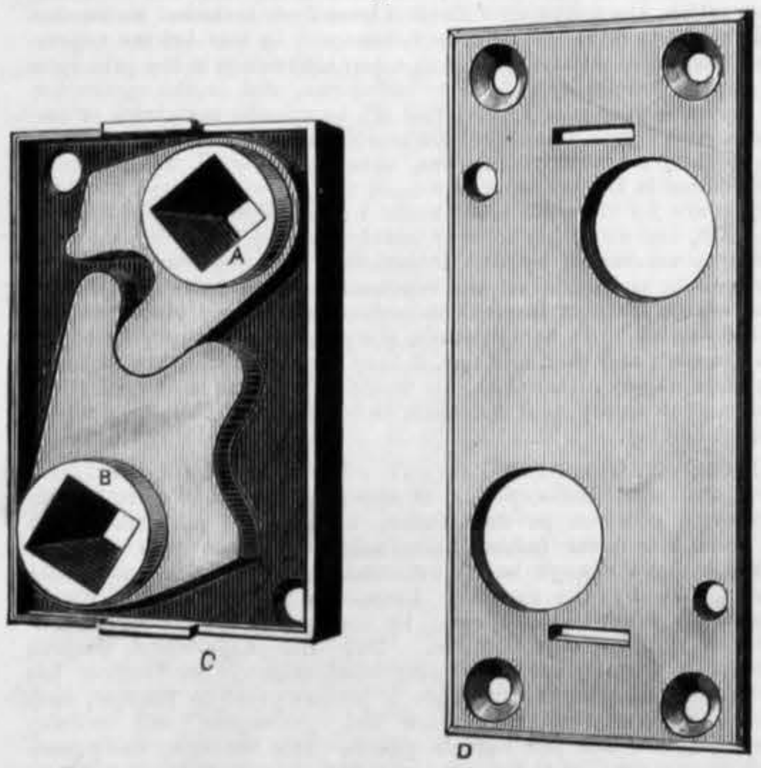

### BRIDGE ACROSS THE AIRE AT BUCK MILL.

The above engraving illustrates a new foot bridge erected across the Aire at Buck Mill by the Idle and Baildon Local Boards, and connecting the two townships by a pathway, which avoids a road distance of about four miles. The general character and type of the bridge is clearly shown by the engraving. The approaches at either end of the bridge are 6ft. wide. The superstructure of the bridge stands on two piers and two abutments, the foundations to the piers and abutments being made a depth of 4ft. below the bed of the river, and constructed of solid cement concrete. The piers, which have angular cutwaters and abutments, are built of sandstone ashlar, from Windhill Wood End quarries, filled in solid with rubble and cement. The coping, or girder foundation stones, consist of large sandstone ashlar blocks. The superstructure, which is about 12ft. above the river at low-water level, consists of three spans measuring 88ft. between centre of bearings, making the total length of the bridge 264ft. The whole of the superstructure is of wrought iron. The main girders are of the single lattice type, 7ft. deep, and placed 6ft. apart, from centre to centre, with parallel horizontal booms, vertical struts, and diagonal ties placed 8ft. centres carrying a 3in. plank platform on the bottom flanges. The booms consist of tee irons and flange plates rivetted together. The diagonals are flat bars, and the verticals are angle irons rivetted to the booms. The girders are braced together and stiffened by means of a complete and ornamental system of horizontal and diagonal wind bracings of the top, bottom, and sides. The fixed ends of the girders are carried on bearing plates, bedded on sheet lead upon the foundation stones, and bolted down, and the end plates of the girders, at the joints of the piers, are also bolted together. Suitable plank plinth, iron railing, and hand rail have been placed alongside each girder. The bridge was constructed by Messrs. J. Bagshaw and Sons, Batley, the contract price being £770.

### COLONEL WETHERED'S RAILWAY CARRIAGE LOCK.

The railway carriage door lock which we illustrate is the invention of Colonel Wethered, of Woolwich. The Metropolitan Railway Company, never backward in testing any promising invention, having given his lock more than a year's practical trial, he has been enabled tc perfect it, and it now appears to embody every requirement.

Fig. 3




The advantages claimed are that it is not only a simple and strongly constructed lock, which automatically fastens the door on its being closed, the outside handle squaring itself, but from the manner in which the bolt is retained in the lock case when the door is open, and the easy manner in which it is again liberated on closing the door, there is an absence of all jar, as the most gentle push from outside, or pull to from inside, securely fastens the door.

One new result and most important feature secured is the reverse action given to the spindle of the outside handle, by means of the inside handle, the latter being operated in a directly opposite direction to all inside handles previously used. It lifts up to open, and falls on closing the door.

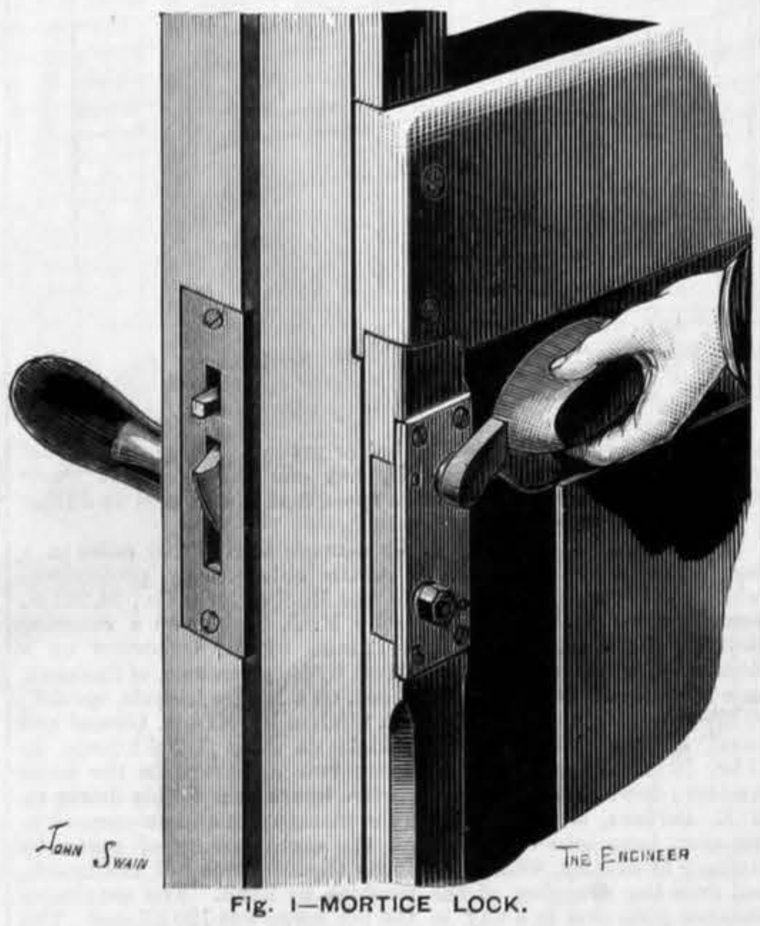



Fig. 1—MORTICE LOCK.

The advantage of this new principle is apparent, as it provides a safe inside handle, so that the more a passenger leans on it, or the more shaking the motion of the train gives it, the more securely the door becomes fastened. The falling weight of the inside handle is utilised to aid the bolt spring in projecting the bolt into the door staple, and to retain it there, consequently the efficiency and security of the lock is rendered independent of the bolt spring, for should the latter break, which it is not liable to do, as there is little strain on it, the falling weight of inside handle would automatically project the bolt, and keep the door securely fastened.

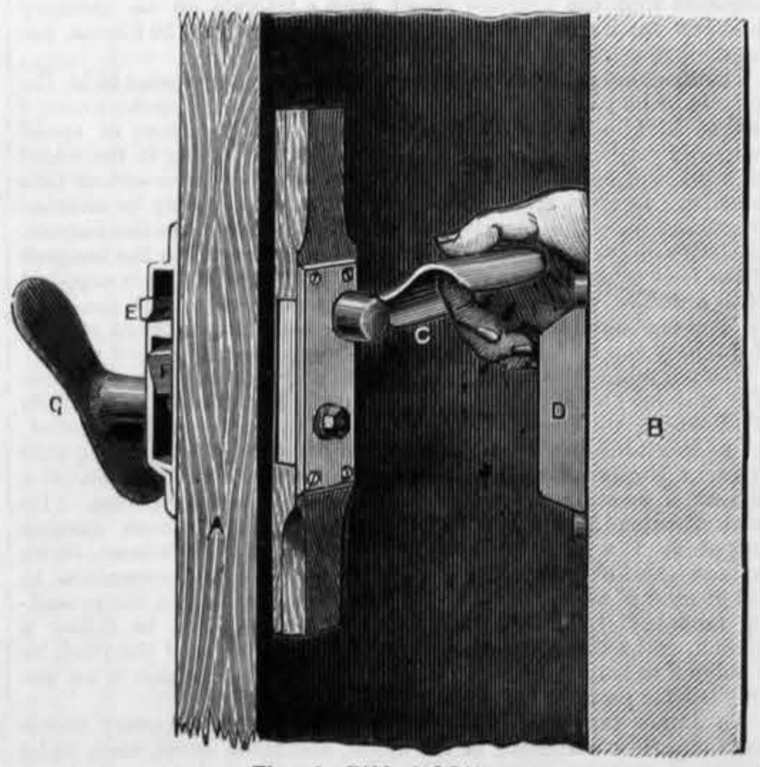



Fig. 4—RIM LOCK.

The form of mechanical arrangement which Colonel Wethered prefers to employ, is shown in Fig. 2, for giving a reverse action to the spindle of outside handle. While it is neatly boxed in and out of the way of dust, or the hands and garments of passengers, it admits of the extent of movement of the inside handle, as well as force employed to open the door, being regulated as required by a simple variation of the length of the interlocking toothed followers.

In the case of all previous door locks having inside handles, the latter have been pivotted on the spindle end of the outside handle, so that the inside handle had to be pushed down to open and lifted up to close, consequently the bolt springs being employed to raise the inside handle as well as project the bolt, these had to be made very strong, which causes friction, wear, and jar when the door is closed.

Fig 2

When the door was fastened the weight of the inside handle acted in a direction to draw the bolt out of the staple, and leave the door open, so that when the spring became weak, its falling weight, combined with the shaking motion of the train, was liable to open the door. When the bolt spring broke, the door would not remain fastened, the compartment was rendered dangerous and useless, and had to be locked up. The Metropolitan Railway Company would appear to be satisfied with the protracted trial given to Colonel Wethered's lock, as they are about to fit it to the new trains.

Fig. 1 is the lock case, with side plate removed, showing the position of the bolt held back by the stud on catch or pawl when the door is open. On closing the door the projecting nose of the pawl rides up the incline on the striking plate, which frees the catch stud on the bolt, Fig. 1, when the latter is projected into the staple by the force of both the spring and the weight of falling handle combined. Fig. 3 is the toothed follower case, with side plate removed, showing how spindles of outside and inside handles are operated by the segments A and B.

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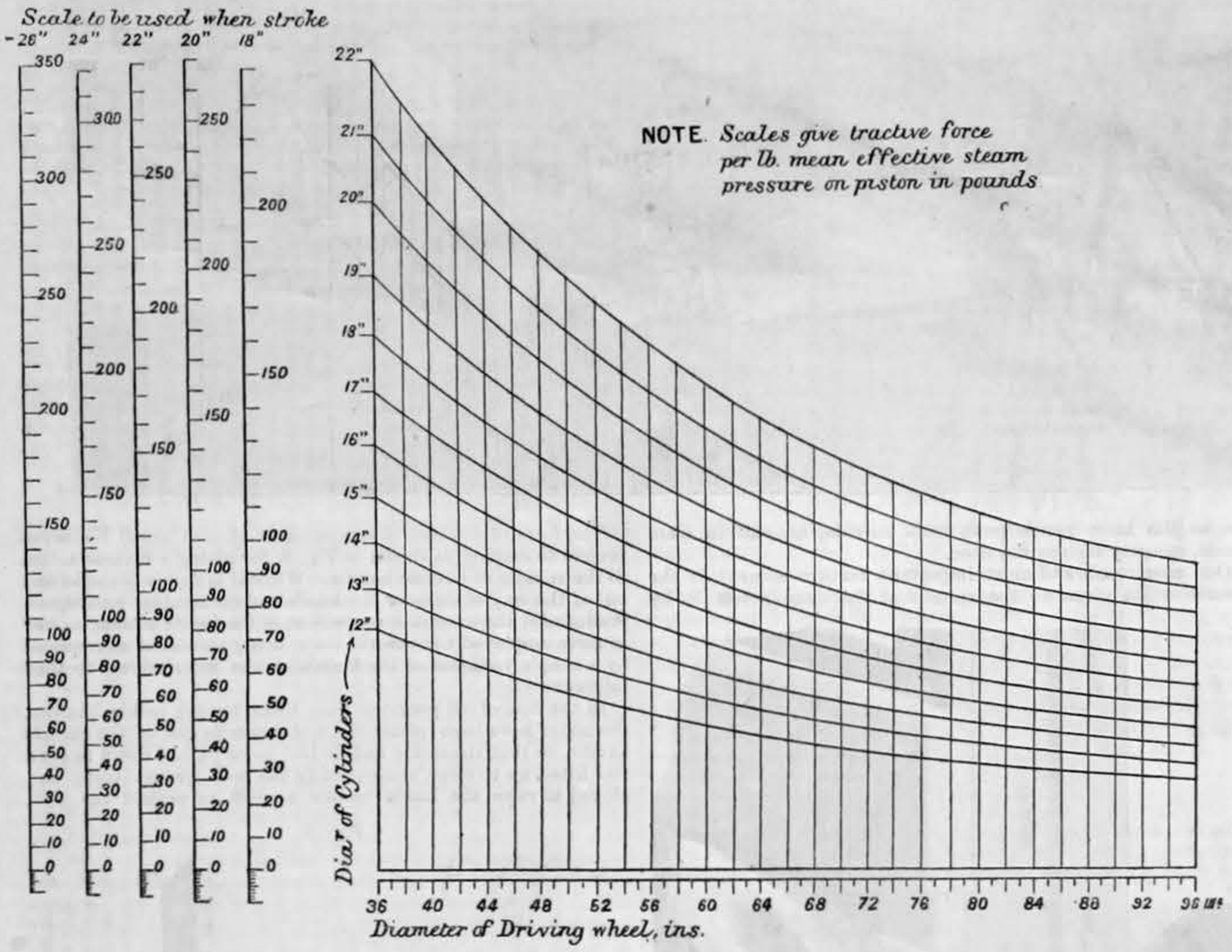
700-Horse-power Engines and Boilers Fitted on Board Ship in Three Days.—A remarkably quick piece of work is reported from West Hartlepool; the s.s. Ermanarich, recently launched from the yard of Messrs. W. Gray and Co., was sent down to the Central Engine Works at three o'clock on Wednesday afternoon, her engines and boilers of 700-horse power were put on board, the connections made, and they were successfully steamed for four hours in the presence of the official and owners' inspectors, on Saturday morning, and the ship returned to the builders' yard by noon on Saturday—that is, in less than three working days from the time she left there. We think this "beats the record;" even in a district noted for quick work it is a capital performance, and one on which the Central Marine Works may be congratulated.

## TRACTIVE POWER OF LOCOMOTIVES.

The diagram below gives the tractive power, in pounds, of locomotives per pound mean effective steam pressure on piston and is one which will be found very useful in solving all questions relating to size of cylinder for given tractive power, length of stroke, maximum diameter of driving wheels, &c., and also for facilitating the comparison of the tractive power of different engines. As an example of the use of the diagram, suppose we require to know what will be the mean tractive power of an engine having cylinders 17in. diameter by 22in. stroke, and driving wheels 60in. diameter. At the point marked 60in. on the scale of diameters of driving wheels at the bottom of the diagram, with a pair of dividers measure the length of the ordinate from the base line up to the line marked 17in. diameter, transfer this to the scale to be used when length of stroke equals 22in., and read off 106 lb. as the tractive force




which will be exerted for every pound mean effective pressure on the piston, or $\frac{17^2 \times 22}{60} = 106$. Again, given the diameter of driving wheels, length of stroke, and tractive power, required the diameter of cylinders:—Reduce the tractive to pounds per pound of mean pressure, and taking this value on the scale to be used for the given length of stroke, set it off over the given diameter of wheels, and read off the diameter of cylinders required. Other uses of the diagram will readily suggest themselves to locomotive engineers.

G. R. B.

## MILITARY VELOCIPEDE IN FRANCE.

The Minister of War has just officially sanctioned the employment of the velocipede in the French army for conveying dispatches. Each infantry regiment of the active army is to contain four velocipedists. The chiefs of the corps themselves to choose these velocipedists among the men of all grades in the reserve and the territorial army who volunteer and offer the best guarantee for fulfilling the service. The velocipedists are to provide their own "mount," and keep it in good condition. In addition to the pay of their grade, they have a right to an allowance of 50 centimes per day as an entertaining premium.

The service of velocipedists on campaign or during the grand manœuvres is to be arranged by the generals commanding the army corps. In fine, these general officers are equally to regulate in every detail, the dress, equipment and accoutrement of the velocipedists. It is to fear that such a method of recruiting may soon become an opportunity for favour to render the time of service as pleasing as possible to certain favourites, whatever may be, moreover, their skill and vigour from the point of view of the velocipede.

The question has nevertheless been studied in France, if not as thoroughly as in England, at least with sufficient attention for the general staff-officer to form a distinct idea of the services one may expect from men, properly mounted and animated, for the transmission of orders. These are the subjects of inquiry we are about to lay before the reader.

The journal, the *Sport Velocipédique* of Paris, official organ of the "Union velocipédique française," issued the first article on the velocipede in the army. Quite a tournament took place after it among authorities in the velocipede world. Then from articles they came to deeds. On the April 22nd, 1886, a velocipedist of Pau, M. Daniel, the same who went from Pau to Calais—1100 kiloms. in 7 days 4 hr. 50 min.—offered to place at the disposition of the Minister of War, for the manœuvres of the 18th corps, five or six trained velocipedists. For reasons it is unnecessary to mention here, it was considered preferable to have recourse to the "Union velocipédique française," which supplied eight velocipedists.

In the interval a practical attempt had been made by the Velo Club Grenoblois at the instigation of M. Terrier, one of its members. On the 15th of August, 1886, M. Brionnet carried a supposed dispatch from Grenoble to Bourg d'Oisans—752m. in altitude—on a bicycle in a very short time. M. Dumoulard went on a bicyclette to prepare, starting from Grenoble, at Tencin and Goncelin, the revictualling and cantonment of a troop on march, that very quickly also. In fine, in another direction and on a bicycle, M. Terrier was reputed to be about to destroy the viaduct of the Moirans Railway. The three velocipedic instruments of most common use had been put into requisition according to their respective qualities. This original attempt won for its authors the praises of the Minister of War.

The manœuvres of the 18th corps in 1886 came at once in corroboration; General Cornat verified in his report that he had not employed any other estafettes, and that his messages had been carried three times as quick as before. The experiments were continued in 1887 at the manœuvres of the 19th and 17th corps, and in 1888 at those of the 3rd and 16th corps, and gave equally very satisfactory results, always employing velocipedists as estafettes.

Those of the 9th corps were very well conducted, and gave rise to the following observations. The number of velocipedists who took part at these manœuvres were twenty-five—nine with bicyclettes, ten with bicycles, and six with tricycles—under the command of M. Martin, sub-lieutenant in the 71st territorial, and president of the Véloce Club of Angers. They were employed solely for the transmission of orders between staff-majors and the different services. They were distributed in bands, each with a chief. The roads and paths followed in the manœuvres were generally bad, the sandy soil of the roads and the pebbles raised by the passage of the cavalry and artillery often rendered the progress of the velocipedists difficult. In spite of that, in a distance of 40 kiloms. it has been shown that a velocipedist arrived in the cantonment one hour and a-half, and sometimes even two hours, before the estafette by horse, without fatigue and without being obliged to rest before setting out again; although it was often necessary to take a devious road, which increased the distance to be travelled over, but presented better ground. The speed varied from 16 to 18 kiloms. per hour, but one should count about 20 kiloms. per hour as the average speed that can be kept up during a journey.

Well trained velocipedists easily manage to ride 250 miles in a day. The following are some results obtained by professional velocipedists; on the machines of the Rudge Cycle Co., 34,242 m. were travelled over in one hour by M. J. Dubois on a coursing bicycle; 40 kiloms. in 1 hr. and 12 min. by M. Oxborrow on a bicyclette; 10 kiloms. in 18 min. 42 sec. by M. Beconnais, of Bayonne, on a tricycle; 8045 m. in 14 min. 8 sec. on a Rudge tricycle, special; 50 kiloms., 2 hr. 4 min. 10 sec. on a tandem by Messrs. Giraud and Laval, of the "Cercle de la Pédale de Paris;" 226 kiloms. in 11 hr. 59 min. 30 sec. by the same two amateurs on the same tandem; 360 kiloms. in 24 consecutive hours on a double driver by M. E. Bertaux, of Caen. But in the manœuvres and on campaign, one must take into consideration the embarrassing of roads by artillery or cavalry, who often force the slackening of the march, and even the dragging of the machine by hand. The maximum distance gone over in a day in the 9th corps was 120 kiloms. The lowest speed was 10 kiloms. per hour in a night march, on a road broken up by the passage of artillery. Colonel Saville, chief of the military velocipedy in England, says that not more than from 6 to 10 miles per hour—9600 to 12,800 m.—should be expected for military cyclists. At the gymnastic school of Joinville, it is admitted that the average speed with a tricycle on an ordinary road and for a course of several hours is from 8 to 10 kiloms. per hour.

The machine most suitable for military purposes seems to be the tricycle or bicyclette. The bicycle, which is the lightest—average weight 16 kilos.—cannot develope these qualifications of speed except on very even ground; its centre of gravity being in the wheel in front, the contact with a stone or rut may cause serious falls forward. In spite of its brake, the stoppage can only be effected progressively. The bicyclette has more stability than the bicycle, its centre of gravity being between the two wheels, on the tangent of the back wheel. Its average weight is 20 kiloms. It is supplied with a brake which can stop it instantaneously, but the man stopped is obliged to descend. It is only with fatigue that a column of infantry can be followed during a certain time, at a slow pace.

The tricycle is the most stable of all, and a soldier can make use of it without any apprenticeship, as in other instances. It admits of advancing with ease at any pace, and to stop remaining seated. It has in addition this considerable advantage, that of being able to carry backwards a burden varying from 10 to 20 kiloms. at a maximum according to the strength of the velocipedist. Its inconvenience is that, with less speed, it occasions greater fatigue to the cyclist, on account of its weight—20 kiloms. on an average—and of the rubbing of the gear, and the formation in soft ground of three ruts instead of a single one, as in the preceding models. In addition, if the cyclist is obliged to follow a column, and to traverse on one of the inclined sides of the road, he is obliged to lean in an inverse direction to his machine in an uncomfortable position for preserving his equilibrium.

An ample vareuse, giving the greatest liberty to every movement, trousers buttoning at the ankle, and laced boots, seem to be the most suitable clothes. Leggings are too hot, and laced brodequins impede the movement of the foot. It is good to add to this an india-rubber tippet with a hood, to protect from the rain, and a leather bag to carry dispatches without their being crumpled. The revolver suffices as an arm for a man not intended for fighting, but only to defend himself against a chance attack. The bag can be adapted to any machine easily, but especially to the tricycle.—*La Nature.*

A useful paper, entitled "Notes on Electric Lighting," was read at the recent annual Congress of the Association of Municipal and Sanitary Engineers at Portsmouth.

## NOTES IN PARLIAMENT.

The following subjects have received attention during the past week:—

*Light Railways (Ireland) Bill.*—On the order to go into Committee on this Bill, Mr. W. H. Smith moved that it be referred to the Standing Committee on Trade. Mr. Storey thought that it had been the intention of the Government to consider this Bill in Committee of the whole House. It was not the kind of measure which ought to be sent to a Grand Committee, because it dealt with large sums of public money, which it was deliberately proposed to give away, and it raised questions which were seriously contested by a considerable section of the House. If the Government persisted in their motion, he should take what means he could to resist it. Mr. W. H. Smith said that notice was given of this motion some time ago, and no serious objection was taken at the time, provided hon. gentlemen interested and Irish members were added to the Grand Committee by the Committee of Selection. The principle of the Bill had been affirmed by the House, and it was such a measure as could be most usefully considered by a Standing Committee. Mr. Craig asked when the Government proposed that the Grand Committee should meet. Sir M. Hicks Beach said it would meet as soon as the fifteen members were added, and this would depend on the Committee of Selection. Mr. Whitbread said that as soon as the order was given the Committee of Selection would be prepared to act. The House divided, and the numbers were—For the motion, 231; against, 60; majority, 171. Mr. O'Doherty then moved the following:—"That it be an instruction to the said Committee that they have power to insert clauses in the said Bill enabling the promoters of a light railway in proper cases to use their capital in construction of piers and in the purchase or hire of proper steamers in cases where otherwise, by reason of intervening arms of the sea, the length of the line and the cost of construction would be excessive, or two lines of railway might be required." Mr. A. J. Balfour said that he did not think that there were many cases in which the proposal of the hon. gentleman would apply, but in view of the fact that if there were any such a great saving would be effected, he was prepared, on behalf of the Government, to accept the proposal.

## THE FORTH BRIDGE.

On page 96 we publish another illustration of one of the pairs of the great cantilevers of this famous structure. The illustration, like that we published last week, helps to convey a more adequate idea than has hitherto been possible of the enormous proportions of the structure. It is from a photograph taken by Mr. Carey, C.E., on the 24th May last, when the cantilevers were completed to about 630ft. from the vertical columns, and courteously placed at our disposal by the engineers.

## TRAVELLING CRANE.--DEPTFORD CENTRAL ELECTRIC LIGHTING STATION.

On page 89 will be found an engraving illustrating a large rope-driven travelling crane, erected by Messrs. Vaughan and Son, Manchester, over the two 1500-horse power engines and 1250-horse power Ferranti dynamo in the Deptford central station of the London Electric Supply Corporation. The engraving also serves to illustrate the roof and masonry of part of the building. We shall give a further illustration of the crane, with some particulars, in another impression.

The Sanitary Institute.—At an examination held for local surveyors, July 25th and 26th, nine candidates presented themselves. Questions were set to be answered in writing on the 25th, and the candidates were examined *viva voce* on the 26th. The following candidates were certified to be competent, as regards their sanitary knowledge, to discharge the duties of local surveyors:—William Gibson, Bonhay-road, Exeter; Joseph Bennett Massey, 64, Burn-street, Burnley; Joseph Radcliffe, Cambridge-place, Todmorden; David John Reid, 2, Post-office-buildings, Inverness; Samuel Towlson, 54, Hanover-road, Plumstead.

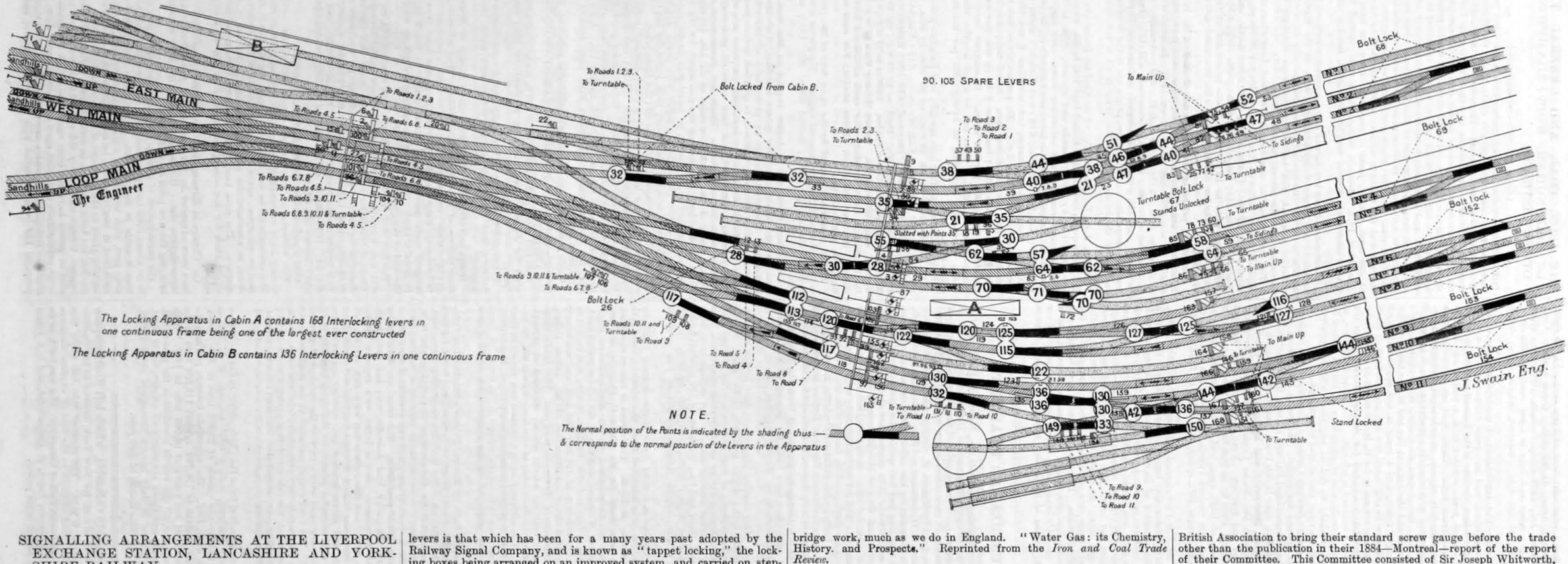
The Conemaugh Dam.—The damage by the Johnstown flood is reported by the Board of Inquiry convened to approach 9,000,000 dols. They divided the losses into six classes, and put the first five at 4,791,749 dols., covering 3364 cases, with an average loss of 1424 dols. The total loss under Class 6 is 1,112,192 dols., with 445 cases. The aggregate loss of borough property is 168,180 dols. The damage in seven school districts is 52,132 dols. Losses on private property so far reported amount to 1,731,662 dols. The Board has not yet heard from the Cambria Iron Company, the Johnstown Manufacturing Company, or the Cambria and Westmoreland Natural Gas Company. The total loss reported to date amounts to 7,894,064 dols., and assuming that the 491 cases not fully reported upon will average as the others, 1550 dols. each, the grand total is estimated at 8,665,114 dols.

Technical Instruction.—Surely, if nothing else will waken the British public to a knowledge of the puerile meddlesomeness of those who lead the attempt to force the taxpayer into paying schoolmasters for that precious amateur thing they call technical instruction, the following definition from their technical instruction Bill ought to do it. It runs as follows:—"In this Act the expression 'technical instruction' shall mean instruction in the principles of science and art applicable to industries, and in the application of special branches of science and art to specific industries or employments. It shall not include teaching the practice of any trade or industry or employment, but, save as aforesaid, shall include instruction in the branches of science and art with respect to which grants are for the time being made by the Department of Science and Art, and any other form of instruction which may for the time being be sanctioned by that Department by a minute laid before Parliament and made on the representation of a local authority that such a form of instruction is required by the circumstances of its district." In other words, the propagandists propose to get an Act first, and then find out, if they can, what they are to teach for their money afterwards. It would pay to give a few of these men a good salary, and ask them to be kind enough to take a perpetual holiday.

Liverpool Overhead Railway.—The contract for the Liverpool Overhead Railway has, it appears, been finally concluded. Although common in the United States, this particular type of road has never before been introduced into this country. Tunnels have always been preferred. The emission of steam and smoke by the ordinary locomotive at the level of dwelling-house windows, and close to them, has always been considered highly objectionable. But the experience derived from the working of the underground railways in London has demonstrated that the nuisance is just as great in tunnels, only that the sufferers there are the passengers and railway servants, and not the outside public. It is becoming daily more and more clear that the steam locomotive is out of place in towns and cities, at whatever level the road is carried. All that is wanted is a really good substitute in the way of a practical electric locomotive, and then tunnels or overhead lines become equally available. The new Liverpool line is about six miles long, and will be composed of steel joists resting on columns, and covered with iron flooring. The order for the joists is said to have been already placed with Messrs. Dorman, Long, and Co., of Middlesbrough, and will comprise several thousand tons. The engineers of the line are Sir Douglas Fox and Mr. J. H. Greathead, MM. Inst. C.E., London, and the contractor is Mr. J. W. Williams, of Manchester.

# LANCASHIRE AND YORKSHIRE RAILWAY.—SIGNALLING ARRANGEMENTS—EXCHANGE STATION, LIVERPOOL.

THE RAILWAY SIGNAL COMPANY, FAZAKERLEY, ENGINEERS.




*The Locking Apparatus in Cabin A contains 168 Interlocking levers in one continuous frame being one of the largest ever constructed*

*The Locking Apparatus in Cabin B contains 136 Interlocking Levers in one continuous frame*

NOTE.

*The Normal position of the Points is indicated by the shading thus — & corresponds to the normal position of the Levers in the Apparatus*

## SIGNALLING ARRANGEMENTS AT THE LIVERPOOL EXCHANGE STATION, LANCASHIRE AND YORKSHIRE RAILWAY.

THE new Exchange Station, Liverpool, of the Lancashire and Yorkshire Railway Company, which has within the last few months been fully brought into use by the Lancashire and Yorkshire Railway Company, is one of the most commodious in the country. We are indebted to Mr. G. Edwards, of the Railway Signal Company, Fazakerley, for the drawings and particulars from which our engraving of the signal arrangements and the following description has been prepared. It is an exceedingly comprehensive and extensive signalling problem, and some account of it will interest our readers. There are six platforms and ten passenger lines in the station, having platform faces, and in one of the bays there is a middle road, which is used for the purpose of engines running round trains. There are six lines of rails outside the station—viz., three down lines and three up lines, and the roads are so arranged that trains from the down east main line can be turned into either one of seven platform lines—viz., 1, 2, 3, 4, 5, 6, or 8, and trains from the down west main line can be turned into any one of the ten platform lines in the station. Trains from the down loop main can be turned into either of seven platform lines—viz., 4, 5, 6, 8, 9, 10, or 11. The same operation can be performed for outward going trains, *i.e.*, trains from either 1, 2, 3, 4, 5, 6, or 8 can depart from the station and go to either the up east main or the up west main; and similarly trains from roads 1, 2, or 3 can depart for either the up west main or the up east main; and from roads 4, 5, 6, or 8 to either the up loop main, the up west main, or the up east main; and trains from roads 9, 10, or 11 can depart for either the up loop main or the up west main. It will therefore be seen that by this arrangement of the roads the greatest facilities for working traffic and utilising the roads in the station have been obtained.

The signalling arrangements are operated from two signal cabins, one marked A on the plan and the other marked B. The interlocking frame in cabin A contains 168 levers in one continuous frame, being one of the largest ever constructed, and the whole of these levers are in operation except two. The locking frame in cabin B contains 136 levers in one continuous frame. The system of interlocking between the levers is that which has been for a many years past adopted by the Railway Signal Company, and is known as "tappet locking," the locking boxes being arranged on an improved system, and carried on step-brackets, so that instead of being one under the other, each is in advance of the other, thus allowing the locking gear to be easily got at for any purpose that may be necessary. The whole of the locking for the 168 levers in cabin A is contained in four locking boxes, and occupies a space of about 2ft. 6in. in width by 1ft. 6in. in depth. It will be seen from the plan that fixed signals have been provided for all important movements, and for both main line, running, and shunting; hand signalling thereby being almost entirely dispensed with at this important station. Although the traffic at this station is a very heavy one, and from its being a terminal station the necessity arises for a good deal of engine shunting, the large locking frame in cabin A is found to be easily operated by two signalmen and one telegraph boy during the busy part of the day, and during the night and on Sundays it is found necessary to employ only one man. The whole of this important station has now been in operation for over twelve months, and the signalling arrangements have been found so complete and satisfactory for dealing with the traffic that it has not been found necessary to make any additions or alterations since the opening.

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PAMPHLETS AND PERIODICALS RECEIVED.—Paper read before the Leeds Association of Foremen Engineers and Draughtsmen on "Modern Steam Boilers," by J. F. Elsworth. Leeds: Jenkin Davenport.—The Mason Science College, Birmingham, Syllabus of Day Classes, Session 1889-90.—"Construzione ed Eserciso delle Strade Ferrate e delle Tramvie. Impiego del Ferroire per transports dei Malati e Feriti in Guerra." Treni Sanitari, pel dott, Gio Francesco, Randone.—"Third Annual Report of the City of London College Science Society." London: City of London College. Contains abstracts of several interesting papers, and a paper in full by G. S. Boulger, F.G.S., on "The Value of Experiment in Biology."—"Iron Viaducts for Highways," by J. A. L. Waddell, C.E., Kansas City, Mo., U.S.A. Kansas City: S. G. Spencer; 1889. This describes a proposed system for America of employing a consulting engineer and limiting the number of contractors invited to tender for bridge work, much as we do in England. "Water Gas: its Chemistry, History. and Prospects." Reprinted from the *Iron and Coal Trade Review*.

DENVER SOCIETY OF CIVIL ENGINEERS.—At a regular meeting of this Society on July 9th, 1889, called to order at 8.15, President Nettleton in the chair, Thos. Withers was elected a member, and applications for membership were received from John W. Nesmith, president and principal owner of the Colo Ironworks, and from John Philips Maxwell State Engineer of Boulder Colliery. Mr. Angell and Mr. Campbell, appointed to prepare and arrange specimens of sandstone given to the Society by the State Board of Capitol, Conn. Mr. Edmund P. Martin illustrated and gave a description of the Fourteenth-street viaduct of Denver. The viaduct will extend from Holliday-street along the south bank of Cherry Creek, over the Platte River to Platte-street in North Denver, a total length of 3500ft. It will cross over most of the railroads coming into the city, and will have a roadway of 40ft. between side-walks, which are 8ft. wide. It will be built of iron and earth embankment, and will cost complete 107,000 dols. Grade on west approach, 3 per cent.; east approach, $2\frac{6}{10}$ per cent. The embankments are built by an endless chain dredger taking sand and gravel from the bed of Cherry Creek, and will be protected by smelter slag for 8ft. in height. Cost of embankment, about 20 dols. per lineal foot; cost of 750ft. of ironwork so far, 44,000 dols.; the girders and posts, about 40 dols. per foot. On the discussion about dams, Mr. E. S. Nettleton, supervising engineer United States Gel. Jur., gave a description of the proposed new dam at Elpaso, Tex., over the Rio Grande, Rio. This dam, if built, will make the largest fresh water reservoir in the world, and is to be built by the United States and the Republic of Mexico. There are three proposed sites for dams, all 60ft. high, and varying in lengths on top from 450ft. to 700ft. long. The lake will average three and a-half miles wide and fifteen miles long, to be used for manufacturing and irrigating, and to have gates to control floods, a silt reservoir, flushes, &c. The members discussed the Conemaugh and Quaker Dams, and adjourned at 10.30 p.m.

STANDARD SCREW THREADS FOR APPARATUS. — The sub-committee appointed by the General Committee of the Electrical Section of the London Chamber of Commerce to consider the recommendation of standard or uniform types, desire to obtain information as to the extent to which the British Association screw thread has been adopted by the electrical trade up to the present. No steps have been taken by the British Association to bring their standard screw gauge before the trade other than the publication in their 1884—Montreal—report of the report of their Committee. This Committee consisted of Sir Joseph Whitworth, Sir W. Thomson, Sir F. J. Bramwell, Mr. A. Stroh, Mr. Beck, Mr. W. H. Preece, Mr. R. E. Crompton, Mr. E. Rigg, Mr. A. Le Neve Foster, Mr. L. Clark, Mr. E. T. Wood, and Mr. Buckney, and were "appointed for the purpose of determining a gauge for the manufacture of the various screws used in telegraphic and electrical apparatus, in clockwork, and for other analogous purposes." In the report of the British Association for 1885—Aberdeen—it is stated that the standard screws "have been officially adopted by the telegraph department of the Post-office, and this step alone may be relied upon to insure their general adoption by the telegraphic and electric instrument trades in the course of a few years." In the 1887—Manchester—report the following statement was made by Mr. Preece 'Owing to the large number of telegraph instruments made by different manufacturers, the number of screws of different forms and sizes in use was very great, and this was found to be a great disadvantage and a great source of expense. When the Post-office commenced to manufacture its own apparatus, it was decided to make all parts to template, so as to be interchangeable. and it was also decided to adopt some standard for screws. The standard recommended by the Committee appointed by the British Association is now being introduced in all instruments and apparatus manufactured by and for the Post-office department a circular to that effect having been issued to all firms manufacturing for the General Post-office." Notwithstanding the above, a considerable number of manufacturers of electrical instruments are still quite unacquainted with these screws, and the Committee feeling that the practical value of such a standard depends largely, if not entirely, on the extent to which it is adopted, invite communications from the trade upon the subject, and for that purpose have drawn up the following set of questions, to which answers are requested from manufacturers:—Electrical Trades Section.—(1) Do you use the British Association standard screw gauge in your manufacturing business? (2) If so, what is the proportion of small screws of this gauge, compared with other screws smaller than the Whitworth sizes used by you? (3) Also, if so, do you find that for ordinary purposes you require to use other screws than those of the Whitworth and the British Association gauges? (4) If you do not use the British Association screw, have you any reason other than that you do not care to incur the expense and trouble involved by their adoption? Note, the name and address need not be given if there is any objection to doing so.

## AMERICAN ENGINEERING NEWS.

*Shipbuilding yard.*—An extensive shipbuilding yard is to be established at Newport News., Va., in connection with Mr. C. P. Huntington's railway and steamship interests. Steel steamers will be built here for the Morgan line, and the United States and Brazil mail line, and repairs made to the existing boats of these lines. The plant will be in operation by January next, and the keels will then be laid for two steel freight steamers of 3500 tons each. There will be an iron foundry, brass foundry, machine shop 400ft. by 60ft., blacksmiths' shop 280ft. by 40ft., tool shed 280ft. by 120ft., bending platform and furnace 300ft. by 120ft., joiner and carpenters' shop, pattern shop, and mould loft, 300ft. by 60ft., with three stories. The Chesapeake and Ohio Dry Dock and Construction Company has been incorporated to manage this enterprise.

*An Exposition for New York* is projected to be held in 1892, to celebrate the fourth centenary of the discovery of America by Columbus. Already the discussion over the site has been commenced. Many objections are urged to its location in Central Park, as it would seriously injure the park, which should be an attractive feature for the large number of visitors who will come to the city. Staten Island has been suggested, and would be easy of access by a number of additional steamers to the present ferry lines. A better location for some reasons is suggested on the north side of the Harlem river, above New York, and on the shore of Long Island Sound. The objection to this would be the means of access, as the present elevated railway system is inadequate for the proper handling of the existing traffic during the busy hours of the day, and a new elevated road would have to be begun very soon to be built the whole length of the city and suburbs by 1892.

*New steamers.*—Four fine new steamers have been put on passenger lines from New York. The Puritan, of the Fall River Line, running between New York and Fall River, by way of Long Island Sound, one of the favourite water routes to Boston, is of the usual American type of boats for the service, with a low hull, wide decks projecting on guards beyond the hull, two or three tiers of upper decks, and a most elaborate interior furnishing. The exterior is painted white. She is 420ft. long, 52ft. beam of hull, and about 90ft. wide above the guards. Her displacement is 4150 tons and gross tonnage 4650 tons. The hull is double, divided into fifty-nine water-tight compartments, fifty-two between the hulls, and seven by athwartship bulkheads. The rudder is of steel with wood filling. It is 14ft. 6in. long and 13ft. high. On the main deck is the entrance hall or "quarter deck," 58ft. by 24ft., with ticket offices, coat-rooms, barber shop, &c.; aft is a cabin 82ft. by 53ft., with floor space 72ft. by 24ft.; aft of this is a ladies' cabin, 42ft. by 27ft. The freight deck has 80,000 cubic feet of space. The dining saloon, below the main deck, 108ft. 4in. long by 30ft. wide and 12ft. high. A continuous promenade runs round the saloon and hurricane decks. The wheels are of the feathering type, 35ft. diameter—smaller than usual; the buckets are 14ft. long, 5ft. wide and of $\frac{7}{8}$in. steel. Each wheel weighs about 100 tons, and they will make about twenty-four revolutions per minute. The engine is vertical, of the beam type, and 7500-horse power. The high-pressure cylinder is 75in. diameter and 9ft. stroke, and the low-pressure cylinder 110in. diameter and 14ft. stroke, both of the cylinders are at one end of the beam, and at the other end is the connecting-rod. The cranks weigh nine tons each, and the crank pin is 19in. diameter and 22in. long. The beam is of lozenge shape in elevation, 34ft. long, 17ft. deep, weighing forty-two tons. There are eight steel boilers, and forced draught is supplied by two Sturtevant blowers. The surface condenser has 15,000 square feet of cooling surface. The electric light is fitted throughout, and the interior fittings, decoration, and furnishing is elegant and elaborate. The Connecticut, a new boat for a competing Sound line of steamers, is 357ft. long, 87ft. beam, and 60ft. from keel to pilot-house. In her machinery there is a radical departure, the engines being of the oscillating type, 6000-horse power. The wheels are of the feathering pattern, and will be driven at thirty revolutions per minute. The boat is expected to make twenty miles an hour. The Sandy Hook and Monmouth are two steel twin-screw boats, running on New York Bay between New York and Sandy Hook, connecting with the New Jersey Southern Railroad for the numerous summer resorts on the New Jersey coast. It is a favourite route for wealthy families living at these resorts, and the company has put on these boats to further increase its popularity. They are 280ft. long, 37ft. beam, and 49ft. wide over the guards, 10ft. 6in. draught, 15ft. 6in. depth of hold; licensed for 2200 passengers. There are two triple-expansion engines, with cylinders 22in., 36in., and 55in. diameter and 28in. stroke. Steam is supplied by four Scotch boilers with internal furnaces. Each is equipped with an Edison incandescent electric light plant of 200 lamps. The fitting, decorating, and upholstery is in the highest style. As the trip is only one hour long each way, and no night trips are made, state-rooms are not required, but in their places are private saloons or parlours for the accommodation of families or parties. They are very swift and handsome craft.

*A centreboard steamer.*—A form of steamer adapted for ocean and river service combined, designed especially for ocean freight steamers to run up the Mississippi river, has been invented by A.H. Lucas, of St. Louis. The design has two separate hulls, united at the forward end by a solid bulkhead forming the bow, and having an open space between them towards the stern. These hulls will contain the machinery and cargo, and will each have an ordinary keel. Between the hulls will be a strong adjustable keel, on the same principle as the centreboard used so successfully for yachts. If the ordinary draught of a 1000-ton steamer is 7ft., with which draught she could run up the Mississippi to St. Louis, on going to sea the keel could be lowered 14ft. to give her a draught of 21ft. When lowered the upper part of the keel will be held in place by steel braces projecting from the inner sides of the hulls. Twin screws would be used. An experimental ship is to be built on this system, and is to be designed for a high rate of speed at sea; it will be built by cramps.

*The Milford Haven Steamship Line*, which has been projected for the past ten years, is again being talked about. Mr. Austin Corbin, president of the Long Island Railroad, is the leading spirit of this scheme, which is to run an entirely new line of swift well equipped steamers between a point at Fort Pond Bay, near Montauk Point, at the easterly end of Long Island, to Milford Haven, in Wales. This route would avoid the voyage off Long Island and up the bay, the passengers being carried by express trains over the 100 miles length of the island to Brooklyn and New York. The sea route would be 2781 miles long. Whether there is anything at the back of this latest revival of the scheme remains to be seen.

*Street railway expenses.*—The following estimates of the cost of construction and operation of street railways for horse, electric, and cable traction, have been prepared by persons interested in putting in an improved system of traction at Baltimore, Ind. The figures are in each case for a line ten miles long:—Horse cars—Track, 70,000 dols.; forty cars at 850 dols. (average), 34,000 dols.; 400 horses at 150 dols., 60,000 dols.; building, 40,000 dols.; total, 204,000 dols. Electric cars—Track, 70,000 dols.; forty cars at 700 dols., 28,000 dols.; ten miles of conduit, at 25,000 dols., 250,000 dols.; steam plant, 20,000 dols.; dynamo plant, 24,000 dols.; forty motor trucks, at 1500 dols., 60,000 dols.; building, 10,000 dols.; total, 462,000 dols. Cable system—Track, 70,000 dols.; forty cars, with grip, at 950 dols., 38,000 dols.; ten miles conduit, from 50,000 dols. to 100,000 dols. per mile of track, according to difficulties encountered (say 65,000 dols. per mile), 650,000 dols.; steam plant, 25,000 dols.; machinery and sheaves, 10,000 dols.; building, 10,000 dols.; total, 803,000 dols. The annual running expenses are estimated as follows:—Horse cars, feeding, replacing, &c., 400 horses at 219 dols., 87,600 dols.; wear and tear, at 5 per cent., 7200 dols.; interest at 6 per cent., 12,240 dols.; total, 107,040 dols. Electric cars—Coal 7756 dols.; engineer and assistant 1460 dols.; firemen, 1095 dols.; wear and tear at 3 per cent., 13,860 dols.; interest, 27,720 dols.; total, 51,891 dols. Cable system—Coal, 9581 dols.; engineer, &c., 1460 dols.; firemen, 1095 dols.; oiling sheaves, 4000 dols.; wear and tear at 3 per cent., 23,694 dols.; maintaining cable, 13,200 dols.; interest, 48,180 dols.; total, 101,210 dols.

*Electric signalling.*—The application of electricity to signalling has been often suggested, and has been carried out to a small extent. One of the latest systems is the Palmer system, in which brushes on the engine make contact with a pair of rail lengths placed between the track rails. These rails are connected with wires running to semaphore signals, drawbridges, switches, crossings, &c., and connected with electric apparatus. In the event of the draw, switch, &c., being open, an electric connection is made between the brushes and the rails at the end of the block section on which the danger exists, and a gong in the engine cab is set ringing, and continues to ring until the engineer or fireman stops it. Very large claims are made for it, but it seems to be too complicated to be practically adopted for regular service under the conditions to which a railroad is subject. The great hindrance, so far, to the general introduction of electricity is, that it cannot be relied upon, but is likely to fail at any time, without apparent cause and without warning, and so lead to accident.

*The Canadian Pacific Railway Company's* line across the State of Maine has been opened for traffic. The route commences at a junction with the International Railway branch from Sherbrooke, crosses the State line near Holeb Pond, and runs through a wild country to Greenville, Brownville, and Mattawamkeag, where connection is made with the Maine Central Railroad. There are numerous bridges and trestles. Near Mattawamkeag the line crosses the Penobscot river by an iron bridge of two through truss spans of 150ft., two of 100ft. span, and 62ft. of trestle approach. At Ship Pond is an iron viaduct 1405ft. long, with one 100ft. span, twelve 60ft. spans, twelve 30ft. spans, and 225ft. of trestle. The height is 120ft.

*Electricity on the New York elevated railroads.*—In October, 1888, the Daft Electric Motor Co. began experiments on the Ninth Avenue line with a motor of increased power. Beginning with light loads, the load was increased until a train of eight cars, each weighing twelve tons, was hauled over the entire length of the line, including a grade of 98·7ft. per mile—about 1 in 52—at an average speed of 14·6 miles per hour. The maximum speed on the level was 16·36 miles per hour. An empty train of three cars ran on the up-town track at a mean rate of 23 miles an hour, the speed on the level being nearly 28 miles. These practical tests have brought out many objectionable features, which have been eliminated, and a new motor has recently been built, which has been designed for regularly hauling trains of six loaded cars on the Ninth Avenue line.

## LAUNCHES AND TRIAL TRIPS.

On Wednesday morning, the 31st ult., Messrs. E. Finch and Co. launched from their shipbuilding yard at Chepstow, the second or intermediate caisson, built to the order of the Barry Graving Dock Co. The caisson was at once taken in tow by three tugs for Barry.

The s.s. Attila, built by Messrs. R. Craggs and Sons of Middlesbrough, for Messrs. J. H. Lennard and Sons, also of Middlesbrough, was taken out on Saturday for her official trial trip, and although the weather was anything but favourable, the result proved, we are informed, very satisfactory. The engines are supplied by Messrs. Westgarth, English and Co., of Middlesbrough, having cylinders 21in., 34in., and 57in. by 39in. indicated 1160-horse power and worked throughout the dayi n a very satisfactory way. The dimensions of the vessel are 280ft., by 37ft. 6in. by 25ft. 6in. She has been built to carry oil in bulk, and is fitted with all the latest improvements. The oil pumps are Messrs Tangyes' Duplex pumps, and the electric light installation is by Messrs. Holmes and Co. of Newcastle.

On Tuesday the s.s. Ironopolis proceeded from the Tees on her trial trip. This vessel has been built for Messrs. J. M. Lennard and Sons, of Middlesbrough, by Messrs. Raylton, Dixon, and Co., of the Cleveland Dockyard, being the seventh vessel they have built for this firm. Her leading dimensions are: length over all, 305ft. 3in.; breadth, 38ft.; depth moulded, 22ft. 10in., with a deadweight carrying capacity of over 3700 tons. She is fitted with raised quarter deck, having bridge and forecastle connected, thus classing her as a "partial awning deck." Her engines have been supplied by Messrs. Blair and Co., Stockton, of 180 nominal horse-power, with cylinders 22½in., 36½in., and 60in., by 39in. stroke. The Ironopolis is the largest steamer owned in the port of Middlesbrough.

On Saturday afternoon a steel screw cargo steamer 225ft. by 32ft. 6in. by 15ft. 9in., was launched from the works of the Blyth Shipbuilding Company at Blyth. This vessel is named the King Alfred, and has been built for Mr. Owen C. Philipps, of Glasgow. The engines will be supplied by the North-Eastern Engineering Company, of Wallsend, and are of the tri-compound kind, the cylinders 16½in., 27in., and 44in. by 33in. stroke, and boilers to work at an ordinary pressure of 160 lb. The hull and machinery have been constructed under the inspection of Mr. James Dykes, superintendent engineer of Newcastle-on-Tyne. The Blyth Shipbuilding Company's building berths are all occupied at present. The berth vacant by the launching of the King Alfred will be immediately filled. The company have, also, two new vessels at their outfitting quay, both rapidly approaching completion. In addition, they are executing repairs to several vessels in the river. A large number of men are employed in the construction of their new dock.

The s.s. Prudentia, built by Messrs. Palmer's Shipbuilding Company, Jarrow, for Mr. Alfred Suart, of London, was taken for load trial at sea on the 23rd ult. She is 312ft. long, 40ft. beam, 23ft. depth, and is constructed for the carriage of petroleum in bulk. She is fitted with seven double oil-tanks capable of holding 3400 tons of cargo, and is specially designed and ventilated for a mixed cargo of crude and refined petroleum. The vessel was designed by Messrs. Flannery, Baggalley, and Johnson, and has been built under their superintendence. She is fitted with engines having cylinders 25½in., 37in., and 62in. diameter, with 42in. stroke, and supplied with steam from boilers having a heating surface of about 4500ft. Electric and steam heating and cooking apparatus are fitted, together with powerful pumps for the quick handling of oil cargo. She is also arranged with a view to the carriage of general cargo, if desired. The dead weight on board at the trial was about 3000 tons, and a very satisfactory progressive trial was made, steam being easily maintained, the full speed runs giving a mean of 10·7 knots. Steam steering gear, evaporator, and feed heater are fitted, together with other modern improvements for economy and quick handling.

The new vessels launched from the Clyde shipyards in the course of July numbered thirteen, with a total tonnage of 17,394, as compared with twenty-one vessels of 23,902 tons in July, 1888, and 8790 tons in July, 1887. The aggregate tonnage put into the water in the seven months is 156,728, against 118,352 tons in the corresponding period of last year and 96,066 tons in 1887. With two or three exceptions, all the vessels launched in the past month have been steamers, and those are nearly all constructed of steel. The new orders placed in July have a tonnage of about 28,000, against 16,000 in the same month of last year.

The new steamship Columbia, which left Southampton on the 20th ult. at 2.40 a.m. for New York, arrived at her destination on the 26th at 6 p.m. The steamer that has made this rapid voyage is the latest addition to the fleet of express steamers of the Hamburg-American Packet Company. She was built, as we stated last week, by Messrs. Laird, of Birkenhead, and is a vessel of 8000 tons and 12 500-horse power.

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

*(From our own Correspondent.)*

The satisfactory condition of trade which it has been possible to report now for some time past is continuing. On Wednesday, in Wolverhampton, and to-day—Thursday—in Birmingham, the markets were fully as good as any that have gone before them for many weeks past. Indeed to-day the market was perceptibly stronger, the result of the advance of 6d. per ton to puddlers and 5 per cent. to millmen, which has now been conceded to the iron-workers. And ironmasters reported the probability of further advances in prices arising out of this additional concession, carrying with it, as it does, an increase in the cost of production. The fact that steel workers' wages are rising in Darlington, and that the wages of the Durham colliers were expected to be advanced 2½ per cent., making them 7½ per cent. upon the basis rates of November, 1879, were also items which strengthened the belief that in most trade centres cost of production has not yet reached its limit.

Consumers of iron are indeed now becoming convinced that it is useless to any longer delay placing orders, as the market seems certain to further rise against them, consequently there was to-day a better demand, and makers' prices were obtained with less bartering than for several markets past.

The new prices of the Pelsall Coal and Iron Company, near Walsall, are as follow:—P.C. bars, £6 10s.; P.C. hoops, £6 15s.; Crown bars, £7 10s.; Crown hoops, £8; Crown sheets, singles, £8; charcoal sheets, £15; hinge strip, £7 5s.; gas strip, £7; and nail strip, 24in. wide to 13 g., £7. These prices are at the Pelsall Company's works for ordinary sizes, with the usual extras as per their list.

The sheet prices of ordinary sizes of Messrs. E. P. and W. Baldwin, of the Welden Ironworks, near Stourport, become, for single, 20 w.g., Shields, £10; Severn, £11; Baldwin-Wilden B., £12; ditto B.B., £13; ditto B.B.B., £14; charcoal, £16 10s.; B. charcoal, £19 10s.; and E.B. charcoal, £21 10s. Doubles, 21 to 24 w.g., are 30s. a ton above singles; and trebles, 25 to 27 w.g., are 60s. above singles. The above prices are at the Wilden Works, and if the sheets are pickled the price is £1 a ton above these rates.

Messrs. John Knight and Co., of the Cookley Ironworks, Brierley Hill, now quote as follows:—Rolled bars 1in. to 6in. wide, and not less than 1in. by 1¼in.; rounds and squares, $\frac{7}{16}$in. to 3in.; half rounds, angle iron, &c., not exceeding 2 cwt. each bar, Knight's crown, £8; Knight's plough (on bars), and Knight's Bt. Bt. (on bands), both £10; Knight's charcoal, £16; and Knight's extra charcoal, £20 10s. Rounds and squares, not less than $\frac{3}{8}$, are 10s. per ton above bars; $\frac{5}{16}$ and 1 and 2 w.g., 20s. per ton above bars; ¼ and 3 and 4 w.g., 30s. per ton above bars. Small flats, &c., less than 1 by ¼, 20s. per ton extra; less than ¾ by $\frac{3}{16}$, 30s. per ton extra; less than ½ by $\frac{3}{16}$, 50s. per ton extra. Hammered bars, 15s. per ton more than rolled. Bars cut to exact lengths, 10s. per ton extra. Strip iron, 1½ to 6in. to 14 w.g., 30s. per ton more than rolled bars.

Knight's crown plating bars are £8; and Knight's plough ditto, £10. Single sheet to No. 20 w.g., up to 96in. by 36in., Debdale, £9 10s.; K.B.C., £10 10s.; Knight's crown, £12; Knight's plough or S.P., £13 10s.; C.S.S. charcoal, £15 10s.; Knight's charcoal, £20 10s.; soft steel, £11 10s. Doubles to 24 w.g., up to 84in. by 36in., are 30s. per ton above singles. Latten to 27 w.g., up to 84in. by 36in., 60s. above singles. Latten thinner than 27 w.g. is quoted for specially. Extra lengths: For each additional foot or part thereof, 20s. per ton extra. Extra widths: For each additional inch, 10s. per ton extra.

Tinned sheets are quoted by the same firm at 24s. per cwt. for coke singles, and 26s. for charcoal singles. Tin-plates are quoted:—Best charcoal, 22s. I.C.; second ditto, 20s. I.C.; and coke, 18s. I.C

Galvanised sheets are in better request on the week. There seems no indication of spelter prices receding. Galvanised sheet consumers, therefore, seeing no probability of reductions, and fearing further advances, continue to give out orders more freely. Makers of black sheets for galvanising purposes are, of course, correspondingly benefitted, and they reported yesterday a better demand than for some time. These last descriptions of sheets remain strong at the association rates of £7 15s. for singles, and £8 5s. for doubles. It is just now the dull season for the Australian demand for galvanised sheets, so merchants do not consider the paucity of orders from that quarter with much apprehension, although there certainly has lately been room for improvement; £12 10s. for 24 gauge at works is still the basis price.

The marked bar makers report a good demand, some of them having taken enough orders to last till the end of the quarter. They are firm, therefore, on the £8 basis. Some good sales have taken place in merchant iron at £7, and common bars are in steady request at from £6 10s. to £6 12s. 6d. and £6 15s. Alike for bars and for sheets some good orders have been booked for the Argentine Republic.

Cable ironmakers are executing considerable orders on Admiralty account, among them being the Earl of Dudley and the New British Iron Company.

Iron and steel plates are in good call in connection with railway work for Japan, which has been received by local engineering firms.

Boiler and tank plate makers hold considerable orders for early delivery, and fully maintain the prices with which the quarter opened.

Hoops and strips are £7, though more money is demanded by some makers of the former descriptions. The advance of £1 in gas tube strip—bringing it now to £7—is not a practical rise to the full extent. Four months ago the Association fixed it at £6, but latterly some makers have been getting as much as £6 10s. Demand is good. Some gas tube makers are full up with work to the end of the quarter.

The fact that Middlesbrough pigs were advanced 1s. on Tuesday was not without its influence in crude metal transactions on 'Change this afternoon, though apart from this the continued strength in cokes and coal permits of no weakness either in Staffordshire or indeed in any of the Midland makes. Spring Vale hydrates are quoted 62s. 6d., B.F.M. 57s. 6d., and common 47s. 6d. Derbyshires sell at 54s. 6d. to 55s., Northamptons 54s., and Lincolns 56s. 6d. to 57s.

Coal is active at 8s. 6d. for useful forge sorts.

The advance in ironworkers' wages will obtain until a new sliding scale is arranged, which will probably be in September. The accountants to the Mill and Forge Wages Board will, when that month opens, again examine the books of the twelve selected firms, to ascertain the selling price for the months of July and August. The data then available from both examinations will afford basis for the arrangements of, it is hoped, a satisfactory scale.

On 'Change in Birmingham this—Thursday—afternoon common bars were advanced 5s. per ton, making small rounds £7 5s. for three-eighths size. Hoops and thin strips were advanced 10s., bringing the new price up to £7 10s.

The consumption of steel in the Black Country is now estimated to be about 5000 tons per week. Of this quantity only about 1500 tons is made in the district. It has been suggested, for a long time past, that an attempt ought to be made to produce the odd 3500 tons in Staffordshire, by adapting much of the existing iron making plant to the purposes of basic steel production. The suggestion has been adopted, in several cases, with a fair measure of success, though until lately the volume of demand and profitableness of prices have not been such as to tempt ironmasters to any large expenditure of capital upon new enterprises. Now, however, that the metallurgical trades are so noticeably more vigorous, the proposal has been repeated with more earnestness; and it is not

unlikely that we shall shortly see a considerable development of steel manufacture in the Staffordshire district.

It is recommended that puddling furnaces now standing idle should be pulled down and utilised for the construction of 15 to 25 ton Siemens basic furnaces, according to circumstances. The cost of such furnaces would be about £1500 each, after allowing for the old materials worked up. The adaptation of an existing ironworks engine plant and forge train to a "cogging" plant would involve an additional expenditure of £5000 or £6000. The remaining processes could be carried out in the existing ironworks with only a nominal addition to staff or general charges.

Rumours were current upon the market to-day—Thursday—of contemplated additions to the steelmaking facilities of the district by the establishment of a new steelmaking plant.

The annual meeting of Messrs. Bagnall and Sons, ironmasters, has been held within the past few days in Birmingham. The report, which recommended the payment of the usual dividend of five per cent. per annum upon the paid-up capital, was adopted. The chairman mentioned that during the latter part of the year the works had been fully employed, and there was every expectation of a fair trade in the future. It was, however, not thought desirable to increase the dividend until the debenture debt had been still further reduced. When this was done it was hoped to pay an increased dividend. It was intended to reduce the borrowed by £1000. One of the works had been lighted up with the electric light, and to meet the increased demand for iron the directors had enlarged one of the works.

There is a great deal of activity at present in the mechanical engineering branch of the Birmingham industries. Demand is active upon both home and foreign account. A good deal of machinery is being supplied for gun and ammunition making, and machine tools are still in active request from the Northern shipbuilding and engineering centres. Such firms as G. E. Belliss and Co., and Taunton, Delmard, and Co., are busy upon Admiralty contracts for air compressing machinery for torpedo boats, &c.

Tangyes have been very busy for a good while past upon steam pumps, horizontal engines, winches, cranes, pulley-blocks, drilling and screwing machines, and all kinds of lifting tackle. All the departments of the great Soho establishment are at date satisfactorily employed.

James Archdale and Co. are in receipt of good orders for lathes and other machine tools upon home and export account. China is one of the best of the foreign markets. Local orders are providing the firm with full employment in their gunmaking machinery.

The Mint (Limited) continues to find plenty of work in the execution of home and foreign Government orders for coining machinery. W. and J. Player are well engaged upon planishing machinery, and Charles Winn and Co. have good lines in hand for screwing and drilling machines, pumps, &c.

Constructive engineers in the South Staffordshire district are very satisfactorily occupied just now, and most of the large establishments in Birmingham, West Bromwich, and Wednesbury, have good home and foreign contracts in hand for railway and other ironwork. Thomas Piggott and Co. have some large Australian, Mexican, and Japanese contracts under execution, for the supply of tubes for water transport.

Edge tools are in brisk request for South American and South African plantations, and there is a moderate inquiry from Australia and India. The call for railway and contractors' tools and implements is increasing. For anvils, vices, and engineers' tools the demand is brisk. In many of these branches, however, makers continue to complain of the difficulty of obtaining advances in the prices of the manufactured article sufficient to cover the greatly increased cost of materials and fuel.

The improvement in the heavy industries of the Midlands is indicated in the activity in the business of transport. The goods traffic on the railways is extending, and now the canals are beginning to share in the business. Messrs. Fellows, Morton, and Co., Fazeley-street, Birmingham, have just initiated a reform in the transport of goods by water which constitutes an important advance in the movement for the utilisation of the waterways for goods traffic which has long been agitating industrial circles in the Midlands. This firm of carriers has introduced steam barges upon the various canals between Staffordshire and the ports. By means of these vessels the journey to London is performed in fifty-six hours, as compared with the five days usually occupied by the journey with horse locomotion. One of these small draught steamers will carry a load of 20 tons, and will tow another boat containing an additional 30 tons. The advantages which this innovation offers have been eagerly accepted by traders.

At the half-yearly meeting of the Railway Rolling Stock Company in Wolverhampton, it was decided to pay a dividend of 6 per cent. per annum upon the paid-up portion of the preference shares, and 4 per cent upon the ordinary shares. The prospects of trade were referred to as hopeful; and it was stated that since the termination of the half-year contracts had been entered into, which would nearly absorb the whole of the capital at the disposal of the directors.

## NOTES FROM LANCASHIRE.

*(From our own Correspondent.)*

In the iron trade of this district the upward movement of prices continues, but there is no materially increased volume of actual trade doing. In the face of the steady advance in prices, merchants are perhaps rather more anxious to cover, but consumers generally are already so well bought for present requirements, that they are under no immediate necessity to come into the market for any large quantities, and in most cases they apparently do not care to buy very much on speculation at current rates. There is, however, a very large weight of iron going into consumption, deliveries on account of contracts already placed being amply sufficient to keep makers fully going for some time to come, and this gives a decided element of strength to the market. With regard to other conditions which are contributing to the upward movement in prices, and to which I have previously referred in my Lancashire notes, there is little or nothing to add. Coke, the advance in the prices of which is really the most serious consideration in connection with the cost of producing pig iron, shows no present indication of any weakening, the tendency rather being still to harden. Supplies of slack, however, are more plentiful, and the increased output of this class of fuel when the winter demand for house fire coal sets in may, if it does not actually bring about cheaper supplies, at any rate tend to modify the difficulties now being experienced in obtaining adequate supplies of coke for iron-making purposes. In the finished iron trade the demand from this district is not quite so brisk as it was, owing probably in some measure to the depression in the cotton manufacturing industries, but makers have quite as much work in hand as they can get through, and are still very indifferent about booking further orders.

The Manchester iron market on Tuesday was fairly well attended, and there was again a very strong tone all through. For some brands of pig iron the prices quoted were fully 6d. to 1s. per ton in advance of those which were being taken last week, and although the actual business done at the full prices quoted was only small, sales could have been readily made in considerable quantity at the figures which makers would have accepted a week or so back. For Lancashire pig iron quotations remain unchanged, but local makers have been selling so freely at their present prices that they have a difficulty in keeping up deliveries to their customers, and there is a decided tendency to stiffen upon late rates. Of district brands makers have still so little to offer, either in Lincolnshire or Derbyshire, that prices remain scarcely more than nominal. Where there are sellers in the market 51s., less 2½, represents about the average figure for both forge and foundry Lincolnshire, and for Derbyshire the average quoted prices are 52s. to 53s., less 2½, delivered here, the cheaper makes, which are the only brands really offering in the market, having stiffened up quite 1s. per ton during the week. The continued advance in warrants has necessarily tended to stiffen the price of outside brands of iron offering here, and good foundry Middlesbrough is not quoted under 50s. 10d. net cash delivered equal to Manchester, whilst Scotch brands have advanced fully 1s. per ton, Glengarnock, delivered at the Lancashire ports, being quoted at 51s. 6d., or about 56s. delivered equal to Manchester, which is an advance of 3s. 6d. per ton upon the prices at which this iron could have been bought within a very recent period.

Hematites, following upon the advance in Scotch iron, show a strong hardening tendency, and good foundry brands delivered here are now quoted at about 61s. to 62s., less 2½.

Manufactured iron remains very firm at the full rates quoted last week, £6 15s. being the minimum for bars delivered in the Manchester district, with hoops quoted at £7, and sheets at from £8 to £8 5s. per ton. There is scarcely so much new business coming forward, but this is more than counterbalanced by the restriction of the output, caused by the interruption of operations at many of the forges owing to the hot weather, and makers have still more than they can do to meet the requirements of their customers, on account of contracts already placed.

Steel-plates for boiler-making purposes are in fair demand, and there is a decidedly stronger tone in prices. Scotch makers, who have been selling at £8 15s. to £8 17s. 6d., are now firm at £9, and Yorkshire plates, which were readily obtainable at £8 17s. 6d., are now quoted at £9 5s. per ton delivered here. The upward tendency in plates coming in from other districts necessarily strengthens the position of local makers, who have all along been holding out for £9 5s. per ton, and at this figure they are exceedingly firm.

The reports with regard to the condition of the engineering trade remain practically much the same as those I have given for some time past. There is no slackening off whatever in the general activity throughout all branches of trade, and in most departments; the leading concerns being very pressed with work. This is especially the case with regard to machine tool makers, stationary engine builders, boiler makers, and locomotive builders.

The new pneumatic rivetters—Allen's patent—which were some time back introduced to this country by Messrs. De Bergue and Co., of Manchester, and of which a descriptive notice was given in the columns of The Engineer, are being adopted in several important works. The whole of the rivetting on the new girder bridge which is being built by Messrs. Handyside and Co. over the Trent at Newark, for carrying the Great Northern Railway, is being done by one of these rivetters, and the firm have now ordered a plant for their own yard at Derby. The Grangemount Dockyard Company, who adopted this system of rivetting soon after it was first introduced, have now ordered a further plant of these pneumatic rivetters for their new yard at Alloa, and I understand that where they have been introduced this system of rivetting is giving every satisfaction.

Messrs. Heenan and Froude, of Newton Heath, are very busy in the bridge department of their works, and the orders they have now in hand include sixteen bridges for the Lancashire and Yorkshire Railway Company, while amongst foreign orders they are constructing a lattice girder bridge, 1650ft. in length, for South America. In their engine department they are also very busy with orders for their well-known Tower spherical engines combined with various types of dynamos for electric lighting, and in order to keep pace with the increasing amount of general work which the firm have recently been securing, they have been compelled to extend the workshop building and to lay down new plant.

In the coal trade a generally steady business is being done, and although the better qualities suitable for house fire consumption are only in very slow demand, requirements are quite as large as could be expected for the season of the year. Common round coal suitable for ironmaking and steam purposes meets with a tolerably ready sale, but supplies are ample to meet requirements. For engine fuel there is good demand generally, but the holiday stoppages and the short time movement in the cotton manufacturing districts tend to throw temporarily a considerable quantity of slack upon the market, and this description of fuel, in consequence, is much more plentiful than it has been of late. As regard prices there is a slight hardening tendency in some cases, but no general upward movement, and the quotations remain practically unchanged from last month; best coal at the pit mouth averaging 10s. per ton, second qualities, 8s. to 8s. 6d.; common round coals, 6s. 6d. to 7s.; good qualities of burgy, 5s. 9d. to 6s. 3d.; best slack, 4s. 9d. to 5s.; and common sorts, 3s. 9d. to 4s. 3d. per ton at the pit.

The shipping trade is somewhat irregular; a few collieries are very busy with orders, and in one or two instances prices have been advanced, but in other quarters a very dull business is still reported, and there is a continued difficulty in getting vessels for coal cargoes. For delivery at the high level, Liverpool, or the Garston Docks, steam coal ranges from 7s. 9d. to 8s. 3d. per ton, according to quality.

All descriptions of coke suitable for ironmaking purposes continue in very brisk demand, with a steady hardening in prices, best qualities at the ovens now fetching from 15s. to 16s. per ton.

*Barrow.*—The hematite pig iron trade is brisk, and orders are still on the increase. Bessemer qualities are in especially good demand and in increasing consumption. Business is increasing all round, and makers find a fuller inquiry as well for prompt as for forward deliveries. Prices have advanced to 51s. 6d. per ton for mixed Nos. of Bessemer pig iron, and to 49s. 9d. for No. 3 forge and foundry iron. There is a ready sale at these prices, as fuller rates ars expected. The works are all well employed, and the small number of furnaces now standing idle are gradually being put in blast. In the steel trade there is a marked improvement, and the several departments are all briskly employed. The mills engaged in the production of rails and steel shipbuilding material are all full of orders, and the greatest activity is maintained in the output. Orders are coming to hand from all sources, and there are indications of a very large trade in the future, something like two years' busy work being now assured. Prices show an advance for rails, heavy sections of which are quoted at £4 17s. 6d. per ton, and some makers who are heavily sold forward are asking £5 per ton. The shipping and engineering trades are more and more briskly employed every week, and orders are coming to hand of some importance practically from all sources. Important Admiralty work is expected which will find plenty of work both in the building and the engineering departments.

The directors of the Naval Construction and Armaments Company, whose works are at Barrow, have just issued their first report for the financial year ending June 30th. They state that although the company was incorporated in February, 1888, the yard at Barrow has not been actively in operation, except to a very limited extent, for more than about eight months; the first eight months of the company's existence having been mainly occupied in reconstructions and additions to the yard and machinery, which have resulted in the company being now in a position to undertake work of the largest and highest class. Under these circumstances it has been deemed expedient to extend the financial year beyond the first eight months, to the 30th June, 1889, that being the close of the company's financial year. In dealing with the question of profit and loss, no credit has been taken for the increased values of the materials purchased, nor for any work in progress, but only for the profit on work completed, which is necessarily but a small proportion of that contracted for; the unfinished contracts on the 30th June amounting to £437,500. In view of the initial expenses incidental to every new company, and the fact that nearly all the large contracts are unfinished, the directors are not in a position to declare a dividend, but the balance carried forward and the profits on unfinished contracts will tend to increase the profits on the current year. Having regard to the large amount of orders actually in hand, and to the prospects of further profitable contracts, the directors look forward with confidence to the future of the company. Since the 30th of June the company has received an order from her Majesty's Government to build three second-class cruisers. The fact that this important contract has been entrusted to the company affords gratifying evidence of the confidence of the Admiralty in the resources of the Barrow yard and the ability of its administration. The company has been further invited by the Admiralty to tender for first-class cruisers. All the preliminary expenses in connection with the formation of the company have been written off. The proposed works at Bilbao are for the present in abeyance, the directors having concentrated all their efforts to perfect the Barrow yard. Four vessels, of a combined tonnage of 17,500 tons, have already been contracted for with the Pacific Steam Navigation Company; and one of these vessels, the Oruba, of 5600 tons, was delivered in a perfect state of completion in less than twelve months from the signing of the contract. The Oruba is now on her voyage to Valparaiso and back, and has afforded the highest satisfaction to her owners. The accounts show a margin to credit of £5356 15s. 11d., which is carried forward to next year. Only £300,000, which is half the authorised capital, has been called up.

On Tuesday the Naval Construction and Armament Company launched from their shipbuilding yard a handsomely-modelled passenger screw steamer named the Santiago, which has been built to the order of the Pacific Steam Navigation Company, of Liverpool, for their South American coast trade. The dimensions of the Santiago are 350ft. by 45ft. by 31ft. 9in., moulded to upper deck. The hull is built entirely of steel on the double-bottom longitudinal principle, the whole of the material being supplied by the Barrow Hematite Steel Company. The vessel is schooner-rigged with two steel pole masts, and externally presents a very light and handsome appearance, and fitted in every way for passenger service in a tropical climate. A full equipment of boats and other necessary appliances for the safe and efficient working of the vessel, including a complete installation of electric lighting to all parts of the ship, is supplied complete in every respect, as usual in first-class steamships. The engines are of the vertical triple expansion type, having cylinders 31in., 49in., and 78in. diameter by 60in. stroke, supplied with steam from two double-ended boilers 13ft. 9in. diameter by 18ft. 6in. long, and two single-ended boilers 13ft. 9in. diameter by 9ft. 8in. long, at a working pressure of 160 lb. per square inch, and will indicate on trial about 3500 indicated horse-power, giving a speed of about 14½ knots. A sister vessel for the Pacific Company is now in course of construction by the builders, and is nearly ready for launching. Iron ore is in very large output, and prices are firm at from 10s. 6d. to 13s. for ordinary qualities net at mines.

Apprehension is felt that a strike in the Durham cokefield might lead to the blowing out or damping down of furnaces on the West Coast, as nearly all the coke used in this district comes from the East Coast. In the meantime the price of both coke and coal is advancing, and the consumption is increasing. Mr. Thomas Nicolls, for twenty-five years with the Barrow Hematite Steel Company as works manager and other capacities, has been appointed general manager of the Paragon Steel Casting Company's Works at Rochdale.

## THE SHEFFIELD DISTRICT.

*(From our own Correspondent.)*

Hematites have gone up to 62s. 6d. per ton, and there is evidence of a still greater stiffening in prices. For common iron, 47s. 6d. to—in some instances—50s. per ton is being asked, but supplies are being delivered on easier terms. The Staffordshire iron firms are universally raising prices, and the effect is telling in Yorkshire and Derbyshire.

At the Newhall Ironworks of the Brightside Foundry Company a very successful casting has been made of a 40-ton anvil block, to be used under one of the large steam hammers at a manufactory in Savile-street. In this, the largest casting ever made by the firm, three cupolas and one air furnace were used in the smelting operations. The molten metal was run into the mould, which is about 11ft. square, from four different points, the work occupying one minute. The casting will take more than a week to cool. Other noteworthy objects in the works included a completed anvil block casting, weighing 17 tons, and a large ingot mould, 12 tons in weight, for ingots used in the manufacture of heavy ordnance at one of the large establishments devoted to the production of military material.

Important colliery extensions are now taking place in South Yorkshire. I have already mentioned the sinkings at Conisbro', belonging to the Denaby Colliery Company, which, with others, will undoubtedly greatly influence the future of the coal trade of the Northern district. The Thorncliffe seam of coal is now being sunk to at the Wharncliffe Silkstone Colliery, and it is intended to get down to the Whin Moor seam, which lies about 65 yards below the Silkstone seam. To reach the Flockton coal a drift is being driven at the Sovereign Colliery, near Dodworth. The Silkstone seam has been largely exhausted, and as the winding machinery is still on the spot, an effort is being made to reach the Flockton bed, which is believed to be about 2ft. 9in. in thickness. At the Nunnery Colliery, Sheffield, the owners contemplate sinking to the Silkstone seam at Darnall, at a point about half-a-mile from the Manchester, Sheffield, and Lincolnshire Railway, which will be approached by a branch. The Rother Vale Company are going down from the Barnsley to the Silkstone seam, the drawing shaft being sunk so as not to interfere with the working of the Barnsley seam. The upcast shaft has been sunk, and the coal is said to have been ascertained to be of good quality. Messrs. Newton, Chambers and Co., Thorncliffe Collieries, are preparing to open out the Flockton seam at the Tankersley Colliery. These extensions affect the leading districts in the coalfields of Sheffield, Barnsley, and Rotherham.

Much activity is reported in the steel and iron departments. Bessemer and crucible steel is equally in brisk request. At the Phœnix Bessemer Works, Ickles, Messrs. Steel, Peech, and Tozer have commenced operations in their new tyre works, which have been in course of erection for nine months. An entirely new structure has been erected, and the special machinery put down for the production of tires includes two six-ton hammers and tire rolling mills, driven by a pair of engines supplied by Messrs. Davy Brothers, the Park Ironworks, Sheffield; with five new boilers supplied by the same firm. A satisfactory start has been made with orders which have been obtained from most of the leading railway companies of this country. The new works will afford employment for about 100 additional hands, and will increase the output by about 150 tons per week.

The new departure at Parkgate, where the manufacture of steel plates, &c., has been commenced, has been successful. Orders for steel come freely in, and there is every prospect of the plant being kept in full operation.

Earle's Shipbuilding and Engineering Company, Hull, the shares in which are largely held in Sheffield, are at present very well off for work, their orders including the machinery for the first-class armoured cruiser H.M.S. Centaur, now building in Portsmouth Dockyard. The engines are of 12,000 indicated horse-power. Earle's Company have also recently obtained the order for the engines of H.M.S. Andromache and H.M.S. Apollo—building at Chatham—each of 9000 indicated horse-power, and the machinery, of 7500 indicated horse-power for H.M.S. Pearl, building at Devonport; and for H.M.S. Philomel, building at Pembroke. The company are now about to deliver the machinery of 3000 indicated horse-power each for H.M.S. Blanche and Blonde, which have been built at Pembroke Dockyard, and have completed the contract for the engines, of 1200 indicated horse-power each, for H.M.S. Magpie, Redbreast, and Redpole, built in the same yards. The Magpie, which is a single screw composite vessel, on its trial trip in the Channel beat record power for this class, the contractors obtaining 882 indicated horse-power, or nearly 25 per cent. in excess of the guaranteed power. The

Redbreast has had its natural draught tried in charge of Mr. W. B. Dixon—Messrs. Earle's engineering manager—when even better results were achieved, as the mean of a splendid run of thirteen hours without a single hitch gave an average of 900 indicated horse-power, and a speed of thirteen knots.

Messrs. Samuel Fox and Co., Stocksbridge Works, Deepcar, have again had a most prosperous year, the report which has just been issued intimating a profit during the twelve months of £35,194 9s. 6d., which, added to £3481 6s. brought forward from last year, gives a total of £38,675 15s. 6d. It is proposed to declare a dividend at the rate of fifteen per cent. per annum, towards which an interim dividend at the rate of ten per cent. per annum was paid on the 1st of March last. This will absorb £36,000, leaving £2675 15s. 6d. to be carried forward to the next account. Mr. Henry Sharp, late managing director of the Bolton Iron and Steel Company, has been appointed to succeed the late Mr. Fox in the general management of the works and business of the company. The directors state that in Mr. Sharp they believe they have secured a manager fully qualified for the position.

Messrs. Joseph Rodgers and Sons, cutlery manufacturers, Sheffield, were lately visited by the Shah of Persia while he was in Sheffield. His Majesty, who has frequently been a customer of the firm, ordered a considerable quantity of their goods. Since his departure, the Grand Vizier has intimated to the firm that they have been appointed "Cutlers to his Majesty the Shah of Persia." The Grand Vizier, in making the intimation, expressed the hope that this and other appointments would contribute towards an increase of those friendly commercial relations which the Shah desires to see existing between the two countries.

A good trade mark is half the battle in winning a market in the hardware trade—always, of course, giving quality. Messrs. George Butler and Co., Sheffield, brought out a razor which they designated the "keen" brand, with the head of Shakespeare on the blade. The name is suggested by the line of the bard of Avon, "Keen as is this razor's edge invisible." Among other firms whom they have supplied are Messrs. Kirby, Beard, and Co., 5, Rue Auber, Paris, who recently received an order from the Baron Gustav Rothschild, which he purchased at their establishment. These razors are hollow ground, a notion for which we are indebted to the Germans. For a considerable time the blades had to be forwarded to Hamburg to be hollow ground, but the process has now been thoroughly mastered by the Sheffield artizans, and Sheffield hollow-ground razors, of which the "Keen" razor is a remarkably fine type, are sold the world over.

## NOTES FROM SCOTLAND.

*(From our own Correspondent.)*

Business has been exceptionally strong in the Glasgow pig iron market this week, and a further considerable advance has taken place in the prices of warrants, which have been up close on 46s. per ton, a rate which a month or two ago few would have cared to predict as likely to be attained during the present year. A great impetus has been imparted to the market by the placing of Admiralty shipbuilding orders on the Clyde, and the tone was further strengthened owing to the shipments being much larger than of late. They amounted to 12,275 tons, as compared with 9127 in the corresponding week of last year, and they embraced 1999 tons to Canada, 1215 to the United States, 825 to Australia, 680 to Russia, 460 to Germany, 427 to Spain and Portugal, 375 to Holland, 200 to Italy, 160 to India, and 60 to Belgium, the coastwise shipments having been 5738, against 4089 tons in the same week of last year. There are eighty furnaces in blast, a reduction of two as compared with last week, and five less than at the corresponding date. There is very little change in the amount of the stocks in the warrant stores, but makers' holdings are understood to be materially decreasing.

The values of makers' iron are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 55s.; No. 3, 52s. 3d.; Coltness, 57s. and 54s.; Langloan, 56s. and 54s.; Summerlee, 57s. and 50s. 6d.; Calder, 54s. 6d. and 51s.; Carnbroe, 49s. and 46s. 9d.; Clyde, 51s. 9d. and 48s. 6d.; Monkland, 46s. and 45s.; Govan, at Broomielaw, 45s. 9d. and 44s. 9d.; Shotts, at Leith, 55s. and 52s.; Carron, at Grangemouth, 53s. 9d. and 49s. 6d.; Glengarnock, at Ardrossan, 53s. 9d. and 48s. 6d.; Eglinton, 45s. 6d. and 44s. 9d.; Dalmellington, 47s. and 46s.

The position of the manufactured iron and steel trades has been further improved and strengthened by the orders for Admiralty vessels placed on the Clyde. These consist of five second-class cruisers of the Medea type, each of 3400 tons and 9000 horse-power. Of these vessels three have been secured by Messrs. Thomson, of Clydebank, and two by the London and Glasgow Engineering and Shipbuilding Company. With reference to the last-named contract, it should be noticed that although the London and Glasgow Company has a reputation for producing machinery of the very best class, and possesses every facility for doing so, the engines for the two vessels to be built by this company have not been entrusted to them, but will be made by a London firm. This arrangement has given occasion for much adverse comment here, as the vessels will cost much more money than if they had been turned out fully equipped with machinery by the builders. The Fairfield Company have received an order for two sets of engines of 12,000-horse power each, with the necessary boilers, to be fitted into vessels that are to be constructed in the Admiralty dockyards. Much of the materials for these vessels and machinery will be supplied by the makers of iron and steel in the Glasgow district, and the orders will prolong the activity that now prevails. Prices of iron and steel are very firm.

There was shipped from Glasgow in the past week locomotive engines and tenders to the value of £38,887, of which five worth £6250 went to the Philippines, seven worth £4637 to Bombay, and twelve, valued at £28,000, to Alexandria. The other shipments of the week were machinery, with £11,726; sewing machines, £5736; steel goods, £14,071; and general iron manufactures, £37,300.

The tone of the coal trade has materially improved this week. The shipments of coal in the past week were large, and the demand has enlarged both for export and home consumption. Furnace coals are in particularly good request, and the trade in steam coals is satisfactory. Prices are also better, 7s. being now easily got for main coals, free on board.

## THE NORTH OF ENGLAND.

*(From our own Correspondent.)*

The Cleveland iron trade has still further improved since this time last week. At the market held at Middlesbrough on Tuesday last, there was, however, no further advance in prices. The attendance was somewhat below the average, and the feeling was one of hesitation, because slightly lower prices were telegraphed from Glasgow. It is still a cause of disappointment and even surprise that the market of the district which produces more pig iron than any other in the world should be so much affected by every little change which takes place in another market, where much less is produced. The explanation is probably to be found in the fact that Glasgow consumers take more iron from Cleveland than do the consumers of any other district. That being so, their ideas as to buying, or refraining from buying, at any particular time must naturally influence the ideas of those who supply them.

Notwithstanding the slightly easier feeling which prevailed on Tuesday last, the aggregate advances since last market-day amount to 1s. 6d. per ton, while Scotch pig iron during the same time only advanced about 4½d. per ton. Merchants now ask 42s. per ton for G.M.B. iron for August delivery, and consumers offer about 3d. per ton less. For delivery to the end of the year, 3d. more than the above-named figures represents the present price. The value of warrants may be taken to be about the same as that of makers' iron. Inasmuch as the latter is at the moment very scarce, those who require prompt supplies have usually to go to the public stores for them. Since the previous Tuesday, 5069 tons have been taken out, and since the beginning of the month about 16,000 tons. It is confidently anticipated that the aggregate stocks of the district will be found to have decreased by about 20,000 tons during July. The price current of forge quality is now 41s. per ton, and of East Coast hematite 52s. 6d. per ton. Shipments from the Tees between the 1st and the 29th inst. inclusive, amounted to 75,315 tons, which is somewhat less than in the corresponding portions of either May or June.

Finished iron is tending upwards in value, because of the gradually increasing cost of production. Common bars are now £5 17s. 6d. to £6; ship plates, £6 2s. 6d. to £6 5s.; and angles, £5 12s. 6d. to £5 17s. 6d., all free on trucks at makers' works, less 2½ per cent. discount. The demand for finished steel is steady, and the market value about the same as last week.

Is sufficient clearance allowed in railway tunnels between the carriages and the masonry? This question may well be asked, in view of the fact that on Saturday last, two persons, both young men, travelling from Tynemouth to Newcastle, in separate trains, arrived with their heads smashed, owing to having had them outside the window when passing through the Shields tunnel. It is said that the accidents occurred at about the same place. In both cases the side windows were also broken, owing to the men having been driven against them. It is not sufficient to contend that no sensible person would lean out of a carriage window when passing through a tunnel. That goes without saying. But it is certainly the duty of railway companies to convey safely a large number of persons who are not characterised by the possession of even an average proportion of sense; and such persons ought not to be able to bring serious injury upon themselves by indulging in any vagary of the above kind. The Shields tunnel is a very old one, and when it was constructed the Board of Trade inspection before permitting passenger traffic was, if existent at all, probably less rigid than it now is. At any rate, why should there not be another official inspection forthwith? Otherwise there will certainly be more heads smashed, and an alteration will have to be made in the end.

The unreasonableness of the demand recently made by some of the ironworkers, namely, that all mills and forges shall be allowed to remain idle on Mondays during three months of each year, is the theme of general conversation.

The contention that the practice would not result in a diminished output is thoroughly disproved by all past experience. It was shown conclusively at the recent meeting of the Board of Arbitration, that there are, on an average, double the number of employés absent on Monday nights than there are on Monday mornings. This was explained by pointing to the greater facilities everywhere offered for drunkenness on Mondays, as compared with Sundays. As a matter of fact, the loss of production has always been greater in strict proportion to the loss of time; because the greater number of defections with a Monday night start causes untold hindrances to those who are at work. The change, if made, would also be singularly unjust to labourers, mechanics, and others not actually ironworkers, who would thus lose a day's work per week against their will. But the worst result of all would be the enhanced cost of production which, sooner or later, would cause the British manufacturer to lose some of his markets, and might, by taking away his margin of profit, in time cause him to close his works altogether. These considerations are so forcible, and so very obvious to all except the ironworkers themselves, that there is little fear that Mr. Dale, the referee, will take their view. But, nevertheless, whilst the matter is still unsettled, it cannot be discussed too frequently or too thoroughly.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

A "boom" has been started in the coke trade this week, which threatens to have an important influence on iron, steel, and tin-plate trades generally; that is, if it can be maintained. For some time supplies of coke have been inadequate, though strenuous efforts have been made to increase work. One large steel works, Cyfarthfa, will soon be in a better position, and be more independent of Rhondda and other coke ovens, for general supply. The coke "boom" was very suddenly worked. On Monday, coke prices at Cardiff were respectively 17s. and 18s. 6d. for furnace and foundry. On Tuesday 20s. and 21s. were asked, and on Wednesday there were indications of higher figures. This will soon tell. Pig is advancing; steel has gone up two weeks in succession, and I note an improvement in demand for foreign ore which will tend to lift prices. At this rate of the raw material advancing so rapidly there can be but one result in the question of prices. Higher quotations are certain. Wednesday's prices were as follows:—Steel rails, heavy, £5 to £5 2s. 6d.; light, £5 10s. to £6; steel sheets, singles, £9 5s. to £9 15s.; Bessemer blooms, £4 12s. 6d. to £4 15s.; tin bars, £5 to £5 5s.; Siemens bars, £5 7s. 6d. to £5 10s. Welsh bars, £6 and upwards to £6 2s. 6d., being a common quotation.

The iron and steel works generally are in a good condition. At some, water still gives a little anxiety, and in several men are scarce.

At Swansea this week Glasgow pig warrants were from 45s. 4½d.; Middlesbrough No. 3, 41s. 9d.; hematites, 51s. 7d. Generally, pig is advanced 1s. per ton this week.

In the steam coal trade prosperity is fairly maintained; demand continues good, and prices firm. Coal and coke shipments, Cardiff totalled 163,289 tons, a very good total for this time of the year; Swansea was a trifle over 30,000 tons; Newport kept up an average trade. The coasting trade last week was close upon 20,000 tons.

At the Cardiff Exchange this week there has been a good attendance, and a creditable degree of briskness in trade. On several days the demand for best steam coal was considerable, and very marked efforts were noted in placing orders for prompt attention. It is expected that a good deal of Welsh coal will find its way to the fleet the next week or two. Latest quotations are as follows:—Best steam, 13s. to 14s.; seconds, 12s. 3d. to 12s. 6d.; Monmouthshire, 11s. 6d.; small steam, 6s. 9d. House coal is at 11s. 6d., not 16s. 6d. as I see quoted! and small bituminous coal, which keeps in strong demand, is at 9s. 6d.

The quotation of 16s. 6d., oddly enough, is about the local price house coal is delivered at to consumers, and it is a subject of wonderment to many how coal that is at 11s. 6d. at pit should, by the handling of a few middle men, increase in price so readily. It is here that railways benefit. The price of any coal used in London at pit, and in London, would show still more remarkable contrasts.

Railways are sharing in the general prosperity. Rhymney keeps up capitally, and the Taff Vale is, as usual, giving 10 per cent. with 5 per cent. bonus.

Patent fuel works are doing well. Best is quoted at 11s. 6d. to 12s. 6d. Pitwood is at 17s. 6d. Best anthracite is offering at Swansea for 11s.

By arrangement with other railways, the Cambrian has established an excellent footing at all the great centres, and its "through" coaches are to be seen at the various seaports in the West, and in all the large towns. In connection with the London and North-Western, the route this year from the great workshops of England has been made both cheap and easy. I have previously noted the capital way in which Mr. Conacher has dovetailed his arrangements; but this year the extension is considerable—toy railways in Blaenau, tourist routes to Llandudno, or steamer to Ireland, runs to Cardiff, Liverpool, Manchester, London, are all well worked in. This month, with the visit of the Queen to Bala, will still further tax the Cambrian and Great Western.

In tin-plate there is a good deal of buoyancy. Last week the shipments were over 59,000 boxes from Swansea alone, make 54,000, and judging from tonnage, the exports next week will be still larger. On 'Change Tuesday signs of improved prices were visible. Latest quotations were: Cokes, 12s. 9d. to 13s.; Bessemer, 13s. to 13s. 3d.; Siemens, 13s. 6d. to 13s. 9d.

Men are agitating for advances, but makers are powerless. Plates to be in harmony with increased cost of material should be 1s. more.

## NOTES FROM GERMANY.

*(From our own Correspondent.)*

In the iron industry all branches are well and remuneratively employed. On the Silesian iron market business continues brisk. Pig is very firm, and tending upwards. On the 20th inst. the Breslau wholesale merchants have again raised the prices for wrought iron and plates M. 5 p.t. The galvanising works are in brilliant employment. Prices remain unchanged.

The liveliness of the Austro-Hungarian iron market has been unfavourably influenced to some degree by the strikes of the Styrian miners and workmen. Still, business is, on the whole, satisfactory, and for pig the demand is very extensive. In the wrought iron branch orders are coming in most freely, and the latest rises have been introduced without any difficulty. The supply of rails for the second line of the Karl Ludwig Bahn will be about 23,000 t.; the—Convention—rail works have tendered at 96fl. p.t. Steel works, foundries, and machine shops are in good operation. The Kaschau-Oderberg Railway Administration has awarded to Ganz-Ringhofer an order for 130 freight cars.

The Belgian iron market is in a favourable position, good demand and a firm tendency being maintained. In the pig trade inquiries are increasing, while prices have a rising inclination. The iron and steel works are actively employed. The Vieille-Montagne Company have raised the price for rolled zinc from 53f. to 54f. per 100 kg. The statistic figures of the five past months give a pretty favourable result. Import in pig was uncommonly high, being 84,165 t. (against 64,730 t. in 1888, and 33,428 t. in 1887, for five months). But export has also improved, being in steel rails, 19,058 t. (against 12,141 t. in 1887, 18,712 in 1888); in plates, 21,405 t. (17,258 t. in 1887, 19,349 t. in 1888); in wrought iron, 102,348 t. (90,008 t. in 1887, 99,863 t. in 1888); finished iron, 12,082 t. (8480 t. in 1887, 9094 t. in 1888). Taking into consideration how German export has decreased of late, in spite of the works having lowered their prices for foreign markets, it appears evident how, after England, Belgium is the most likely to take the place of Germany in export business. Thus, the increase of Belgian export shows, at the same time, the decrease of German export, which, a standstill being in itself equal to a relapse, is in reality larger than stated by German official accounts.

The French iron trade has not yet recovered from its former unfavourable condition, and there is no change to note either in prices or demand.

The Siegen iron market has increased in firmness, and in all branches great activity prevails. In iron ores the output continues large, and prices have been again raised, M. 14·50 being noted for best sorts. The blast furnaces are best off, 9000 t. Spiegeleisen—20 p.c.—having been booked for America at M. 72 p.t., and for inland 6000 t.—10·12 p.c.—at M. 67 p.t. Blooms have also obtained higher prices of late, for, while some months ago they were to be bought at M. 80, at present M. 100 are asked and paid without discussion. An export order for 14,000 t. 20 p.c. Spiegeleisen has been accepted by the United Siegerland Works. An order of like importance has not reached this part of the country for some time, and is likely to create a further upward movement in the Siegerland pig trade.

The situation of the Rhenish-Westphalian iron market has remained firm during the week; prices are maintained without exception, in most branches a rising tendency prevailing. For Spiegeleisen M. 69 is noted for the 10 to 12 p.c. grade, otherwise the pig trade has remained within its former limits. Forge pig and basic are in good request; Bessemer shows a rising inclination, M. 58 to 59 being present quotation, while foundry pig remains unchanged. Basic costs M. 52 to 53. It must be noted that the Board of the Convention has desisted from a further advance on pig, a measure likely to prove highly advantageous to export. Bars are in as brisk demand as ever, and the orders booked are sufficient to keep most works well employed for the greater part of the year; inquiries from abroad seem also to be slightly increasing. The plate mills continue to be in full employment. There is an improvement in the sheet trade, as is shown by the advance of M. 10 p.t., noted in our last letter. Foundries, machine and wagon factories, are, on the whole, actively employed.

At the latest tendering for steel rails for the Berlin Railway Administration, the lowest offers were M. 130, 130·50, 133·75, 135 p.t. Compared with previous tenderings, these figures show a further rise, equal to that of the raw materials. At a tendering for rails in Belgium, an inland works made the lowest offer—132f.—while a Rhenish works asked 141f.

The *Silesian Berg und Hüttenmännische Zeitung* gives the following statistical numbers regarding the output and consumption of coals in Germany from 1872 to 1886. It was in tons—1000 kg.:—

*Pit coal.*

| | 1872. | 1879. | 1886. |
|---|---|---|---|
| Output | 33,306,418 | 42,025,687 | 58,056,599 |
| Import | 2,267,849 | 1,893,747 | 2,060,291 |
| Export | 3,819,789 | 6,612,033 | 8,655,240 |
| Total consumption | 31,754,478 | 37,907,401 | 51,961,649 |
| Consumption per head | 767 | 860 | 1,116 |

*Brown coal.*

| | 1872. | 1879. | 1886. |
|---|---|---|---|
| Output | 6,018,048 | 11,445,029 | 15,625,986 |
| Import | 1,016,743 | 2,859,226 | 4,084,930 |
| Export | 19,729 | 7,707 | 15,856 |
| Total consumption | 10,015,053 | 14,296,649 | 19,695,060 |
| Consumption per head | 245 | 324 | 423 |

The consumption of brown coal has almost doubled within a period of fifteen years, import became four times as much, while export has decreased after a rise in 1884, and has become even weaker than it was in 1872. The brown coal pits of Bohemia have the benefit of this increase in import. They sell their output as far as Berlin, and compete most successfully with the German brown coal pits, in spite of the comparatively high carriage. Although the growing demand for brown coal is chiefly for household supply, the consumption of pit coal is also vastly increasing, owing to the enormous and constantly growing supply required for steam and general manufacturing purposes. Import of foreign pit coals has not perceptibly increased, while export has doubled since 1872. For the last five years, however, a slight falling off is to be noted. The consumption of both kinds of fuel put together would be, per head, 1539 k.g. in 1886, against 1020 k.g. in 1872. It is assumed that one-quarter goes for domestic, and three-quarters for industrial use. Thus, industry consumed, in 1886, 40,000,000 tons, against scarcely 24,000,000 tons in 1872, which shows an increase of 66⅔ p.c. The total output of coals in Germany rose to 73⅔ million tons in 1886, equal to 201·870 t. per day

The late Jonathan Priestman.—The memory of the late Mr. Jonathan Priestman, of Shotley Bridge, near Consett, Durham, is to be perpetuated in a way which, when living, he would heartily have approved, and which deserves more frequent imitation. Mr. Priestman was formerly general manager of the Consett Ironworks, and latterly an extensive coal and shipowner. He was always distinguished by his philanthropic tendencies. Consequently the memorial is to take the form of a permanent fund to enable necessitous persons belonging to the neighbourhood of Shotley Bridge, and who are temporarily out of health, to be sent for a time to some suitable convalescent home. On Saturday afternoon last the various friendly societies of the district organised a demonstration in aid of the above fund. The afternoon being fine large numbers attended, and a considerable sum of money was, it is believed, obtained.

## AMERICAN NOTES.

(*From our own Correspondent.*)

NEW YORK, July 25th, 1889.

THE threatened great strike in Pittsburg has been averted by a practical yielding of the firms on the question of a sliding scale. The workmen and their families surrounded the works and rendered it impossible for either non-union workmen or deputy-sheriffs to obtain admission. The workmen of the mills operated by Carnegie, Phipps, and Co., in other parts of the city, threatened to quit work and assist their friends at Homestead, which is a suburb of Pittsburg. The contest would have been a prolonged one. It was bad generalship to attempt to force non-union labour into the mills at this time, when excitement is running high on the question of wages. The puddlers' scale is being signed by manufacturers all over the country. The iron trade is too good to allow of any contest over the wages question. Too much work is in hand and in sight to allow of any delay or trouble.

Prices for the most part are firm in all markets. Autumn business is very promising, and much winter bridge work for the North-Western States is in sight. Winter is the favourite time for erecting bridges over streams in the Northern States, as the ice forms a good working basis. There is still great commotion among the railroads over unkept arrangements. The crop reports are all favourable. The latest private information gives the estimate at 475,000,000 bushels. The Government estimate is 490,000,000 bushels. The average exportation for the past ten years has been 133,700,000 bushels, and average production 445,000,000 bushels. Home consumption has been 312,000,000, and for seeding 53,000,000 bushels are used.

The latest rumour is that a plan is under consideration for a series of trusts among railroads by which the difficulties which have beset the railroad companies heretofore will be surmounted. Anything which promises relief from the present condition of affairs will be considered earnestly. The earnings of 117 railroads for the month of June were 31,577,710 dols., against 30,224,110 dols. in 1888. The mileage increased from 76,000 to 79,470. The percentage of earnings increased from 4·48 to 4·56. For six months gross earnings increased to 197,460,793 dols. on 138 roads, from 184,988,195 in 1888. It looks as though something like a concerted attack will be made by railroad interests on the Interstate Commerce Commission.

The copper situation is unchanged, with 50,000 tons awaiting sale. The Tamarack is standing out for full prices. Western buyers are making large purchases of tin-plate for fall requirements. The iron trade is stronger than thirty days ago, because of heavy purchases of structural and plate and pig iron. The present production of anthracite furnaces is 34,000 tons per week, and of bituminous and coke furnaces 90,000 tons per week. The hardening tendency still continues, and as southern companies have all advanced prices, northern furnaces will withdraw the quotations recently made to meet the southern cut. A good many rumours are afloat concerning commercial combinations, the objective point of which is to arrest the force of competition and control production. Prices in mills and shops are firm, as most buyers now desire early deliveries. Electricians are crowded with work.

The Board of Control of the Bessemer Steel Rail Company, Limited, report sales up to June 30th of about 575,000 tons rails in all this year, against 934,987 tons for the first half of last. Orders for the half-year foot up 963,550 tons, against sales last year to June 30th of 934,987 tons. This great falling-off has not been attended with such serious results as might be supposed. Rail mills are turning their attention to billets and slabs intended for use in various channels of manufacturing. So far this year the three combined companies at Chicago have shipped 139,574 tons; the Edgar Thompson, 134,700 tons. Much of this material is for repairing requirements. We have over 150,000 miles of track, and upwards of three-quarters of a million tons are needed for repairing. This includes some 60,000 miles of iron track in which repairs are properly made with steel rails. The threatened strike in one of the Carnegie mills at Pittsburg was averted by liberal and timely concessions.

Sales of rails for the week foot up about 20,000 tons, at 27·50 dols. to 28 dols. Western mill quotations, 29 dols. to 30 dols. Old rails are moving quickly. Sales were made at 22·75 dols., and more were wanted. Old steel rails are 18 dols. There is an urgent demand for track material. The activity in rolled iron continues, and all mills east and west have about as much work as can be conveniently gotten out. The demands of bridge builders are crowding in every day, and some of the orders are exceptionally large. The small buyers who always wait are crowded out in the rush. Crude iron markets are firm everywhere. In the South the advance made a month ago has been adhered to, and a still further advance is talked of, but will scarcely take place.

Southern forge iron is offered here at 14·50 dols.; No. 3, at 15·50 dols.; No. 2, at 16 dols.; and No. 1 coke foundry, at 16·50 dols. to 17·50 dols. The corresponding quotations for Pennsylvania anthracite is 17 dols. to 18 dols. at tide water for No. 1; 16 dols. to 17 dols. for No. 2; and forge, 15 dols. to 15·50 dols. A few companies are delining to sell for autumn delivery at quoted rates, in the belief that demand and consumption is laying the foundation for higher prices. We are looking for an advance in ocean freights. Wire rods are quoted here at 43 dols. Steel ship plates are active at 2·25, delivered. Heavy orders for wrought iron pipe have been taken; the work to be delivered from and after August 1st. A heavy movement is setting in for merchant steel, sheet iron and galvanised, girders and plate iron and nails. Quite a number of enterprises, calling for a great deal of material, have come to market for supplies, and the effects have been beneficial on prices and on the confidence of halting investors. Merchant iron is strong at 1·70 to 1·90. Nails range from 1·70 to 1·90 for cut in eastern markets, to 2·35 dols. for wire nails in western markets for car load lots. The hardware manufacturers and jobbers are doing an immense business. The rapid filling up of the Far West is helping trade much. Shop and factory and mine equipments are needed. Mill work of all kinds is abundant. Labour strikes are not occupying much attention.

## NEW COMPANIES.

THE following companies have just been registered:—

*Graydon Dynamite War Material Syndicate, Limited.*

This company was registered on the 20th ult., with a capital of £55,100, in £1 shares, 100 being founders' shares and the remainder preference shares, to acquire any inventions or patents, for all countries other than the United States of America, relating to guns, torpedoes, cartridges, shells, and other projectiles, &c., the inventions of Lieutenant Graydon, late of the United States Navy. The founders' shares are to be issued as fully paid up, in consideration of property acquired by the company, but will not entitle the holders to any dividend until 15 per cent. has been paid upon the amount paid up on the preference shares. After such payment, the surplus profits available for dividend shall be divided into two equal parts—half to be paid to the preference shareholders, and half to the holders of founders' shares. The first subscribers are:—

| | Shares. |
|---|---|
| Lieutenant-Colonel F. Baring, St. James' Palace | 2 |
| C. Jones, 4, Tokenhouse-yard, E.C. | 1 |
| E. Bauman, 109, West End-lane, Hampstead, secretary to a company | 1 |
| R. Heard, 23, Bentinck-street, W. | 1 |
| E. H. Goold, C.E., 4, Dane's-inn, W.C. | 1 |
| G. Coxon, 16, Devonport-street, Hyde Park | 2 |
| A. Tibbits, 28, Bedford-row, W.C., solicitor | 1 |

There is not to be less than two nor more than seven directors. The first are to be appointed by the subscribers. Any holder of preference shares is eligible as a director. Remuneration, £200 per annum each. Registered office, 8, Drapers-gardens.

*Uruguay Great Eastern Railway Company, Limited.*

This company was registered on the 22nd ult., with a capital of £1,100,000, in £20 shares, to acquire from the Government of the Oriental Republic of Uruguay, or others, the concession to construct and work a railway from Monte Video or Pando to the Lake of Merim. The subscribers are:—

| | Shares. |
|---|---|
| A. Betzold, Bartholomew House, merchant | 1 |
| H. Beste, 33, Manry-road, Stoke Newington | 1 |
| A. Malden, 24, Oakfield-road, Croydon, clerk | 1 |
| W. Bayley, Pembury-road, Lower Clapton | 1 |
| A. C. Taylor, Twickenham, secretary | 1 |
| C. Lock, 283, Upland-road, Dulwich | 1 |
| T. C. Richards, 47, Gowrie-road, Lavender Hill, clerk | 1 |

The number of directors is not to be less than three, nor more than seven; qualification, twenty-five preference shares; the subscribers are to appoint the first. The remuneration of the board is to be at the rate of £300 per annum to each director, to be divided as they may determine.

*Edward Bennis and Company, Limited.*

This company was registered on the 24th ult., with a capital of £20,000, in £5 shares, to adopt an agreement for the purchase of the business of a mechanical engineer carried on by E. Bennis, and the steam engines, lathes, patterns, stock-in-trade belonging to the business, and all contracts in connection therewith, and certain inventions for which letters patent have been granted. The first subscribers are:—

| | Shares. |
|---|---|
| E. Bennis, 365, Blackburn-road, Bolton, mechanical stoker | 1 |
| Emily Bennis, 365, Blackburn-road, Bolton | 1 |
| A. W. Bennis, 365, Blackburn-road, Bolton, iron-founder | 1 |
| J. Livesey, 25, Crescent-street, Manchester, accountant | 1 |
| W. J. Sutcliffe, Godley, Cheshire, cement manufacturer | 1 |
| W. Renwick, 5, Quayside, Newcastle-on-Tyne, iron merchant | 1 |
| C. Hardman, 71, King-street, Manchester, solicitor | 1 |

There is not to be less than three nor more than five directors. The first are J. E. Livesey, W. J. Sutcliffe, and W. H. Renwick. Remuneration as the directors may determine, but not to exceed £2 2s. per meeting, and first-class railway fares from place of residence. Registered office, Bamber-court, Bolton, Lancaster.

*General Electric Company, Limited.*

This company was registered on the 26th ult., with a capital of £60,000, divided into 7000 first preference shares, 1000 second preference shares, and 4000 ordinary shares of £5 each, to acquire and take over as going concerns the businesses carried on under the style of the General Electric Company, at 71, Queen Victoria-street, E.C.; Nos. 22, 23, and 24, Garlick-hill, E.C.; and No. 71 and 73, Bentham-road, South Hackney, under the style of the General Electric Company; also the business carried on in Clegg's-court, Chapel-street, Salford, Lancaster, under the style of the Manchester Electric Works Company, and the several patents, goodwill, and other assets of the proprietors of such businesses. The first subscribers are:—

| | Shares. |
|---|---|
| *Gustav Binswanger, 71, Queen Victoria-street, electrical engineer | 2000 |
| J. H. Ward, 22, Lower Phillimore-place, Kensington, barrister | 3000 |
| *Hugo Hirst, 71, Queen Victoria-street, E.C., electrical engineer | 1 |
| S. Smith, 159, Milkwood-road, Herne Hill, S.E., accountant | 1 |
| G. S. Joseph, 165, Fenchurch-street, E.C. | 1 |
| Albert R. Bernhard, Hilbrow-villas, East Finchley, N., clerk | 1 |
| H. Heritage, 7, Wendover-road, Harlesden, N.W. | 1 |

The number of directors is not to be less than four, nor more than nine, and the first are Gustav Binswanger, Max Binswanger, and Hugo Hirst, and two directors to be appointed by John Henry Ward. The two directors so appointed are to be paid £214 out of the funds of the company in any year in which the profits of the company shall be more than sufficient to pay a dividend of 10 per cent. on the capital paid up.

## THE PATENT JOURNAL.

*Condensed from the Journal of the Commissioners of Patents.*

### Application for Letters Patent.

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

*22nd July*, 1889.

11,626. PREPARING GRINDING SURFACES, S. Dixon and H. Pinson, Manchester.
11,627. DOFFING BOBBINS, H. Rawcliffe and J. Eastwood, Manchester.
11,628. ATTACHING LOCKS to TRUNKS, W. Wakelam, Willenhall.
11,629. TRUNK LOCKS, W. Wakelam, Willenhall.
11,630. LATCHES and LOCKS, J. Ash, Willenhall.
11,631. CONSTRUCTION of CANDLESTICKS, W. M. Gardner, London.
11,632. STEERING MOTION, W. Garvey, J. Tattersall, and E. Jones, Manchester.
11,633. FIXING BLINDS, W. C. Jones and J. Anderson, Leeds
11,634. CORKING BOTTLES, T. Bowskill and W. Durant, Barnsley.
11,635. DRYING YARNS, &c., J. B. and E. Whiteley, Halifax.
11,636. MEASURING ELECTRIC CURRENTS, P. Jolin, Bristol.
11,637. SIGNALLING on RAILWAYS, J. Hodgeson, Liverpool.
11,638. NAIL, H. Peck, London.
11,639. COLOUR PRINTING, J. M. Black, London.
11,640. BRACKETS for DISPLAYING BOOTS, &c., J. R. Bruce, Birmingham.
11,641. HEEL BURNISHING MACHINES, J. M., J., A. J., and S. A. Gimson, Leicester.
11,642. YARN SPINNING MACHINES, D. R. Malcolm, Dundee.
11,643. CORNICE-POLE RINGS, C. F. Grimmett and J. F. K. Simpson, Birmingham.
11,644. COMBINED FOLDING BED, &c., A. A. Vernon, Canada.
11,645. FLUSHING WATER-CLOSETS, R. Scott, Newcastle-on-Tyne.
11,646. COMPOUND STEAM ENGINES, W. J. Norris, Leyton.
11,647. AIR GUN, J. Tourtel, London.
11,648. GAME, J. Tourtel, London.
11,649. LOCKS, S. W. Hunton, London.
11,650. TOBACCO PIPE, S. Carew, London.
11,651. HORSESHOES, J. W. Graydon, London.
11,652. PNEUMATIC APPLIANCES, R. K. Boyle, London.
11,653. KNITTING MACHINES, H. S. Long, Yeadon.
11,654. PREVENTION, &c., of SMOKE, J. Drabble, Edmonton.
11,655. RAILWAY RAILS and CHAIRS, G. Brocklebank, Anerley.
11,656. HANSOM GIGS, P. Chadwick, Liverpool.
11,657. NAILS, &c., W. P. Thompson.—(*B. Junquera*, ——.)
11,658. PLASTERING WALLS, G. Bastucchi, London.
11,659. STOPPING, &c., TRAMCARS, R. Fenn, London.
11,660. SOAP, H. Schuster, London.
11,661. THERMO-ELECTRIC BATTERIES, C. Huelser.—(*H. Mestern, Germany.*)
11,662. GAME, J. W. Stansfield, London.
11,663. COLOURING CALCAREOUS STONES, &c., J. W. and T. Breakell, London.
11,664. EXPLOSIVES, Sir F. A. Abel and J. Dewar, London.
11,665. SMOKELESS GUNPOWDER, W. Schückher, London.
11,666. PRODUCTION of COLOURING MATTER, O. Imray.—(*The Farbwerke vorm. Meister, Lucius and Brüning, Germany.*)
11,667. EXPLOSIVES, Sir F. A. Abel, J. Dewar, and W. Anderson, London.
11,668. FIRE and SOUND-PROOF PLASTERING, W. Doehring, London.
11,669. HATS, W. H. Elliott, London.
11,670. BELL BUOYS, J. Gibson, London.
11,671. FOOD HOLDERS for BIRD CAGES, S. Arnold, London.
11,672. WITHDRAWING BUNGS from CASKS, J. Smith, London.
11,673. RAILWAY SIGNALS, G. Brockelbank, Anerley.
11,674. MANUFACTURE of BOTTLES, W. P. Bonwick, London.

*23rd July*, 1889.

11,675. CARVING FORK GUARDS, &c., F. C. Askham, Sheffield.
11,676. PRINTING TELEGRAPHS, H. J. Allison.—(*Major D. Porter, United States.*)
11,677. BRUSH BLOCK BORING MACHINERY, A. H. Morier.—(*J. C. Murphy, United States.*)
11,678. BUFFERS, J. E. L. Barnes.—(*S. W. Winslow, United States.*)
11,679. COVERINGS for BUFFERS, J. E. L. Barnes.—(*S. W. Winslow, United States.*)
11,680. SCOURING and POLISHING COMBS, J. Sutherland, Glasgow.
11,681. RED, WHITE, and BLUE PUZZLE, A. Stuart, jun., Edinburgh.
11,682. PARING LEATHER MACHINES, W. A. Horne, London.
11,683. FIXING BUTTONS to GARMENTS, E. H. Naden, Birmingham.
11,684. CREEL PEGS for TWISTING MACHINERY, B. Firth, Halifax.
11,685. EXTENSION STANDARDS for LAMPS, J. Hinks, Birmingham.
11,686. WELDING COMPOUND, C. U. Fisher.—(*H. F. Lord, United States.*)
11,687. DRILLING MACHINE, R. Wilson and J. J. Robins, Derby.
11,688. STRETCHING MACHINES, R. Clegg, Longsight.
11,689, TREADLE MOTION, W. H. Doughty and W. Nagle, London.
11,690. FLOWER VASES, POTS, &c., M. Poumarède, London.
11,691. HUMIDIFIERS, E. Breadner, Manchester.
11,692. CYCLING SADDLE, P. A. Bans, Aston, near Birmingham.
11,693. PENHOLDERS, F. Knade, Glasgow.
11,694. MILITARY and other SIGNALS, G. W. Moon, London.
11,695. VELOCIPEDES, W. H. J. Grout and G. Watts, London.
11,696. VALVES, J. A., S., and J. Fletcher, Ashton-under-Lyne.
11,697. AUTOMATIC GRIP for ROPES, &c., H. Emanuel, Surbiton.
11,698. PUZZLE, H. Reichardt, London.
11,699. STENCIL PLATES, W. Needes and E. P. Steeds, Leicester.
11,700. CIRCULAR BEEHIVE, W. F. B. Waterhouse, Bexley Heath.
11,701. CONVERTIBLE SEATS for PHAETONS, H. Brandon, Newcastle-on-Tyne.
11,702. DRILL STEERAGE, T. C. Sargeant, Northampton.
11,703. TROUSERS, A. Tait, Bath.
11,704. GLOVES for CYCLISTS, W. Sykes, Horbury, near Wakefield.
11,705. ECONOMISING ELECTRICITY, F. W. Engelbach and E. B. Bright, London.
11,706. FEED-WATER HEATER CLEANER, J. D. Sullivan, London.
11,707. SODIUM, &c., T. Parker and A. E. Robinson, Wolverhampton.
11,708. SUSPENDING TROUSERS, M. Schnerb, jun., London.
11,709. GAS, &c., FITTINGS, A. S. Williams, Manchester.
11,710. SEWING MACHINES, C. L. and H. W. Reynolds, London.
11,711. SAFETY FUSE, J. Altschul and R. H. Punshon, London.
11,712. AERATED MINERAL WATERS, R. Punshon and J. Altschul, London.
11,713. VELOCIPEDES, A. Sterry, Redhill.
11,714. COLLARS of COATS, J. Hall and G. Smith, Sheffield.
11,715. SQUARE MITRE and BEVEL, V. Broughton, Birmingham.
11,716. STOP MOTION for CARDING ENGINES, J. Vaughan, Manchester.
11,717. PAINT BRUSHES, J. H. Dickson, London.
11,718. SIGNALLING CARRIAGES, &c., J. Womersley, London.
11,719. PHONOGRAPHS, W. P. Ingham, London.
11,720. CASH REGISTERS, H. J. Haddan.—(*The National Cash Register Company, United States.*)
11,721. DESTROYING INSECTS, G. I. MacMunn, London.
11,722. ADJUSTABLE SPANNERS or WRENCHES, J. Woodward, London.
11,723. PERCUSSION TOOLS, T. E. Thorpe and W. J. Crossley, London.
11,724. VIEW FINDERS, J. J. D. Cleminson and H. W. G. Bloomfield, London.
11,725. PROTECTING SERVANTS' LIVES in WINDOW-CLEANING, N. Newns, Stratford.
11,726. STEAM BOILERS, D. T. Lawson, London.
11,727. STEAM ENGINES, H. Grafton, London.
11,728. STOVES, &c., A. M. Clark.—(*The Elterich Art Tile Stove Works, United States.*)
11,729. SUGAR CANE MILLS, J. E. Hatton, London.
11,730. FLAKED MALTS, J. White, London.
11,731. MACHINES for MAKING CURVED METAL PIPES, H. H. Lake.—(*O. Knapp, United States.*)
11,732. ELECTRIC TELEGRAPHS, F. Anderson, London.
11,733. EMBROIDERING MACHINES, P. A. Newton.—(*J. Irish, United States.*)
11,734. JOINING PIECES of METAL FOIL, J. Y. Johnson.—(*L. H. Rogers, United States.*)
11,735. STEAM BOILERS, F. B. King and N. B. Clark, London.
11,736. COMPRESSING AIR, C. A. Jensen.—(*D. Dudley, United States.*)
11,737. UNDERFED STOVE APPARATUS, C. J. Oliphant and A. Cunnew, London.
11,738. STAGE MEDIUM, J. Scott and H. D. Smith, Manchester.
11,739. BIRD SHOOTING, J. Gardener, London.
11,740. SCOURING GRAIN, H. H. Lake.—(*G. S. Cranson, United States.*)
11,741. RAILWAY SIGNALLING, S. T. Dutton, London.
11,742. PRODUCING FRESH WATER from SEA WATER, H. Ferguson, London.
11,743. FORKS, A. J. Boult.—(*T. Häusler, Germany.*)
11,744. SHIPS' LOGS, W. P. Thompson.—(*A. Heberle, Germany.*)
11,745. FRICTION CLUTCH and BRAKE, W. H. Batts, London.
11,746. SACK LIFTERS, T. W. Cook, London.
11,747. MOWING or REAPING APPARATUS, D. Richards, London.
11,748. EXPLOSIVES, J. Harper, R. Punshon, and F. Parker, London.
11,749. REGULATING the MOTION of MACHINERY, C. T. Guthrie, London.

*24th July*, 1889.

11,750. MOVING CURTAINS To and FRO, W. Holbrook, London.
11,751. PROJECTILES, E. J. Bowles, London.
11,752. TEAPOTS, R. Simpson, Sheffield.
11,753. COVERS for COOKING UTENSILS, H. Inglis, London.
11,754. METAL MATCH-BOXES, A. J. Thurman, Birmingham.
11,755. ARC LAMPS, J. Kent, London.
11,756. FISH FORKS, T. Gibson, Birmingham.
11,757. MINERS' SAFETY LAMPS, L. Jenkins, Birmingham.
11,758. DYEING, &c., MACHINE, J. Don, A. B. Duncan, and W. Don, Dundee.
11,759. COMBINED AIR and STEAM BLAST, J. Morrison, Stockton-on-Tees.
11,760. ADVERTISING TABLET, S. Skerritt and H. Jones, Sheffield.
11,761. ATTACHMENT for BOOTS, R. R. Ambler, Keighley.
11,762. OPERATING the HEALDS of LOOMS, J. Culpan, Halifax.
11,763. LOCK-NUTS and BOLTS, J. C. Bourgeaud, Birmingham.
11,764. ROOT CUTTERS, W. H. Baines, Sheffield.
11,765. GRINDING PANS, T. C. Fawcett, jun., Halifax.
11,766. WATER or FLUID METER for PUMPS, A. Barclay, Glasgow.
11,767. LAMPS for BURNING PARAFFIN OIL, &c., W. Sands, Glosgow.
11,768. GAS, O. Rose, London.
11,769. SIGNAL BELL, E. Olsen, London.
11,770. ATTACHING STEEL BRUSHES to WOODEN DISCS in POLISHING MACHINES, H. C. Gros, Berlin.
11,771. PAINTS or ENAMELS, S. Banner, Liverpool.
11,772. HEATING STOVES, W. P. Thompson.—(*L. Lenaerts, Belgium.*)
11,773. POCKET RAZOR, A. B. Ball, Sheffield.
11,774. EAR for RAIN-WATER and other PIPES, D. Baker, Folkestone.
11,775. AUTOMATIC VERMIN TRAP, J. Barlow, Nottingham.
11,776. SHIPS' ANCHORS, J. R. Steele, Liverpool.
11,777. WHEELS for ROAD VEHICLES, H. Williams, Liverpool.
11,778. PREVENTING NECKTIES from MOVING OUT of PROPER POSITION, E. H. Churchill, Bristol.
11,779. PAPER and CARDBOARD, A. Durand, London.
11,780. ELECTRIC GENERATORS, C. E. Buell, London.
11,781. PORTMANTEAU, A. Gründel, London.
11,782. WINDOW CASEMENTS, J. Smith, London.
11,783. FILES for SECURING ORDER BILLS, H. Garle, London.
11,784. WATER MOTOR, O. T. Hobday, London.
11,785. AUTOMATICALLY-TILTING STAND for BEER, &c., BARRELS, G. Cruse, London.
11,786. SPRINKLER STOPPER and CAPSULE for BOTTLES, G. Procter and F. C. Peel, London.
11,787. HEATING WATER for BATHS, H. C. Willings, London.
11,788. OBTAINING METALS from their ORES, D. Dennes.—(*T. K. Rose, Denver.*)
11,789. LETTER FILES, E. T. Lacey, London.
11,790. EXTRACTING COPPER from ORES, F. A. Kieffer, London.
11,791. TEAPOTS, &c., E. Tomlinson, London.
11,792. TRAPS, A. E. Bates, London.
11,793. EYE-BARS. N. Browne.—(*Charles Morse, United States.*)
11,794. HOLDING DOWN the FRONT of WAISTCOATS, D. W. Baker, London.
11,795. COLOURING MATTERS, H. H. Leigh.—(*R. G. Williams, United States.*)
11,796. PRESERVING MEAT, E. Serrant, London.
11,797. SOLUBLE BLOOD ALBUMEN EXTRACT, A. Hommel, London.
11,798. TREATMENT of SEWAGE, C. G. Moor, London.
11,799. PRINTING TELEGRAPHS, J. E. Wright and J. Moore, London.
11,800. TIRES of WHEELS of BICYCLES, W. E. Bartlett, London.

*25th July*, 1889.

11,801. BOILING WATER, HEATING, and COOKING, J. A. Groom, London.
11,802. EQUAL TOBACCO CUTTER, B. and S. S. Austin, London.
11,803. HYDRAULIC MOTOR, J. Graham, E. D. Collicutt, and G. E. Thowburn, Newcastle-upon-Tyne.
11,804. RACK PULLEY for BLINDS, T. A. Wooldridge, Birmingham.
11,805. BUTTON, W. R. Birt, jun., Birmingham.
11,806. PREPARING EXTRACT of MEAT, W. Palmer, London.
11,807. CLIP for SUSPENDING UMBRELLAS, F. R. Baker, Birmingham.
11,808. HEATING WATER, J. Shanks, R. Barnside, and A. McCorkindale, Glasgow.
11,809. STRAINING PULP for PAPER, W. Proudlock, St. Neots.

11,810. Heater-boxes and Gas Burners, J. A. Tillcock, London.
11,811. Railway Wagons for Cattle, S. Bowler and P. Murray, Manchester.
11,812. Frames for Astigmatic Glasses, R. S. Robinson, Dublin.
11,813. Hoisting, &c., of Sails, R. D. Fergusson, Greenock.
11,814. Regulating Tension of Bobbins, J. Newton and J. Pycroft, Nottingham.
11,815. Umbrella Canes, W. Hatchman, London.
11,816. Spring in Household Bellows, A. Duke, Dublin.
11,817. Ammoniated Soaps, C. R. Huxley, London.
11,818. Labelling of Trees, &c., H. Friend, Rye.
11,819. Automatic Detaching Hook, C. E. Stephenson, London.
11,820. Reeling Machines, E. Rushton, Manchester.
11,821. Directing Hands, J. H. Ferrabee, Stafford.
11,822. Propeller Shafts for Steamers, J. Taylor, London.
11,823. Velocipedes, G. Gilbert, Birmingham.
11,824. Mules for Spinning, J. Calderbank and J. Winward, London.
11,825. Bottles and Stoppers, G. S. Spencer and J. Cutting, Derby.
11,826. Floors for Fowls' Houses, &c., C. A. Jones, Gloucester.
11,827. Driving Mechanism for Winding Yarns, A. Hitchon, Accrington.
11,828. Dobbies used in Looms, J. McMurdo, Manchester.
11,829. Lawn Tennis Nets, J. M. McQuade, Manchester.
11,830. Portable Pumping Apparatus for Baths, D. Noble, London.
11,831. Separation of Dust from Air, J. Higginbottom, Liverpool.
11,832. Couplers for Electrical Conductors, E. R. Dolby, London.
11,833. Cabinet for Coins, C. Dowling, London.
11,834. Hoof Pads for Horses, &c., W. C. Pedley, London.
11,835. Apparatus for Heating and Cooking, J. A. Groom, London.
11,836. Hand Punch, G. S. Brooks, London.
11,837. Machine Knitting of Fabrics, R. Haddan.—(*L. Richebourg, France.*)
11,838. Railway Sleepers, R. D. Ker.—(*T. Ker, India.*)
11,839. Printing on China, W. Worrall, London.
11,840. Washing Machine, W. Freebury, London.
11,841. Railway Carriage Coupling, A. W. Johnson, London.
11,842. Fenders for Ships, C. J. C. Hynen, London.
11,843. Extension Ladders, W. L. Wise.—(*J. Eltbogen and Sons, Austria.*)
11,844. Drying Grain, J. Sleeman, London.
11,845. Drying Grain, J. Sleeman, London.
11,846. Constancy of Electrical Potential Difference, Siemens Brothers and Co.—(*The firm of Siemens and Halske, Germany.*)
11,847. Electrical Energy, Siemens Brothers and Co.—(*The firm of Siemens and Halske, Germany.*)
11,848. Colouring Matter, O. Imray.—(*The Society of Chemical Industry in Basle, Switzerland.*)
11,849. Refrigeration of Stores, R. C. A. Banfield.—(*C. Linde, Germany.*)
11,850. Fastening Device, S. A. T. Coxon, London.
11,851. Indicators for Carriages, H. Lane, London.
11,852. Cycles, F. Broughton and J. Bennett, London.
11,853. Ornamental Surfaces, R. Scully, London.
11,854. Propulsion of Ships, J. W. T. Olan and J. A. Archer, London.
11,855. Artificial Fuel, J. Morris, London.
11,856. Saucepans, H. S. Burton, London.
11,857. Holder for Cartridges, R. F. Walker, London.
11,858. Sprinkler, F. Maynard, London.
11,859. Mechanical Toy, C. Judson, London.
11,860. Printing Machines, E. Causse, A. Stalin, and C. Conrads, London.
11,861. Scrubbing the Inside of Casks, J. W. and A. F. Flower, and R. J. Cousins, London.
11,862 Turning Over the Leaves of Books, W. L. Binstead, London.
11,863. Button-hole Sewing Machines, D. Hermann and L. Flatow, London.
11,864. Steam Boilers, J. J. Barclay, London.
11,865. Refrigerating Apparatus, &c, L. Perkins, London.
11,866. Automatic Coin-freed Machine, A. Engelfred, London.

*26th July*, 1889.

11,867. Removing Scale from Boilers, J. Platt and T. Thorp, Manchester.
11,868. Self-acting Mules, J. Charlesworth, J. Fisher, and R. Yates, Manchester.
11,869. Refreshment Table, T. H. Thompson and F. A. Powell, Birmingham.
11,870. Antiseptic Linings for Cups, C. J. Deane, London.
11,871. Astringent Enema Syringe, C. J. Deane, London.
11,872. Wool Combing Machines, C. Bradley, J. Radford, and J. Richardson, Bradford.
11,873. Locking the Nuts of Fish-plates, T. Lealand, Birmingham.
11,874. Upholstering by Mechanical Appliance, J. Reilly, Manchester.
11,875. Flue Tubes of Steam Boilers, A. Jackson, Hartlepool.
11,876. Draw-bars of Tramway Cars, L. Milloy and J. R. Pennycook, Glasgow.
11,877. Spring for Scissors and Shears, W. Bartram, Sheffield.
11,878. Chilled Boxes or Bushes for Axles, E. Birks, Birmingham.
11,879. Air-tight Packing Coverings, F. Stelzner, London.
11,880. Brushes, C. H. Simon, London.
11,881. Apparatus for Shaping Handles, W. Taylor, London.
11,882. Roasting Ores to Obtain Metals, S. Trivick, London.
11,883. Extracting Precious Metals from Ores, S. Trivick, London.
11,884. Valves for Water, Steam, &., Sir W. Thompson, Glasgow.
11,885. Mustard Pots, M. C. Macleod, London.
11,886. Game, W. C. Owston, Wintbridge.
11,887. Clips for Paper and Holders, &c, W. Jones, Bradford.
11,888. Construction of Guns, J. Potts, Newcastle-on-Tyne.
11,889. Convertible Carriage for Children, C. F. Owen, Manchester.
11,890. Hats and other Head Coverings, B. Herzberg, London.
11,891. Modulating Whistle Mouthpiece, J. W. Black, Glasgow.
11,892. Saddles and Cushioned Seats, &c, G. Cole, London.
11,893. Driving Mechanism of Bicycles, R. and A. Parker, London.
11,894. Artificial Draught in Boilers, J. A. Cole, Sheffield.
11,895. Puzzles, R. A. Lowe, London.
11,896. Reflector for Breech-loading Fire-arms, B. Seidenberg, London.
11,897. Drawing Pens, G. M. Asher, London.
11,898. Slicing Onions, C. Huelser.—(*P. J. Rademacher, Germany.*)
11,899. Converting Oxygen to a Solid, C. Huelser.—(*G. Kassner, Germany.*)
11,900. Conduit for Electric Railways, M. Dallas, London.
11,901. Sanitary Arrangements of Buildings, E. T. Truman, London.
11,902. Combination of Steam and Gases, O. W. Ketchum, London.
11,903. Springs, J. Gilligan and A. Tilney, London.
11,904. Water-closets, E. Cubbon, London.
11,905. Perfecting Combustion, J. Gilligan and A. Tilney, London.
11,906. Shuttles for Sewing Machines, W. Blakey, London.
11,907. Decanting Liquids, W. P. Thompson.—(*S. Sturm, Germany.*)
11,908. Grindstones, &c., D. Wilson, London.
11,909. Clips, C. H. Avery, London.
11,910. Curtained Doorways, R. Haddan.—(*M. Chotzen, Germany.*)
11,911. Christmas, &c., Greetings, F. Fitt, London.
11,912. Copper Pipe Joints, A. Thomson, London.
11,913. Corsets, M. J. van de Waal, London.
11,914. Plates for Voltaic Batteries, A. Reckenzaun, London.
11,915. Corn-milling Machines, J. E. Evans-Jackson.—(*J. Pope, Virginia.*)
11,916. Fastener for the Laces of Boots, S. P. Wood, London.
11,917. Drag for Spinning Machinery, A. V. Newton.—(*J. Good, United States.*)
11,918. Putting Belts on Pulleys, P. J. Holloway, Northwich.
11,919. Pipe Joints, C. A. Gibault, London.
11,920. Coke for Foundry Purposes, F. J. Jones, London.
11,921. India-rubber Buffer, &c., A. Spencer, London.
11,922. Composition for Covering Walls, G. F. Redfern.—(*J. G. Maardt, Germany.*)
11,923. Albums, F. W. Hochheimer, London.
11,924. Indicating Stations in Carriages, F. W. Hochheimer, London.
11,925. Valves for Regulating Gas, C. A. Rempen and E. Andre, London.
11,926. Vapour and Gas Engines, J. C. Bull, London.
11,927. Covering Electrical Conductors, S. Pitt.—(*J. B. Atherton, United States.*)
11,928. Bolt and Lock Nuts, S. Pitt.—(*A. J. Parry, United States.*)

*27th July*, 1889.

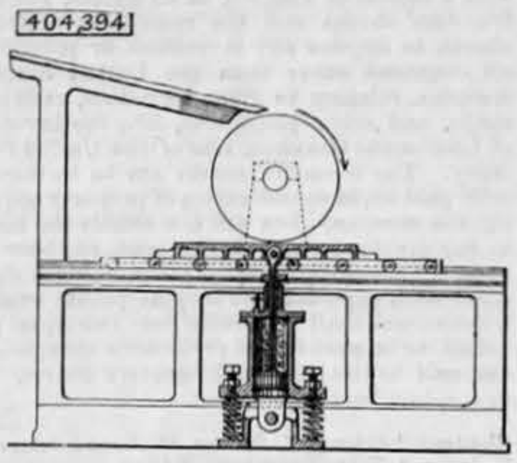
11,929. Double-action Springs for Rings of Pistons, W. C. Lockwood, Sheffield.
11,930. Frames for Umbrellas, J. B. Seel, Manchester.
11,931. Governors for Engines, W. H. Knowles, London.
11,932. Powder Distributing Machinery, W. Walters and C. A. Smith, Birmingham.
11,933. Enabling Wind to Raise Water, &c., C. Slagg, Leominster.
11,934. Cooking Utensil, H. and E. McClelland and T. E. Bassett, Birmingham.
11,935. Necktie, W. H. Williams, Moss Side.
11,936. Self-steering Safety Bicycles, H. H. Taylor, Bridlington Quay.
11,937. Cycle Gearing, D. Jones and C. Wade, Coventry.
11,938. Sizes for Fixing Colours, &c., R. Leigh, Farnworth.
11,939. Protecting Cricket Bats, E. Whitehouse and Co., Melton Mowbray.
11,940. Signal Lamp, M. and H. Simpson, Liverpool.
11,941. Switch Boards, Mix and Genest Co. and W. Oesterreich, London.
11,942. Letter Clips, F. E. Blackmore, Reading.
11,943. Cigar Boxes, J. H. Young, Glasgow.
11,944. Bookkeeper's Ruling Guard, D. Denison and H. J. Moorhouse, Bradford.
11,945. Earthenware Toilet Ware, H. C. Harrison, Birmingham.
11,946. Springs for Vehicles, C. E. Hawley, Walsall.
11,947. Feed Motion for Sewing Machines, J. Köhler, Manchester.
11,948. Hanging of Window Sashes, J. S. Lovell, London.
11,949. Brushes, E. Ehrenberg, London.
11,950. Belt Fastener, W. Tattersall, Bradford.
11,951. Advertising, W. Neeves, Leicester.
11,952. Handle, &c., for Table Knife, J. Skidmore and J. R. Windmill, Staffordshire
11,953. Pickle Forks, T. Marsden, Manchester.
11,954. Packing Piston-rods and Spindles, J. Johnson, London.
11,955. Caps, &c., for Spinning Fibres, E. Milnes, London.
11,956. Cleaning Tobacco Pipes, A. J. Haughton, London.
11,957. Extinguishers for Lamps, J. W. Renshaw, London.
11,958. Manufacturing Horseshoe Blanks, P. Thuillard, London.
11,959. Chimney Cowl, J. Stenner, S. Hamlin, and R. Stenner, London.
11,960 Printing Machinery, W. R. Schürmann, London.
11,961. Steam Engines, H. Gourlay, London.
11,962. Manufacture of Preoxide of Lead, P. Naef, Liverpool.
11,963. Roofing in Ricks, W. Dowland, Pontrilas.
11,964. Cisterns for Water-closets, R. W. Thompson, Newcastle-on-Tyne.
11,965. Hand Ejector for Liquids, &c., T. W. Stone, London.
11,966. Plates, W. Douslin, Huddersfield.
11,967. Boot Stretchers, M. D. Czvetkovics and A. Konte, London.
11,968. Heating, &c., Wire, J. Tetlow and E. Hodgson, Huddersfield.
11,969. Coupling for Locomotive Wagons, T. Averell, Belfast.
11,970. Machines for Moulding Wood, &c., A. Martin, London.
11,971. Motion of Vehicles, C. H. Maxwell-Lyte, G. Miles, and F. F. Ommanney, London.
11,972. Corks, &c., F. J. McGrady, London.
11,973. Moistening Atmosphere, N. Simin and S. Jutschkow, London.
11,974. Preparing Antiseptics, F. G. A. Roberts, A. Shearer, and W. B. Giles, London.
11,975. Soda Alum, E. Ange, London.
11,976. Curtain Rods, H. P. Picot, London.
11,977. Removing Hairs from Skins, E. Schroeder, London.
11,978. Automatic Machine for Photographs, C. H. C. Föge, C. H. Griese, and J. L. F. Raders, London.
11,979. Enamelling Articles of Copper, H. H. Lake.—(*A. Glibert, Belgium.*)
11,980. Pneumatic Machine for Distributing Liquids, G. F. Strawson, London.
11,981. Separating Foreign Bodies from Coffee Berries, W. A. Dieseldorf, London.

## SELECTED AMERICAN PATENTS.

*From the United States' Patent Office Official Gazette.*

**404,394.** Mechanism for Cushioning Traversing Beds of Reciprocating Machinery, *H. P. Feister, Philadelphia, Pa.—Filed July 26th*, 1888.

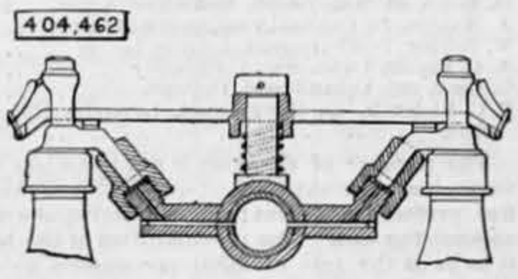
*Claim.*—(1) The combination, in a machine, of the reciprocating or traversing bed with a piston connected to and moved with said bed, a cylinder in which said piston reciprocates pivotted or hinged at one end to the frame or foundation plate of the machine. (2) The combination, in a machine, of the reciprocating or traversing bed with a piston connected to and moved with said bed, a cylinder having its end closed and provided with a relief valve, and in which cylinder said piston reciprocates, and in which the said cylinder is pivotted or hinged at one end to the frame or foundation of the machine. (3) The combination, in a machine, of the reciprocating or traversing bed with a piston connected to and moved with said bed, a cylinder in which said piston reciprocates pivotted or hinged at one end to the frame of the machine, and springs to counterbalance and cause said cylinder to normally assume an upright or substantially vertical position. (4) The combination, in a machine, of the reciprocating or traversing bed with a piston connected to and moved with said bed, a cylinder in which said piston reciprocates pivotted or hinged at one end to the frame or foundation of the machine, springs to cause said cylinder to normally assume an upright or substantially vertical position, and means to adjust the tension of said springs. (5) The combination of the reciprocating or traversing bed, a piston hinged to it on a transverse axis, and a cylinder closed at one end and hinged at or near its other end also on a transverse axis, and in which the piston reciprocates, the said cylinder having an aperture at or near one end for the admission of air above the piston when fully lowered. (6) The combination of the reciprocating or traversing bed, a piston hinged to it on a transverse axis, a cylinder closed at one end




and hinged at or near its other end also on a transverse axis in which the piston reciprocates, the said cylinder having an aperture at or near one end for the admission of air above the piston when fully lowered, and a pressure relief valve at or near its closed end. (7) A reciprocating or traversing bed, combined with a pivotted cylinder and piston connected to and operated by the movements of the bed to compress air in the cylinder. (8) The combination of a main frame, a reciprocating traversing bed, and a spring continually acting on said traversing bed and always opposing its movement and tending to bring it to a central and fixed position.

**404,462.** Manufacturing and Bottling Aerated Water, *O. Avedyk, Louvain, Belgium.—Filed June 13th*, 1888.

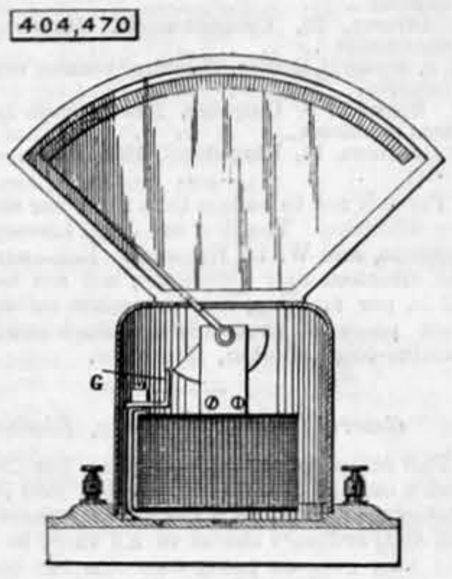
*Claim.*—(1) In a device for bottling aërated liquids, the combination of a main supply pipe connected with a source of water, and also of gas, and provided with means by which one or both of them may be admitted to it, as desired, nozzles connected with said pipe by an invertible connection, and a yoke pivotted to the invertible connection, each end of which is adapted to engage the neck of a syphon bottle and hold it against a nozzle, substantially as described. (2) In a device for bottling aërated liquids, the combination of a main




supply pipe connected with a source of water, and also of gas, and provided with means by which one or both of them may be admitted to it, as desired, nozzles connected with said pipe by an invertible connection, and a yoke pivotted to the invertible connection, each end of which is adapted to engage the neck of a syphon bottle and hold it against a nozzle, and provided with a ring or hook adapted to engage the valve lever of the bottle and maintain it in an open position while the bottle is being filled, substantially as described.

**404,470.** Voltmeter, *L. Daft, Plainfield, N.J.—Filed July 10th*, 1888.

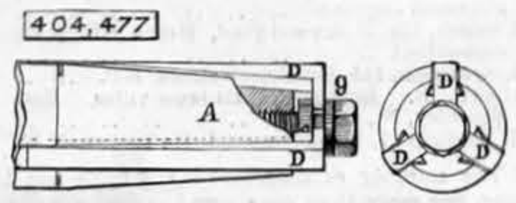
*Claim.*—(1) A voltmeter consisting of a coil, the core of which is provided with a slotted extension supporting a cam-shaped armature within the slot, and having a pointer connected to the armature, whereby the cam-shaped armature is normally maintained in a




uniform field of force, and is operated by repulsion in accordance with the variations of the current passing through the coil, substantially as described. (2) In a voltmeter, the combination of the coil, the slotted core extension, the cam-shaped armature supported therein, and a slotted adjustable polar extension $G^1$, substantially as described.

**404,477.** Expansible Mandril, *P. H. Griffin, Buffalo, N.Y.—Filed December 5th*, 1888.

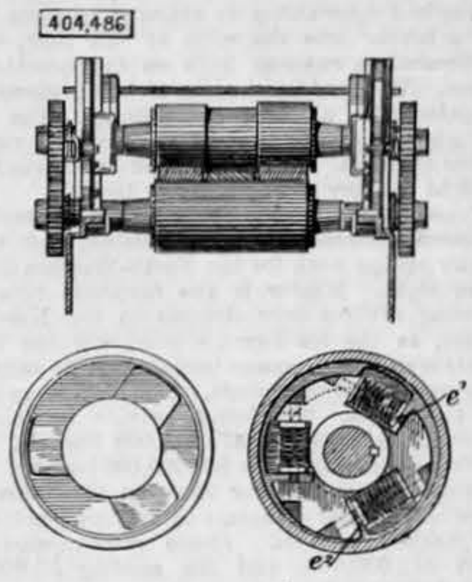
*Claim.*—(1) In expansible mandrils, the combination, with a tapering arbour A, provided with an internally screw-threaded central aperture and with parallel dovetail longitudinal grooves at the periphery of the wedge-shaped jaws D, having parallel toes *g* at their heads, and the spindle B, having the head C and circular nut *e*, the whole being constructed to operate




substantially as and for the purpose stated. (2) In expansible mandrils, the combination, with a tapering arbor having dovetailed longitudinal grooves at its periphery, of taper jaws having toes at their heads, a revolving screw-threaded spindle engaging said arbour, provided with a head having a circular base, and a removable nut upon said spindle, said toes engaging the neck *f* in said spindle, substantially as and for the object stated.

**404,486.** Feed Roll for Planing and Surfacing Machines, *L. P. Hoyt, Aurora, Ill.—Filed October 31st*, 1888.

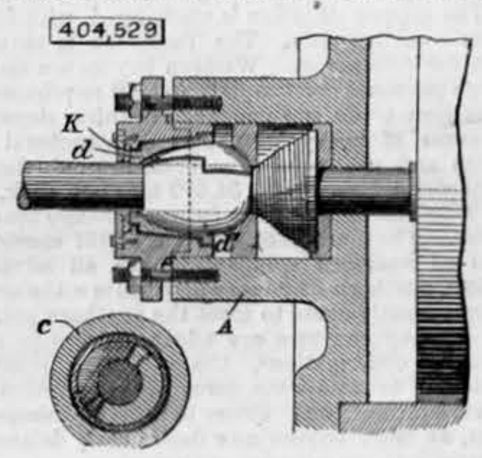
*Claim.*—(1) The combination, with a rotary shaft and a feed roll section arranged about the same, of a set of springs interposed as connections between the shaft and roll section and arranged in lines tangential to the shaft, the compression and expansion of said springs during the lateral movement, hereinbefore set forth, of the roll section being in lines tangential to the shaft, substantially as and for the purpose described. (2) The combination, with the hollow roll section provided with internally arranged abutments, of the shaft carrying a hub which is provided with jaws, plates arranged for engaging said jaws, and abutments and springs held between the plates, substantially as set forth. (3) A chambered roll section




containing radial guideways combined with a hub held upon a rotary shaft and carrying springs which are confined between followers that engage said guideways, substantially as and for the purpose set forth. (4) A chambered roll section containing radial guideways, combined with a hub held upon a rotary shaft and carring springs which are retained between followers $e^1$, that engage said guideways, said springs and followers being arranged in recesses on the hub and therein retained by pins $e^2$, substantially as and for the purpose described.

**404,529.** Stuffing-box, *L. C. S. Frick, Buffalo, N.Y.—Filed March 3rd*, 1888.

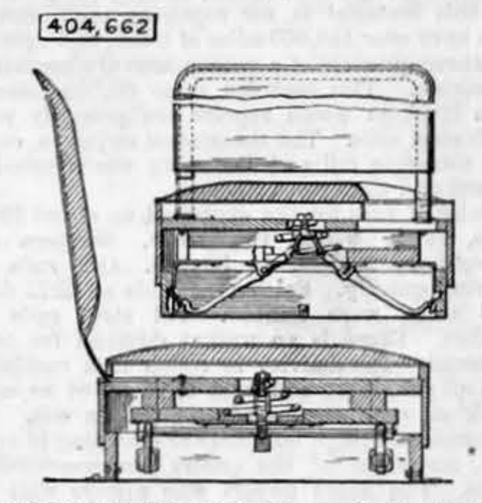
*Claim.*—The combination with the stuffing-box $A^1$, of the gland C, provided with a tapering cavity, the tapering bushing loosely fitting all around its sides in said cavity, so as to leave an annular space, the flange $d^1$, the shoulder *k*, the oval shaped packing E, fitting




in an oval cavity in the bushing, so as to leave a space *d* between the two, and the ring *l*, loosely fitting around the piston, whereby provision is made for the settlement of the piston by wear, so as to preserve the fit of all the parts, substantially as set forth.

**404,662.** Locomotive Cab Seat, *G. W. Stone, jun., Waukesha, Wis.—Filed December 21st*, 1888.

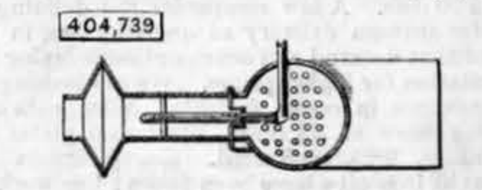
*Claim.*—(1) A locomotive cab seat comprising a stationary frame, a spring platform having a yielding connection with the stationary frame and adjustable as to tension, and a seat supporting frame arranged on the spring platform, to surround said stationary frame and have telescopic movement with relation thereto, substantially as set forth. (2) A locomotive cab seat




comprising a stationary frame provided with lateral cars for attachment to a side box in a locomotive cab, a spring platform having a yielding connection with the stationary frame, and a seat supporting frame arranged on the spring platform, to surround said stationary frame and have telescopic movement with relation thereto, substantially as set forth.

**404,739.** Exhaust Mechanism, *J. D. Smith, Murfreesborough, Tenn.—Filed December 18th*, 1888.

*Claim.*—The combination of the stack, the exhaust pipe, a pipe pivotted in the stack and having its lower end movable in relation to the exhaust pipe, and a




mechanism for adjusting the lower end of the movable pipe, the upper end of the movable pipe being contracted and perforated and thereby partially closed, substantially as described.

A Manganese Mountain in Colorado.—A syndicate of Chicago and Pennsylvania capitalists have found a huge mountain of almost chemically pure manganese of iron, together with almost unlimited veins of anthracite at Gunnison, Col. This manganese is the spiegeleisen of commerce, and every manufacturer of Bessemer steel rails who uses the article in his furnaces will know the value of these discoveries.