MANCHESTER SHIP CANAL.

No. III.

IN immediate connection with this work it was necessary that due provision should be made for dock accommodation for the vessels using the canal, and the promoters have provided dock space sufficient at least for the earlier requirements of the traffic.

At Warrington there will be a basin of suitable capacity, adjoining the site of which there is abundance of low-lying land favourable in every respect for extension, should additional space be required; and at Barton half-a-mile of quay will be constructed for the convenience of coal and other trades. The principal docks will, as a matter of course, be at the terminus of the canal in Salford, where the land is low, and being for the most part unoccupied by buildings, is in every respect suitable for the construction of docks. Provision has so far been made for only 70 acres of actual dock space at the terminus, but a considerable area of land has been scheduled in the immediate neighbourhood, which can be employed for dock extension, graving docks, &c. Vessels arriving from foreign ports, and as a rule vessels carrying cotton, require frequent overhauling, and therefore it will be necessary to make adequate provision for dry docking in order that there may not be any necessity for vessels leaving Manchester on their outward journey to stop in Liverpool for repairs. The main dock will be of a palmate form, as shown in the accompanying map, with three jetties projecting into the water space, so as to gain as great a length of frontage as possible. Upon these quays, sheds and warehouses will be erected, and, no doubt, sidings will be laid in connection with the existing railways, which are all within easy distances of the docks, though most of them are at the other side of the river Irwell.

In addition to the main dock a certain area of water will be provided by widening the river to a width of 300ft. immediately below the Old Trafford Bridge, so that altogether there will be 100 acres of dock space and four miles of quay front, which is a safer indication of the capacity of the docks than their area. In relation to the existing railways the position of the proposed docks is very favourable; within half-a-mile there are five separate lines, the London and North-Western, the Cheshire Lines Railway, the Lancashire and Yorkshire, the Didsbury and Stockport, and the Manchester South Junction and Altrincham lines, so that there will be abundant means of communication from the dock to all the centres of industry near Manchester. The entrance to the main dock, which will be 80ft. wide, will be sufficient for the reception of vessels of the largest tonnage. It is pretty clear that if the expectation of the promoters of the canal scheme are fairly realised, the dock space will before long become inadequate for the requirements of the trade, and its extension will be necessary; but it would have been the height of imprudence to provide, in the first instance, such a very large extent of dock as might possibly be required in the future. This is an error that the Furness Railway Company has fallen into, for the area of dock surface at Barrow is far beyond what the most sanguine hopes could anticipate as being necessary for many years to come.

When considering the treatment of a river by canalisation, it is both important and interesting to ascertain in what respect and to what degree the river will be affected in relation to its natural function as the main outlet for the watershed which it drains. Both the Irwell and the Mersey are most uncertain in their character, constantly liable to freshets and floods, which the formation of the valley shows to have prevailed from time immemorial. The terrace formation of the valley in certain places, and the contour of the sandstone rock below the drift and alluvial deposits, assure us that very important changes have taken place in the valley, and that the level of the river bed has altered considerably during the lapse of time. It now happens as frequently as once or twice in every year that the whole of the valley, from Manchester down to and including Warrington, is laid under water.

In 1866, 1879, and 1880, disastrous floods occurred in Salford, causing loss and misery which it would be difficult to estimate, and consequently the flood question is one of ever-increasing importance to the people of Manchester and Salford, more especially to the latter; and also to the authorities at Warrington, whose town and district suffer greatly. That the tendency to flooding has been much increased by the erection of weirs, the contraction of the river channel, and other interference, is undoubted; but the removal of any or all of these artificial impediments to the flow of the stream would not remedy the evil completely, though it would mitigate it considerably. It is usual to attribute the whole of the evil of the flooding in Salford to interference with the river channel, whereas the most that can be asserted with truth is that the artificial obstructions have made flooding more frequent than formerly in a river always liable to inundation. The construction of the ship canal would of itself secure the abatement of flooding between the terminus at Old Trafford and the sea; but to relieve the flooding in Salford, certain additional works would have to be undertaken by the borough authorities, and the execution of these works would certainly be facilitated by the construction of the canal.

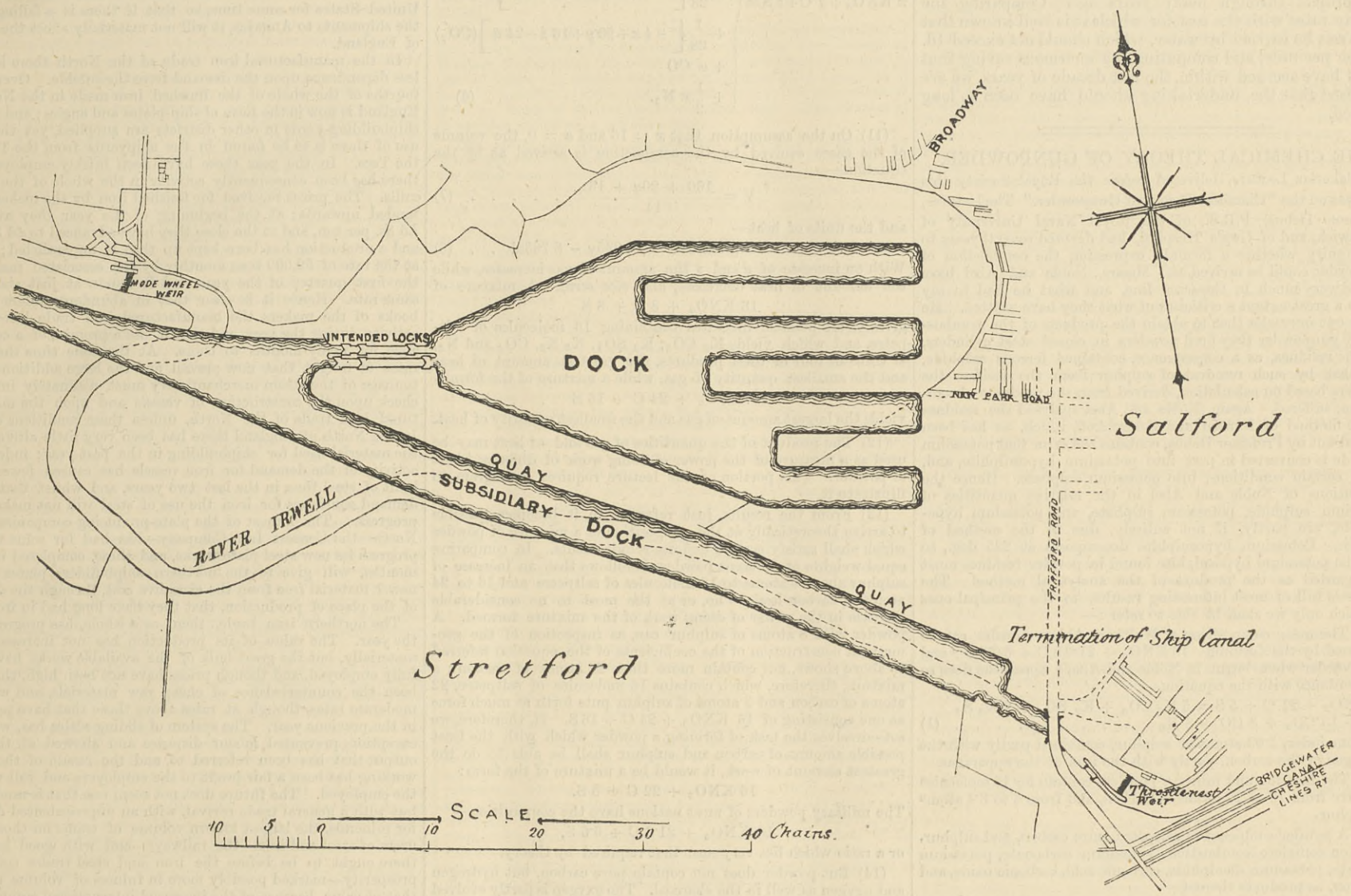
At the head of the canal the bottom is intended to be 8ft. lower than the bed of the Irwell. The canal will be not less anywhere along its course than 20ft. deeper than the river, and being more direct in its course, in the ratio of 21 to 35 miles, the general inclination of the bed will be greater, so that the new watercourse will be deeper, have a larger sectional area, and a better average inclination when the sluices are open than the river in its natural condition. At each group of locks will be constructed a bye-wash, consisting of a series of capacious sluices of sufficient opening to create a brisk current in the canal during floods, which will have the effect of removing any silt that may be deposited between each set of locks. The navigation of the Mersey and Irwell is at present constantly liable to interruption from the silting of the stream, but chiefly just above the junction of the Mersey and in the tideway below Warrington. Above the Mersey the velocity of the Irwell is checked by the resistance caused by the tributary stream entering it, and the suspended matter of the Irwell forms a bank immediately above where the streams unite. Again, where the river in flood carries a quantity of silt down to where the influence of the tide is felt, the stream is brought to a standstill by the inflowing tide, and as a consequence depositing takes place in the channel. It is clear that this evil can easily be got rid of by flushing the channel out during low tide by the water impounded in the upper reaches of the river when canalised, which cannot be accomplished at present. The Bridgewater Navigation Company is now beginning to be aware of the importance of employing the scouring power of the river for keeping its bed free from shoals, and of the superiority of this mode of treatment over dredging, and it is now converting one of its most important solid dams into an open weir, which it is fully expected will keep the pond above it free from deposit. We illustrated the sluicing works at Throstle Nest in our issue of the 1st September, and we learn that the company has in view the adaptation of movable shutters to certain of its weirs along the course of the stream, showing that it has confidence in this system; though it is clear that if the ship canal is carried out, the river Irwell and all the old works in connection with it will become a thing of the past.

In respect of the floods which periodically devastate portions of the Borough of Salford, the canal will considerably facilitate the action of the Corporation. For many years the council have been anxiously endeavouring to carry out a scheme for the abatement of floods. Hitherto they have been baffled in their attempts, chiefly by the apathy and indifference of those whose interests are really affected equally with those of the Corporation, landowners, and neighbouring authorities, who, whilst professing to approve of the action of the Corporation, will not raise a hand to strengthen that body in its attempts to mitigate a perpetually recurring evil.

The only available means of averting floods in Salford is to take off from the river Irwell, at a convenient point above the flooded district, about one-third of its flood discharge, and deliver this surplus water by a tunnel driven through the higher part of the district to a point below Manchester and Salford proper. More than one scheme has been matured with this object in view, but for want of the requisite powers each and all have had to be abandoned one after the other. It was urged in opposition to these projects by local authorities lower down the river, that to facilitate the discharge of floods through Salford would increase the evil of flooding below, though it is hard to see why such should be the case; but it is quite clear that the improved state of things which the canal would bring about would remove all ground for apprehension on this point.

At the head of the canal the bottom would be 8ft. lower than the bed of the Irwell at the same point, which would give a better inclination for the artificial overflow which the Corporation's engineer, Mr. Arthur Jacob, recommended for the relief of the Broughton floods, and such a material addition to the fall of the channel would enable its size to be reduced with a proportionate saving of expenditure.

Having described this scheme at some length in its technical details, it will be well to consider for a moment the results which are calculated to follow the completion of the undertaking. It would appear at first sight that there are ample means of communication between Manchester and the sea, but from the Manchester point of view, the provision for the carriage of goods is both inade-



SALFORD DOCKS, MANCHESTER SHIP CANAL.

quate and expensive beyond all reason. Complaints of delay in the delivering of heavy goods are constant, and appear to be amply justified by facts, but the principal justification for the construction of the canal is found in the excessive rates charged by the railway companies for the carriage of goods from Liverpool. That the rates are unduly oppressive will be learned from a comparison of the Liverpool rates with the rates on the same class of goods carried from the ports on the east coast of England. Taking, for example, timber, the rate from Liverpool is 7s. 11d. a ton, the distance being 31½ miles, whilst the rate from Hartlepool to Manchester, about 110 miles, is 13s. 4d. Estimating the rate from Liverpool at the latter price, and in proportion to the distance the charge from Liverpool to Manchester should be 3s. 10d., which is 48·5 per cent. only of the rate actually charged.

Applying the same test to slates and other building materials, we find that the Liverpool rates are all round about 50 per cent. per ton per mile higher than goods can be profitably carried, from the eastern coast of England to Manchester. Again, to these excessive charges have to be added the cost of transhipment, dock dues, &c., at Liverpool, which in the aggregate represent an enormous tax upon the Manchester trade and population annually.

On reviewing the existing state of things, it appears surprising that the Manchester public have not carried this project through many years ago. Comparing the railway rates with the cost for which it is well known that goods can be carried by water, which should not exceed 1d. per ton per mile, and computing the enormous saving that would have accrued within the last decade of years, we are surprised that the undertaking should have been so long delayed.

THE CHEMICAL THEORY OF GUNPOWDER.

The Bakerian Lecture, delivered before the Royal Society this year, was on the "Chemical Theory of Gunpowder." The lecturer, Professor Debus, F.R.S., of the Royal Naval University of Greenwich, and of Guy's Hospital, had devoted several years to the inquiry whether a formula expressing the combustion of gunpowder could be arrived at. Messrs. Noble and Abel have worked very much in the same line, and what he had to say was to a great extent a criticism of what they have written. He points out *inter alia* that to obtain the products of the combustion of gunpowder they fired powders in closed steel cylinders, and the residues, as a consequence, contained ferrous sulphide, and that by such removal of sulphur from the residue the numbers based on calculation, derived from the products of combustion, suffered. Again, Noble and Abel analysed the residues by the method of Bunsen and Schischkoff, which, as has been pointed out by Professor Debus, contains the error that potassium sulphide is converted in part into potassium hyposulphite, and, under certain conditions, into potassium sulphate. Hence the fluctuations of Noble and Abel in the relative quantities of potassium sulphide, potassium sulphate, and potassium hyposulphite, are partly, if not entirely, due to the method of analysis. Potassium hyposulphite decomposes at 225 deg., so that the potassium hyposulphite found in powder residues must be regarded as the product of the analytical method. The lecture is full of most interesting results, to the principal ones of which only we shall be able to refer :—

(1) The mean composition of Waltham Abbey powder can be expressed by the formula—$16\,KNO_3 + 21{\cdot}18\,C + 6{\cdot}63\,S$; and such powder when burnt in Noble and Abel's apparatus does so in accordance with the equation—

$$16\,KNO_3 + 21\,C + 5\,S = 5\,K_2CO_3 + K_2SO_4 + 2\,K_2S_2 + 13\,CO_2 + 3\,CO + 8\,N_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

The remainder, 1·63 atoms of sulphur, combined partly with the hydrogen of the carbon, partly with the iron of the apparatus.

(2) The hunting and military powders contain for 16 molecules saltpetre from 13 to 22 atoms of carbon, and from 6 to 8·4 atoms of sulphur.

(3) A powder composed of saltpetre, pure carbon, and sulphur, gives, on complete combustion, potassium carbonate, potassium sulphate, potassium disulphide, carbonic acid, carbonic oxide, and nitrogen, as products thereof.

(4) By increasing the pressure during the combustion, *cæteris paribus* the amount of carbonic oxide appears to decrease, and side by side with it an increase in the amount of potassium carbonate, of potassium disulphide, and of carbonic acid, while the yield of potassium sulphate is less. These variations in the products of combustion are, however, inconsiderable.

(5) The burning of the powder consists of two different processes, the one following the other ; (*a*) is a process of oxidation, during which potassium sulphate and carbonate, carbonic acid and nitrogen, and perhaps a portion of the carbonic oxide, but no potassium sulphide, are found ; and (*b*) a process of reduction, where the carbon remaining free reacts on the potassium sulphate formed by the combustion, and the free sulphur reduces the potassium carbonate. The potassium disulphide is formed during this second stage of combustion.

(6) The first stage of the combustion, the actual explosion of the powder, takes place in powders of very different composition according to the equation

$$10\,KNO_3 + 8\,C + 3\,S = 2\,K_2CO_3 + 3\,K_2SO_4 + 6\,CO_2 + 5\,N_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

As, however, it is probable that carbonic oxide is formed at the same time it may, perhaps, be more truly represented by the equation :—

$$16\,KNO_3 + 13\,C + 5\,S = 3\,K_2CO_3 + 5\,K_2SO_4 + 9\,CO_2 + CO + 8\,N_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

The constituents of the powder and of the products of combustion stand, according to equation (3), nearly in the same relation as in equation (2).

(7) The ratio of the oxygen in the carbonate to that in the potassium sulphate and the carbonic acid, is shown in equation (2) to be the simplest oxygen ratio, which by the combustion of a mixture of saltpetre, carbon, and sulphur to potassium sulphate and carbonate, carbonic acid and nitrogen can be formed. In other words, the equation (2) represents the simplest distribution possible of the oxygen of the decomposed saltpetre among the products of combustion. As now the molecular relation of the products of combustion in equation (4) lies very near those of equation (2), it follows that the oxygen ratios of the products of combustion in equation (3) represents the simplest case possible.

(8) If the combustion follows equation (3) without, in short, any formation of potassium sulphide, the development of heat is the greatest possible which a mixture of the three constituents can bring about, the heat of formation of carbonic acid, potassium sulphate, and potassium carbonate stand in the simplest relation to each other. The relation of the heat of formation is :—

$$3\,K_2CO_3 : 5\,K_2SO_4 : 9\,CO_2 = 1 : 2{\cdot}05 : 1{\cdot}04$$

(9) The sorts of powder in general use contain, however, more carbon and sulphur than is required by equation (3). This surplus of carbon and sulphur remains over at the end of the first stage. The carbon acts on the potassium sulphate as follows :—

$$4\,K_2SO_4 + 7\,C = 2\,K_2CO_3 + 2\,K_2S_2 + 5\,CO_2 \quad . \quad (4)$$

and the sulphur on the potassium carbonate :—

$$4\,K_2CO_3 + 7\,S = K_2SO_4 + 3\,K_2S_2 + 4\,CO_2 \quad . \quad (5)$$

and they collectively form the second stage of the burning of the powder ; they are endothermic, heat is not evolved, but rendered latent ; they are not of an explosive nature, and in practice are probably seldom complete. During the second stage of the combustion the temperature of the products of explosion is diminished and the volume of the gas is increased.

(10) If x, y, and z be positive numbers, and a represent how many molecules of carbonic oxide are formed by the complete combustion of a weight of powder containing x molecules of saltpetre, y atoms of carbon, and z atoms of sulphur, we have—

$$x\,KNO_3 + y\,C + z\,S = \begin{cases} \frac{1}{28}\left[4x + 8y - 16z - 4a\right](K_2CO_3) \\ + \frac{1}{28}\left[20x - 16y + 4z + 8a\right](K_2SO_4) \\ + \frac{1}{28}\left[-10x + 8y + 12z - 4a\right](K_2S_2) \\ + \frac{1}{28}\left[-4x + 20y + 16z - 24a\right](CO_2) \\ + a\,CO \\ + \frac{1}{2}x\,N_2. \end{cases} \quad (6)$$

(11) On the assumption that $x = 16$ and $a = 0$, the volume of the gases evolved by the combustion is arrived at by the equation—

$$V = \frac{160 + 20y + 16z}{14} \quad . \quad . \quad . \quad . \quad . \quad (7)$$

and the units of heat—

$$W = 1000\,[1827{\cdot}154 - 16{\cdot}925y - 8{\cdot}788z] \quad . \quad . \quad (8)$$

With an increase of y and z the amount of gas increases, while the amount of heat decreases, and *vice versâ*. A mixture of

$$16\,KNO_3 + 8\,C + 8\,S$$

gives of all possible mixtures containing 16 molecules of saltpetre, and which yields K_2CO_3, K_2SO_4, K_2S_2, CO_2 and N_2, or three or four of these products, the greatest amount of heat and the smallest quantity of gas, while a mixture of the form—

$$16\,KNO_3 + 24\,C + 16\,S$$

yields the largest amount of gas and the smallest quantity of heat.

(12) The product of the quantities of gas and of heat may be used as a measure of the power of doing work of different kinds of powder. This portion of the lecture requires a diagram to illustrate it.

(13) From the results, just referred to, it becomes possible to arrive theoretically at the composition of a mixture of powder which shall satisfy certain definite requirements. In comparing equal weights of different powders it follows that an increase of sulphur above 8 atoms to 16 molecules of saltpetre and 16 to 24 atoms of carbon leads to no, or at the most to no considerable increase in the power of doing work of the mixture formed. A powder with 8 atoms of sulphur can, as inspection of the geometrical construction of the coefficients of the equation referred to above shows, not contain more than 22 atoms of carbon ; a mixture, therefore, which contains 16 molecules of saltpetre, 22 atoms of carbon and 8 atoms of sulphur puts forth as much force as one consisting of $16\,KNO_3 + 24\,C + 16\,S$. If, therefore, we set ourselves the task of forming a powder which with the least possible amount of carbon and sulphur shall be able to do the greatest amount of work, it would be a mixture of the form:

$$16\,KNO_3 + 22\,C + 8\,S.$$

The military powders of most nations have the composition—

$$16\,KNO_3 + 21{\cdot}2\,C + 6{\cdot}6\,S,$$

or a ratio which lies very near that required by theory.

(14) But powder does not contain pure carbon, but hydrogen and oxygen as well in the charcoal. The oxygen is partly evolved as water in combination with some of the hydrogen ; the rest of the hydrogen causes the formation of ammonia, marsh gas, and hydrogen sulphide, or sulphuretted hydrogen. These bye-products, which form only from 1 to 2 per cent. of the burnt powder, and stand in no direct relation to the explosion, may consequently be disregarded.

(15) Powders containing an excess of carbon burn more slowly. The oxygen of the carbon is not separated as water, but in combination with carbon as carbonic acid or carbonic oxide. A specimen of Curtis and Harvey's powder burned in the apparatus of Noble and Abel in accordance with the equation:

$$4\,KNO_3 + 7\,C + 2\,S = K_2CO_3 + K_2S_2 + 3\,CO_2 + 3\,CO + 2\,N_2,$$

or with the oxygen divided thus :—

$$K_2CO_3 : 3\,CO : 3\,CO_2 = 3 : 3 : 6.$$

THE NORTHERN IRON TRADE IN 1882.

The year 1882 commenced for the iron trade of the North of England with prospects that were exceedingly bright ; but though there has been little retrogression, it can scarcely be said that the prospect now is quite so unclouded. There has been little change in the extent of the production, prices have varied less than in most years, and there has been a decrease of the stocks of crude iron in the hands of the makers that has continued throughout the year. At the beginning of the year pig iron in the Cleveland district stood at about £2 2s. per ton, and it rose until, at the end of the third quarter, £2 5s. might be given as the quotation, but 1s. from the latter price will best represent its latest value. This is not due to any increase of stocks in the hands of the makers, for there has been a decline in these to the extent, in round numbers, of about 130,000 tons. The production for the year may be put at about the same as that for the latter months of the past year—at about 1,600,000 tons of Cleveland iron, and about 850,000 tons of hematite and other irons used in the production of steel. The shipments of iron in the crude state have been very large, and may be estimated at about 950,000 tons for the year from the river Tees, and thus with the large local and inland demand, the cause of the fall of the stocks in the hands of the makers is clearly shown.

It may be thus taken for granted that the extent of the production of pig iron in the year in the North of England has not very materially varied from that of the preceding year, although there is now an increase in the proportion of the iron used for steel-making purposes, which is largely smelted from ores imported from Spain and other countries ; and though a growth of the production of this class of iron is to be expected, it is not certain that it will be at the further cost of the native or Cleveland iron, because there is certain to be an extension of the production of basic steel in which Cleveland pig iron is used. There is to be an extension of the works at Eston, where the process was developed, and early in the year operations will be commenced at other works which have been long in progress. It is probable that by these the consumption of the native iron of Cleveland will be stimulated, and as the stocks in the hands of the makers are now brought within a moderate compass, it is scarcely probable that at the worst the limitation of the production, which has now been carried out for over a year, will be extended. It is one of the curious features of the trade that whilst in the early months of the restriction the prices of pig iron rose, in the later months, when the effect has been more seen on the stocks of iron held, there has not been the accompaniment of any rise in prices. The period of limitation would expire at the end of the year, but though no decision has been come to, it is improbable that there will be any large addition to the production early. The demand for the crude iron falls off in the winter, and it is not often that there is then any large accession to the number of the furnaces in blast, so that it is scarcely probable that there will be any now, when the outlook of the iron trade is momentarily clouded, so far as the demand for crude iron for export is considered. At the same time, it may be remarked that there has not been much iron sent from the Cleveland district to the United States for some time, so that if there is a falling off in the shipments to America, it will not materially affect the North of England.

In the manufactured iron trade of the North there is much less dependence upon the demand from the outside. Over three-fourths of the whole of the finished iron made in the North of England is now in the form of ship-plates and angles ; and though shipbuilding yards in other districts are supplied, yet the chief use of these is to be found in the shipyards from the Tyne to the Tees. In the year these have been briskly employed, and there has been consequently activity in the whole of the rolling mills. The prices received for finished iron by the makers have tended upwards ; at the beginning of the year they averaged £6 3s. per ton, and at the close they have advanced to £6 5s. 6d. ; and a production has been kept up that is unparalleled ; it was at the rate of 52,000 tons monthly by the associated makers in the first quarter of the year, and it is now at just about the same rate. Hence it is clear that in abundant orders on the books of the makers the manufactured iron trade has known activity during the year, and that it has a promise of a continuance for many months to come. At the same time the lower rates of freight that now prevail and the large addition to the tonnage of the steam merchant navy must ultimately impose a check upon the construction of vessels and upon the manufactured iron trade of the North, unless these conditions change. In the North of England there has been very little alteration in the material used for shipbuilding in the past year ; indeed, the activity of the demand for iron vessels has caused fewer to be built of steel than in the last two years, and whilst that active demand continues for iron the use of steel will not make rapid progress. The largest of the plate-producing companies of the North—the Consett Iron Company—has had for some time in progress its new steel plate works, and these, completed in a few months, will give to the northern shipbuilders plates in the newer material free from the excessive cost, through the distance of the place of production, that they have long had in iron.

The northern iron trade, then, as a whole, has progressed in the year. The value of its production has not increased very materially, but the great bulk of the available works have been fully employed, and though prices have not been high, there has been the counterbalance of cheap raw materials, and wages at moderate rates, though at rates above those that have prevailed in the previous year. The system of sliding scales has, with one exception, prevented labour disputes and allowed of that full output that has been referred to, and the result of the year's working has been a fair profit to the employers and full work to the employed. The future does not seem one that is unclouded, but with a general trade revival, with an unprecedented demand for minerals, the largest known volume of traffic on those great users of steel and iron—the railways—and with good harvests, there ought to be before the iron and steel trades continued prosperity—marked possibly more in fulness of volume than in that of value, because of the increased international competition.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty :—William E. Blackburne, chief engineer, to the Ranger ; and George Quick, chief engineer, to the Valiant, vice Stephens, who has retired ; Richard J. Wheeler, chief engineer, additional, to the Hibernia, vice Benbow ; William H. Mitchell, engineer, additional, to the Cambridge, vice Campbell ; Richard S. Hamm, engineer, additional to the Asia, vice Russell ; and William Cook, engineer, to the Asia, vice Hamm.

Water and the Brigade Force at the Fire in Wood-street.—The following statistics will be of interest :—The fire broke out at ten minutes to three on Friday morning, and between that time and eleven o'clock on Saturday morning 3,000,000 gallons of water were used. After that time, until the fire was extinguished, 1,000,000 gallons more were thrown on the *débris*. The water was that of the New River Company, and for its use nothing will be paid. During the fire twenty-four steam fire-engines, four public hydrants, with six lines of hose, two stand pipes, with one line of hose each, were in use, and kept up a steady pour of water on the fire. After the engines left, fourteen public hydrants, with twenty lines of hose under pressure, gave steady deliveries of water on to the *débris*.—*City Press*.

The First Sydney Newspaper.—A venerable Colonist recently re-visited London, and among other antipodean relics that he brought over was a newspaper purchased by him in Sydney in the year 1828, just fifty-four years ago. This old journal from a New World is called the *Australian*. It is a small four-page sheet of sixteen columns, about equally divided between news and advertisements. The imprint runs thus :—"George-street, Sydney. Edited, printed, and published by the proprietor, Robert Wardell, LL.D." The sum of one shilling, which the learned doctor charged for this organ of public opinion, would assuredly be thought more than exorbitant in the present age of newspaper enterprise. Nevertheless, this modest little sheet, the chronicler of small beginnings, is of considerable interest, since it enables us to realise, by comparison, the immense progress which has marked the last half-century of colonial life. Let us glance at one or two of the advertisements in the *Australian*. It is announced, for instance, that the new brig Margaret, 152 tons burden, is to sail, "with all possible despatch," for Glasgow, and that "she is the first vessel that has sailed direct for the Clyde from the colony." We, says the *Colonies and India*, have then in this tiny craft of 152 tons the pioneer of a magnificent fleet of colonial-built ships that have, during the last half-century, traded between the ports of Sydney and Glasgow, not to mention other great ports. The colonial-owned shipping registered in New South Wales now amounts to nearly 100,000 tons.

RAILWAY MATTERS.

THE French Minister of Public Works has passed for traffic the railway connecting the St. Germain stations, nearly three kilometres long, and also the Tréport, Eu, and Abbeville line of the Northern Company, thirty-seven kilometres in length.

ALL the formalities connected with the railway between Trilport and Ferté-Milon are fulfilled, and the French Chamber has voted it one of public utility. It is believed that this line, which will become the direct route between Paris, Rheims, and the Ardennes, will be begun next year.

ON Saturday night last the Helensburgh train, which left Glasgow at ten o'clock, came into collision with another passenger train at North British Cowlairs junction, two miles from Glasgow, and nineteen persons, principally working men in three third-class carriages, were injured. It is reported that the cause of the accident was the breaking by a lump of coal of the rod of the points, which consequently did not work.

MR. W. ABBOTT, of Tokenhouse-yard, has published a map showing the connection of the Grand Trunk Railway, and the New York, Ontario, and Western Railway, with New York. The map also indicates the connection with the New York, West Shore, and Buffalo, now approaching completion, which will give the Grand Trunk Company direct access to New York, and the connection *viâ* the Lake Shore, at Cleveland, with the Atlantic and Great Western, and the C.C.C. and I. Companies.

COLONEL YOLLAND'S report on the burning of a Pulman car on the Midland Railway is simply to the effect that the fire did not originate with the stove fire, that the rule which prevented the driver from applying the continuous brake is a bad one, and should be entirely changed, that the cord communication of the train was bad, that Dr. Arthur's life might have been saved if the train had been stopped immediately the alarm whistle was sounded, and that reading lamps should not be permitted in sleeping berths.

THE Geneva correspondent of the *Daily News* says it is officially stated that the French Government railway, which now skirts the southern shore of Lake Leman as far as Evian, and which it was intended to continue to Chamouny, and possibly by a tunnel through Mont Blanc to Italy, will not be carried further than Cluses. This being construed as sounding the knell of the Mont Blanc project, is causing great consternation among its partisans, and real elation among the friends of the rival Simplon scheme.

A NOTICE was recently credited to the Brighton Railway Co. to the effect that there were missing from their rolling stock seven first-class carriages, two composite carriages, eight second-class carriages, two second-class brakes, eleven third-class carriages, three passengers' brakes, four passengers' luggage vans, and one horse-box. The statement has since been contradicted as absurd, which is to be regretted, for if such a loss could occur, one might wish it to take place every week for a year on the South-Eastern Railway.

THE Headingly section of the Leeds Tramway has been relaid with steel rails, and is to be worked as soon as Board of Trade permission has been obtained, by a steam locomotive made by Messrs. Thos. Green and Son, Leeds, under the patent of Mr. W. Wilkinson, of Wigan. The boiler is vertical, and consists of tubes, in a casing not under pressure. The engine is also vertical, and the motion and spur gearing is all arranged so as to keep it out of the mud. The exhaust steam is made invisible, except when the thermometer is very low, by superheating it after it leaves the cylinders, by passing it through a superheater in the furnace.

THE Regent's Canal, City, and Docks Railway Company has commenced the purchase of lands along the line of route, and has completed an important purchase in the neighbourhood of Aldersgate-street. The project includes the construction of a station in that locality, not far from the Aldersgate-street station of the Metropolitan Company; and for the station of the new company, and the general purposes of their undertaking, the company has just purchased the large area of land on the south-eastern boundary of the City in Golden-lane. The land, which has for some time past been vacant, and which contains 45,336ft., has been bought from the local authorities for the sum of £80,592.

THE Lady of the Lake is an express passenger engine designed, over twenty years ago, by Mr. John Ramsbottom, for express traffic on the London and North-Western Railway, with 16in. cylinders, and 7½ft. driving wheels, weighing 27 tons in working order, and with the tender 44½ tons. This engine, with an average train of eight or nine carriages, weighing about 73 to 75 tons, runs at a speed of forty miles per hour, consuming 27 lb. of coal per mile run. A four-coupled express engine of later design, for the same traffic, with 17in. cylinders, and 6½ft. driving wheels, weighs about 29½ tons in working order. This engine can take, on a level, a gross load of 293 tons, including the weight of the engine and tender, at a speed of forty-five miles per hour, with a working pressure of 120 lb. per square inch on the boiler.

AT the meeting of the City Commission of Sewers on Tuesday, a deputation attended from the parishioners of St. Mildred, Poultry, and other City parishes, stating that notice had been given of an intended application to Parliament next session for an Act to authorise the construction of a railway from Lancaster-gate to Aldgate, called "the Mid-Metropolitan Railway." The railway was projected to be carried by means of an underground line beneath the centre of Oxford-street, Holborn, Newgate-street, Cheapside, Poultry, and Leadenhall-street, and the rails would be laid at a depth of from 30ft. to 40ft. The line was so laid out as to touch as little private property as possible, the object being, no doubt, to avoid paying for land or house property, but to make use of public property without payment if possible. The traffic would be seriously impeded during the construction of the railway, and great injury would be inflicted upon the inhabitants and shopkeepers. The stability of St. Mary-le-Bow, Cheapside, and other large and important buildings would be endangered. The deputation viewed with great dismay the state of things, and as it might result from the tactics adopted by the promoters that private opposition in Parliament to the scheme was rendered unavailing, they pressed upon the Court the desirability of actively opposing and defeating the scheme on behalf of the citizens. The memorial was referred to a committee to consider.

A REPORT by Major-General Hutchinson on the accident which occurred on the 30th August, near Leiston Station, on the Aldeburgh branch—single line—of the Great Eastern Railway has been published. In this case, as the 2.30 p.m. down passenger train from Saxmundham to Aldeburgh was running round a curve of thirty-five chains radius, the tank engine and four vehicles composing the train left the rails. Two passengers were injured, and also the driver, fireman, and guard of the train. The engine was running chimney in front. It was an eight-wheeled engine, with coupled leading and driving wheels, and a four-wheeled trailing bogie, weighing altogether about 42½ tons, of which 14½ tons were on the leading wheels, 13 tons on the driving wheels, and 15 tons on the bogie wheels; the distance between the centres of the coupled wheels was 6ft. 10in., and between the centre of the driving wheels and bogie centre 10ft. 10in. Judging from the evidence, the nature of the engine, and the character of the permanent way, Major-General Hutchinson concludes that the accident was probably caused by the injudiciously high speed—considering the nature of the road—of a heavy tank engine—weighing about 42¼ tons—running on a light permanent way laid with rails weighing 70 lb. per yard, secured to chairs weighing only 21 lb. each at central intervals of 3ft., the condition of some of the sleepers being probably defective, and the road being still further weakened by the ballast near the spot not having been thrown back after repairs. From these combined causes the engine appears to have burst the road. This is another case in illustration of the danger of running round curves at speeds equal to or above thirty miles an hour. The curve in this case was thirty-five chains radius.

NOTES AND MEMORANDA.

THE exports of German rails have increased 300 per cent. during the last ten years, according to figures published by the *Leipziger Tageblatt*.

SOME recent tests of yarns made from different hemps gave the following relative average strengths:—Manilla, 245; Italian, 221; New Zealand, 143; Sisal, 128; Russian, 122.

M. MARSAUT, having found all safety lamps defective, including the Mueseler, has invented one with a metal shield, which causes the entering air to make a tortuous passage before reaching the flame. In this way downward, oblique, and rapid currents are avoided, which no lamp yet invented has been able to withstand.

IF a small bit of any selenious compound be brought on an asbestos thread into a small reducing flame, and a glazed porcelain dish of cold water be held one-half inch above it, a brick-red film will be deposited on the cold porcelain; heated with strong sulphuric acid, it gives an olive green solution, which yields a red precipitate when poured into water.

IN a supplementary note read before the Paris Academy of Sciences on the 4th inst., on "The Electric Currents Produced by Nitrates in Igneous Fusion in Presence of Carbon," Mr. Brard described an electro-generative fuel, which on any hearth yields heat and electricity, and an electro-generative hearth on which these may be generated with other fuel.

ACCORDING to recent experiments, the linear expansions of sodium and potassium, deduced from the volume-expansions, were, for sodium, 0·000853, and for potassium, 0·000721; pretty similar values were obtained by direct measurement of longitudinal expansion of a metal block. This co-efficient of linear expansion exceeds that of all other metals, and is about three times the linear expansion of lead.

TELEGRAPHING on the 18th inst., the Geneva correspondent of the *Times* says one of the largest avalanches ever known in Western Switzerland fell a few days ago near Ormons Dessus, in Canton Vaud. It carried away several houses, piled up a mass of ice and snow 200ft. thick, and covered three square kilometres of ground. Some of the ice blocks were 18ft. long. The inmates of the houses struck were got out safely.

THE action of light on selenium was first observed by Willoughby Smith and his assistant, Mr. May, in 1874. At first the effect was attributed to heat, but the experiments of Lord Rosse, Werner Siemens, and others, soon demonstrated the fact that it was light and not heat that effected this change. Selenium, like most non-metals, is a very poor conductor of electricity; in the amorphous form it does not conduct the current at all, in the crystalline form it conducts the current feebly, but the resistance is less when the selenium is exposed to light than when kept in the dark. Even the cold light of the moon has the same effect as found by Adams.

AT a recent meeting of the Paris Academy of Sciences a paper was read on a "General Law of Congelation of Solvents," by M. Raoult. Every substance, dissolved in a definite liquid compound capable of solidifying, lowers its freezing point. In all liquids, the molecular lowerings of congelation with different compounds approach two values invariable for each liquid, and one of which is double the other, the greater being normal. The normal lowering varies with the nature of the solvent. A molecule of any compound, dissolving in 100 mol. of any liquid, of different nature, lowers the freezing point of the latter a quantity nearly constant, and near 0·62 deg.

FROM experiments made in America under the auspices of insurance companies it appears to be established that the best door for the prevention of the spread of fire is one made of two or more thicknesses of solid hard wood planking or matched boards, connected together with joints crossing diagonally or at right angles, and the whole then covered with tinned sheet iron soldered together. The tinned door is supported by hangers moving on an inclined rail or track over the doorway, so that when free to move it will close by its own weight. The door is kept open by a small bolt held by a wire having a link soldered with or made of metal that will melt at 160 deg. Fah.

SELENIUM is easily reduced from its solutions, whether acid or alkaline, by the voltaic current. According to Schucht the deposit is at first light red, but as it grows thicker becomes darker. The precipitation is so complete that it could be employed for quantitative estimations. Only a feeble current of two elements can be employed, or the selenium would become pulverulent. When deposited on a platinum electrode, it rubs off easily; probably on brass or copper it would adhere better. From its combination with potassium, selenium precipitates nicely with a feeble current; in acid solutions some seleniuretted hydrogen is given out at the negative pole. If the solution contains a metal like copper, the selenium and copper are precipitated together, and the colour of the deposit is darker than that of pure copper. The *Scientific American* says that for covering metals with selenium the method of melting on seems preferable to electrolytic deposition.

THE development of the telephone system has been rapid during the six years that have elapsed since that instrument was brought out. It is in America, of course, where telephony is freer than on this side, that the development has been greatest. New York counts 4060 subscribers; Chicago, 2726; Cincinnati, 1880; Boston, 10,325; San Francisco, 1300, &c. Some of these figures refer to May. There are now in the United States more than 100,000 subscribers, and certain small towns, with populations less than 1000, have yet thirty to fifty telephonic subscribers; some even more. As regards the absolute number of subscribers, Paris comes third, after New York and Chicago; it had on October 1st no fewer than 2422 subscribers, while London had only 1600; Amsterdam, 700; Stockholm, 672; Vienna, 600; Berlin, 581; Brussels, 450; Turin, 410; Copenhagen, 400; Mexico, 300; St. Petersburg, 145; and Alexandria, 118. While the annual subscription is 600f. in Paris, 500f. in London, and 400f. in the provincial towns of France, it descends to 300f. and 200f. in Belgium, 135f. and 130f. in Italy, and only 120f. in Switzerland. A calculation of the ratio of the number of subscribers to that of inhabitants for each town reveals a goodly number of small towns in America where there is a telephone for every twenty inhabitants; in Chicago and in Zurich the proportion is about one per 200; in New York, one per 500; in Brussels, one per 800; in Paris, one per 1000; in Berlin, one per 2000; in London, one per 3000; and in St. Petersburg, only one per 4000.

S. SMITH gives the following on varnishing drawings, plans, and prints, in the *Engineer and Building Trades' Almanack*:—"Many recommend isinglass size as a preparation, to be followed by mastic varnish or Canada balsam, thinned with turps, or camphine, or other spirit. These are good, but expensive, and not only so, are attended with some difficulty in preparation, as well as in procuring occasionally. The simplest and most reliable plan is to get Young's patent size—2d. per lb.—at an oil shop—which may be kept any amount of time if melted and poured into a round-mouthed bottle, and closely corked from the air; reduce as much as may be required with nearly half as much boiling water, and give a coat, and when dry repeat it. If a drawing, water-colour painting, &c., that will not stand the brush, take a large dish, or teaboard, or anything of the kind, float well with hot water; then pour this away and replace it with the size, into which immerse the sheet or place it face downward, being careful to cover it if immersed; gently draw it sideways, so as to allow the superfluous size to run off, and get it level to dry. When dry, give another coat with the brush; and when thoroughly dry, give a coat of pale paper or crystal varnish, such as decorators use for marble paper staircases; and if flowed on while flat pretty freely, this will answer every purpose and save expense; whilst, at the same time, it is easy of execution. In each case use a good-sized, clean, worn brush, which may be washed out afterwards—that used for the size in warm water, and that for the varnish with turps.

MISCELLANEA.

A SILVER medal—the highest award at the Bradford Exhibition for non-conducting compositions for covering boilers, pipes, &c.—has been granted to Messrs. F. Leroy and Co.

THE German newspapers have given prominence to the fact that the powder used by the Inflexible during the bombardment of Alexandria was of German manufacture. It was the specially made prismatic powder from Hamm, one of the factories of the United Rhenish Westphalian Powder Mills, whose head offices are at Cologne.

THE scheme for the development of the Ribble has now been approved by the ratepayers. It involves an expenditure of over £500,000. The designs of Sir John Coode, the chief engineer, show a dock of thirty acres in extent. Guide walls will be extended to beyond Lytham, and the river will be made deep enough to admit the largest vessels.

AT a meeting of the Paddington Vestry on Tuesday, Mr. John Williams in the chair, it was resolved unanimously that, having regard to the magnitude of the interests involved in the case of "Dobbs *v.* the Grand Junction Waterworks Company," the Vestry were of opinion that the case should be taken for final decision before the House of Lords.

TWO old locomotive boilers are placed underground at the Mariemint Colliery, Belgium, for alternately supplying steam for the mechanical haulage. The chain pulley is keyed on to the second shaft driven by gearing from the leading axle of an old locomotive, the wheels serving as fly-wheels, and the cylinders and motion being utilised for their new office.

THE savings on the estimate for the construction of the southern breakwater at Colombo will, according to the *Colonies and India*, amount to nearly £130,000, a sum which it is thought by the resident engineer will suffice to build a northern breakwater. A Harbour Board has been constituted for the working of the port of Colombo, and ere long both port tonnage and coal dues will be collected.

"THE Gas Consumers' Manual" is the title of a small pamphlet which can be procured for one penny from Messrs. Houlston and Sons, Paternoster-buildings, or from almost every bookseller, and is one which should be in the possession of every consumer of gas. It explains the reading of the gas meter, the detection of escapes, and gives many useful hints on the use of gas and gas fittings, and on the laying of gas into a house.

REFERRING to a paragraph in this column of our last issue, on chilled rolls, a correspondent writes from Leith, saying, "I am proud to say we have a founder in this district who turns out hard chilled rolls quite equal to the American article. This founder has expended a great deal of money on this branch, and has, after many failures, succeeded so well that his rolls are replacing American rolls, and are held in high esteem by many paper makers. He also makes chilled tramway car wheels."

WE have received a copy of a new catalogue descriptive of Mr. R. H. Tweddell's well-known system of hydraulic rivetting machinery. It is very fully illustrated with engravings of steam engines and high-pressure hydraulic pumps, and of the very various forms of rivetters for boiler, girder, and shipbuilding purposes, and of the various forms of cranes for lifting and manœuvring them. Descriptions and illustrations are also given of the plate-flanging presses as used for locomotive and portable engine fire-box and tube plate flanging.

THE Fire Brigade at the present time has only 50 steam engines, 120 manual engines, and 500 firemen. The income of the Fire Brigade is raised by a rate of ½d. in the pound, and produces £100,000. The estimated value of the property to be protected is £1,200,000,000. In this respect, therefore, Londoners pay an insurance premium of 120th part of 1 per cent. to prevent the whole from being destroyed. The fund is insufficient, and ten years ago the London of then stood as 80 to the 100 of to-day. Ten years ago Captain Shaw asked for an annual allowance of £20,000 more per annum than he gets to-day.

MR. G. J. SYMONS, F.R.S., 62, Camden-square, London, N.W., writes that he is now preparing to issue to all the observers of rainfall known to him blank forms for the entry of their records for the year shortly about to close. This staff now exceeds 2000, but still as they are not unfrequently rather clustered, there are many parts of the country where additional records are needed. He thinks it probable that records are already kept in many places unknown to him, and he invites communications from any one who has kept an accurate record, and offers to supply either those already observing or contemplating doing so with a copy of the rules adopted by British observers, and with all necessary blank forms.

THE iron twin-screw steamer C. W. Eborall, which has been built by Earle's Shipbuilding and Engineering Company, Limited, of Hull, for the South-Eastern Railway Company's passenger and cargo service between Folkestone and Boulogne, has been launched. This boat, which is a sister vessel to the steamships Folkestone and Boulogne, is a handsomely-modelled fore-and-aft schooner-rigged steamer, measuring 190ft. b.p., 25ft. beam, and 12ft. depth of hold; her gross tonnage is about 410 tons, and she has been constructed under special survey to class "A 1 Channel service" in Lloyd's Register. Her engines are 110 nominal horse-power collectively, each engine having two cylinders 20in. and 39in. diameter by 24in. stroke.

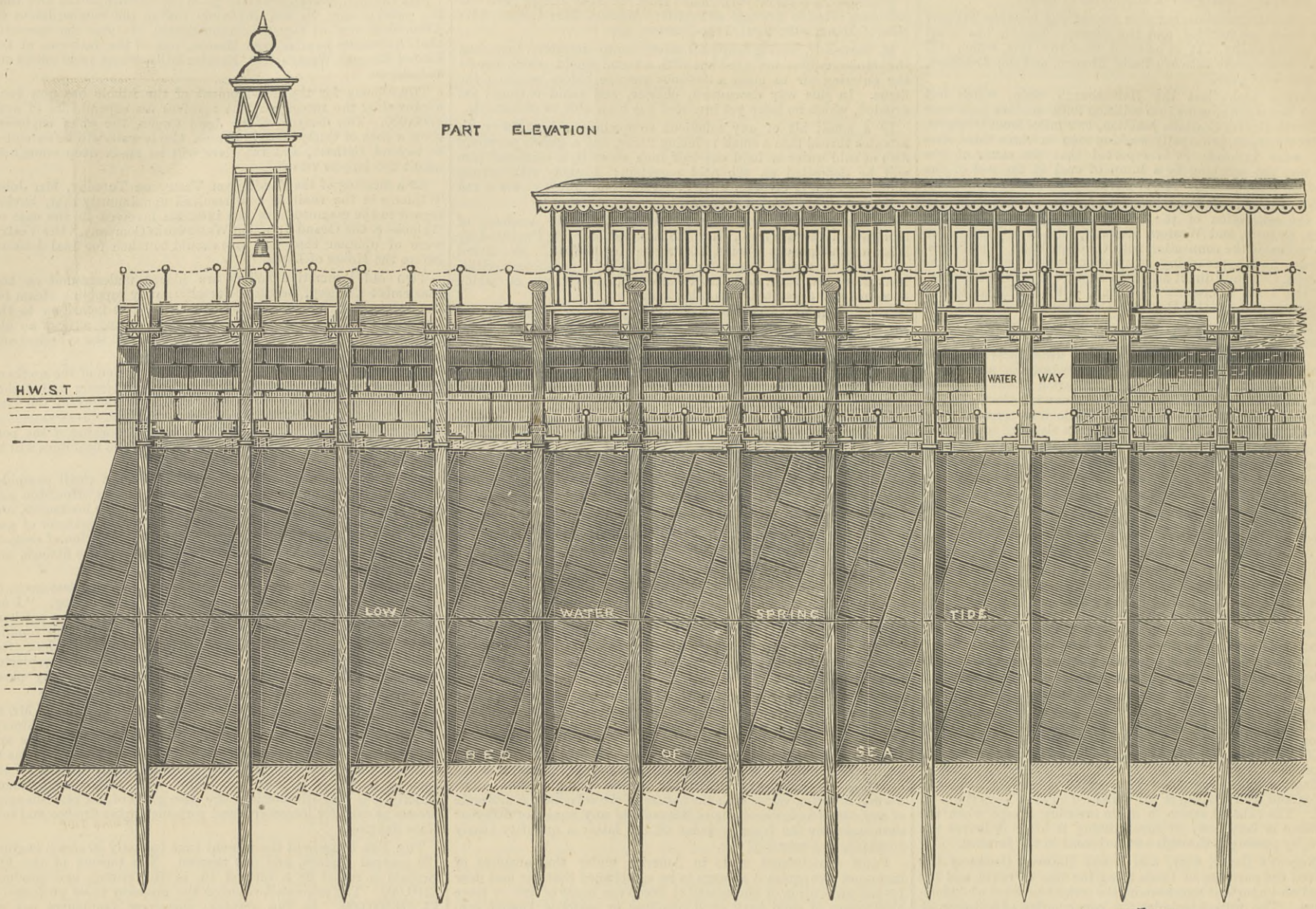
A CORRESPONDENT in Philadelphia, Pennsylvania, writes to us referring to a paragraph in our issue of November 3rd, on page 329, describing a cancelling ink for cancelling postage and other stamps, invented by Dr. W. Reissig, of Munich, and enclosing for our inspection specimens of stamps which have been cancelled by an ink made by a personal friend. We do not know of what the ink consists, but it effectually cancels the stamps and prevents their re-use. We are told the ink is made in any shade of colour, and is used with the same stampers and pads now in use. If a "washer" attempts to remove the cancellation he finds the stamp has lost all colour wherever the ink has touched it and is entirely destroyed, but the ink does not affect the paper of the envelope or of the stamp.

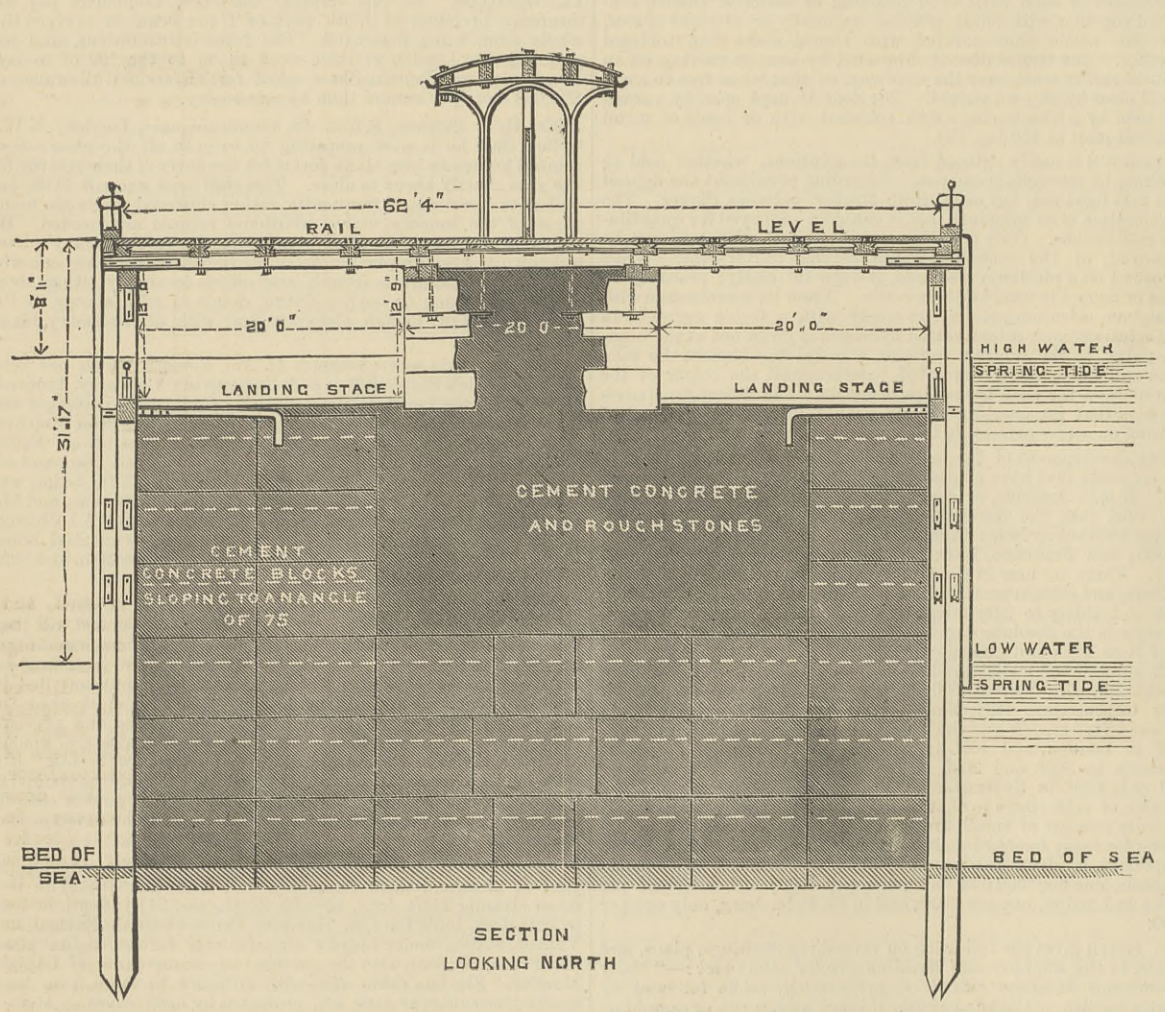
THERE was launched on the 11th inst., from the shipbuilding yard of Messrs. Robert Thompson and Sons, Southwick, an iron screw steamer 243ft. long, breadth 33½ft., and 24¾ft. depth in hold to spar deck, built for Cie. Havraise Peninsulaire de Navigation à Vapeur, Havre, under Lloyd's special survey for the highest class, and French Veritas, also the personal superintendence of Captain Montier. She has cabin aft—with entrance to same from large smoke-house on spar deck aft, protected by hood covering stern—fitted up in first-class style for captain and passengers, and accommodation under spar deck for officers and engineers, amidships and forward for firemen and crew. She will be fitted with engines of 150-horse power, by Mr. George Clark, Southwick. As the vessel left the ways she was named the Ville de Tarragone by Madame Brault, wife of the French Consul at Sunderland.

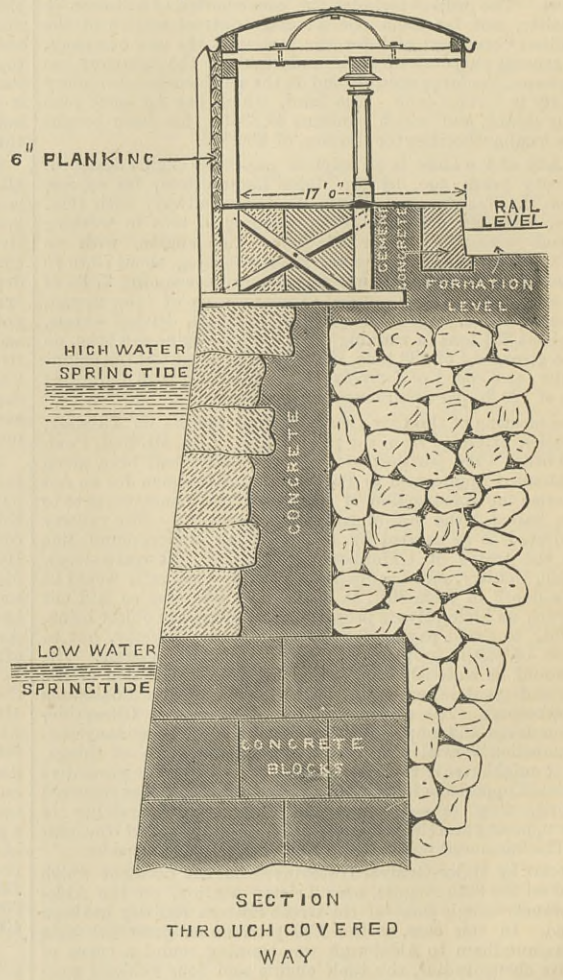
FROM the report of Messrs. Crookes, Odling, and Tidy, to the President of the Local Government Board, on the London water supply, it is seen that throughout the month of November the condition of the metropolitan water, in respect to its degree of freedom from colour and turbidity, was considerably in advance of that to which we called attention as being noticeable, in some instances, during the latter part of the preceding month. As usual, indeed, in the winter season, when despite the excellent state of aëration of the water, the processes of oxidation take place more slowly, the proportion of organic matter was somewhat high, and corresponded very closely with that found to prevail a month later in the previous year. So far, however, as the ratio of organic carbon to organic nitrogen can be depended on as a criterion, this organic matter would appear to have mainly a vegetable origin, a conclusion that is further borne out by other considerations.

THE NEW PIER AT FOLKESTONE.

MR. FRANCIS BRADY, M.I.C.E., ENGINEER.







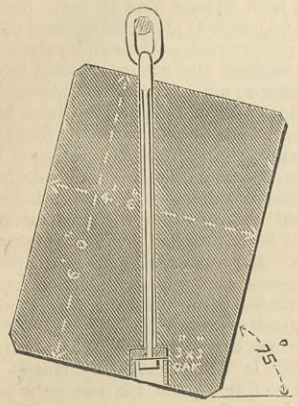
THE HARBOURS AND TRADE OF FOLKESTONE.

PART II.

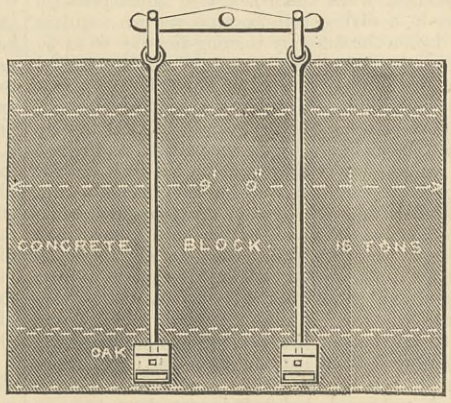
THE new pier in course of construction consists at its northern termination of the end of the promenade leading to the harbour lighthouse. The old work at that end consists of rough rubble, with a depth of 34ft. from the deck level to the bottom of the sea. From this point the new pier is 600ft. long, including the length of old pier to be built into it, as described in the first part of this article. The depth along the new length from deck level to the bottom of the sea varies from 34ft. at the northern end to 48ft. 6in. at the southern end. At high water spring tides the level below deck of the surface of the water is 9ft., and low water spring tides 31ft.; the level of low water below the new landing stages will be 18ft. 7in.; the width of the new pier between the bollard heads of piles will be 62ft. 4in.; the lower landing stages, one on the east and the other on the west, are 20ft. wide and 13ft. high; the eastern stage is 400ft. in length, and the western stage 280ft.; the pier between the landing stages is 20ft. wide, with three gangways 9ft. wide each. The south end of the pier is solid work for 45ft. from the foundation to deck level. A staircase, 100ft. from the south end of the pier rises from the landing stage to deck level; another staircase from the platform of the covered way descends to the landing stage on the west side, but has a covered way at the bottom to the east side, so that passengers can embark or disembark at either side of the pier, according to the state of the weather. This pier, when completed, will admit of a fixed service instead of the present tidal service, so far as the Folkestone side of the Channel is concerned. The new work of the pier, from the foundation to 2ft. above low-water spring tides, is wholly built of cement concrete blocks, of an average weight of 16 tons. They are 4ft. 6in. by 6ft. by 9ft., above the foundation to the landing stages, and the 45ft. pier head will be built of cement concrete blocks, with a hearting of rubble stone and cement concrete. The central pier between the landing stages is faced with random rubble work, with a hearting of rough stones and cement concrete. The concrete blocks on the west side are laid as headers, sloping towards the land at an angle of 74 deg. On the east side they are laid horizontally. On the west side from the termination of the piles to the west groyne, the work will be brought up from the foundation to the level of the rails with large concrete blocks to carry the timbers at the back of the covered way, and will be filled in at the back with dry rubble. There are forty-four double piles creosoted by Blythe's process, on the east side, where they vary from 50ft. to 60ft. in length; on the west side there are thirty-three double-creosoted piles, from 55ft. to 60ft. in length. These piles are shod with 40 lb. wrought iron shoes, steel pointed, and are driven into the sea bed to a depth of from 10ft. to 15ft., according to the nature of the bottom. These piles are 14in. square, and 10ft. from centre to centre. Oak rubbing pieces 32ft. long, by 12in. by 6in. are fixed to piles where necessary with 1in. screw bolts. Cast iron bollard heads are fixed to each pile. Wrought iron stanchions in cast iron sockets guard the sides of the pier, and are connected by chains; they are removable, so can be taken away for traffic purposes. Transverse timbers

THE NEW PIER AT FOLKESTONE.

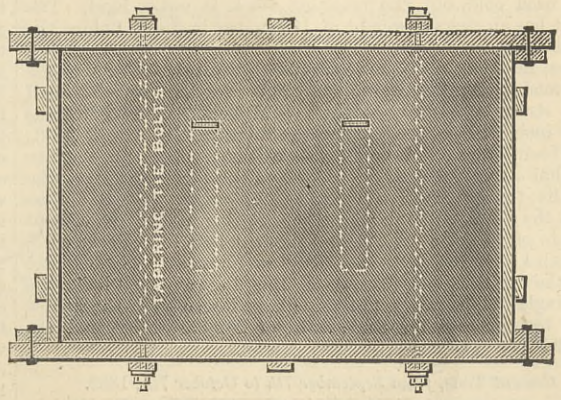
MR. FRANCIS BRADY, M.I.C.E., ENGINEER.



CROSS SECTION OF BLOCK



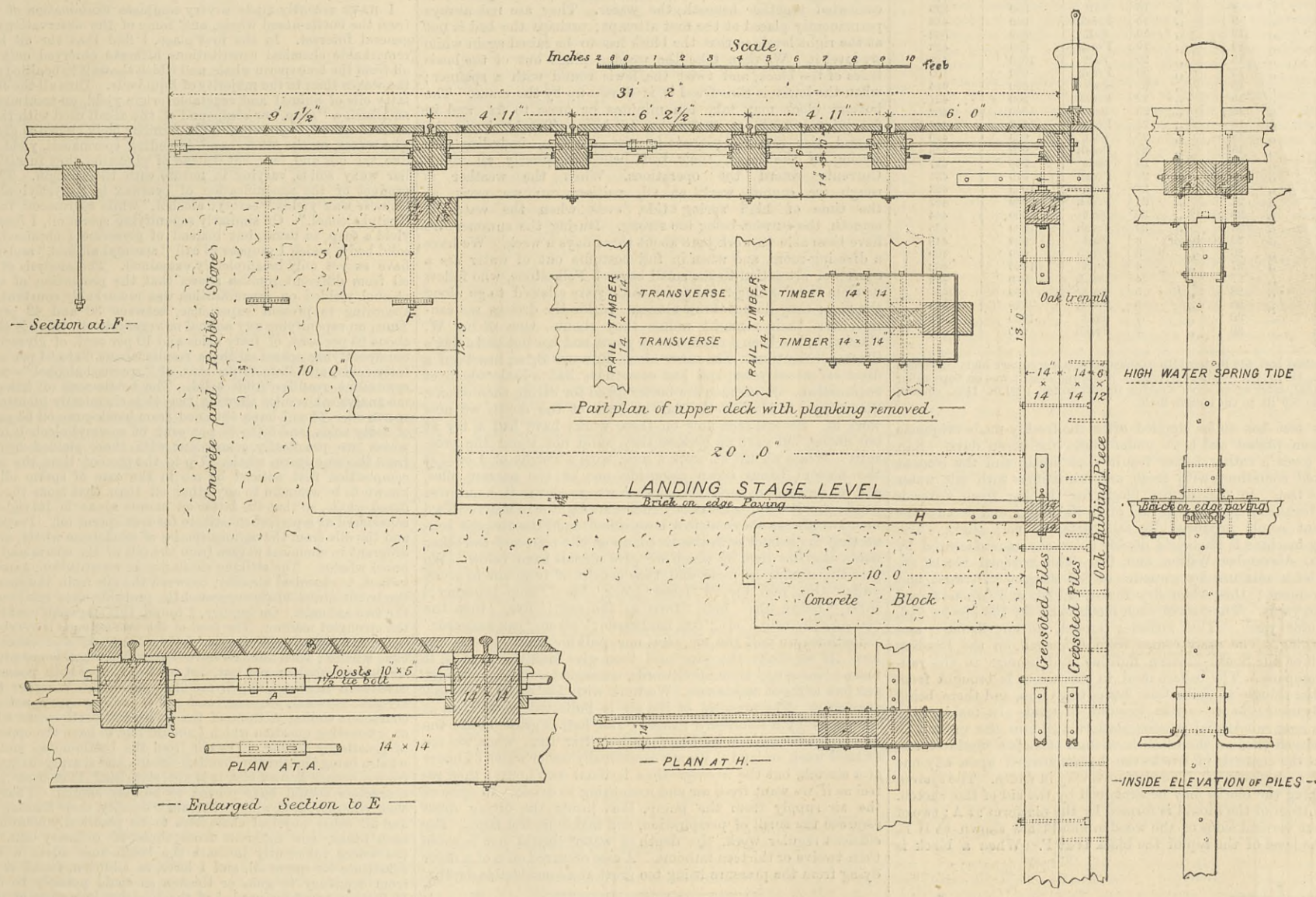
LONGITUDINAL SECTION OF BLOCK

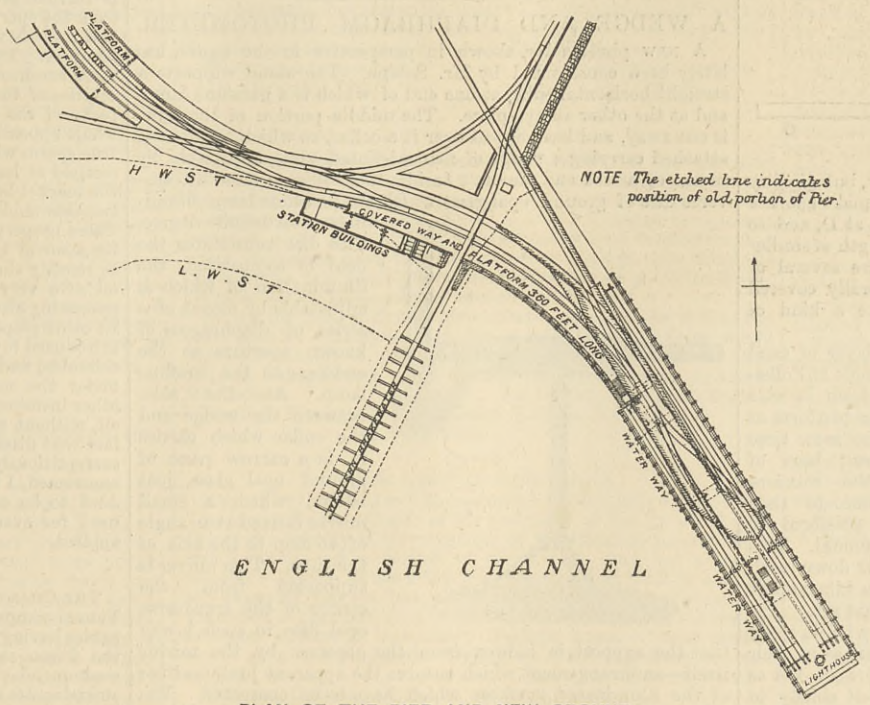


PLAN OF MOULDING BOX

SCALE
12 0 1 2 3 4 5 6 7 8 9 10 FEET

METHOD OF TRANSPORTING THE CONCRETE BLOCKS.





PLAN OF THE PIER AND NEW GROYNE.

64ft. 8in. long and 14in. square will run from pile to pile across the deck, one on each side the pile to carry longitudinal and rail timbers, which will all be 14in. square; the joists to carry the deck planking will be 10in. by 5in., and three in a 10ft. bay. The deck planking will be 3in. thick, with bevelled edges, and laid with an opening between of $\frac{3}{8}$in.; every alternate plank to be screwed down with 9in. coach screws, countersunk flush with the deck, and to admit of ready removal during rough weather. Each plank not screwed down to be secured with double wrought spikes 10in. long to each bearer. Wrought iron 1$\frac{1}{2}$in. tie bolts, one to each bay, run from one outside longitudinal to the other, and are secured to rail timbers by cotters on each side, as shown in the detail engravings. The lower landing stages are paved with blue bricks on edge. From the termination of the piles on the west side of the pier to the west end of the station buildings a covered way is erected, with a platform 360ft. long and 17ft. wide. The platform posts are 15ft. apart, 7ft. from the edge of the platform, and 10in. square, supporting 12in. by 10in. longitudinals and 12in. by 4in. joists. The back of the platform will be protected by double 13in. square timbers, framed as shown in the section, and carrying 6in. ∧ jointed fir planking, the whole secured at top and bottom with double-faced running rails, fish-jointed. The platform roofing will be formed of stout corrugated galvanised iron plates, of No. 21 Birmingham wire gauge, strongly rivetted, and will be secured to the supporting timbers. A shutter will be erected at the south end of the new pier on the upper deck, composed principally of bent double-faced rails securely bolted together; it will have a partition in the centre of the posts and doors as shown in the section, and be so constructed that the doors can readily be unshipped in rough weather. The accompanying engravings give the principal details of the new pier.

The station buildings at the north end of the pier, north of the present west groyne, will comprise a general waiting-room, a ladies' waiting room, lobby, buffet, and other conveniences; it will be built on piles, all of which, as well as the longitudinal timbers, are 14in. square. Skylights will be constructed in the roof of the station, also in the ceilings of the waiting-rooms. The roof will be of straight corrugated galvanised iron, No. 21 Birmingham wire gauge, well rivetted, and strongly secured to boarding. There will be wrought iron gutters as shown in the engraving. The new pier was designed by Mr. Francis Brady, chief engineer to the South-Eastern Railway Company, who furnished us with the foregoing particulars, and the works are in charge of Mr. A. Oborne, who attends to the details of construction under Mr. Brady's superintendence. No contractors are employed, and all is done by the South-Eastern Railway Company. In the work now going on of driving the piles for the new station, a monkey weighing 25 cwt. is used, with a fall varying from 15ft. to 16ft. The beach, consisting of smooth rounded stones thrown up by the sea, is remarkably hard, as estimated by the resistance it offers to pile driving. Nearly all the beach through which they are being driven has been thrown up by the sea within the last year or two; the ground is old only at a few feet from above the bottom of the driven timbers. After each blow on the top of the piles the spring is such that the monkey gives three or four rebounds. The piles are from 17ft. to 18ft. long, and are driven to a depth of 14ft. or 15ft. The men, working with a windlass, are two working days of ten hours each driving one pile. When the weather is rough, causing the submarine work of the pier to be suspended, the yard engine being liberated from carrying artificial blocks to the pier end is employed in pile driving; the chain of the monkey is passed over pulley wheels to the engine, so that the latter by a run of a few feet can pull up the monkey, which is then liberated by the man in charge of the work. By this system fifteen blows of the monkey are given in ten minutes; the engine thus drives two piles a day.

The artificial blocks used in the construction of the pier are made of a mixture of shingle, sand, and Portland cement, well punned in a wooden mould, then left for about six weeks to

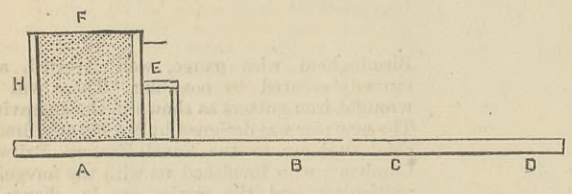
harden. The largest of these blocks being 9ft. by 6ft. by 4ft. 6in., there are exactly nine cubic yards in a block; the weight of each block is 142 lb. to the cubic foot. The cement, as it comes in sacks from the Folkestone Cement Works, described in these columns on the 25th of August last, is warm, and takes a long time to cool. If used warm it sets more quickly than when used cold, but the resulting block is not so hard. The cement has an average weight of 118 lb. per bushel. Before the cement is used it is tested to see that it is up to contract quality. The test imposed by Mr. Brady is that 1½ square inch of artificial stone made with it without admixture of other material shall bear a strain of 810 lb., which is equivalent to 360 lb. to the square inch. Since the testing began on the 28th April, 1881, it has been a rare occurrence for a breakage to take place at less than that strain. Mr. A. M. Oborne, of the new pier works, who does the testing, says:—"Those few breakages were doubtless due to the imperfect mixing in the testing room; the cement comes in of uniform quality, and it is the best I have ever used, although I have had large experience with cement. Some pieces bear the extraordinary strain of 1000 lb. and 1100 lb." We accordingly, haphazard, asked Mr. Oborne for a copy of the entries in his testing book for the month of September last, and the extract is here given:—

Cement Tests, from September 7th to October 7th, 1882.

1882.	When made.	When tested.	Water.	Per 1½in. sq.	Per 1in. sq.
				lb.	lb.
	September 7	September 14	Salt	940	418
	,, 7	,, 14	Fresh	920	409
	,, 8	,, 15	Salt	910	405
	,, 8	,, 15	Fresh	980	435
	,, 9	,, 16	Salt	890	396
	,, 9	,, 16	Fresh	940	418
	,, 12	,, 19	Salt	860	382
	,, 12	,, 19	Fresh	930	413
	,, 13	,, 20	Salt	1010	449
	,, 13	,, 20	Fresh	920	409
	,, 15	,, 22	Salt	1000	444
	,, 15	,, 22	Fresh	960	427
	,, 16	,, 23	Salt	1040	462
	,, 16	,, 23	Fresh	1010	449
	,, 18	,, 25	Salt	990	440
	,, 18	,, 25	Fresh	980	435
	,, 19	,, 26	Salt	960	427
	,, 19	,, 26	Fresh	970	431
	,, 21	,, 28	Salt	1020	453
	,, 21	,, 28	Fresh	960	427
	,, 23	,, 30	Salt	1000	444
	,, 23	,, 30	Fresh	890	395
	,, 26	October 3	Salt	990	440
	,, 26	,, 3	Fresh	920	409
	,, 27	,, 4	Salt	1040	462
	,, 27	,, 4	Fresh	910	404
	,, 28	,, 5	Salt	970	431
	,, 28	,, 5	Fresh	980	435
	,, 30	,, 7	Salt	1020	453
	,, 30	,, 7	Fresh	980	435

Specified test, 810 lb. per 1½in. square = 360 lb. per square inch. Average weight, 118 lb per bushel. Greatest breaking weight was on September 30th, 1881, after seven days' soaking in salt water, 1260 lb. 1½in. square, equal to 560 lb. to the square inch.

The test has to be applied after the freshly-made briquette has been placed and kept under water for seven days. Salt water gives a rather better result than fresh, and the cement is mixed sometimes with fresh and sometimes with salt water for the test. In making the blocks for the pier fresh water is used, because fresh water is laid on to the works, and because the different result produced by salt water is very slight. The testing machine is Michele's double lever one, manufactured by Messrs. Alexander Wilson and Co. The artificial blocks are made of a mixture by measure of 8·8 shingle, 1·76 sand, and 1·40 cement; this when dry makes 11·96, and when mixed 9 cubic yards. The cost of each block is £4 5s. 10d., or 9s. 6½d. per cubic yard. This includes cement, labour, haulage, and everything. The sand comes from Gomshall, on the Reading branch of the South-Eastern Railway, and belongs to the railway company. The ballast used in the blocks is brought from Rye, the shingle at Folkestone being too clean, and there being an advantage in a certain amount of sand. In making the blocks long substantial wooden platforms laid on the ground in an enclosed yard on the beach have lines of rails alongside them, so that the contents of trucks can be discharged upon any one part of each platform. The platforms vary in width. The system of making the blocks may be explained by the aid of the sketch. The bottom of the mould is formed by the platform at A; two of the four vertical sides of the wooden mould are shown at H E, and the level of the top of the block is at F. When a block is



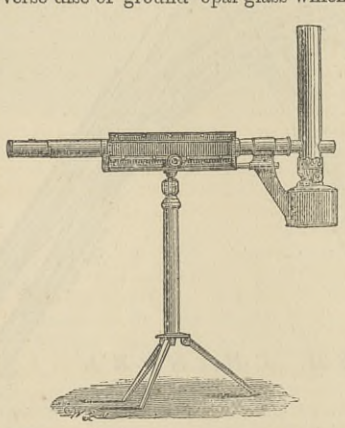
made at A it is left there for about six weeks to dry, but directly the workmen have filled the mould they proceed to make another block at B, afterwards a third at C, then a fourth at D, and so on, until long before the block A is dry a great length of similar blocks extends all along the platform. There are several of these platforms in the yard, and as they are liberally covered with blocks, the whole establishment looks like a kind of Stonehenge.

The trucks from Rye, laden with ballast, have a layer of sand 2in. or 3in. thick, thrown upon the top of the Rye shingle at Folkestone. When a truck is brought alongside the platform its side is removed and its contents shovelled out on to the platform at a few yards from the mould, sand and shingle at the same time being well mixed by several men with spades; bags of cement are then added to a portion of the mixture and well worked in with spades; the wet concrete thus made is thrown to the top of the temporary platform E, Fig. 1, from which two men shovel it into the mould. Two other men level it in the mould, and ram it well down with punners. The walls of the mould cannot safely be taken apart in less than two days, by which time the concrete has set.

The submarine work is executed by two divers, who, in reply to our questions, have given the following particulars as to their experiences:—"On first beginning to work as divers we felt as if our heads were stopped up; the pressure was felt chiefly in the ears. The increase of depth of water when we are descending is perceptibly felt; the difference of level between high and low water is clearly appreciable. Eight or ten fathoms—48ft. or 60ft.—is a reasonable depth to work in; divers are said to have gone down 220ft.; if so we should not like to do it ourselves. At 10ft. depth we feel the pressure, and at 20ft. can feel the increase, but do not feel quick or slow variations of but 4ft. or 5ft. In deep water we feel the pressure all over the outside of the body, and some divers are said to have borne a pressure of 18 lb. or 20 lb. to the square inch. At the present extension of the Folkestone pier we are working at a depth of six or seven fathoms at high water. We then feel the pressure on the outside of the body a little, but not enough to hinder us in our work. When working in shallow water there is not so much pressure in a diving dress as in a diving bell, because we can regulate the pressure better inside the dress by turning the tap so as to give a larger orifice for the escape of the air. We cannot see far through the glass of the helmet; when the water is exceptionally clear we can see about 20ft., but usually cannot see beyond 5ft. or 6ft. Fishes sometimes come to look at us, and mostly from above our heads, because we stir up the bottom, and where the water above is rather clearer they wait on the look out for any food they can get. If we lift a hand towards them they are off like a shot. Flat fish near the ground are too quick when we try to catch them with the hand, but we can spear them sometimes with our crowbar. We have never seen any large fish near; the largest which one of us ever saw was a conger eel, about 2ft. 6in., which came near about a week ago. He came alongside quietly, and when the crowbar was raised towards him he was off. In laying the foundations of the present pier we first level the sea bed; sometimes it is pretty flat, and sometimes we have to dig away 1½ft. or 2ft. The concrete is slightly damped right through, not much, before it is sent down to us in bags by means of the crane overhead; some of the bags contain 2 cwt. We lay the concrete, bags and all, and the average thickness of the concrete along the bottom is about 15in. Only one of us works at a time. When the concrete is laid the blocks of artificial stone are slowly lowered down to us, and we guide each one into its place; this is all the more easily done because they weigh so much less in water than in air. They are not cemented together beneath the water. They are not always permanently placed at the first attempt; perhaps the bed is not at the right level, so that the block has to be raised again while we level it. We then take the wooden plugs out of the lewis holes of the block, and twist the lewis round with a spanner; when the lewis is thus freed it is drawn up by the crane. The bottom block may take ten minutes or more to fix, and in exceptional cases as much as an hour. The blocks in the second tier are all placed in ten minutes, including the freeing of the lewis, their bed being necessarily all right. Currents retard the operations. When the weather is rough we cannot work at all, neither can we work at the time of high spring tide, even when the water is smooth, the current being too strong. During the summer we have been able to work here about three days a week. We have a dressing-room, and when in full costume out of water are a source of attraction to the small boys of Folkestone, who follow us from the dressing-room as far as they are allowed to go along the pier; they do not throw stones. Inside the dresses we cannot hear their remarks unless they shout. One of us, W. Chadwick, has been a diver eleven years, and has not had a day's illness all the time. The other of us, Edward Brice, has been a diver seventeen years, and has sometimes had a little touch of rheumatism. Some men are better fitted for diving than others. Some begin to bleed at the ears at once at the depth we now work in. Several men now on these works have had a try at our duties, but gave up because they could not stand the pressure. While we are at work a rope with a weight of 1 cwt. at the bottom hangs down alongside one of the nearest piles, and in descending from the surface we go down it hand over hand; this is easy, because our bodies are lighter in water. Two men are always above us in a boat, one to hold the air pipe connecting the helmet with the air pump on the pier, and the other holds the life line, by which we give signals from below. We give the signals in pulls, and they consist of from one to seven pulls. One pull means 'lower block,' two, 'stop lowering;' three, 'heave up;' four, 'turn to the east;' five, 'turn the crane to the west;' six, 'run landwards;' seven, 'run seawards.' Sometimes we pull the air pipe, one pull for more air, two for less. If we shake the pipe and then give four sharp pulls, it means 'hung up,' or in other words, entangled so that we cannot get free without assistance. We work with Siebe and Gorman's apparatus. The pressure of the air is indicated to the men at the pump by a Bourdon's gauge. The heat is great inside the dresses while we are working, much hotter than when we are at hard work on land. We are occasionally under water 3½ hours at a stretch, but the average time is about two hours; then we feel as if we want fresh air and something to drink. In spite of the air supply from the pump, that inside the diving dress acquires the smell of perspiration, and makes us feel faint. For efficient regular work, the depth of water should not be more than twelve or thirteen fathoms. A case occurred once of a diver dying from the pressure being too great at a considerable depth."

A WEDGE AND DIAPHRAGM PHOTOMETER.

A new photometer, shown in perspective in the figure, has lately been constructed by Mr. Sabine. The stand supports a straight horizontal tube, at one end of which is a paraffine lamp, and at the other an eye-piece. The middle portion of the tube is cut away, and has slipped over it a collar, to which a frame is attached carrying a wedge of neutral-tinted glass, adjustable by means of a rack and pinion. Inside the collar is fixed a transverse disc of ground opal glass which the paraffine lamp illuminates to a definite degree. This disc constitutes the field of comparison, the illumination of which is adjustable by means of a series of diaphragms of known aperture at the end near to the paraffine lamp. At the side, between the wedge and the collar which carries it, is a narrow pane of ground opal glass, just behind which a small mirror is fixed at an angle of 45 deg. to the axis of the tube. This mirror is supported from the centre of the transverse opal disc in such a way that the support is hidden from the observer by the mirror itself—an arrangement which ensures the apparent juxtaposition of the illuminated surfaces which have to be compared. The light to be measured is placed on the right-hand side of the photometer, and the collar turned so that the light falls normally upon the face of the wedge, passes through the wedge, through the pane of opal glass, and is incident upon the mirror which reflects a portion of it to the eye of the observer. The wedge is then, if necessary, shifted to interpose a greater or less thickness of absorbing medium until a balance is obtained—that is, until the apparent illumination of the mirror is equal to that of the field of comparison in the middle of which it is seen. If the range of the wedge is insufficient to admit of this, the degree of illumination of the field is altered, by means of the diaphragms, and the wedge then adjusted.



The employment of glass wedges for photometric comparisons is not new, having been already used by both Xavier le Maistre and Quetelet; but no practical photometer based upon this method has hitherto been constructed. The employment of diaphragms for extending the range of the wedge is found to work well and to enable the operator to adjust the illumination of the field with exactitude, the bright part of the paraffine flame being, of course, kept opposite to, and so as to well cover the diaphragm-aperture. A table is constructed, giving for each position of the wedge and for each diaphragm the value, in standard candles, of any light placed at a distance of one metre from the instrument; and if the light be placed at any other distance the number in the table has simply to be multiplied by the square of the actual distance in metres. For ascertaining approximately the amount of light which passes through any given coloured glass—for example, orange glass—the eyepiece is furnished with a rotary disc containing small panes of white and different coloured glasses, either of which can be interposed at pleasure.

This photometer is being made by Messrs. Elliott Bros., West Strand, in two forms—one for use as a portable photometer, as shown in the figure, and the other on a more solid stand, for laboratory purposes.

ON THE OIL FROM THE BOTTLE-NOSED WHALE.

By Mr. Alfred H. Allen, F.I.C., F.C.S.

I have recently made a very complete examination of the oil from the bottle-nosed whale, and some of the observations are of general interest. In the first place, I find that the oil has the remarkable chemical constitutions hitherto observed only in the oil from the true sperm whale, and which shows it to be allied more to the waxes than to the majority of liquid oils. Thus all the ordinary fatty oils of animal and vegetable origin yield, on treatment with an alkali, a "soap," or compound of the alkali used with the fatty acids of the oil, together with the familiar body known as glycerine. The waxes, on the other hand, including spermaceti, yield a soap like the oils and fats, but instead of glycerine they furnish peculiar waxy solids, varying in nature with their origin. Thus the product of the saponification of beeswax is "myricyl alcohol." Chinese wax yields "cerotyl alcohol," while spermaceti furnishes "cetyl alcohol." On similarly saponifying sperm oil, I found it to yield a soap, as usual, but instead of glycerine I obtained a new solid body, which I propose to call "spermyl alcohol," and which I have as yet only incompletely examined. The analysis of sperm oil from different sources shows that the proportion of spermyl alcohol yielded on saponification was remarkably constant, lying, according to present experience, between 38 and 42 per cent. Thus, on saponifying any animal or vegetable oil, there is obtained about 95 per cent. of fatty acids and 10 per cent. of glycerine, but on saponifying sperm oil there results about 60 to 64 per cent. of fatty acids, and 38 to 42 per cent. of "spermyl alcohol"—a white, crystalline, readily-fusible solid. The bottle-nose oil has yielded me analytical results showing that it is chemically identical with sperm oil. Thus I have obtained from bottle-nose oil 64 per cent. of fatty acids, and 39 to 40 per cent. of spermyl alcohol, numbers which are practically concordant with those yielded by the oil from the true sperm whale. Up to the present time the peculiar composition first noticed by me in the case of sperm oil is not known to be common to any other oil than that from the bottle-nosed whale, so that the latter oil stands alone in its right to be considered as a perfect substitute for true sperm oil. Porpoise oil, and the oils from the various species of whalebone whale, are quite different in chemical nature from the oils of the sperm and bottle-nosed whales. The striking similarity in constitution, amounting, in fact, to chemical identity, between the oils from the sperm and the bottle-nosed whale suggested the probable close relationship of the two animals. On inquiry, I found this suspicion confirmed in the strongest manner. The food of the two animals is very similar, and quite different from that of the Greenland and other whalebone whales; both animals have a back fin, which is not present in whalebone whales; and last, but not least, they both possess large cavities in the head, which are filled with oil. Whether the oils of the narwhal, dugong, and other *cetacea* may not possess characters similar to those of the sperm and bottle-nosed whales is an interesting question which I should like to have the opportunity of practically testing. The oils from the bottle-nosed and sperm whales being identical in chemical nature, and sharply distinguished from all other known oils, it is not surprising that their physical characters should have proved to be very similar. Thus, I find their viscosity, or flowing power, their density, their flashing points, and all other physical characters to be practically identical with each other, and different from those of ordinary oils. These characters sufficiently indicate the bottle-nose oil as a suitable substitute for sperm oil, and I have, in addition, found it as free from tendency to gum or thicken as could possibly be desired. If further proof be needed of the identity in nature of the oils from the sperm and bottle-nosed whales, it is to be found in the fact that they each deposit spermaceti when cooled to a low temperature. This property of sperm oil is well known, though it is often erroneously supposed to be limited to the oil from the head cavities of the animal, whereas it is in fact true of the oil from all parts of the body. The spermaceti yielded by the bottle-nosed whale appears to be fully equal in quality to that furnished by the true sperm whale, but the quantity obtained is smaller. From the method of its treatment, some of the bottle-nose oil at present in the market has a somewhat strong smell, and possesses an objectionable tendency to become green in contact with copper or brass. These properties render such lots of oil as possess them unsuitable for some of the most valued uses of sperm oil. I have attempted to remedy these defects, and have succeeded in producing a refined oil of a very pale yellowish colour, having but little smell, and possessing absolutely no tendency to act on brass or other metals. In other respects it is unchanged. The amount of bottle-nose oil introduced into commerce during the last two years has been considerable, and is rapidly increasing. In some cases it has been sold under the not inappropriate name of Arctic sperm oil, but in other instances it has been mixed with or substituted for real sperm oil, without any acknowledgment of its true nature. From the fact that dissatisfaction has not resulted when the oil has been thus surreptitiously substituted, as well as from the considerations already mentioned, I believe further experience will prove the refined product to be equal to the finest sperm oil, and capable of being used for every purpose to which the latter has hitherto been applied.

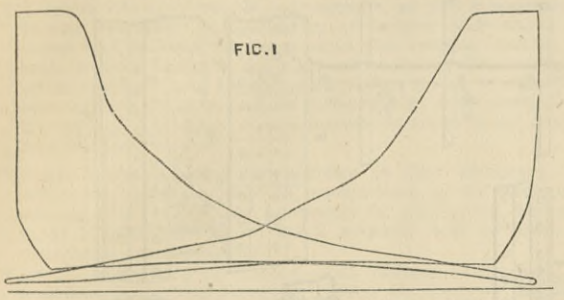
The Channel Tunnel.—The new plans issued by the Channel Tunnel companies contain some important alterations, both companies having altered or amended their original plans with a view, the *Times* says, to meet the requirements of the objections or recommendations of the Channel Tunnel Commissioners. The amendments shown by the South-Eastern Company are of great improvement, in point of defensibility, on their previous plan. It is proposed to carry the present lines inland to the extent of about three miles, and then to run down the Alkham Valley, forming a detour and joining the South-Eastern main line at the pier station. This would bring the entrance and approach to the tunnel well within the range of the defences of the garrison of Dover. A branch line will also connect the London, Chatham, and Dover line at the upper end of the town. The Channel Tunnel Company have reverted to their old scheme of commencing a descent to the base of the tunnel at St. Margaret's, about three miles from Dover.

LETTERS TO THE EDITOR.

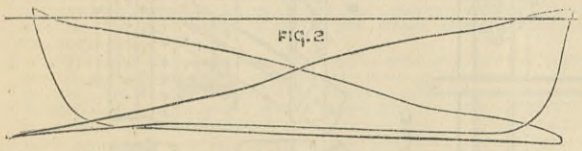
[*We do not hold ourselves responsible for the opinions of our correspondents.*]

COMPOUND ENGINES.

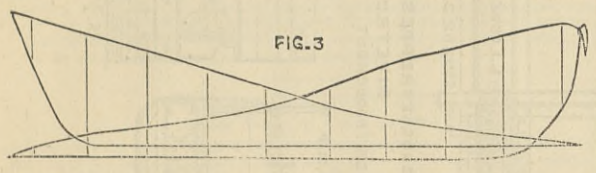
SIR,—Being a very old subscriber to your valuable journal, I beg to ask you to kindly insert the two enclosed indicator cards, Figs. 1 and 2, I have taken off a pair of compound engines under my supervision, which I think will interest my fellow engineers, illustrating practically how little may be the loss from undue and useless



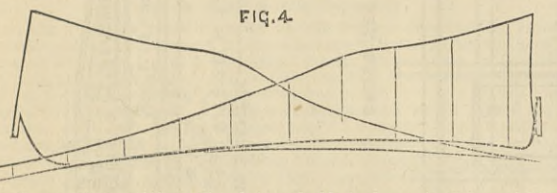
expansion by the large capacity betwixt point of exhaustion in the small cylinder and steam entering the large cylinder—which capacity in my case consists of 45ft. of 10in. steam pipes, and a steam box over 2ft. long by 2ft. wide—where a good arrangement of valves and travel is secured. The two cards marked 3 and 4 are from the original cylinder belonging to a "pusher," that was compounded with my old



beam condensing engine in the year 1872, and was then considered a first-class job, having been made and put to work by a leading Lancashire firm of engine makers. Owing to the crippled area of the steam ports I could not get within 12 lb. per square inch of the boiler pressure, though the cylinder had improved double short slide valves with cut-off plates fitted with hand regulating motion of simple and efficient construction. Not being at all satisfied



with the great loss of initial pressure and great wire-drawing, I got my employer to consult Mr. G. Sellers, then manager to a Yorkshire firm of engine makers, and he contracted for and superintended the making and fixing of a new cylinder, same diameter and of similar make as old one, with his cut-off arrangement, a modification of Allen's automatic valve gear, which allows full pressure in the steam pipes to be maintained in the steam box, not allowing the reduction of pressure on charging the cylinder



with steam when cutting off as late as half-stroke, cut-off is variable to zero and regulated by quick speed governors, Porter's principle; the coal consumption cannot be given accurately owing to the large quantity of steam used in warming the mill and combing and washing wool. REUBEN BRAMHALL, Engineer.

Penny Oaks Mill, Leeds-road, Bradford.

REFRIGERATORS.

SIR,—Some years ago, perhaps twenty, I first saw the freezing machine, containing a strong solution of ammonia, with the construction of which is identified the name of Carré. About four or five years since I was shown a new refrigerator, containing a trough partly filled with strong sulphuric acid; I was told that this also was devised by M. Carré. In a new edition of "Lessons in Elementary Chemistry," published by Roscoe in 1877, a drawing of this machine is given on page 44. In describing its mode of action he writes in this book: "By a very ingenious arrangement the plan of freezing water by its own evaporation has been practically carried out *on a large scale* by M. Carré, by means of which ice can be most easily and cheaply prepared. This arrangement consists simply of a powerful air-pump and a reservoir of a hygroscopic substance, such as strong sulphuric acid. On placing a bottle of water in connection with the apparatus, and on pumping for a few minutes, the water begins to boil rapidly, and the temperature of the water is reduced so low by its own evaporation as to freeze to a mass of ice."

Now, Sir, in your impression of October 20th last, I read an account of the trial of a refrigerator in London, which is called "the Windhausen refrigerator," which is stated to be "the invention of Mr. Franz Windhausen, of Berlin," and I find an engraving of the machine. May I be allowed to say I think "it would puzzle the Dutch and all the satellites of Jupiter," to tell in what the invention of Mr. Franz Windhausen consists? He provides, it is true, a means of making concentrated again the diluted sulphuric acid, but the process in all its essential features is that devised by M. Carré; or I am not, Sir, GORILLARUM REX.

South Kensington, December 18th.

RAILWAY WEIGHING MACHINES, AND THE CAMBER OF PULLEYS.

SIR,—Regarding the complicated combination of levers and rods and accumulation of centres in a railway weighing machine, it does not require an engineer to be able to say *à priori* that such a machine will be very liable to get out of order. Its levers are multiplied, combined, extended, refined, and tapered away until a few pounds balances a ton. Very ingenious is this machine no doubt, and probably very accurate, if allowed to stand in a show-room and do no work all day. But given the tear and wear of an active railway life, it is sadly behind the age. Here in India, to keep weighing machines in anything like fair condition, they require constant attention. They may weigh correctly at six a.m., and by twelve noon, when the sun is powerful and the machine gets partly heated, they will probably be out about ½ cwt.; or you may have the machine properly adjusted, and if you then run some wagons over it, ten to one but you will find it out of truth if you test it over again. Now I contend that if there's nothing better than this sort of weighing machine in the market, it is high time there was. It surely does not require a great inventor to devise a simple beam arrangement with spring balances or water pressure, to counterbalance and indicate a load up to twenty tons or so. Here is an extensive opening—as they say—for an enterprising young man, or for a firm that wishes to make a fortune.

What is the proper camber to have on a pulley? I have been led to ask this question because it is of more importance than most people think. Indeed, it is thought of so little consequence that it is generally left to the discretion of the turner. We all know that the camber on the pulley affects the running of the belt. It must also affect the wear of the belt and the grip it takes round the pulley. It is only reasonable to suppose that if the pull or constant strain on a belt be greatest towards the middle and least at the edges, that it will not only be stronger, but will last longer. That is to say, other things being equal, a belt running on a straight pulley will not stand so long as it would running on a pulley with a certain amount of round on it. What that certain amount should be is the question. It ought not to be left, as at present, to the fancy of Jack, Jim, or Joe, or even to the draughtsman. I often find draughtsmen anything but practical men. I once saw a person who had temporary charge of a large engineering concern give orders to have the round turned off all the main pulleys. Happily he was prevented before he did much mischief. Another genius thought that if pulleys were turned hollow instead of round they would do better. You will say, there's surely some bright mechanics abroad. I know an establishment where the boss makes his man keep a tin can full of fine emery and oil to smear anything with that has to be a tight fit, such as putting a shaft into a crank. He says it makes it seize much better. This Solon tried to increase the power of an engine by scooping out the piston like a dish; he said he increased the "area." But pardon this digression; I wish to know where I can find a scientific rule for the camber on a pulley? "Molesworth" says ¼in. to 1ft.—a rule taken, I suppose, from the usual practice of machine makers.

Jumalpore, Bengal, November 28th. H. ADIE.

HYDRAULIC BALANCE LIFTS.

SIR,—I would again trouble you with a few remarks on this subject. I have to thank your various correspondents for the further information given. Taking the lift illustrated in your impression of November 24th, I assume that it will hold eight people—say, 12 cwt. The weight of the ram, H-beams, cage, &c., I estimate at about 21 cwt.—33 cwt. in all. To balance the hoist would take two weights, say, 9 cwt. each, carried by steel wire ropes over two pulleys. I estimate the cost of these, including the pulleys, bearings, &c., at about £17 10s.; while I make the cost of the two cylinders E and F, with their rams and connections, about £38 10s. I do not see any difficulty in stiffening the cage by iron straps, to stand the strain of balance weights, and yet add very little indeed to the total weight of it. The weight of metal in balance cylinders and rams E and F, and connections, exceeds that of the balance weights by about one-third in the case of the above hoist. Is there any reason why the accumulator may not be worked at 400 lb. or 500 lb. per square inch in place of 700 lb.? and will not the power, and consequently the expense, required to keep up the pressure, be decreased in proportion, or nearly so? It comes then to a question of, first, which of the two methods of balancing works with the least friction; secondly, which is the least expensive in point of maintenance? I am unacquainted with any rule that gives the power required to bend wire ropes over pulleys, but think I am within the mark in assuming that a weight of 28 lb. placed on either side would overcome the friction of the pulley journals, bending of ropes, &c. Against this we have got the friction of the stuffing boxes of the two rams, which, from the most reliable data within my reach, would be at least six times that amount.

I am surprised that steel wire ropes should require renewal every twelve months, as stated by Mr. Ellington in your last issue. Perhaps some readers who may also be acquainted with the durability, &c., of these wire ropes might give us the benefit of their experience. I was in a machine shop last week, where a 20-ton travelling crane was furnished with steel wire lifting ropes, and was informed they had been in constant use for eighteen months with no signs of failure. I do not apprehend any serious mishap from the fall of a balance weight, either in the lift illustrated or in the larger one referred to in Messrs. Stevens and Major's letter. It is, of course, best to have two balance weights to the cage, and it is very unlikely that both could fall at once. Taking the case of the one illustrated, to which, of course, my first letter referred, and supposing a 2¾in. diameter ram was worked by 400 lb. pressure per square inch; should a weight fall while cage is ascending, it would stop or descend very slowly, and, on the outlet valve being opened, the increase of pressure in the lift cylinder would not be more than 35 per cent., which is trifling. I admit that it might be profitable to return the water to the top of the house for re-consumption, but only in cases where the value of the water used would more than pay the interest of the additional first cost of the lift.

Kilmarnock, December 19th. JOHN BARR.

HYDRAULIC BALANCE LIFTS.

SIR,—A letter appears in your last issue upon the above subject from Mr. Ellington, from which it might be inferred that your correspondent was the original inventor of this type of lift. We cannot admit this, though we are fully alive to the value of the improvements which your correspondent introduced. Respecting cost, Mr. Ellington is of course the best judge of the cost of his own apparatus, but regarding ours, we do not find any difficulty in getting it manufactured at the rates named in our last letter, the users not complaining of the article they receive.

Queen's-road, Battersea, JOHN S. STEVENS.
December 19th. C. J. MAJOR.

THE CRYSTAL PALACE GAS AND ELECTRIC EXHIBITION.

SIR,—With reference to your brief notice of this as yet imperfect exhibition, wherein you mention our patent dwarf piles, you appear not to be aware that we have granted the exclusive license of same to Messrs. Siemens, Bros., and Co., Limited, for electric purposes only. This simple invention has proved so effective that many thousands have been made within a short time from its introduction, and possibly some of the particulars given in Messrs. Siemens' pamphlet may be of interest.

Seeing the great saving of time effected, it seems to us that the same plan of foundation adapted to railway signal posts would prove an economy to railway companies, and we should not hear of posts being blown down so often in storms owing to rotten foundations. LE GRAND AND SUTCLIFFE.

Magdala Works, 100, Bunhill-row, London, E.C.,
December 19th.

BACK-LASH IN CORN MILLS.

SIR,—I find it stated in "Molesworth"—p. 322, 18th edition—that "In corn mills the velocity of the periphery of the fly-wheel must exceed the velocity of the periphery of the stones to prevent back-lash." Is it not a matter of momentum, and not alone of velocity? Again, as the velocity of the fly-wheel must be continually changing, more or less, and the resistance to be overcome by the stones is constant, does it not follow that back-lash, to a greater or lesser extent, is inevitable? Perhaps some of your readers would give the public the benefit of their experience on this subject. ROBERT GILL.

Palermo, December 15th.

PRESSURE OF FLUIDS IN MOTION.

SIR,—"H. S. T." cannot manipulate formulæ applied to physical facts in the manner he wishes. The context of my letter would show that I meant $\frac{Wv^2}{g}$ = twice "work."

Chelsea, December 11th. G. PINNINGTON.

LEGAL INTELLIGENCE.

COURT OF SESSION.—OUTER HOUSE.

Before LORD ADAM.

Wednesday, December 13th, 1882.

THOMSON *v.* THE LANCEFIELD FORGE COMPANY AND OTHERS, *et e contra.*

THE leading action in these cases was raised by Messrs. James and George Thomson, engineers and shipbuilders, Finnieston-street, Glasgow, and Clydebank, Dumbarton, against the defenders, who carry on business at the Lancefield Forge, Glasgow, concluding for payment of £12,865 16s. 3d. in name of loss and damage for alleged breach of contract.

In 1879 the pursuers entered into a contract with the Cunard Steamship Company to build and engine for their Transatlantic trade a large steamship, afterwards called the Servia. In Nov., 1879, the pursuers entered into a sub-contract with the defenders for the supply of the ship and engine forgings of the vessel. At that time, the pursuers aver, the defenders were informed that they had undertaken to deliver the Servia on 30th April, 1881; that the contract made with the defenders was partly verbal and partly in writing; that no definite times were fixed for delivery of the various forgings in the letters between the parties; that at a meeting held between them in December, 1879, certain times were then fixed on for the delivery of the more important forgings; that towards the end of February, 1880, it became apparent that the defenders could not fulfil the obligation undertaken in December previously; and that a further agreement was then entered into, fixing specific times for the delivery of each forging; that the pursuers continued to press the defenders urgently for delivery; that none of the obligations undertaken in the second agreement were fulfilled within the times specified; that the time taken to complete the various forgings was altogether unreasonable; that during the whole period the pursuers warned the defenders of the serious liabilities they were incurring in respect of these breaches of contract and unreasonable delays; that in consequence of said delays the launch of the Servia was delayed for nearly five months, thus involving a direct pecuniary loss to the pursuers in their contract with the Cunard Company, and also throwing a great part of the work upon the vessel into the winter months, thus causing a much heavier cost to the pursuers than it would have been during the summer and autumn months; that a defect in the workmanship of the crank shaft was discovered after the vessel had been launched, and that the pursuers had to get a new shaft made at Sheffield; and that the vessel was delayed at Glasgow until November, 1881, before the new shaft could be fitted up. By the contract between the pursuers and the Cunard Company it was stipulated that a penalty of £5000 should be payable by the pursuers in the event of their failure to deliver the vessel on 30th April, 1881; and that penalty has been exacted, it being an invariable custom in shipbuilding contracts to do so. The pursuers also aver that during the whole period no delay occurred on their part, the work being pushed on as rapidly as possible.

The defenders deny that they were informed or were aware of the terms of the pursuers' contract with the Cunard Company, and aver that no definite times were fixed for delivery of the various forgings; that the second agreement was entered into with one of the defenders' foremen, who, as the pursuers well knew, had no authority to enter into it so as to bind them; that the time taken for the delivery of the forgings was not unreasonable, looking to the nature and magnitude of the work and other circumstances; that there was no defect in the crank shaft, but that on receiving notice of the alleged defect the defenders recalled their men, who were dispersed for the Fair holidays, lighted four furnaces, and began four portions of the shaft, when they received a letter from the pursuers countermanding the order and holding the defenders liable for the expense of replacement; and that the defenders repudiated liability and complained of the pursuers' breach of the custom of the trade in not allowing them to make a new shaft. The defenders also aver that it is the usage and custom of trade implied in sub-contracts between the shipbuilder or engineer and the forgemaster that the former takes into consideration in making his contract with the shipowner the fact of the ship being delayed by forgings turning out defective and requiring to be replaced, and the forgemaster is not held responsible for the consequences of such delay; that the forgemaster, however, in the event of the discovery of a material flaw in the forgings, is held bound to take back the defective piece of work and make a new one in its place without extra charge; that iron forging is a series of processes of great delicacy and difficulty, and that it is impossible, notwithstanding the greatest care, to guard against the accidental occurrence from time to time of flaws and defects, especially in large and heavy forgings; that that custom is reasonable and necessary for the protection of the forgemaster, and was implied in and formed part of the contract between the pursuers and the defenders; that the forgings required for the Servia were of an unprecedented size, her dimensions being greater than any vessel previously built on the Clyde; that greater care was thus required, and the risk of accident in forging much increased; that the defenders' works had to be altered in consequence of the unusual size of the forgings; that during the whole time the contract was being executed the defenders were engaged in other work for the pursuers; and that the pursuers frequently delayed forwarding scrap iron purchased from them by the defenders for the purpose of their castings, while they were also impeded by the miners' strike causing difficulty in obtaining a supply of coal for the furnaces. The defenders further aver that throughout the execution of the contract they proceeded as expeditiously as they could, and that the forgings were delivered in reasonable time. Having regard to the stages of the vessel's progress in the hands of the pursuers, which is all that the defenders were bound to do, according to the usual custom and course of dealings between forge masters and engineers. The defenders therefore plead *inter alia* that, having executed their contract according to its terms and the custom of trade applicable thereto, they are not liable in damages; and that, never having been informed by the pursuers of the terms of their contract with the Cunard Company, and never having undertaken any obligation in connection therewith, the defenders are not liable in the damages claimed for alleged delay.

The defenders raised a counter action against the pursuers for payment of £3744 1s. 3d., being the balance alleged to be due of the price of the sub-contract. In defence to the action the pursuers plead the alleged breach of contract and consequent damage to a greater extent than the sum sued for.

Both actions were conjoined and the records closed, and proof fixed for the 24th of January next.

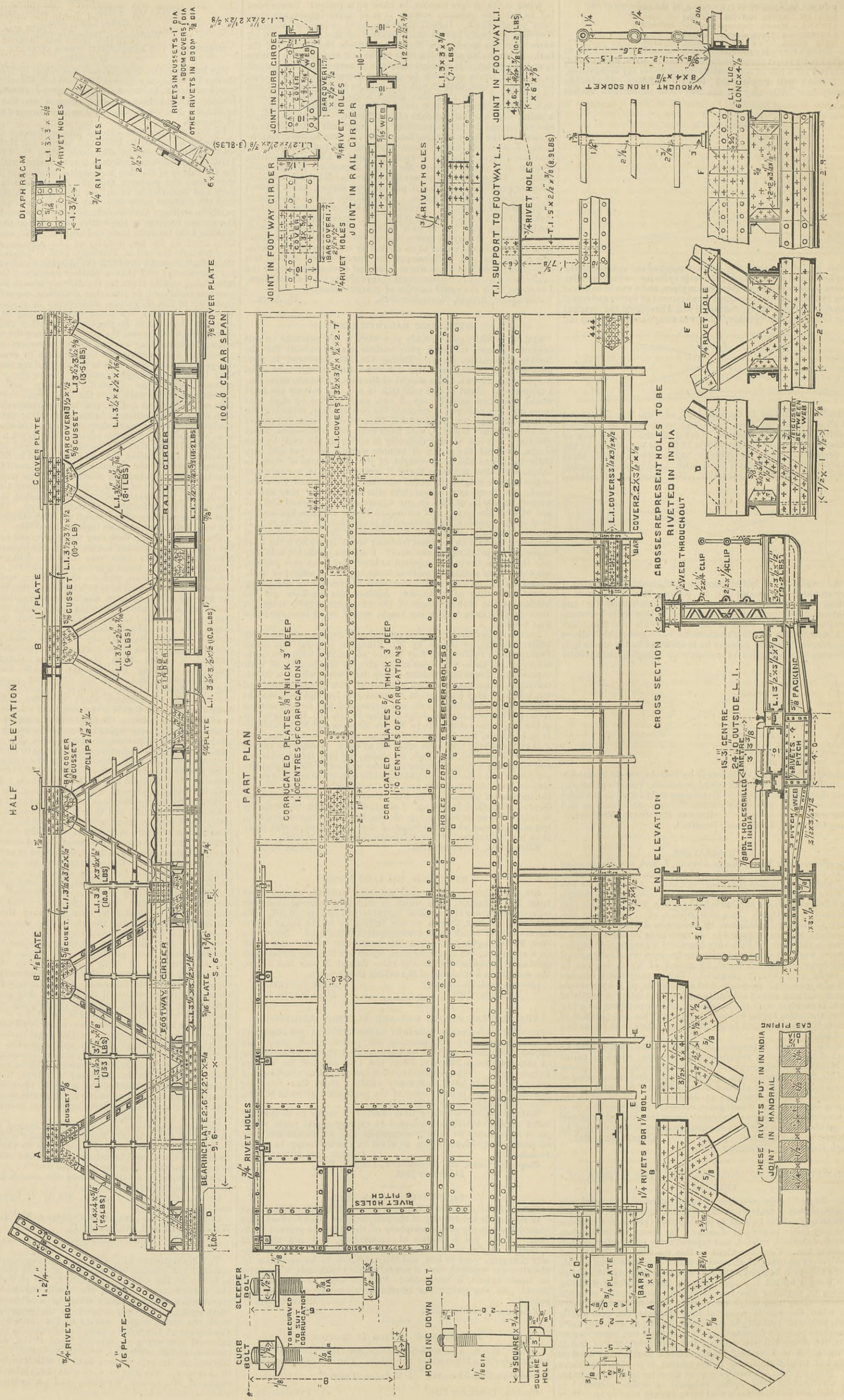
Counsel for Messrs. Thomson, Mr. W. C. SMITH; agents, Dove and Lockhart, S.S.C.

Counsel for the Lancefield Company, Mr. LORIMER; agents, Webster, Will, and Ritchie, S.S.C.

THE MANCHESTER SHIP CANAL.—The Manchester Ship Canal is certainly not wanting in support so far as the passing of resolutions in favour of the scheme is concerned. At all manner of meetings the subject crops up with the usual resolution; organisations representing the workmen's interests in all sections of industry most strongly give their support to the project, and during the week the steam engine makers of the district and the Miners' Conference at Leeds have passed resolutions in favour. A private informal conference of mayors, town clerks, and other gentlemen connected with the various boroughs in the district interested in the scheme, was held in the Manchester Town Hall on Tuesday, with the view of obtaining information from the engineer, Mr. Leader Williams, and promoting friendly understanding with regard to the project.

CONTRACTS OPEN—IRONWORK OF BRIDGES, INDIAN STATE RAILWAYS.

(For description see page 471.)



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BERLIN.—ASHER and Co., 5, *Unter den Linden.*
VIENNA.—Messrs. GEROLD and Co., *Booksellers.*
LEIPSIC.—A. TWIETMEYER, *Bookseller.*
NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

TO CORRESPONDENTS.

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

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

W. M. J.—*The address of the Secretary of the Institution of Civil Engineers is* 25, *Great George-street, Westminster; that of the Secretary of the Institution of Mechanical Engineers is* 10, *Victoria-chambers, Westminster.*

R. E. D.—*The Taschenbuch is in the hands of the reviewer. Your questions will be answered in our review. We thank you for the suggestions respecting books received, but we could not give the prices, as these are seldom supplied by the publishers. Thanks also for remarks on chilled rolls.*

F. Y.—*You may communicate with Messrs. Ormerod, Grierson, and Co., Manchester, and Messrs. Thos. Piggott and Co., Birmingham. There are other makers, including Messrs. Easton and Anderson, London; Messrs. Mirrlees, Tait, and Watson, Glasgow; and Messrs. Manlove, Alliot, and Co., Nottingham.*

P. P. (Wexford).—*It is more than probable that your pinions break because they are not properly put to work, for the mixture of irons you use should be strong and tough. You will find considerable difficulty in using steel, as the temperature required to melt it is very high, and it would have to be fused in crucibles and added to the melted cast iron. If you add a little more hematite to your mixture, putting in less scrap, you will probably improve the quality. The strength of the iron will also be improved if you run it into a pig and break it up and remelt it for casting. Your pinions are probably too wide on the face. Send us a sketch of the gearing.*

W. J. (Beech Villas, Liverpool).—*We do not think you would be wise to try to take out a patent without the aid of a patent agent, as certain forms must be complied with. The application for a patent must be drawn up on a proper form, which you can obtain from a law stationer's. The £5 stamp is impressed on the form. You will have to make a declaration, according to another form, before a magistrate or commissioner for taking oaths, and you will have to supply copies of your specification, and comply with a good deal of routine work in a way that you will find very troublesome, and in the end, after all, your specification would probably be badly drawn, and your invention not properly secured.*

SAMSON SCREW-CUTTING LATHE.

(To the Editor of The Engineer.)

SIR,—Would some of your readers please favour us with the address of maker of the Samson screw-cutting lathe? G. B. AND SONS.
Sheffield, December 20th.

DYNAMOMETERS.

(To the Editor of The Engineer.)

SIR,—Will any reader kindly inform us where we can get one of Morin's dynamometers, or a good dynamometer of a cheap construction?
Bradford, December 18th. S. C. AND Co.

CEMENTING LEATHER TO IRON.

(To the Editor of The Engineer.)

SIR,—In your last issue there is a letter from a Birmingham correspondent asking for a cement to unite leather to iron. If he will apply to me, or Mr. Plant, No. 8, Nelson-street South, Birmingham, he will tell him more about the cement, of which I enclose a sample, or he may apply to me. I have made it now for many years for my own use and friends, but never for sale. I am in no business, but amuse myself with lathe, &c., and I find this cement most useful—waterproof, but it will not stand much heat. It is particularly useful in pattern making, holding wood, iron, &c., in lathes whilst being turned, mending wood and iron buckets, iron spouts, glazing, &c.; in fact, I use it for nearly everything. I use it with a hot iron of a suitable shape for the purpose wanted.
Fros-yr-Afon, Beaumaris, December 18th. THOMAS SMITH.

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DEATHS.

On Dec. 18th, Mr. WILLIAM HENRY THWAITES, aged 32, of the firm of Thwaites Bros., Vulcan Ironworks, Bradford.
On the 19th Dec., at his residence, 100, Fentiman-road, S.W., WILLIAM BEATTIE, aged 46 years, Assoc. M.I.C.E. and Asst. Locomotive Supt. L. and S. W. Ry.

THE ENGINEER.

DECEMBER 22, 1882.

THE BOARD OF TRADE AND BOILER EXPLOSIONS.

FOR sime time past the Board of Trade has sent an inspector to investigate every case where a boiler explosion has caused a death. The object had in view is laudable, and the practice might be made useful. Unfortunately, the Board of Trade appears to have been unable to secure the services of competent inspectors, and not a few of the reports of the gentlemen actually employed are more amusing than edifying. The experience of the inspectors seems to have been acquired solely among marine boilers, and they bring this experience to bear in a very curious fashion when they have to deal with land boilers. There is a story told of a prince who was made a present of an elephant. No one in his retinue knew anything about elephants, save that they were big beasts, and strong withal; but a house had to be provided, and so he consulted with various artificers as to of what this house should be. The mason said it must be of stone; the carpenter held that wooden beams would answer better; the blacksmith insisted that to restrain elephants there was nothing of any use but iron; and last of all, the shoemaker held that a tough house, made of leather properly stitched was the thing above and beyond all others the best for restraining the evil passions of elephants. The Board of Trade inspectors remind us of the shoemaker, holding, as they do, that special forms of construction only applicable to marine boilers should be universally adopted. The results of this theory on their reports are at times ludicrous. It is also noteworthy that, as a rule, they fail satisfactorily to explain why a boiler explodes, and we find them even consulting small boys to try and solve the puzzle.

A noteworthy example of the Board of Trade report lies before us. We will not give the author's name. He is, we believe, a highly competent man as regards marine work; but, so far as can be gathered from this report, he knows next to nothing about land boiler explosions. The report is entitled "Explosion of an Upright Tubular Boiler at Maesycwmmer Ironfoundry, Monmouthshire." Such boilers are usually called "vertical," but we may pass this by. The boiler was made some seven or eight years ago by Messrs. Powis, James, and Co., of Lambeth, and was of a very common type. It had a shell 37½in. in diameter and $\frac{5}{16}$in. thick, and a fire-box 33in. in diameter, $\frac{11}{16}$in. thick, with a crown plate $\frac{3}{8}$in. thick. This was united to a dry smoke-box on the top of the shell by thirty-eight tubes, 2½in. diameter by 4ft. 5in. long. The top of the boiler was originally of ½in. plates, reduced by corrosion between the tube holes to about $\frac{5}{16}$in. A wrought iron stay rod, 1in. in diameter, connected the top of the boiler and the crown of the fire-box at the centre. It will be seen at once that the boiler was of a type which is still very popular. Hundreds, if not thousands, of such boilers have been made and are still in use. The maximum safety valve load appears to have been 85 lb. on the square inch, but the weight was not kept at the end of the lever, and the valve seems to have blown off at 50 lb. The author of this report has taken the trouble to tell his readers that the boiler "was not provided with a hand pump, and the only steam pump with which it could be fed was that driven by the engine." It was hardly necessary, however, to waste space in telling us what every one would have known. It is not likely that in a little foundry, employing in all four men, a donkey engine would be specially provided to supply a small vertical boiler employed to drive an engine working the cupola fan. But marine boilers have donkey pumps, and the absence of one in this case no doubt appeared to be a circumstance worth making a note about.

It seems that on the day of the explosion steam was being got up, when what is described by one of the witnesses as a "rattling noise" was heard. The owner of the boiler was called, and a kind of inspection seems to have been made by all hands. A man named Pugh, who drove the engine, said "it was all right." The men returned to their work, and fifteen minutes afterwards the boiler exploded, killing Pugh. The tubes and central stay were pulled out of the fire-box crown, which cambered down 2½in. The top of the boiler was broken up into fragments, and tore itself away from the shell all round. The writer of the report has found this a very puzzling explosion indeed. There was, he says, no overheating, for there was plenty of water in the boiler. None of the men in the works knew anything about the boiler, so he went to the Great Western Railway running sheds at Newport, and found a boy who at one time had driven the engine, and got all the information he could from him. This did not amount to much. The explosion had to be accounted for, however, and this he has had much trouble in doing. He asks: "Was it due to over pressure, or to inherent weakness? I am afraid this question cannot be definitely answered, although I carefully examined the seams of the shell with the object of finding symptoms of over straining, and failed to discover any." He then proceeds to hint that the explosion took place because the tubes drew out of the fire-box crown, in which they had become slack. "Experience has taught us that many tubes actually in use become so slack in the tube plates as to be unfit to bear a force that is worth considering, and for that reason it has become the practice to tie together the front and back tube plates of marine boilers by a sufficient number of stay-bars or stay-tubes to prevent slipping over the tube ends." After a good deal concerning the calculated bursting pressure, he comes to the conclusion that over pressure was the cause of the catastrophe. "After duly considering all the circumstances in connection with the explosion, I am of opinion that the pressure that caused the separation of the tubes and bottom tube plate did not exceed that on the safety-valve when the weight was at the end of the lever, viz., 85 lb., and it is highly probable that it was even less. I am further of opinion that the boiler was inherently weak, and that the explosion should be chiefly attributed to that cause." It is more than probable he is right as to the cause of the explosion, but he has arrived at the conclusion on no adequate grounds. One of the very first steps to be taken in such an inquiry as this was, is to ascertain the quality of the iron; but on this point the report is quite silent. It is impossible, however, to look at the drawings which accompany the report and to escape the conclusion that the top of the boiler was as brittle as glass.

In all boilers of this kind there is a very heavy upward thrust put on the top of the boiler by the expansion of the tubes when steam is being got up, and this causes a bending of the end-plate at its circumference, which ultimately causes grooving or renders the iron brittle. In this case there was a perfectly flat plate flanged downwards all round and rivetted inside the uppermost ring of the boiler shell. Not one of the rivets was shorn across, nor does it appear that the plate was injured in the flange, but the shell has given way all round right through the rivet-holes almost as neatly as though it had been cut off with shears. We think that when the "rattling" noise was heard, and a small escape of steam was noticed, a seam rip had been started, and when the pressure was higher, the rip ran like lightning all round the boiler, and the whole strain being then thrown on the tubes, they were pulled out of the crown-plate; the top plate was broken up, and all the rest followed. It is not impossible, however, that the crown-plate was the first to give way, being weakened in a way which we have recently explained; and this seems to be indicated by the depression of the crown.

We may now turn to the comments made by the inspector on the construction of the boiler "Had the tube-plates been stayed," he writes, "as is usual in marine practice, the boiler would have been stronger, and the uncertainty as to whether the ordinary working pressure or a higher pressure caused it to explode would have been removed. It is a great mistake to make boilers like the one under consideration that are held together by friction only, and especially when it is known that the friction frequently becomes almost *nil* from ordinary causes, such as leakage, unequal expansion, accumulation of scale, &c. The exploded boiler, apart from the defective staying, of its tube plates, was of a dangerous character, inasmuch as the crown of the fire-box and the other portions of the heating surface could not be cleaned or even inspected without drawing the tubes. Owing to this defect it is surprising that it did not burst long ago, and its immunity from explosion speaks volumes for the purity of the water used as feed. I may add that the feed-water was obtained from a deep well close to the works until about three months ago, when it was given up for rain water, sometimes supplemented by well water. Possibly the rain water and the composition used for cleaning the boiler may have had the effect of loosening the tube ends; but this is doubtful, as Mr. Reynolds said, so far as he knew, the tubes leaked very little since they were renewed, and always took up when the boiler got properly heated." The inspector does not seem to be aware that there are many thousands of portable engines in existence, the tube plates of which are held together by friction. There was nothing dangerous about the absence of means for cleaning the fire-box crown, at least not more than is met with every day in boilers that do not explode. The tube plates of portable engines and of locomotives could not be cleaned without drawing the tubes, and they are never cleaned more than two or three times in the life of the fire-box. They are exposed to quite as great a heat as was the crown of the box in question. Indeed, as the boiler seems to have been worked for the most part without any chimney or forced draught of any kind, overheating is pretty well out of the question. The hint that the use of rain water might perhaps loosen tubes comes on us with startling effect. When the author of the report has made himself more familiar with the construction of small land boilers he will be able to write with more influence about them.

Finally, we may point out that reports such as that from which we have quoted possess no value. The duty of an inspector in such a case is not fulfilled by looking at the broken boiler and asking a few questions. But it requires special qualifications to make inquiries of this kind. It is not the fault of the Board of Trade officials that their reports are not satisfactory. This is, we think, the sixteenth issued, and as several gentlemen have been employed in preparing them, the experience obtained by each hitherto must be small. Very special training is needed to fit a man for the work which the Board of Trade is now attempting to perform. In process of time, no doubt, its officials will learn a great deal, but meanwhile their reports savour of the amateur, and are not worth the money expended in printing them.

RAILWAY SPEEDS.

A GERMAN journal, *Die Verkehrszeitung*, has recently published a tabular statement of the maximum speeds of trains in Great Britain, Europe, and the United States. The table is inaccurate and incomplete to a very considerable degree, but it contains nevertheless some suggestive information. The American *Railroad Gazette* has supplemented it by a statement of the speeds of some of the fastest trains in the United States, and this statement has been in turn supplemented and corrected by two correspondents. The prominent fact which comes out is that the time taken to traverse any given distance between two places connected by rails shows that speeds are much slower than most people suppose. If we take, for instance, the run from London to Edinburgh, a distance of 397 miles *viâ* York, this is made in nine hours by Great Northern trains, the average speed being thus 44·1 miles per hour. From Euston the distance is 401 miles, and London and North-Western trains make the run in ten hours, or 40·1 miles an hour. By the Midland Railway the distance is 404 miles, and the time 10 hours 5 minutes, or very nearly the same speed. The German journal to which we have just alluded makes the distance 116 miles and the speed 41 miles per hour, which is an error. Some of the fastest trains in the world are those run between Leeds and London. From King's Cros the distance by the Great Northern is 186½ miles. From St. Pancras by the Midland it is 196 miles. The fastest train on the Great Northern makes the run in 4 hours 5 minutes, or an average speed of 45·4 miles an hour. The Midland trains traverse the distance in 4 hours 30 minutes, giving an average velocity of 43·5 miles an hour. The fastest train in the world is the Flying Dutchman, broad gauge, which makes the run to Swindon at 53½ miles an hour. The Great Northern trains run from London to York, 188 miles, at 48 miles an hour, and at least one train runs to Peterborough at 51 miles an hour.

The run from London to Grantham has been made repeatedly at 51 miles an hour. On the United States railways the quickest run appears to be that made between Jersey City and Philadephia, 89 miles, made at the rate of 47⅔ miles an hour. There is not in the world a train timed to run at 60 miles an hour, although it is, of course, certain that that velocity is often exceeded. If a speed of 60 miles an hour could be maintained continually between London and Edinburgh, the journey would occupy only 6 hours 36 minutes; and allowing for three stops of ten minutes each on the route, the time would be under 7¼ hours, instead of 10 hours. So far as the machinery of a railway is concerned—by which we mean the road, the rolling stock, and the signals—there is nothing to prevent an average speed of 60 miles an hour being maintained. That it is not attained is certain. It is worth while to inquire why.

The first essential to great average speed is that the runs shall be long; that is to say, there must be long intervals between stopping places; and this is necessary, not so much because of the time lost in a station, as that spent in getting into and out of it. The station must be approached and left at a comparatively slow speed if for no other reason, then because it would be dangerous to do otherwise. The next essential is that the train shall be light, because the engine ought to be able to maintain a high speed when running up hill as well as when on a level. High speed trains cannot fully avail themselves of the compensating effects of inclines. Let us suppose that the maximum speed attained must not exceed 70 miles an hour. Then if the up and down inclines balance each other, the speed of the train must never fall below 50 miles an hour, or else the average velocity cannot be 60 miles an hour. If the maximum speed permitted was 60 miles an hour, and the average speed 40 miles an hour, then trains might ascend the banks at 20 miles an hour, and still keep time. It would not be advisable to run at a higher speed under any circumstances with ordinary rolling stock than 70 miles an hour, and there are no locomotives built which would never run at less speed than 50 miles an hour between London and Edinburgh with a greater load than about 55 tons; that is to say, 75 tons for engine and tender, and 55 tons for four passenger coaches and a brake van, or in all 130 tons. The maximum number of passengers carried would be about 200, so that the dead weight moved would be about 13 cwt. per passenger. The first-class fare now is 57s. 6d. If we call it £3 we should have £600 as the total returns, or, say, 30s. per mile run. It is not at all impossible that such a train might be made to pay. No doubt there would be now and then a strong temptation to add another carriage, but to give way would be to ruin the whole scheme. Its success would depend entirely on keeping the load to be hauled so small that engines might be worked at a speed never under 50 miles an hour. Three engines would be employed on the run, each making a distance of about 135 miles; and we cannot see that any great difficulty would be encountered in doing this. It must not be forgotten, however, that although the load would be small, the excessive speed would make large demands on fuel and water. It would not be safe to reckon on a less consumption of coal than 40 lb. a mile, so that the tender would have to carry about 3 tons; and allowing that each pound of coal evaporated 10 lb. of water, including waste, the tank must hold 5400 gallons, or 24 tons of water. It would, however, be highly objectionable to attempt to carry such a load as this, and Ramsbottom's water troughs supply a way out of the difficulty, and a tender capacity of 2000 gallons would be ample. On a grate of 20 square feet the consumption would be at the rate of 120 lb. an hour, which is much too fast for comfortable or regular working, and a special design of engine would be absolutely indispensable, one with a very long grate being required to provide the requisite surface. It will be seen that the engine which could comply with the required conditions has yet to be designed. The fastest train in the kingdom is, as we have said, the Flying Dutchman, and this is 7ft. gauge. Many persons think that the utility of the wide gauge in this case is that it prevents risk of oversetting. This is an entire mistake. There is no speed, perhaps, at which a train can run which would entail the least risk of such an accident on a good road of 4ft. 8½in. wide. The speed advantage conferred by the 7ft. gauge is that it permits an enormous boiler—and particularly an enormous grate—to be used. The Great Britain, for example, has nearly double the heating surface of powerful express engines on other lines, and there would be no difficulty in increasing its grate grate surface up to 35 square feet, if necessary. A photo-lithograph of the Great Britain will be found in our impression for June 16th, 1882. Engines of this class have 1953 square feet of heating surface and 21 square feet of grate. The Flying Dutchman consists of engine and tender weighing 65 tons 18 cwt., one eight-wheeled van 16 tons, and five eight-wheeled coaches weighing 88 tons; total, 169 tons 18 cwt.

The principal reason why high speed trains are not run is that it is difficult to provide locomotives of sufficient steaming power. It is evident that if an engine could be produced which could do as much work with 20 lb. of coal per mile as the existing engine does with 40 lb., an enormous advantage would be gained; but it is not at all probable that any great saving can ever be effected in the consumption of coal. Mr. Webb's compound engine may do something, but the existing locomotive is "bad to beat" in this respect. The designing of a locomotive to make long runs at 60 miles an hour average speed presents, however, an interesting problem, which will, perhaps, be attacked some day. We have pointed out briefly a few of the more important conditions to be kept in mind. Locomotives are so absolutely interwoven in the dimensions of parts, if we may use the words, that to augment the area of a grate by one-half will suffice to almost revolutionise the proportions of an engine. That a good engine of this kind could be made we have, however, no doubt. It remains to be seen whether England or America will have one first. Every year the number of miles travelled by each member of the population increases, and this growth of travel will no doubt rapidly encourage the running of long distance express trains, by which alone can high mean speeds be attained or made to pay.

STANDARD GAUGES FOR SMALL SCREWS.

The Society of Arts Committee appointed for the purpose of determining a gauge for the manufacture of the various small screws used in telegraphic and electrical apparatus, clockwork, and analogous purposes, has separated with practically no result. In the report of the Committee, which has just been published, the importance of a uniform gauge for these screws is strongly presented, and the system proposed by the committee appointed in 1876 by the Société des Arts de Genève is highly spoken of, but for reasons not stated at length, the Society of Arts Committee is unable to recommend this system, partly, it appears, because it is based on the metric system of measures. The Swiss Committee took 1 millimetre pitch as the basis of the system. It was agreed that such a pitch was best adapted to a screw having a diameter of 6 millimetres. The form of thread adopted was triangular, the angle made by producing the two sides being approximately 47½ deg.; the depth being $\frac{3}{5}$ of the pitch, the top being rounded off by a radius $\frac{1}{6}$, and the bottom by a radius $\frac{1}{5}$ of the pitch. The method by which the relation between pitch and diameter is arrived at will be gathered from the following explanation :—Let D represent the diameter and P the pitch. Then, generally, $D = f(P)$. Evidently there can be no constant term, for when D = 0, P must also = 0. Moreover, D practically cannot be a simple multiple of P, for experience has shown that small screws must have a less number of threads per diameter than large screws. Hence the formula will be of the form $D = m P^k$, where m and k are constants to be determined. Since 1^k is 1 whatever be the value of k, if follows that the coefficient m represents the value of D when P is 1. The Swiss Committee agreed that the unit pitch—1 millimetre—should be adopted for the screw having a diameter of 6 millimetres; in other words, they make $m = 6$. The value of k must be ascertained by trial. $k = 1$ would give a constant ratio, which we know is inadmissible. $k = 2$ will be found on trial to give a far too rapid decrease in the ratio of diameter to pitch. The several simple fractions between these limiting values were tried in succession, and the results obtained when using $\frac{8}{5}$ were found to give results that best accord with practice and experience. Substituting the values thus arrived at, the formula becomes $D = 6P^{\frac{8}{5}}$. The Swiss system is thus very complete, but, as we have said, there are reasons which have prevented the Committee from recommending its adoption in its entirety. They have, instead, the report says : "Decided on recommending the adoption of the Whitworth form of thread, not only because it is so well known, but because experience has proved it excellent and unsurpassed when employed for engineers' bolts. The Committee, however, are not unanimous on all questions involved by this proposal, and as there are several points that require to be thoroughly sifted and tested, they ask to be reconstituted and to be allowed a small grant to put their proposal to the test of practice, and to have a few gauges constructed for distribution or examination." That the members of this Committee have been unable to arrive at an agreement on this subject seems to suggest a process of elimination of names as the best mode of reconstruction. To arrive at the new Committee, a list of the names constituting that just dissolved with two new names might be given to each of its members for voting the new Committee, each member being expected to strike out four names, exclusive of his own, leaving him free to remove that if he chose to do so. The Committee just dissolved consisted of Sir J. Whitworth, Dr. Siemens, 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. Latimer Clark, Mr. Buckney, and Mr. H. Trueman Wood, secretary.

THE INSTITUTION OF CIVIL ENGINEERS.

The annual general meeting of the Institution of Civil Engineers took place on Tuesday, and an unusually large number of corporate members assembled to take part in voting for the new president, vice-presidents, and council. Mr. James Brunlees was elected president, Mr. G. B. Bruce took the place of Mr. Brunlees in the list of vice-presidents, the new name in the new council list for the ensuing year being that of Mr. J. Wolfe Barry. The report of the council for the past year showed that the Institution now numbered 3385 members, irrespective of 707 students attached to, but not forming part of the corporation. The publications were referred to in some detail, as constituting the most important part of the work of the Institution. To this almost every member of the Institution will agree, and although two or three speakers at the meeting made some remarks unfavourable to the abstracts of foreign proceedings published with each of the four volumes of "Proceedings," which, under Mr. Forrest, are issued every year, but very little notice was taken of these remarks. There can be no doubt of the value of these abstracts, and to quibble upon their being published with or separate from the "Proceedings" is absurd. The report showed that there had been twenty-five ordinary meetings, and twelve supplemental meetings exclusively for students, and of the papers read at the latter two had been found worthy of being printed in the "Minutes of Proceedings." It was thought that the great increase in the number of members and in the routine business would before long necessitate larger accommodation. At several of the meetings this year the theatre and rooms had been much crowded, and this will no doubt continue, for the present policy of the Institution must result in a very large increase in the number of its members, especially amongst those who are devoted to mechanical engineering, and not a few who are manufacturing engineers. In the library the books had been compared with the catalogue and counted, and had been found to number 18,302 volumes, of which 345 were volumes of tracts. Several valuable additions had been received from foreign Governments, mostly reports on public works, not to be bought in the ordinary way. The financial condition of the Institution was in all respects satisfactory. The income proper for the year had amounted to £12,898, whilst the capital and trust fund receipts were £3527 and £431 respectively. The general expenditure had reached £12,788, of which £1500 was on account of the decoration of the premises, and £5806, the cost of producing the four volumes of "Minutes of Proceedings;" £3380 had been invested on Institution account. After the reading of the report, the medals and premiums awarded during 1882 were presented, and votes of thanks were passed to the president, the council, and the secretaries. The proceedings terminated with the declaration of the scrutineers that the above changes had been made in the governing body of the Institution.

THE MANUFACTURED IRON TRADE.

The position of the manufactured iron trade in the North of England at the present time is rather abnormal. When, two months ago, Mr. Waterhouse reported to the Board of Arbitration the amount of the orders for manufactured iron on the books of the associated makers, the quantity was 261,796 tons, or more than five months' work at the recent rate of production. The selling price of the iron averaged £6 7s. 7½d., and though this was less than had been anticipated at the beginning of the year, and was slightly lower than that actually received in the third quarter of the year, it was above that of preceding periods. When so large a quantity of the production of the rolling mills of the North is known to be contracted far ahead, it is at the least surprising to find that there are complaints as to difficulty in securing orders to keep some of the plate and other mills at work, and to hear that there is a possibility of the stoppage of some of those inland, which feel most strongly the depression, because they are burdened with the cost of the carriage of the raw material from the furnaces and with that of the finished iron to the ports where the great bulk is used by the shipbuilders. Some of the larger places near to the seaports have abundant work; but even in these cases, where orders have been booked at rates much above those new prevailing, there is a great difficulty in getting specifications for those orders, and the result of the depression is that those who wish for plates that are not contracted for hold back from making fresh contracts in the hope that there will be a reduction of prices. If the rates that are now current could be obtained, it would appear that there is a fair profit in present prices, because pig iron is lower than it was at the beginning of the year, and the recent reduction of 5 per cent. in the wages of the ironworkers benefits the manufacturers appreciably if not very largely; and as the shipbuilding trade is brisk, and has a probability of continued briskness over the whole of the next twelve months, it may be expected that there will be full work for the ironworkers for that time, although the question of prices is one that cannot be quite so fully looked upon with satisfaction. Where the plate mills are well situated there is abundance of work, and prices may be said to be remunerative; but where they are away from the smelting plant and from the sources of consumption, it may be that the low prices will injuriously affect them, and possibly, by closing one or two, cause commercial restriction of the output.

THE NEW METHOD OF MAKING ALUMINIUM.

In our last impression we referred to a new method of preparing aluminium, devised by Mr. Webster. We may supplement the information we then gave by saying that the raw material at present used for the production of the metal on a large scale is the mineral bauxite $(Al\ Fe)_2\ O_5\ H_4$, which contains about 50 per cent. of alumina and 25 per cent. of iron oxide, together with silica and other impurities. This is pulverised and heated with soda in a reverberatory furnace, when sodium aluminate is formed, and this is dissolved out of the cool mass of water. The clear solution is decomposed by passing a current of carbon dioxide through it, then sodium carbonate is formed, and a precipitate of alumina thrown down. This is collected on linen filters and well washed, an operation occupying much time. After drying it forms a white powder, which is then mixed with common salt and coal-dust and the mixture formed into balls, which are then rapidly dried. These are placed in an upright retort built of fire-clay slabs, and the temperature is slowly raised until a white heat is reached, and then dry chlorine led in at the lower part of the retort. The double chloride of aluminium and sodium volatilises, and passes through a tube to the upper end of the retort. For the reduction, 100 kg. of the double chloride are mixed with 35 kg. of sodium and 40 kg. of cryolite which serves as a flux. After reduction the fused metal is cast into moulds. The cost of producing aluminium up to the present time has been 80f. a kg., and it is sold at about 100f., and "at present," wrote Roscoe and Schorlemmer in 1878, "there is no prospect of the cost of manufacture being much reduced." Still the aluminium industry has seriously affected many branches of manufacture as well as science. For example, the price of sodium, which in 1852 was 10s. an ounce, is now reduced to 5s. per pound. The changes the long-ripening invention to which we have referred may bring about, we await with interest.

LITERATURE.

The Dragon-fly, or Re-active Passive Locomotive: A Vacuum Theory of Aërial Navigation based on the Principle of the Fan Blower. London: Charles Whittingham and Co., Chiswick Press. 1882.

This is a curious book. It is a quarto of eighty-five pages, printed in old-fashioned type on thick hand-made paper, with red initial letters to the chapters. It is a prose poem, and this, we think, without the consent of the author, who appears to be unable to express himself on even such mundane things as fans, save in the language of fairy tales. Indeed, this might readily be mistaken for a fairy tale, and is of about as much practical utility. We do not know the author's name. He has devoted years of his life, he tells us, to the study of the flight of birds and insects, and has arrived at the conclusion that man can never fly, but that he may be able to rise in the air and transport himself from place to place without the aid of a balloon. This is apparently a distinction without a difference. Our author does not think so. It is very difficult to arrive at his precise meaning; but, as we understand him, he holds that insects, and especially the dragon-fly, by the use of their wings establish round them a sphere which is more or less nearly a vacuum; just as we have less dense air in the centre of a fan than near the tips of the blades; and that the sphere then floats in the surrounding air as a cork does in the water. He does not attempt any proof of the accuracy of this view; and we suppose that he is very ignorant of mechanics. He suggests, for example, that ships should be fitted at their sides with screws with vertical shafts, by the aid of which they would be kept afloat in case they sprang leaks. Those who have leisure for reading, and six shillings to pay for this book, will find in it half-an-hour's amusing and extremely graceful writing. In fact, as we have said, the book is a prose poem, abounding in quaint conceits, and in certain places manifesting not a little sententious shrewdness. For example, nothing of its kind can be better than the statement, "The pest of an inventor's life is that his *facts* won't accommodate themselves to his theories." And again, "There is nothing so satisfactory or delightful to an inventor as *ideal* mechanical construction; all the parts are so perfect, move with such precision and with no friction; and then, too, everything comes out exactly in accordance with your theory." The story of his childish experience with india-rubber shoes, with which he thought he could bound 20ft. into the air, is delicious, and so is the account of his first attempt at flying, when, with two huge wings fastened to his shoulders, he was hurried down a steep hill, with his brother-in-law

holding him up on one side, and the man who had made the wings on the other. He did not solve the problem of flying then, nor has he been more successful since; but he has written a very pretty book, and we thank him for the enjoyment he has given to us at all events.

MR. W. T. HENLEY.

THE history of a modern application of science is found to be an almost impossible task, and yet if there is one thing in which history should be accurate it is in the applications of science in the nineteenth century. The steam engine is practically of the century—at any rate, the locomotive is certainly, whilst telegraphy is still younger; and that branch of telegraphy which relates to submarine work is still in its infancy. Yet even here those entering this life have little fellowship with those leaving it; and thus the pioneers in these gigantic enterprises are not always credited with the admiration they deserve. Mr. W. T. Henley, who died on December 13th, at the age of sixty-nine, and whose funeral took place last Monday at Kensal-green, was closely connected with the birth of land and the birth of submarine telegraphy. The late Mr. Henley was born at Midhurst, in Sussex, and at the age of sixteen, not liking the leather trade, he came to seek his fortune in London. Hard work, first as a light porter at a silk mercer's in Cheapside, then at the docks, did not deaden his ambition, and having an inherent tendency towards light mechanical work, he strove early and late to make himself an excellent workman. He became acquainted with the late Professor Wheatstone, who employed him to construct apparatus, and when the company was formed to introduce the telegraph he constructed a large amount of the apparatus required, but through a lawsuit about a partially executed order, he lost this connection. In 1852 a company was formed to work the magnetic needle telegraph, as invented and patented by Mr. Henley in conjunction with Mr. Forster. Mr.—now Sir Charles—Bright was the engineer to this company. Mr. Henley manufactured instruments for the company. It was in 1851 that the first success of submarine telegraphy was achieved, and then men's minds became gradually filled with the desire to conquer oceans and to connect nations by telegraphic wires. In 1857 Mr. Henley commenced the manufacture of cables, and although his operations have not equalled those of the Telegraph Construction and Maintenance Company, or the Silvertown Works, or Messrs. Siemens, still he made and laid a good many miles of cable. Short lengths of cable were manufactured for Ceylon, Australia, Spain, &c., and longer lengths for the Indian Government. In the height of this work he employed the three ships—the Africa, the La Plata, and the Cavalier. Besides the large works at Greenwich, Mr. Henley was interested in some profitable Welsh ironworks; but after a season of prosperity there came a time of depression, and Mr. Henley was ruined. He endeavoured to resuscitate the telegraph works in 1876, but there did not seem to be life in the concern. In 1880, however, the Henley's Works Company was formed, and Mr. Henley was a director to the time of his death. Of late the attention of the works has been given to ozokeritised core, an insulating material upon which very favourable reports have been given, and which promises well.

The early struggles of Mr. Henley enabled him to thoroughly understand his workmen, of whom, in the time of his greatest activity, he employed about 2000; he sympathised with them in their trials and difficulties, and they knew it, and were devoted to him. It should have been mentioned earlier in this brief notice that Mr. Henley put up machinery at the Greenwich Works to draw and to galvanise the wire he required. He constructed some of the earliest electric light machines, and, as the records of the Patent-office show, he had in the recent development of the industry devoted considerable attention to the subject and taken out a patent for a machine.

CONTRACTS OPEN.

IRONWORK OF BRIDGES, INDIAN STATE RAILWAYS—RANGOON AND SITTANG VALLEY RAILWAY.—METRE GAUGE.

TENDERS are invited for bridges with spans of 100ft. with footways, as illustrated by the engraving, page 468.

The work required under this specification comprises the construction, supply, and delivery in England, at one or more of the ports named in the conditions and tender, of the whole of the ironwork for nine triangulated girder spans of 100ft. in the clear, with footways outside; and all the rivets required to complete the erection of the bridges in India, and all holding-down bolts, with an addition of 50 per cent. to the net number of rivets, and of 10 per cent. to the net number of bolts required, for waste. With each span are to be supplied eighty bolts for sleepers and eighty bolts for curbs. 4 cwt. of service bolts and 4 cwt. of ordinary platers' washers, to be selected by the Inspector-General of Railway Stores, for use in the erection of the work in India, are also to be supplied with each span. The timber work and permanent way are not included in the contract.

Materials.—The wrought iron must be of such strength and quality as to be equal to the following tensional strains, and to indicate the following percentage of construction of the tested area at the point of fracture:—

	Tensional strains per square inch.	Percentage of contraction of fractured area
	Tons.	
Round and square bars, and flat bars under 6in. wide	24	20
Angle and T-bars, and flat bars, 6in. wide and upwards	22	15
Plates	21	10
Plates across grain	18	5

The iron intended to be used for the rivets must, whilst cold, be capable of being bent double without showing signs of failure.

It is to be expressly understood that the greatest accuracy is to be observed in every part of the work, a main object of the design being to facilitate as much as possible the erection of the girders in India by perfection of workmanship in this country. All corresponding parts of all spans must be made exactly similar and interchangeable. All rivet holes to be filled in India, except those in and for the deck plating, and bottom plates of rail girders are to be drilled. All other rivet holes may be either drilled or punched, at the option of the contractor, but any plate or bar in which the holes are not accurately in place will be rejected. The holes through which any one rivet passes must correspond in any number of plates or bars. The main girders are to be built with a camber of 2in. in the arc of a circle, the upper members being proportionately longer than the lower. The joints to be riveted in India must be chipped and filed so as to butt with perfect accuracy over the whole of the meeting surfaces to the true radius necessary for the specified camber. The bearing plates of all girders are to be perfectly level, and the rivets countersunk. Two bed-plates, each 6ft. long, are to be supplied with each span. All bolts are to be screwed to Whitworth's standard thread, and all nuts must fit too tightly to be turned by hand. The heads and nuts for the timber and service bolts are to be square, for the others they are to be hexagonal. The head and body of all bolts are to be forged out of one piece of rod or bar iron. All bolts are to be screwed for a length of three diameters. The cross girders are to be made to fit accurately between the main girders and upon the longitudinal angle irons of the booms. The struts and ties must be carefully gauged to fit between the gusset plates.

All the spans are to be temporarily erected complete, so that accuracy of fit and perfection of workmanship may be assured.

The whole of the ironwork, with the exception of the bolts and rivets, is to be scraped perfectly free from rust, scale, and dust, and then brushed all over with boiling hot linseed oil. It is afterwards to be painted with two coats of good oil paint, the first being of red lead, and the second of Roman ochre, or other colour to be specially approved by the Inspector-General. The bolts are to be heated to the temperature of melted lead, and then dipped into boiled linseed oil. Every portion of every span is to be very distinctly stencilled with paint and marked with the punch, for guidance in erection in India, and every piece or bundle of iron and all packing cases are to be similarly marked or branded, with such shipping marks as the Inspector-General may require. All parts of the work are to be stamped with the letters "I.S.R." A neat casting, bearing the name of the manufacturer, with place and date of manufacture, is to be bolted conspicuously on every main girder. The upper and lower booms of the main girders are to be sent away each in five lengths. Each length is to be riveted up complete, with the exception of the covers and gusset plates at the joints, and is to be protected from injury by the insertion of blocks of timber not less than 6in. thick, bolted between the sides and between the gusset plates in a manner and to an extent satisfactory to the Inspector-General. The angle iron covers for the joints of the booms are to be temporarily rivetted inside the troughs, as near as practicable to their several places, but in such a position as not to project beyond the ends. The cross girders and the struts and ties are to be rivetted up complete. The rail, curb, and footway girders are to be divided as shown on the drawing, each length being rivetted up complete, except that each length of rail girder is to be in three parts, the bottom plates being sent separately. The angle irons for supporting the bottom plates are to be rivetted to the web plates. The ends of the struts and ties, and of the various sections of the rail, curb, and footway girders are to be efficiently protected by timber chocks or angle irons bolted or rivetted to them. All loose angle irons, bracing bars, floor plates, cover plates, hand rails, unattached gusset plates, &c., are to be sent out loose, or in convenient bundles temporarily rivetted or bolted together, or bound with rod iron, as may be directed by the Inspector-General. All small cover bars and packings, all standards and sockets for hand rails, all bolts, nuts, and washers, and all rivets required for erection in India, including the 50 per cent. extra, and generally such other small articles as may be selected by the Inspector-General, are to be packed in strong cases, each weighing, when full, not more than 7 cwt. The cases are to be made of 1¼in. deal boards, with elm ends, nailed with 3½in. wire nails, and strengthened by battens and hoop iron, the joints tongued and grooved, and the whole made secure for transit to India.

The contractor is to supply, without charge, seven sets of neatly executed hand-made tracings on cloth of one span with its accessories as constructed, drawn to the same scale as the contract plan. They must be fully dimensioned and contain all erection and shipping marks, notification as to the colour the bridge has been painted, the name of the manufacturer, and any alterations from the contract drawing which may have been made in carrying out the work. The tracings must not exceed 25in. in width, and must not be folded in any way, but must be rolled on a wooden roller. The first set must be submitted to the Inspector-General for approval before the rest are proceeded with. The contractor is also to supply twenty well executed unmounted photographs to a large scale of the first of the spans, taken from two points of view, as erected and rivetted up complete, showing the erection marks very clearly.

The supposed quantities in one span of 100ft. are as follows—Wrought iron:—

	Tons	cwt.	qr.	lb.	Tons	cwt.	qr.	lb.
Main Girders:—								
Web plates in top booms	2	17	3	0				
Flange plates in ditto	5	2	3	12				
Flange cover plates in ditto	0	18	0	21				
Gusset plates in ditto	1	16	0	27				
Diaphragm plates in ditto	0	2	1	17				
Diaphragm angle irons in ditto	0	5	1	16				
Angle irons in ditto	3	18	3	3				
Covers for angle irons in ditto	0	5	3	4				
Web plates in bottom booms	3	3	1	16				
Flange plates in ditto	4	18	2	18				
Flange cover-plates in ditto	1	4	0	7				
Gusset plates in ditto	2	7	3	27				
Angle iron in end gusssets in ditto	0	1	3	13				
Angle irons in ditto	4	7	3	6				
Covers for angle irons in ditto	0	6	1	25				
Angle irons in bracing	7	13	2	11				
Stiffening plates and bars in ditto	1	10	0	19				
					41	1	1	18
Cross Girders:—								
Plates	4	1	2	12				
Angle irons	11	14	1	19				
Packing pieces	0	4	3	18				
					16	0	3	21
Rail Girders:—								
Plates	2	19	1	20				
Cover plates	0	2	1	6				
Angle irons	3	16	0	8				
Covers for angle irons	0	3	2	26				
					7	1	2	4
Curb Girders:—								
Plates	1	6	2	27				
Cover plates	0	1	0	11				
Angle irons	1	2	0	7				
Covers for angle irons	0	0	3	22				
					2	10	3	11
Footway Girders, &c.:—								
Plates	1	6	2	27				
Cover plates	0	1	1	1				
Angle irons	2	1	1	24				
Covers for angle irons	0	1	2	13				
T-iron supports	0	4	2	18				
					3	15	2	27
Floor plates, &c.:—								
Corrugated-plates	11	0	0	6				
Angles irons at ends	0	3	3	9				
					11	3	3	15
Resting plates:—								
Plates	0	8	3	10				
Bars for ditto	0	0	3	19				
					0	9	3	1
					82	4	0	13
Spare rivets and rivet heads, say seven per cent.					5	15	0	15
					87	19	1	0
Holding-down bolts and washers					0	4	0	20
Sleeper and curb bolts (No. 80 of each)					0	3	0	24
Service bolts and washers					0	8	0	0
Handrails, &c.:—								
Handrails	1	13	3	13				
Standards	0	12	2	8				
Sockets for standards	0	1	1	25				
Clips for handrails	0	1	3	10				
					2	9	3	0
Total					91	4	1	16

Tenders are to be delivered at the Store Department in the India-office, Westminster, S.W., on Thursday, 28th inst., before Two p.m., after which hour no tender will be received. They are to be addressed to the Secretary of State for India in Council, with the words "Tender for Ironwork for 100ft. Spans" on the left-hand corner of the envelope, and are to be placed in a box provided for that purpose in the Store Department.

THE NORTHUMBERLAND WORKS, NEWCASTLE-ON-TYNE.

WE have stated that the North-Eastern Marine Engineering Company was putting up large works in Newcastle-on-Tyne. These works have now been completed, or nearly so, and the following account of them, for which we are indebted to the *Newcastle Chronicle*, will be read with interest:—

"The announcement of the intention of the North-Eastern Marine Engineering Company to erect works upon the Tyne was made in the 'Journal' of December 24th, 1880; and, under the direction of Mr. William Allan, the company's manager, the undertaking has now been brought to a successful issue. A large portion of the engines built by the company have been placed in ships built upon the Tyne, and it was necessary that the vessels should be towed from the Tyne to the Wear to be engined. Owing to the increased trade and the larger power of the engines now in demand, the Sunderland works of the company became too limited in extent, and the directors—among whom are some of the most influential and progressive commercial men of the North of England—decided to erect new works on the Tyne, from where they received so many orders, and thus do away with the necessity of towing vessels from this river to Sunderland to be engined, these works to be capable of turning out engines of any power. The Tyne establishment is called the 'Northumberland Engine Works.' A large plot of land extending from near Wallsend Church, on the Newcastle and Tynemouth-road, down to the Tyne, has been purchased by the company. The ground is of great extent, and allows not only ample space in connection with the present works, but also for extensions, and for the erection of dwelling-houses for the workmen employed. The Newcastle and Tynemouth Railway, and also the Riverside Railway, intersect the land and divides it into three portions. The principal portion of the ground lies between the Riverside Railway and the Tyne, and upon it the Northumberland Works have been erected. Between the two railways is another large plot of ground, upon which the company intend to erect additional works, the plans for which are prepared. On the north side of the Newcastle and Tynemouth Railway is the third plot of ground, and upon it a number of workmen's dwellings have been erected, there being still room for more houses. A road has been made from the Newcastle and Tynemouth turnpike across the two railways to the entrance to the works, and in the course of a short time it is expected that the new main road which has been formed between the two lines of railway will be extended eastward and so intersect the first-named road. The means of approach to the Northumberland Works will be therefore excellent. A large population will soon be gathered together near the works, and it will be a public convenience if a station is built at that part of the Riverside Railway. The planning of such a vast establishment as the Northumberland Works has, no doubt, been a matter of much thoughtful attention on the part of Mr. Allan, and anyone inspecting the works will at once perceive that the plan adopted is one which will tend to the efficient and economical carrying on of the concern. Every department is, practically speaking, directly under the eye of the manager whilst sitting in his office, from whence, by means of speaking tubes, he can communicate with the heads of the various departments. The main building, which is midway between the Riverside Railway and the Tyne, covers an area of about four acres in extent. It is about 400ft. in length, and is about the same distance in width, and except in a few parts, where low brick walls divide certain departments, the interior is open from end to end. All the light is obtained through the roof, which is composed of glass and iron, and in the entire works there are no less than two acres and a-quarter of glass. The interior is divided into six spans or bays, two of which are 60ft. wide, and four 50ft. in width, the bays being separated by iron columns, strengthened by means of latticed girders. The columns support the roof, and the height of the girders above the floor is 47ft. 6in. The weight of the iron used for pillars, girders, &c., is 3500 tons. There is only one entrance to the works, and that is on the north side. A large gateway gives direct admission to the machine shops, and at either side of the entrance is a staircase leading to the gallery, on one side of which are the commercial office and the secretary's private office, and on the opposite side is the chief drawing office, each being fitted with every requisite needed by the *employés*. In the centre of the large drawing office are placed several drawers, in which plans are deposited, and instead of the drawers having tops made of wood, they are covered with slabs of slate; and gentlemen, when giving instructions for work, will be able to sketch upon the slabs plans illustrating their ideas. On the side of the gallery adjoining the workshops are the offices for the directors, the head manager, the works manager, and the head draughtsman; and all these rooms are lighted by windows facing into the workshops, and by means of these windows the directors and managers can obtain a view over almost the whole interior of the extensive factory. Enclosed in a glass case, placed upon the gallery, is an improved clock gear, the work of Mr. J. G. Allison, Sunderland, and by means of it the time is indicated at six different places in the works. Notwithstanding the great distances between the dials and the clockworks, the variation has been found not to exceed one second a month. On the fourth side of the gallery are placed the lavatories, &c. The entrance to the workshops is by a wide passage under the managers' offices, and at each side are large store-rooms. In the general store-room every conceivable arrangement has been made to secure ready access to the innumerable articles required in a factory, and upon all the drawers and cupboards is painted a description of the contents. The drawers are locked by means of Hobbs's patent locks; and in order to avoid any delay and trouble in finding the key of any drawer, the drawers and keys are each numbered and lettered from A to L. All the keys of each letter are fastened upon one ring; and all are hung up, under their respective letters, in the storekeeper's office, and the manager has a 'master key' which unlocks all the drawers. Among the articles kept in the store room are Whitworth's rules; and in order to insure accuracy in measurements no workman is allowed to use his own rule, but must take the gauges by Whitworth's rule. The general store-room opens into a long narrow office, and along the full length of this office are windows opening into the factory; and from these windows the stores are delivered to the workmen on the production of orders from the foreman. In this office there are large 'pigeon-holes,' one for the drawing of each portion of a marine engine; and the name of any workman who takes away a drawing is written down, and the return of the drawing is recorded; and by this means every drawing can be easily traced. On a line with the storekeeper's office is the office of the time-keeper; and when this point is passed, the main building is entered. The foundry department occupies the south-western corner of the building, and is 210ft. long by 100ft. wide; and at one side are three cupolas, and also three stoves for drying the moulds. Attached to this department is a loam house, in which is placed a pug mill, driven by an independent engine. Overhead, in the foundry department, are four cranes, capable of lifting from five to forty tons, and all are worked by means of square shafting. Contiguous to the foundry is the foundrysmiths' shop. At the north end of the foundry is the coppersmiths' department, where are made pipes and taps of all descriptions; and adjoining is the brass foundry—a department which is now in full work. Attached to the brass foundry is a loam house and pug-mill. Opening out of the brass foundry is the brass finishing department, and adjoining is the pattern-making shop. The departments above described occupy the two western bays—each 50ft. wide—of the main building; and east of them is the large machine shop occupying a bay 60ft. wide and 200ft. long. Along one side of this shop are placed lathes, and at the other side are a number of planing machines of various sizes,

each driven by an independent steam engine. Some of the planing machines weigh one hundred tons, and one of them—which will plane a width 26ft. by 19ft. high—is the largest machine of its kind in Great Britain. The first bed-plate cast at the new foundry is for engines of 750-horse power, to be placed in a ship built by Messrs. Leslie, and the plate was last week placed upon one of the planing machines. In the centre of the machine shop are machines for boring cylinders, and the largest machine is capable of boring a cylinder of 130in. diameter by 7ft. stroke. Overhead are two travelling cranes, one to lift up to 20 tons, and the other to 40 tons. In the centre of the floor of the department is a surface-table, 18ft. square, upon which all bed-plates and cylinders are marked off. All castings from the foundry are brought upon a line of rails into the machine department, and between the two departments is a weighing machine capable of weighing up to 40 tons, and upon it all castings are weighed previous to being planed. To the south of the machine department is the shafting department, which is 60ft. in width, and upwards of 100ft. long, and here are erected the lathes and machinery requisite to finish crank shafts and propeller shafting. The adjoining bay of 60ft. width and 360ft. in length is used as the erecting shop, and overhead are four travelling cranes—two capable of lifting 60 tons, one 30 tons, and one 10 tons. Eastward of the erecting shop are two bays, each 50ft. in width. One of these bays is used as the small or light machine shop, and is fitted with all the plant necessary for the manufacture of the different parts of marine engines. The plant includes shaping machines for 8in. to 24in. stroke; screwing machines capable of screwing from ¼in. to 4in., and lathes of all descriptions; and the motive power is supplied by two compound engines. A gallery which surrounds this shop is fitted with benches and vices. Eastward of the small machine shop is the blacksmiths' shop, on each side of which is a set of smiths' fires, and the flues from each fire open into two central chimneys. In this shop are two large steam hammers, and several machines for making nuts and bolts. Opening out of the south side of the blacksmiths' shop is a store-room, in which are stored bar iron, rivets, bolts, &c. On the south side of this store-room is the boiler department, which occupies a space 200ft. long by 100ft. in width. In this department there is a boiler-drilling machine, for boilers up to 18ft. diameter; and it has four 'heads,' so that four drills can be worked simultaneously. There are also a large set of rollers for shaping boiler plates, a large plate-planing machine, three tube plate-drilling machines, and also a large flanging machine, worked by hydraulic power. There is also an hydraulic rivetting machine, by means of which rivets can be subjected to a pressure of 70 tons to the square inch. The boilers, when completed, are, by means of a railway, taken out of the boiler shops direct to the ships, which will be moored in the river opposite the southern gateway. Near to the boiler department, but in a detached building, is the forge, in which is a 50 cwt. steam hammer, with a 4ft. 6in. stroke. In connection with the railway on the quay at the south end of the factory is a machine capable of weighing up to 80 tons—one of the largest weighing machines made by the well-known firm of Pooley and Co. A jetty has been constructed at the side, and by means of dredging, capital berths for mooring vessels have been made. At the jetty there is a pair of shear-legs, 110ft. in height, strong enough to lift 100 tons; and the gearing is arranged so that heavy or light weights can be lifted without the necessity of the chains on the barrels being shifted. A boiler and a pair of horizontal engines are placed in a building alongside the river, and are used to provide the lifting power for the shear-legs. Outside of the main building are erected workshops for the workmen engaged in fitting up steamers, stables, and other requisite buildings. A large detached building is set apart for the storage of patterns which have been manipulated in the foundry; and, by this arrangement, the danger of the patterns being destroyed in case of fire is lessened. Two boiler-houses have been erected, one at the north-west corner, and the other at the north-east corner of the main buildings; and in each are placed two Lancashire boilers from the works of Messrs. Adamson, of Manchester. Adjoining each boiler-house is a pumping engine and condensing engine. By means of a siding to the Riverside Railway, the works are placed in communication with the North-Eastern Railway. Lines of railway are laid alongside of the boiler-houses and loam-houses, so that coals are dropped from wagons direct into store-holes opposite the boilers, and loam is also delivered direct from the wagons. Inside the factory lines of railway are laid in various directions, and by means of these lines and the travelling overhead cranes heavy weights can with ease be moved from department to department, until finally taken out of the works and placed on board steamers by means of shear legs. It is impossible to conceive a better arranged establishment than the Northumberland works. Everything has been done that can be suggested to lighten manual labour, and to secure economical and, at the same time, efficient workmanship. There is but little danger of the premises being injured by fire; but in order to be prepared for such a disaster, apparatus for the extinguishing of fire is kept in the entrance passage ready for use. There is, apart from the offices, only one department in the main building in which there is any material to burn, and that is the pattern shop; but that shop is surrounded by a brick wall, so that a fire could not spread beyond it. Every attention has been paid to the sanitary arrangements, and to insure the comfort of the workmen at meal times, two large smoke rooms have been provided for their accommodation. Work has been commenced in some departments, and when in full operation there will be about 1200 men employed. As already stated, two streets of houses have been erected by the company, and these houses are now occupied by about 400 persons. On the side of the hill facing Rosehill ten semi-detached villas have been built for the occupation of the foremen.

"The works have been designed by Mr. William Allan, the general manager, and the execution of the works was entrusted to the following:—Mr. Robert Allison, Whitburn, has built the works and dwellings; Messrs. Richardson, Dean-street, Newcastle, were the contractors for the glazing and painting; Mr. Redshaw, Newcastle, plumbing; Messrs. Angus, the belting; Messrs. Sopwith, Newcastle, the office furniture. The iron columns and great girders have been supplied by the Stockton Forge Company, the crane girders by the Tees-side Engine Company, and the shafting and hangers by the Grange Iron Company, near Durham. The whole of the machinery has been supplied by Messrs. Butterfield, Keighley; Messrs. Harvey, Glasgow; and Messrs. Smith, Glasgow; and the five pairs of compound surface condensing engines for working the shafting, cranes, and those for the steam shears have been made by Messrs. Cowan and Sheldon, Carlisle."

THE CLEVELAND INSTITUTION OF ENGINEERS.

THE PRESIDENT'S ADDRESS.

Mr. E. F. Jones, the new president, delivered the following inaugural address at the last meeting of this Institution:—It is not my intention to trouble you with a long address. I propose to review the development of the Cleveland iron trade from 1853 and 1854, but I shall bring the past before you in a general way, and from a mechanical point of view. In 1853 there were only two rolling mill firms in the district—Messrs. Bolckow and Vaughan, and Messrs. Snowdon and Hopkins—and their mills were small and few in number. They were very much the same as those existing in other parts of the country, except that they were driven by direct-acting engines, instead of the old beam long connecting rod, with numerous cog-wheels to the various mills. The mills generally in the district remained in very much the same state for several years. About 1859 Messrs. Fox, Head, and Co. and a few others increased their mills both in strength and size, and introduced the reversing gear and blooming. As the demand for rails improved, and the district was gradually increasing in importance, the Britannia Mill was built, expressly, I believe, for turning out rails. It turned out that particular kind of work until about 1870, when the iron rail trade began to decline, and steel got more into public favour. The Britannia Mill was one of great power, and turned out some rails fully 128ft. to 138ft. in length, which at that time was thought a very great achievement. As the iron rail trade was dying out, the mills, of course, got into a period of rest, but soon after a great leap was made, culminating in that most powerful compound direct-reversing engine at Eston, which produces, I am told, not iron, but steel rails exceeding 150ft. in length. That, gentlemen, was the work of your late president, Mr. E. Windsor Richards. The only appliance in 1854 in this district for producing wrought iron was the puddling furnace, and from that period until 1871 it remained in very much the same state; but, as the number increased, and there being a great demand for puddlers at that time, labour troubles arose. Complaints of the quality of the iron were numerous from all parts of this and other countries, and all these circumstances combined caused a desire and eagerness on the part of the employers generally to take up anything that would help them out of their difficulties. Consequently, anything in the way of puddling machines was then introduced and tried, in order to improve the quality of the iron, and ensure constant work and attendance at the furnaces. About this period Mr. Danks brought out his revolving puddling furnace, which was eagerly taken up by some new and also by some of the older companies; but in consequence of its weak and undeveloped state, the wear and tear was very severe, the expense great, so that in a few years it naturally died out, leaving, I regret to say, a sorry trail behind. We still have the puddling furnace with us, apparently very lively, but I warn those gentlemen present who, like myself, are interested in it, to be prepared for its ultimate departure, however sorry we may be to part with old associations. In 1862 I visited the district of Falun, in Sweden, and whilst there went to see a Bessemer works, and how their operations were carried on. There I saw the metal taken direct from the blast furnace to the converter. At a meeting of the Iron and Steel Institute at Barrow-in-Furness, many years afterwards, the question arose as to whether they could take the iron direct from the furnace to the converter. Some thought not, and considered it necessary that the iron should be carefully selected previous to being melted in the cupola. But we see to-day that the hearth of the blast furnace is not only the source of its own heat and power required for its own production, but that the liquid metal, as recently witnessed, carries within itself to the converter all the necessary fuel for that and subsequent processes. The steel, you know, is poured into the moulds; from thence at once to the soaking pits—a recent discovery of one of your late presidents, Mr. Gjers—where the liquid heat percolates through the skin of the ingot, forming one homogeneous glow, without the thick ferro-oxide formed by exposure in the ordinary furnace, from the pits to the blooming rolls, and from thence to the splendid finished rail, and that without a particle of fuel. A late president of the Iron and Steel Institute—Mr. E. Williams—remarked on the occasion I have just referred to that we were on the eve of great and important changes, and that in the immediate future we should see steel rails made with one-tenth of the fuel and one-fourth of the labour that were necessary for the old and greatly complained of iron rail. I will now carry you back to the state of our river in the past. This month six-and-twenty years ago I was standing on a sand-bank which at high tide was covered with water. On that particular occasion the tide was very low, and the river appeared in the distance like a narrow streak of light. I asked some fishermen who were near how much water there was over the bar, and I was told that if I did not care for the wetting I might walk across. About a mile from that spot there was a lias shale rock, where the water was almost as shallow as on the bar itself. At that time the only vessels that came in and out of the river were chiefly Norwegian timber ships, and an occasional Welsh schooner with slates, and the chartered stipulation of loading was about 30 tons per day. Years after that the breakwater was commenced, and the Fifth Buoy Scarp was cleared away, as many of you are aware, through the enterprise of Colonel Beaumont. To the Tees Commissioners a great deal of credit is due, and likewise to one of our vice-presidents, Mr. John Fowler, their engineer, for what they have done in this direction, and for the remarkable improvement they have made in the navigation of the river. To-day we see fine ships and steam vessels, some of them built on the banks of the Tees itself, of immense tonnage, and showing remarkable improvements both in marine engineering and in naval architecture. The progress made in this latter direction will be more vividly brought before those who visited the recent North-Eastern Exhibition at Tynemouth than by any idea I can give. We have now ships entering the river from 2000 to 3000 tons burthen, and more than ten times the size and capacity they were at the time I have referred to; and 1000 tons pig iron can now be shipped at our wharfs, and if the vessels are not loaded in twenty-four hours the owners complain, and think us slow. Last month 100,000 tons of pig iron alone were shipped from this river, which was more than five times the make of the whole of Cleveland twenty-six years ago. I am now coming to a subject that perhaps will interest you more. It will be necessary for me to refer to other furnaces in order to lead up to what they now are in this district. Some years before the civil war in America broke out I visited the Swedish Manufacturing Iron Company's Works in South Carolina, where they had four furnaces, two of which were at work. They were built very much on the Swedish model, 7ft. to 9ft. bosh, and 36ft. high, 2ft. hearth, with two dry tuyeres fixed opposite to each other. The tuyeres were large, allowing an inch space around the 1½in. to 2in. nozzles, which were connected to the blast pipes by a leather bag in order to facilitate the drawing out the nozzles when necessary. The blowing cylinders and pistons were well made of hard wood, driven by a crank shaft direct from the water wheel; pressure of blast varying—mean pressure about 1¼ lb. This was an improvement upon the method of blowing then in use in other places by bellows made of wood, the two halves of unequal diameter, worked by water-power. The ores, containing 50 per cent., were magnetic and hematite mixed, carefully selected, and evenly spread over the furnace top. The fuel was charcoal, taking about 3 tons to the ton of iron produced, or more than four times the quantity recently heard of in Styria. The iron made was grey, 25 tons per week being considered good work. An intelligent keeper—all being negroes—would through the space assist the cold blast impinging on the hot scoria to form a scoria pipe, extending beyond and above the tuyere thereby forming a minute heating apparatus. The smelting, under such conditions, was most favourable; the velocity of combination of blast with fuel increased, the temperature higher, and the globules of iron falling into the hearth outside the decarbonising influence of free air and carbonic acid. The escaping gases had a warm tint; the iron produced was grey and good, and taken from the furnace direct to hollow-ware moulds; but if from any cause the scoria pipe broke away, the blast became diffused, combustion was retarded, the globules of iron decarbonised, and white iron was the result. Escaping gases appeared harsh, white, and apparently cold, all other conditions being the same. It would have been interesting to have known the composition of those gases, but in those days they were all called sulphur. I may mention that while there I met with a young, fair-haired Swede, who persisted in believing I was a countryman of his, and in consequence we got on well together. In 1829 Mr. John Beaumont Neilson introduced the use of heated air at the Clyde Ironworks, near Glasgow. The change was marvellous, and the economy of fuel immense. Iron blast pipes to nozzles and water tuyeres became absolutely necessary; the temperature increased in close proximity to the tuyeres; the rapidity of air and coal combination heightened; and double the quantity of material was smelted in the same time with the same quantity of fuel as compared with cold blast experience. Complaints arose as to the quality of the iron, particularly No. 1, with increase of free carbon and more fixed silicon, showing "facets in fracture the size of a shilling." "The pigs could not be sent any distance without breaking into several pieces." The complaints did not apply so forcibly to Nos. 3 and 4 forge, showing that the furnaces were not charged with ironstone fully up to their reducing power. The discovery spread not only in Scotland, but in England, and with the adoption complaints multiplied. In 1842 a fierce controversy took place in the *Mining Journal* on the merits of hot blast iron—"That if used the public safety would be endangered." The contention became personal; intimate friends became distant enemies; if they had understood their subject better they might have spared their animosity. We now come to the Cleveland blast furnaces of 1854. The dozen odd furnaces then existing were short, and slender in build, and were from 3800 to 5200 cubic feet in capacity, being from 3000 to 4000 cubic feet less than furnaces then at work in Glamorganshire. In 1854 Messrs. Cochrane and Co. built their furnaces, which were 6000 cubic feet in capacity. For some years afterwards, as the works increased in size, some furnaces increased in capacity, others remained stationary, and some even receded, it being the opinion of their owners that no good iron could be made out of a large furnace. This went on until 1862, when Messrs. Whitwell and Co., at the Thornaby Works, built their furnaces with 20ft. bosh and 60ft. high, and the late Mr. John Vaughan increased the furnaces at Witton Park to 63ft. in height, both being 11,500 cubic feet capacity. We will return to this by and bye. The late Mr. Jas. Morrison in 1856 told me that he was the first who introduced from France the utilisation of the gases of the furnace, and he said he sold his right to the proprietors of the British Ironworks, in Monmouthshire, for £500, and he thought he had got by far the best part of the bargain. In Middlesbrough, at that time, the late Mr. John Vaughan was the only proprietor utilising the gases of the furnaces. One furnace at Middlesbrough and another at Eston were then working with bells and cones 4ft. 6in. in. diameter, but, like others in Staffordshire, Wales, and Scotland, their results were very unsatisfactory; in fact, so much so, that in Scotland and Staffordshire they had been again and again abandoned, and were only kept on where white iron was of little consequence to them. In 1860, at the Mechanical Engineers' meeting at Birmingham, a paper was read by Mr. Lloyd upon the utilisation of gases and the reason why furnaces were working so unsatisfactorily. He attributed the production of white iron to the pressure of gas acting upon the furnace. Mr. Cochrane attributed it to the want of height and the want of material for absorbing the heat from the ascending gases. Mr. Cowper referred to the Eston experiment. Mr. Lloyd, in order to avoid this, introduced a central tube into the furnace, while Mr. C. Cochrane applied a stopper and cone. Still they were unsatisfactory. There is no doubt, however, that Mr. Lloyd escaped the nuisance of white iron. At the same time there were satisfactory results from Vaughan's furnaces. He had changed his bells from 4ft. 6in. to 6ft., and again to 8ft. Before Mr. Charles Cochrane settled this great question in 1864, he attached to his stopper a kind of parachute as a temporary experiment; the iron changed immediately from white to grey. He thus settled the question of the whole cause of their troubles; the charging was too near the centre of the furnace. As soon as that experiment was carried out by Mr. Charles Cochrane all other schemes for taking off the gases were abandoned. The difficulty was solved. Whether Mr. Cochrane knew of the Eston results I know not. With the Cleveland materials and mode of filling the furnaces the small fell into the centre of the furnace, forming a dense column, which the ascending gases could not penetrate, deoxidation of ironstone being prevented, and the results being furnace scouring, black slag, and white iron. After 1854 taking off the gases became general. Mr. James Morrison changed his opinion, and utilised the gases at Ferryhill after working open-topped for six years. Coming back to the Cleveland furnaces, between 1854 and 1858 the average heat of blast was slowly increasing. In 1859—that is, three years before Messrs. Whitewell and Vaughan increased their furnaces—the late Mr. Archbold Slate sent me the tracing of that furnace on the blackboard—40,000 cubic feet capacity. You will perceive that he passes the fuel through a central tube, with the iron-stone outside, under the idea that it should absorb all the heat from the rising gases, and save consumption of fuel; he does not take the gas off, because that had not been at the time definitely settled. He wrote to me saying that if a furnace like that were built we should see pig iron made at a certain price. Ten years afterwards, the price and cost of materials being higher, pig iron was made at 2s. per ton below the figure he mentioned, which, at the time, was considered almost impossible. From 1863 to 1865 a rapid change took place in this district. Old furnaces disappeared, and those large colossal things which we see to-day were built in their stead. Hot air was increased in temperature, and all the appliances introduced at the furnaces were very much improved, enlarging the make, and reducing coke consumption from 42 cwt. to 22 cwt. per ton of pig iron. The increase in size of furnace building in this district was not due to any one man in particular, but to general progress. If, however, it was due to one man more than another, that man was the late Mr. A. Slate. He anticipated the change long before it took place. Referring to the high temperature of blast now used, from 1000 to 1400 deg., I am inclined to think that with 1000 deg. the highest velocity of combination is attained, and the highest temperature possible got in the immediate vicinity of the tuyeres, and that any increase of blast heat will not cause further economy in fuel, except in so far as the descending materials will absorb the extra heat. And, again, if the escaping gases are cooled too much, the combination with cold air at stoves and boilers will be slow, and gases burning at the top of the chimneys instead of being concentrated under the boilers, which can, of course, be rectified by using heated air, and economising gas for calcining ore and saving further fuel. Looking back to the three great discoveries for saving coal which has so much benefitted many countries—viz., hot blast, utilisation of waste gases, and the Bessemer discovery—and bearing in mind the struggle and opposition they have passed through, how necessary is it for us to investigate any new invention with intelligent care and practical knowledge? I would especially draw the attention of the younger members of this Institution to the immense advantage they have as compared with the older engineers of this and kindred societies. Surrounded by laboratories, libraries, and opportunities for improvement almost without end, if they do in the future as much as the older members of this Institution have done in the past, we shall see Middlesbrough, Stockton, and the adjacent district become one great city, not with a shallow mud-bank stream, but a deep flowing river passing through, filled with the ships of the world, laden and ready to steal away to our brethren of the Antipodes, and returning with their produce to feed and clothe our people, and that in spite of the tariffs of the world.

The Electric Light in Sheffield.—The Sheffield Corporation, who have appointed Mr. Conrad W. Cooke, of Westminster, as their electrician, are fairly committed to a scheme of lighting up the centre of the town if they obtain the provisional order for which they have applied. Mr. Cooke estimates the cost of the scheme at £49,726. The electric light is being rapidly adopted by business firms in Sheffield as well as by various works in the neighbourhood.

Educational Engineering Drawings.—We have received from Messrs. W. and A. R. Johnston, of Edinburgh and London, a number of large sheets of new drawings of engines and boilers, designed to assist the teacher in conveying to students accurate ideas on the construction, working of steam generators and motors, and their chief details. The designs are by Mr. Michael Reynolds, and are illustrative of modern practice, and the sheets are accompanied by a descriptive key. They are well drawn, clearly lithographed in plain colours, and supply a want much felt by teachers and students. They are published as Johnston's "Illustrations of Natural Philosophy."

MACHINERY FOR FORGING ANCHORS.

MR. JOHN NOCK, HASSKENI, CONSTANTINOPLE, ENGINEER.

FIG. 7.

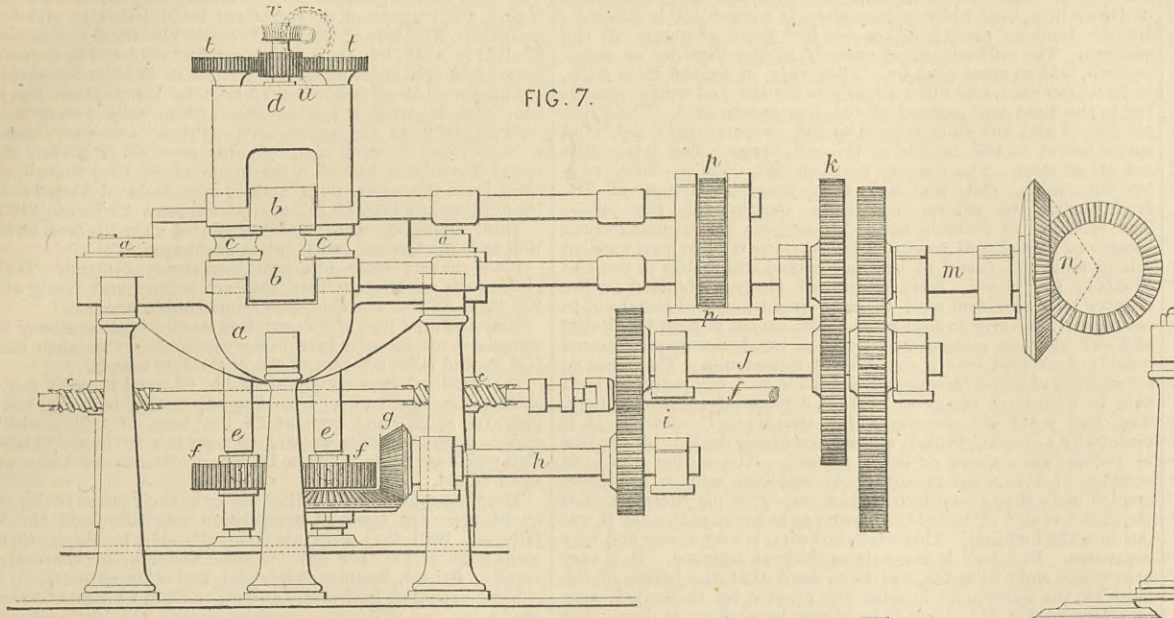


FIG. 9.

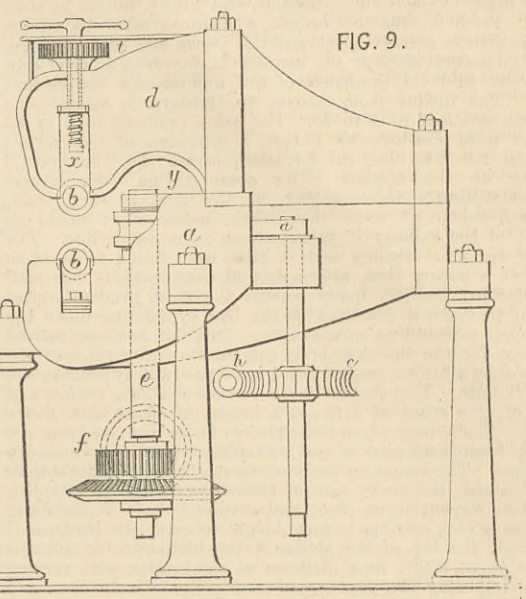


FIG. 8.

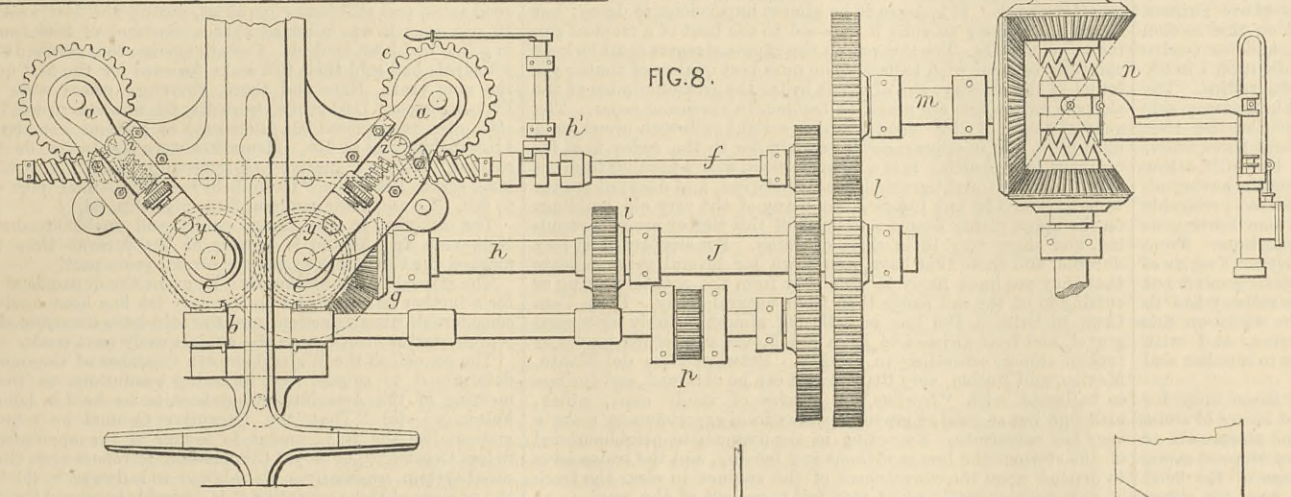


FIG. 2.

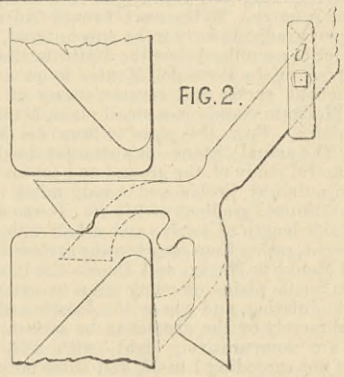


FIG. 6.

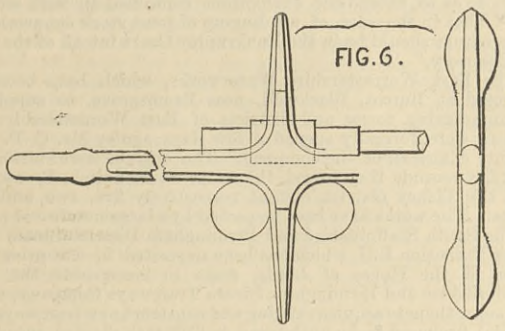


FIG. 3.

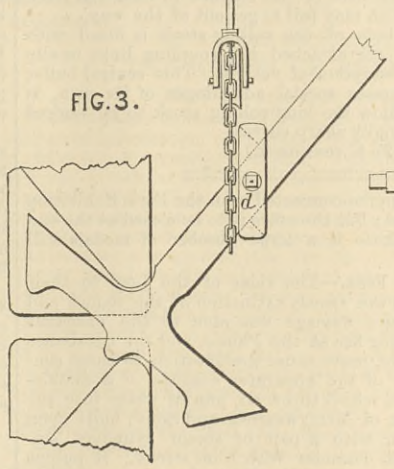


FIG. 4.

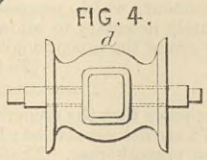


FIG. 1.

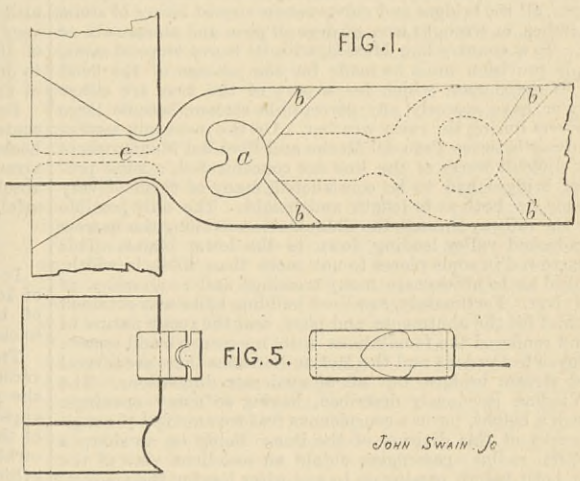
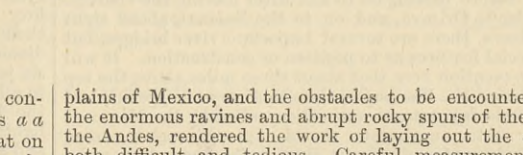


FIG. 5.



JOHN SWAIN Sc

MR. JOHN NOCK, of Hasskeni, on the Golden Horn, Constantinople, has patented improvements in the manufacture of anchors by machinery. The invention relates to the manufacture of anchors in one piece of wrought iron or steel, and to apparatus for rolling the several limbs of the anchor into shape. A flat slab or ingot of the metal, sufficient to constitute several anchors, is prepared, and in this slab are punched, as shown in Fig. 1, holes *a* of a C shape; the metal is severed by oblique cuts *b*, taking care to provide between each hole and the next sufficient metal, which is forged down to a square section convenient for rolling to form the shank, and is hollowed in at the neck *c* by suitable swages, as shown in Fig. 1. The blank thus formed has its jaws opened apart by swaging, as shown in Figs. 2 and 3. For convenience of holding and turning the blank there is fixed on its shank a dog *d*, shown in plan at Fig. 4, which prevents the bridle chain from slipping up the shank. The flukes are then spread out by swages, as shown in section and plan at Fig. 5, these swages being shaped to form the rounded rib or continuation of the arm behind the palm. The blank so far prepared has its limbs brought to shape, as shown in the side and end views Fig. 6, by rolling them successively between rolls arranged so as to give the required taper and variations of width and thickness at different parts of the limbs. After the rolling, the two arms which stand at right angles to the shank, as shown in Fig. 6, are bent to the required curvature. The curving of each arm may, however, be done or partly done while it is undergoing its last rolling by attaching the shank by a chain to a fixed point of the framing of the mill, so that the arm while passing between the rolls is made to travel in a curve. Finally the hole is made in the shank at the forge. For anchors which have their arms jointed to the shank, the same apparatus is applicable to roll the shank to shape as one piece and to roll the two arms to shape as a separate piece. The rolling apparatus consists mainly of a pair of horizontal rolls, which, while they revolve, are adjustable nearer to or farther from each other, and of a pair of vertical rolls close beyond them, these being also adjustable, so that the shank and limbs of the anchor in passing through between these rolls, as indicated in Fig. 6, while the rolls of each pair are themselves made to approach towards or recede from each other, receive the desired form and taper. Fig. 7 is a back view, and Fig. 8 is a plan of the rolling mill, and Fig. 9 is an end view. *a* and *d* constitute the framing containing the bearings for the horizontal rolls *b b* and for the vertical roll *c c*. The bearings of the upper rollers are fitted to slide vertically, so that these rolls can be raised or lowered by screws connected by wheels *t t*, gearing with an intermediate wheel *u*, which can be turned by a hand-wheel or by a worm-wheel *v*, driven, when required, by a countershaft. The upper bearings for the vertical rolls *c c* are in blocks *y y* fitted to slide diagonally, these blocks being connected by adjusting screws to slides *z z* linked to cranks *a a* fixed on the vertical axis of the worm wheels *c c*, so that on turning the shaft of the worms that gear with the wheels *c c* in the one direction or the other, the rollers *c c* can be caused to approach towards or to recede from each other. The vertical shafts *e e* of the rolls *c c* are connected to wheels *f f* by couplings sufficiently loose to permit of the to-and-fro movement of the rolls, and in like manner the shafts of the horizontal rolls *b b* are loosely coupled to the wheels *p p*, by which they are geared together. The gearing for driving the mill is as follows: A main shaft, by means of clutch and bevel reversing gear *n*, drives a shaft *m*, which, by gear wheels *l*, drives a countershaft *j*. From this shaft by gear *k* the shaft of the lower roll *b* is driven, and by gear *i* is driven a shaft *h*, which by bevel gear *y* drives the shaft of one of the vertical rolls *c c*. From *k* is also driven a countershaft *f*, which works the worms of the wheels *c c*, a clutch *h* and hand lever being provided for coupling the worm shaft to *f* or uncoupling it as required. The reversing clutch *n* is worked by the piston of a steam or hydraulic cylinder, as shown in Fig. 8, according as the slide of that cylinder is moved by hand. As the anchor is passed through between the rolls, as shown in Fig. 8, the clutch levers are manipulated so as to vary as required the distances of the rolls from each other for forming the several limbs of the anchor to their desired shape and taper, and with the required protuberances on them.

THE INSTITUTION OF CIVIL ENGINEERS FOR IRELAND.

THE MEXICAN RAILWAY.

THE following paper was read on Wednesday evening, May 3rd, 1882, by Mr. W. Hemingway Mills, C.E., vice-president.

THE writer was for some years engineer and general manager of the Mexican Railway, and had the entire charge of the open line, permanent way, works, rolling stock, and traffic. The following remarks are written from his own notes and experience, and will be assisted by reference to the sections and diagram sketches prepared to make the description more clear:—The main line of the Mexican Railway, which extends from the sea port of Vera Cruz to Puebla and Mexico, a distance of about 300 miles, occupied several years in its construction. Political movements, changes of governments, and other disturbing influences all contributed their share to retard the completion of this great enterprise. The studies for the location of a line of such magnitude were naturally complicated, and especially so in the total absence of maps or other data of a reliable nature. The great summit level which had to be attained in the ascent of over 8000ft. from the sea-level at Vera Cruz to the upper table lands or great plains of Mexico, and the obstacles to be encountered in passing the enormous ravines and abrupt rocky spurs of the great chain of the Andes, rendered the work of laying out the central portion both difficult and tedious. Careful measurements had to be obtained, and levels taken in almost inaccessible places, and much time was occupied in the exploration and comparison of trial routes. The heavy nature of the works on the central portion caused the construction of that part of the line to be discontinued for some years, and attention was directed to the completion, first of the section from Vera Cruz to Paso del Macho, 47¼ miles, and then from Puebla to Mexico, 115¾ miles. The central portion was afterwards finished, and the entire system completed and opened through from Vera Cruz to Mexico in January, 1873. In laying out the line from Vera Cruz, the principal Mexican port on the Atlantic side, to the city of Mexico, the capital, care was taken to cause the route of the railway to pass through the towns of Cordova and Orizava, these two towns being not only of considerable size, but forming the centres of very large and important districts. From Orizava to the upper table-lands the engineering problem was to select the most practicable route to ascend the Cumbres, or great mountain inclines. Once on the upper table-lands there is no great difference in level along the plains between Boca del Monte and the city of Mexico. Schemes were considered for including the large town of Puebla on the route of the through main line, but the Malinche chain of mountains, of which the highest peak is 13,400ft. above sea-level, presented so many difficulties as to make such course all but impracticable, and it was ultimately decided to take the main line through by way of Huamantla and Apizaco, and connect Puebla by means of a branch from the latter. The map shows generally the route of the line from the sea port to the capital, and on the longitudinal section the heights in feet above sea-level are given at each of the stations. The line is single throughout, and is laid to the gauge of 4ft. 8½in.* Upon referring to the section a very good idea may be formed of the general contour of the country through which the line has to pass. It will be seen that there is one continuous rise from the seaport to the summit level, with the slope of the country becoming steeper, and the gradients of the line more severe, as the line approaches Boca del Monte. From Vera Cruz to Soledad the ground rises gradually, but not to any great extent; the gradients on that portion are therefore comparatively easy. At Soledad the railway crosses a large river, and from this place to Camaron there is one continuous gradient for about thirteen miles of 1 in 84. From Camaron to Paso del Macho the gradients are lighter. For the entire distance from Vera Cruz to Paso del Macho, 47¼ miles, the ground, although in one continuous rise, is of an even or very slightly undulating nature. Good curves have been obtained on this section, for although several rivers and mountain streams are crossed, there are none of those ravines and passes which distinguish the upper portion of the line. At Paso del

* For convenience of reference a list of the stations is annexed to this paper, with the distances given in English miles from Vera Cruz, and the heights above sea-level in English feet.

Macho the character of the country undergoes an entire change, as we pass from the comparatively open plains and begin to ascend the lower mountains of the Andean range. For the next six miles the railway passes through the great valley of the Chiquihuite, where the ravines are so abrupt, tortuous, and peculiar in their formation as to necessitate works of great magnitude. On this section the line is full of sharp curves—several of them 400ft. radius—and contains many large bridges, tunnels, and heavy works in rock cuttings. From Atoyac to Cordova, a distance of about twelve miles, the district is less rugged, and the works are comparatively light. The natural slope of the country is, however, steeper than lower down, and the gradients of the line become longer and heavier. The incline from Atoyac to Cordova is almost one continuous gradient of 1 in 33. The same gradient of 1 in 33 continues from Cordova to Fortin, a distance of five miles. At Fortin the line had to be taken across the "*barranca*," or valley of the Metlac. The great ravine, the largest and most difficulty to overcome on the line, is very wide, and has a depth of more than 300ft. below what would be the level of the railway if taken across in a direct line. The necessary works for crossing such a place were found to be of so stupendous a nature that, although well considered, it was ultimately decided that for many reasons the most prudent course would be to make a diversion of the line by skirting down the valley on one side and up on the other. This plan has been carried out; space for the line has been cut in the rocky sides of the ravine, and by a falling gradient of 1 in 33 the railway reaches the Metlac Viaduct. This viaduct is on a curve of 325ft. radius, and consists of nine spans of 51ft., at a height of about 80ft. above the river. The wrought iron plate girders under the roadway are carried on framework piers of cast iron columns, resting on masonry foundations. The ascent on the western side is more difficult than on the eastern, the rocky side of the ravine being more perpendicular and serpentine in plan, and involved three tunnels and several heavy rock cuttings to form ledges to carry the permanent way. From the top of the Metlac Valley incline to Orizava the line rises about 650ft. in a distance of eight miles, with varying gradients following the contour of the comparatively open and cultivated country. In the next twenty-five miles above Orizava the steepest gradients have to be encountered, and on this section the line for three miles below the Maltrata station, and for twelve miles above, up to Boca del Monte, is on a gradient of 1 in 25, with frequent curves and reverse curves of 400ft. radius. The town of Maltrata stands on a small plain, hemmed in on every side by mountains. From this place to Boca del Monte the line rises 2373ft. The actual distance in a straight line is about three miles, but by careful study of the ground and contour of the hills a line has been obtained twelve and a-half miles in length, having an almost continuous gradient of 1 in 25. It was considered preferable to make this length of twelve and a-half miles in one continuous direct ascent, rather than resort to any system of zigzag lines. From Boca del Monte to Mexico and Puebla the line traverses a series of vast open fertile plains of many miles in extent, with ground but slightly undulating, and where the location of the railway had to be guided merely by the district to be served. The works on this portion are comparatively light, with easy curves, and with gradients not exceeding 1 in 66, and these only few in number and short in length.

Bridges.—With but very few exceptions, and those only for small spans, all the bridges and culverts now consist either of stone or brick arches, or wrought iron girders on piers and abutments of masonry. In a country like Mexico, with its heavy tropical rains, very ample provision must be made for the passage of the flood waters. Watercourses, which for a part of the year are either quite dry or have scarcely any perceptible stream, become large swollen rivers during the rainy weather. On the mountain section of the railway between Paso del Macho and Boca del Monte, where the most difficult works of the line are concentrated, a large proportion of bridges had to be constructed, many of them of very considerable size both as to length and height. The only possible route for the railway through the Chiquihuite was along the narrow mountain-locked valley leading down to the lower plains. This valley, narrowed in some places to not more than 400ft. in width, is so crooked as to necessitate many crossings and re-crossings of the same river. Fortunately, excellent building stone was obtained near at hand for the abutments and piers, and the rocky nature of the ground rendered the foundations both inexpensive and secure. From Atoyac to Cordova and the Metlac Barranca there are several river and stream bridges, but all of moderate dimensions. The Metlac Viaduct previously described, having so many openings, and at such a height, forms a conspicuous feature amongst the engineering works of this division of the line. Being on so sharp a curve—325ft. radius—passengers obtain an excellent view of the structure, both before passing on to and after leaving the viaduct. From the Metlac to Orizava, and on to the Encinal, about eight miles above Orizava, there are several important river bridges, but without any special features as to position or construction. It will be interesting to mention here that about three miles above the top of the Metlac ravine the line passes close to a very fine specimen of one of those wonderful natural curiosities, called by the Mexicans "*sumideros*," or subterranean water shafts. Into this rock-bordered opening falls all the water of a large river, more than 40ft. wide. The water disappears with the noise of a cataract, and whether the quantity passing over be from the river in the dry season, or when swollen with floods, the result is the same—there is no overflowing; the "*sumidero*" has capacity for all. How far it flows underground, and where its ultimate outlet, remains in this case, like many others, still to be discovered. By some it has been conjectured that this body of water finds its way into the Metlac Barranca, but as the stream in the latter is merely a tiny rivulet in comparison to the disappearing river, there is little doubt that this supposition is untenable. From the Encinal to Boca del Monte the works are very heavy, both in bridges, tunnels, and rock cuttings. Between the Encinal and Maltrata the railway traverses a long, perpendicular-sided ravine, so deep and narrow as to appear almost impassable. Indeed, the traveller making his first trip by rail becomes impressed with the idea that the train must come to a stand for want of any possible outlet. In some places new beds have been cut for the river and mountain streams, long and heavy retaining walls have been built to protect the line, and ledges and tunnels cut through the solid rock. The bridges on this length were both difficult and expensive to construct, the sites were almost inaccessible, the material could only be brought to the places in small quantities or weights, and the men had to work in most confined and inconvenient spaces. Between Maltrata and Boca del Monte the bridges are proportionately fewer in number, but there are several large tunnels, and a great many large culverts to carry away the mountain streams. The rock cuttings are some of them very heavy. The first eight miles above Maltrata form in plan the outline of an enormous boot, this curious figure being the result of the skirting round the various spurs of the mountain chain to gain length in overcoming the height. As the train proceeds slowly winding its way up the heavy inclines, the effect, as seen from the upper portion, is very peculiar and interesting. The passenger looks down upon that part of the line over which he has just travelled, and which seems like a tiny thread some hundreds of feet below him, its course disappearing and reappearing round the different hilly slopes which distance has dwindled into mere insignificant mounds. Between Boca del Monte, Mexico, and Puebla, there are not any tunnels, but a large number of bridges and culverts were necessary for the crossings of the numerous rivers and streams met with in the route along the upper table-lands. Some of these were of considerable size, but as they were all of them in comparatively open country, they presented no difficulty beyond the conveyance of suitable building materials. So long as the line traversed the mountain range suitable stone for masonry could always be obtained almost close to the site of the work, but out on the upper plains good stone is scarce, and in many places had to be brought long distances. The ironwork in all the plate and lattice girders was made and fitted together in England, and then sent out in small pieces carefully marked for facility of erection. The timber-work in the planking, rail-bearers, &c., was partly obtained from forests in the locality and partly from the United States.

Permanent Way.—The line is laid to the gauge of 4ft. 8½in., and is single throughout, with the exception of the short length of between three and four miles from the city of Mexico to the village of Guadalupe, over which portion there is a considerable suburban traffic. Suitable passing places are laid down at nearly all the stations. The rails are almost entirely of the Vignoles or flange pattern, laid on cross sleepers. They vary in weight from 60 lb. to 75 lb. per yard, and differ slightly in section and weight according to the time and portion of the line constructed. The joints are fished and the rails secured to the sleepers with dog-headed spikes driven on the outside of the rail flange. The latter rails are all of steel. The sleepers used are 9ft. long by 10in. wide by 5in. thick, and are laid at a general distance of 3ft. from centre to centre, but close together at the joints. The selection of suitable wood for sleepers has occupied much attention. Good well creosoted Baltic sleepers have been tried on a large scale and found to become decayed and useless at the end of about four years. Hard strong oak sleepers obtained in the country have also been tried in large quantities, and found not to last more than three to four years. The timber of both the Baltic and oak sleepers seemed to undergo a rapid change and become quickly converted into a dry spongy consistency. There was no appearance of insect ravages; the timber had evidentiy not been able to withstand the great heat or dryness of the atmosphere. The best wood yet discovered for sleepers is "*zapote.*" It is essentially a tropical timber, and is exceedingly durable for outdoor or indoor work above or below ground. The author has seen samples of this wood taken out of buildings said to have been erected more than two centuries ago, and certainly there was not the slightest sign of decay; the wood was as sound as the day it was put into the building. This wood, however, is very scarce and very expensive. In colour it is nearly as dark as logwood. It is very heavy, and sinks in water, and is so hard that the boring of the holes for the spikes, and forming the grooves for the rails is very laborious work. It appears to be almost impervious to decay, but it has a tendency to split if exposed to the heat of a tropical sun for a few months. For this reason the zapote sleepers must be kept carefully covered with ballast. The next best quality of timber yet found in the country, and of which by far the greater number of the sleepers on the line are made, is "*sabino,*" a species of cedar. The general colour of this wood is either a light yellowish brown or a light pink, and in appearance is very similar to the cedar used for ordinary lead pencils. It is a resinous wood with a peculiar fragrant odour, and is straight-grained, readily worked, and does not appear to be attacked by any insects. In many of the very old buildings on the upper plains beams and posts of this timber are still standing, and show very little signs of decay. For sleepers it is very durable, and those that have been down for several years indicate that they are more likely to give way from the actual wearing or cutting in of the rail flange than from natural decay. From Vera Cruz to Orizava the line is ballasted almost entirely with good gravel, and from Orizava to Boca del Monte with either gravel or broken stones, according to locality. Between Boca del Monte, Mexico, and Puebla, very little gravel can be obtained, and the line is ballasted with "*tepetate,*" a species of sandy marl, which, although not so good as gravel, appears from experience to make a very fair substitute. Excepting in the immediate neighbourhood of the stations the line is without any fencing, and the trains have to depend upon the cowcatchers of the engines to clear the track of any straying cattle which may fail to get out of the way.

Rolling Stock.—The whole of the rolling stock is fitted with central buffers, to which are attached the coupling links or clip hooks according to the description of vehicle. This central buffer arrangement, which possesses special advantages of its own, is absolutely necessary to allow the long rolling stock to be worked safely round the exceptionally sharp curves.

(*To be continued.*)

It appears that the accounts connected with the Paris Exhibition of 1878 are not yet settled; but the office is to be closed at the end of the present year. There is a large number of medals still unclaimed.

The Hampton Court Fire.—The rider of the jury to their verdict, to the effect that the speedy extinction of the flames and the prevention of excessive damage was due to the excellent apparatus for extinguishing fire at the Palace, and the excellence of the Palace fire brigade, must cause gratification to those concerned. The chief part of the apparatus consists of a double-cylinder steam fire engine, which threw six jets of water into the fire. This engine is one of Merryweather and Sons', built upon their Admiralty pattern, with a pair of steam cylinders 7in. diameter, and pumps 5½in. diameter with 18in. stroke. It pumps six jets, each capable of throwing 120 gallons of water per minute to a height of double that of the Palace buildings; the boiler is on the Field principle, and raises steam within ten minutes from lighting the fire. This engine is connected to a main running in and around the Palace, and all that is necessary on alarm of fire is to couple hoses to the various hydrants and start the engine with such excellent results, as has been already shown.

Professor Challis.—It is with deep regret that we have to announce the death, at the advanced age of seventy-eight, of the Rev. Professor James Challis, M.A., F.R.S., Plumian Professor of Astronomy and Experimental Philosophy in the University of Cambridge, and Fellow of Trinity College. He expired at his residence at Cambridge, after a long illness, on Sunday, the 3rd instant. Professor Challis, than whom no living man had rendered more service to astronomical science, graduated at Trinity College as Senior Wrangler and first Smith's prizeman in 1825. He was appointed to the Plumian Professorship in 1836, in succession to Sir George Airy, late Astronomer Royal. During his long life he has contributed a great many papers to science, and prepared several works on teaching science. One of his first papers, in 1828, was an extension of Bode's empirical law; this was followed by others on aberration of light, observations on comets and the small planets, velocity of sound, lunar eclipses, occultation of stars by the moon, theorems in hydrodynamics, the zodiacal light and shooting stars. His later papers are more mathematical, and they number altogether about two hundred and thirty memoirs. In 1869 he published his work on the "Principles of Mathematics and Physics," which is characterised by great clearness of style, and is the result of much thought; the style of this work may commend itself to anyone seeking a good model of terse, pure English. Still later, in 1873, he issued, "An Essay on the Mathematical Principles of Physics, with Reference to the Study of Physical Science by Candidates for Mathematical Honours in the University of Cambridge," the conclusion of which we may quote to illustrate his style: "It may, I think, be asserted that the completion of these theories will demonstrate the existence of a vast and wonderful *mechanism*, of which not the least wonderful quality is its being so constructed that we can understand it. If it be objected that we do not know what the æther is, or what atoms are, it seems sufficient to answer that by personal experience we can understand with what qualities they are endued as elementary constituents of the system of the universe, and that this is enough for enabling us to comprehend the whole of the mechanism. It would be thought unreasonable if an engineer, after explaining the construction of a steam engine, should be required to say what fire is or what water is; he would think that his explanation of the mechanism and working of the engine should satisfy the inquirer if it rested on properties of fire and water that are known by ordinary observation. Just so our knowledge of the mechanism of the earth and heavens ought to be regarded as complete when the explanation of it has been made to depend exclusively on properties of the constituent elements which are perfectly intelligible to us by common experience and observation."

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

(*From our own Correspondent.*)

The mills and forges have been unusually busy this week in preparing for the suspension of operations for stock-taking and for the holidays. Numbers of them will remain idle for the whole of the Christmas week, but those which are best off for orders, including some of the old sheet mills, will resume on Wednesday night.

There were sheet makers on 'Change in Birmingham this afternoon who reported a fair number of new sales during the past week, chiefly to the galvanisers. Prices, however, were not stronger than a week ago. Singles were £8 to £8 5s., doubles might have been had at a minimum of £8 15s., though, on the other hand there were a few makers who declared they would sell for nothing less than £9 5s., and lattens were £9 15s. to £10.

Thin—stamping—sheet makers reported a good call on foreign as well as home account, with prices unchanged.

Plate makers spoke of a quiet but steady demand. Tank and girder sorts are the qualities that are selling most freely at date. For these £8 10s. was the figure quoted this afternoon.

Manufactured iron of a description needed by the railway wagon companies has recently been in increased sale. One such contract just booked is for 800 tons of one of the best brands.

Earl Dudley's bars remain at £8 12s. 6d., and those of the other chief houses at £8 to £7 10s. Capital quality bars are, however, plentiful at £7, and even at £6 10s. bars, of a fibre which the makers assert will bear working on a smith's anvil, are obtainable. Nail strips are being rolled at £6 10s., while coopers' hoops are £7 to £7 2s. 6d.

Tin-plate makers were rather firmer in their prices to-day, consequent upon the lessened competition resulting from the Welsh failures. Still they were not generally able to obtain their full quotations of 22s. per box for coke and 25s. for charcoal, delivered at Bristol, Swansea, Liverpool, and other outports.

Some agents of Derbyshire and other distant pig makers reported good sales, and still better inquiries, during the last week or two. In one case it was asserted that a contract of 3000 tons of pigs in a line had been booked. Certain agents, too, asserted that their principals had sold their full make forward for the first quarter of the new year. Here and there, therefore, prices were to-day a little stronger. Derbyshires were 47s. 6d. upwards; good Leicestershire pigs were quoted 50s., delivered at stations hereabouts; and Lincolnshire pigs at 51s. Hematites were 65s. to 70s. on the open market. Turley's—native—all-mine pigs were 67s. 6d. for hot blast sorts; Bradley's "Caponfield"—native—mine pigs were 55s. to 56s. 3d.; and their common forge pigs, 42s. 6d.

The activity in the chain, cable, and anchor trades around Netherton and Tipton is greater at the present time than has marked the Christmas season for several years past.

The refusal of the coalmasters to grant the demands of the men for a further rise in wages on January 1st has been received with considerable dissatisfaction, and the men have determined to hold representative meetings on the subject early next week.

The council of the Wolverhampton Chamber of Commerce have determined to submit the following resolutions to the annual meeting of the Associated Chambers, to be held in London next February:—(*a*) "That the Executive Council be requested to memorialise the Government in favour of the appointment of a Select Committee or Royal Commission, to report upon the present canal system, especially in its relation to railways." (*b*) "That in the opinion of this association it is desirable to amend the definition of trade machinery expressed in Section 5 of the Bills of Sale Act, 1878, so as to extend the exemptions contained in such section." (*c*) "That in the case of winding-up of joint stock companies the proceedings should be in the Bankruptcy Court intead of the Court of Chancery."

The East Worcestershire Waterworks, which have been constructed at Burcot, Blackwell, near Bromsgrove, to supply the manufacturing towns and districts of East Worcestershire with water, were formally opened a few days ago by Mr. C. P. Noel, deputy chairman of the company. The engines were started, and in a few seconds they forced the water to Redditch, Bromsgrove, and the Lickey district, distant respectively five, two, and three miles. The works have been inspected by a large number of people.

The South Staffordshire and Birmingham District Steam Tramways Extension Bill, which has been deposited in the private bill office of the House of Lords, seeks to incorporate the South Staffordshire and Birmingham Steam Tramways Company, and to empower them to acquire existing and construct new tramways. The capital proposed to be authorised is £300,000, divided into 30,000 shares of £10 each.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron market here continues in much the same depressed condition which has prevailed for the last month or so, and that there will be any material change before the turn of the year is now altogether improbable. The usual stock-takings and the holidays will necessarily stand in the way of any large buying; but apart from this, there is the belief entertained by consumers that prices will have to give way still further, and although stocks are for the most part low, where they have iron to go on with, users generally prefer to wait. During the week a few sales of foundry iron have been made to some of the engineering firms in the district on the basis of the recent reduction in prices, but for forge qualities there has been little or no inquiry, and where any offers have been made they have been at under current rates.

There was a full attendance at the Manchester market on Tuesday, but little or no buying going on. Lancashire pig iron for the present seems to be altogether out of the market; local makers have not yet issued revised lists, their old rates of 49s. to 50s., less 2½, for forge and foundry qualities delivered equal to Manchester, are now quite out of the question, and offers are not being made to test what they would really be prepared to take, so that there is actually no business being done in local brands. A few transactions in district brands of pig iron are reported on the basis of 48s. 6d., less 2½, for No. 3 foundry Lincolnshire delivered, but for forge qualities, which are quoted at 47s. 6d., buyers are not to be found at this figure, although orders might be secured at about 6d. per ton less. For good brands of Derbyshire iron the average figure is about 49s. to 50s., less 2½, delivered here, but there are sellers at 1s. per ton under this point.

For hematites there are inquiries in the market, and consumers show a disposition to buy forward at low prices. During the week a large order for Bessemer hematites has been given out by the Manchester, Sheffield, and Lincolnshire Railway Company. The order, which amounts to 5000 tons, has been distributed amongst several firms, and I am unable therefore to give the precise figure at which it has been placed, but an average of 62s. 6d. to 63s. 6d., less 2½, delivered equal to Manchester, will be pretty near the mark.

Finished iron makers report very few orders coming in, and although forges generally are being kept going with deliveries, some of the works which have a large output are beginning to feel seriously the dearth of new business. There is, however, comparatively little disposition to yield in prices; here and there makers, no doubt, would be open to book good specifications for bars at £6 7s. 6d., but the average figure remains at £6 10s.; hoops, £7 to £7 2s. 6d.; and sheets, £8 10s. to £8 12s. 6d. per ton delivered equal to Manchester.

Founders report a slackening off in work, and prices are cut very fine to secure orders. I have heard of builders' castings being done at less than £4 10s. and ordinary pipe castings can be bought at as low as £4 10s. to £4 12s. 6d. per t. delivered into Manchester.

Some branches of engineering keep very busy, and this is especially the case with locomotive builders who have orders to carry them forward for some time. Tool makers and firms engaged on special classes of work are also kept well employed, but it can scarcely be said that the general engineering trade of the district is brisk. A good many complaints are made of the want of new orders to take the place of those being worked off, which indicate a falling off in prospect. The men, however, do not experience any shortness of employment, as the activity in some branches is sufficient to absorb surplus labour from others.

The Mayor of Manchester—Alderman Hopkinson—himself an engineer, and formerly partner in the firm of Messrs. Wren and Hopkinson, has consented to take the chair at the annual dinner of the Manchester Association of Employers, Foremen, and Draughtsmen, to be held in February next.

Although electric lighting can scarcely as yet be said to have established its claims as a competitor with gas, its application to public buildings and works is being slowly pushed forward in this district. I have previously referred to its introduction at the engineering works of Messrs. Mather and Platt, Salford; and more recently at the Manchester Royal Exchange. In cotton mills, where the risk of fire is so great, there would certainly seem to be a wide field for the introduction of a system of illumination attended with less danger than the open gas light, and the first experiment with electric lighting in this direction is now being made. At the quarterly meeting of the Higginshaw Spinning Company, Oldham, last week, it was stated that Messrs. Weston, of London, had entered into arrangements for lighting one spinning room and part of a card-room with sixty-six of their patent incandescent lamps, the mill company providing the driving power, and Messrs. Weston putting down the necessary plant and machinery at their own risk in case of failure.

Last week I referred to the extraordinary termination of a meeting in Salford which had been promoted with the object of memorialising the Corporation with reference to the smoke nuisance. As an illustration of how little real difficulty there is in the way of successfully effecting an abatement of smoke without the aid of any complicated or expensive arrangements—which have been one of the chief obstacles in the way of securing a comparatively pure atmosphere in the neighbourhood of works—it may be of interest to refer to what has been done at the Miles Platting Locomotive Works of the Lancashire and Yorkshire Railway Company. Mr. Yates, the chief of the department, has adopted a very simple and effective arrangement to the various firing boilers and furnaces throughout the works, by simply introducing steam and air direct to the fire-grates, and has secured a practically perfect combustion. This is done without any complicated mechanism whatever. Its success is solely the result of careful observations as to the proper application of well-known principles in the most simple manner possible to the requirements of the respective fires, and the effective way in which Mr. Yates has overcome any difficulty in dealing with the smoke suggests the possibility that similar careful study might in other cases attain the same end by equally simple means.

Notwithstanding considerable difficulties, of which an illustration was recently afforded at Blackburn, steam tramways are gradually making headway in Lancashire. The Manchester, Bury, Rochdale, and Oldham Steam Tramway Company has now nearly completed its line, which links on to the Manchester system at Kersale. The whole of the metals are of steel, and the gauge is the same as on the Manchester and Salford Tramways. The engines are being built by Messrs. Wilkinson and Co., of Wigan, and Messrs. Beyer, Peacock, and Co., of Gorton, and are of similar construction to those which have been in use for some time past at Nottingham and Wigan. The whole of the company's system when completed will extend over upwards of forty miles, connecting a number of the outlying towns throughout the district.

In the coal trade a somewhat better demand is being maintained both for house fire and manufacturing classes, but this is due more to special causes than to any actually established improvement in the market, and colliery proprietors in many cases find it very difficult to hold to their full rates. The average prices at the pit mouth are about as under:—Best coal, 10s. to 10s. 6d.; seconds, 7s. 6d. to 8s. 6d., according to quality; common house coal, 6s. 6d. to 7s.; steam and forge coal, 6s. to 6s. 6d.; good burgy, 4s. 9d. to 5s. 3d.; and good slack, 3s. 6d. to 4s. per ton.

With more favourable weather vessels have not been quite so scarce at Liverpool and Garston, and orders have been shipped which have been held in abeyance, but there is no very great actual improvement in this branch of trade, and comparatively low prices are still being taken.

Barrow.—There is no change to note this week in the hematite pig iron trade, the business doing being of an exceedingly limited character. There are, I am told, but very few orders coming to hand, either on home or foreign account, and what I have had occasion to note previously is becoming more confirmed every day, namely, the buyers of iron seem to be very reluctant to enter into any business transactions until the commencement of the new year. Owing to the absence of leading transactions it is impossible to give accurate quotations, but I am informed that prices are not so firm as of late; 55s. to 56s. per ton is the quotation for ordinary qualities of Bessemer iron, although I have heard that sales have been effected at lower prices. 54s. per ton is the ruling quotation for No. 3 forge iron at works. There is a good demand for iron ore at from 13s. to 14s. per ton at mines. There is a good employment ruling amongst steel makers, who are well sold forward with all descriptions. Very few new orders are falling into the hands of iron shipbuilders, but they are, nevertheless, fairly employed at present, and are in negotiation for new work. There is a heavy consumption of coal and an efficient supply. Quietness reigns in the shipping trade, although heavy consignments of steel and iron are being shipped.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THE late severe cold weather has had the effect of staying the movement for reducing miners' wages, and there is now little prospect of the question being revived before the spring of next year. It is somewhat curious to observe how speedily the storm drifted away even all negotiations on the subject. The manager of one of the largest collieries in South Yorkshire informed me that the movement for the repeal of the 10 per cent. would soon take as serious proportions as the miners' agitation which led to its being conceded. Twenty-four hours after our conversation the snow began to fall, and long before it cleared off the very idea of reopening the wages question had been abandoned. The miners' officials, emboldened by the collapse of a movement to deprive them of what they had so recently gained, have been actively pushing their agitation for the restriction of the output to five days' labour a week and eight hours a day. They are also boldly going forward for another 10 per cent. advance. I have reason to know that although many of the coalowners were strongly opposed to any disturbance of the existing wages arrangement, they will all present a firm front to the doctrine of idleness if it is attempted to carry it into practical effect.

An interesting item of the week is the purchase of the Limerick Wheel, from the Sheffield Water Company, by Alderman David Ward, of the firm of Ward and Payne, West-street. The Limerick Wheel is situated near Malin Bridge, which was brought into prominence at the great Sheffield flood in 1864, and from that day has remained a total wreck. It consists of over eleven acres of freehold land, with all the ashlar, stone, and other building material on the ground. It is Mr. Ward's intention to rebuild the Wheel, and erect extensive works for the further development of the steel, sheep-shear, and edge-tool branches of his business, and if he pleased he could transfer the whole of his great undertaking to the locality, and thus have at liberty for mercantile establishments the property in West-street, which is one of the most valuable in the town. In 1864 Mr. Joseph Barker, one of the proprietors of Limerick Wheel, was lost in the flood, which caused the drowning of 240 persons and the destruction of property to the value of half a million sterling.

Mr. David Craven, the well-known contractor for embankments, who constructed the Dale Dyke reservoir, which burst and caused the Sheffield flood, died at Sheffield on the 15th inst., and was buried on the 19th at Ecclesall churchyard, in the presence of a large concourse of friends. Mr. Craven, after the calamity, was engaged to rebuild the reservoir. A committee of five engineers decided that the giving way of the embankment was owing to a landslip.

The coal dealers in this district have established a Coal Merchants' and Agents' Protection Association. Mr. Thomas Firth has been appointed president.

It spite of the thaw which has cleared off the snow in the towns, and penetrated far enough into the country to prevent skating, there is still a keen demand for skates, a hard winter being, for some reason or other, generally anticipated.

Messrs. Steel, Tozer, and Hampton, the Ickles, Rotherham, have just taken a contract for 4000 tons of steel rails for the Great Northern Railway. Rails are now making about £5 2s. 6d. at the works.

Earl Fitzwilliam has a strong objection to the interference of union officials in his colliery affairs. At Elsecar the men have complained about not getting the 10 per cent. generally conceded in South Yorkshire. Earl Fitzwilliam, through his steward, Admiral Douglas, informs them that it is his desire all his workmen should be well paid for their labour, and be as comfortable as possible; but he will not brook the interference of outside people who have no connection in any way with the work of the colliery. His lordship adds that as his colliers do not seem to be able to get along with satisfaction to themselves, they had better look out for other situations. The letter of course has given great umbrage to the colliers.

The official returns of the quantity of coal carried to London show that there were sent by rail last month 606,367 tons, as against 654,908 tons in October. There was not such a large falling off in South Yorkshire as in the Silkstone and Derbyshire fields.

The Yorkshire Miners' Association, which meets at Barnsley, is making rapid progress, its members' roll now showing 15,000 names. At the last Council meeting 105 delegates attended, and nearly £700 was received for contributions, &c., being the fortnightly receipts from the lodges. The Council has passed resolutions approving of the construction of the Manchester ship canal, and giving its hearty sympathy to the directors of the company. The Council has also passed resolutions strongly condemning Sunday labour in coal mines, and recommending that an agitation be commenced in the district "on the question of not allowing—for the first time—men to work in the mines above twenty years of age before any person be allowed a set of tools."

The year's business, which will practically close to-day, has been on the whole fairly satisfactory, though not quite up to general expectation. The collapse of American business during the closing months of 1882 will have a very serious influence on the total trading when the official returns are published. At present the exports of Sheffield goods to the States are very limited, and in some items—such as steel rails—temporarily suspended With the colonies and the Continent there has been a decided improvement, and the home trade generally has been better. Work for the new year, however, is not so promising as at the close of 1881. The heavy branches have much brighter prospects than the lighter departments.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THERE was but a poor attendance at the Cleveland iron market, held at Middlesbrough, on Tuesday last, and few sales were made of either pig or manufactured iron. The tone of the market was, however, somewhat firmer than last week. The price quoted by merchants for No. 3 g.m.b., for early delivery, was 43s. per ton, and what business they did was at that figure, or 3d. per ton more than they accepted during last week. Makers outside the combination were also quoting 43s. for No. 3. The principal firms, however, asked 43s. 6d. and would not take less. A good many of them have three months' work in hand, and can well afford to wait and see what the immediate future will bring forth. It is not improbable that a better feeling will arise with the new year, but in the meantime very little business is likely to be done. The Cleveland ironmasters have decided to continue to restrict their production of pig iron 12½ per cent. until the end of March, when the matter will be again considered.

Next week and the week after the Cleveland iron market will be held on Wednesday instead of Tuesday, on account of the holidays.

The stock of Cleveland iron in Messrs. Connal and Co.'s Middlesbrough store, on Monday night, was 99,823 tons, being a decrease of 911 tons for the week.

The shipments have improved somewhat with the milder weather of the last few days, but the total quantity for the month is not likely to be large. Up to Monday night only 30,164 tons of pig iron and 8974 tons of manufactured iron had been shipped.

The manufactured iron trade has not improved during the past week. Orders are being given out very slowly, and there is the greatest difficulty in getting specifications to keep the mills going. Prices are unchanged, ship-plates being £6 10s. to £6 15s., angles £5 17s. 6d., and common bars £6 per ton, all free on trucks at makers' works, less 2½ per cent. discount. Puddled bars are £4 per ton net at works. The plate-makers have decided to close their mills for a week; some of the firms will close for the Christmas week, and others for the New Year's week, as may be most convenient to themselves.

Messrs. Bolckow, Vaughan, and Co., of Middlesbrough, are putting up another new converter for the manufacture of basic steel ingots by the Thomas and Gilchrist process, and have a second new one on order. When Messrs. Bolckow, Vaughan, and Co. have got these two converters to work, they will be able to produce about 16,000 tons of basic steel per month.

Messrs. Jones Bros., of the Ayrton Rolling Mills, Middlesbrough, have commenced the manufacture of steel plates. They have an order in hand for 1000 tons for a firm at Glasgow, and made 50 tons of them last week. The steel blooms they are using are supplied to them by the Darlington Iron and Steel Company. It is said that Messrs. Jones Bros. intend to put down a new mill specially for rolling steel.

The ironworkers in the North of England have lately been having meetings to consider the question of joining the Ironworkers' Association, in addition to belonging to the Board of Arbitration. An appeal was made by the council of the Ironworkers' Association some little time since. The leaders of the men have also pressed them to take the matter up, and the result is that large numbers have joined the Association. It is now intended to make some changes in carrying on the work of the Board of Arbitration, and it is believed the men will work more harmoniously now that they also belong to the Association. At all events, they will be more under control.

The Skerne Ironworks at Darlington were stopped on Friday last, throwing idle about 600 millmen and puddlers. The stoppage is owing to the work in hand having been completed, and the masters having decided not to book fresh orders at the present unremunerative prices. The men did not receive any notice, and decided at a meeting held on Tuesday night to demand six days' work, or six days' pay in lieu of notice.

The Bishop Auckland Iron and Steel Works are also likely to be temporarily closed. The district Local Board of Health has been prosecuting the proprietors on account of the nuisance said to arise from the smoke emitted by their furnace stacks, and also from the fumes proceeding from their cinder tip. The worry and uncertainty arising from this prosecution, together with the undoubted slackness of trade at the moment, have caused the proprietors to decide upon the above measure. Intense indignation has been manifested by the workmen, who will be thrown out of employment, and by the tradesmen of the town, against the authors of this unfortunate prosecution. It is considered that £500 per week will be lost to the neighbourhood, and property will certainly depreciate in value. Not only so, but no one will, it is thought, attempt again to carry on the works, even should times improve, for fear of a renewal of this legal prosecution. Surely the members of the Bishop Auckland Local Board can never in their infancy have been taught that "fools only, quarrel with their bread and butter."

Thus it will be seen that the manufactured iron trade of the North is in rather a bad way. Should, however, such extensive stoppages continue to take place, the production may soon be overtaken by the demand. The output of the Skerne and of the Auckland Works amounts collectively to 900 tons per week, or, say, 8 per cent. of the entire make of the North of England plate trade.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THERE has been rather more animation in the warrant market this week, not that there is any actual improvement in the legitimate trade, but on account of considerable purchases having been made by speculators in the belief that quotations will advance towards the close of the year. They are, no doubt, warranted in this impression, as it has frequently been verified. But there have been exceptions when warrants have advanced at this season, those occasions being either when trade was well known to be bad, or when the good reports about to be issued regarding it were discounted. The condition of the pig iron trade just now is pretty well understood by all who take a particular interest in it, but it is not unlikely that outsiders may be attracted by a rumoured advance in prices, and induced to purchase. This week the prices of warrants have been advancing, although not to a large extent, and this in the face of advice of an unfavourable nature from nearly all the foreign markets. Freights for pig iron show a decided fall to the United States; but the demand for Scotch pig iron there at present is by no means very brisk. The failures in the English iron trade have for the moment certainly had no evil influence upon our market. The stock of pigs in Messrs. Connal and Co.'s Glasgow stores is still on the decrease, although the exports have been small on account of bad weather.

Business was done in the warrant market on Friday forenoon at 49s. to 49s. 2d. cash and 49s. 2d. to 49s. 4½d. one month, the afternoon's quotations being 49s. 2½d. to 49s. 3½d. cash and 49s. 4½d. to 49s. 6d. one month. On Monday business was done at from 49s. 1d. to 49s. 2½d. cash, and 49s. 4½d. one month. Business was done on Tuesday up to 49s. 5d. cash, and 49s. 7d. one month. On Wednesday business was done at 49s. 6d. to 49s. 9d. cash, and back to 49s. 7½d. At the close to-day—Thursday—the market was firm, with business up to 49s. 11½d. cash.

The prices of makers' iron are as follow:—Gartsherrie, f.o.b. at Glasgow, per ton No. 1, 63s. 6d.; No. 3, 54s.; Coltness, 67s. 6d. and 56s.; Langloan, 67s. 6d. and 56s.; Summerlee, 63s. and 53s.; Calder, 63s. and 52s.; Carnbroe, 56s. and 51s.; Clyde, 54s. and 51s.; Monkland, 51s. and 49s.; Quarter and Govan, each 50s. 6d. and 48s. 9d.; Shotts, at Leith, 65s. 6d. and 56s.; Carron, at Grangemouth, 53s.—specially selected, 57s. 6d.—and 52s.; Kinneil, at Bo'ness, 50s. and 48s. 6d.; Glengarnock, at Ardrossan, 56s. and 50s. 6d.; Eglinton, 51s. 6d. and 49s. 6d.; Dalmellington, 51s. 6d. and 50s.

Although the malleable ironworks are busy, there is a lack of work offering for the future, but this may probably to some extent be supplied by the beginning of the year. Bars are quoted at £6 5s. to £6 15s. per ton; angles, £6 2s. 6d.; and ship-plates, £7. Steel angles are £8 15s.; ship-plates, £10; boiler-plates, £11.

The past week's launches on the Clyde include, by Messrs. Barclay, Curle, and Co., of Glasgow, an iron sailing ship of 1575 tons, named the Anaurus, for the Clyde and San Francisco trade of Messrs. Carmichael, of Greenock; by Messrs. David J. Dunlop and Co., of Port Glasgow, a twin-screw steamer, 180ft. long and 100-horse power, entirely built of steel, named the Mayrink, for Messrs. Reis and Co., of Rio de Janeiro; by Messrs. Alex. Stephen and Sons, of Linthouse, Glasgow, a beautifully modelled steel screw steamer of 1750 tons, named the Rosslyn, for Messrs. John Warrack and Co., of Leith; by Messrs. T. B. Leath and Co., of Rutherglen, a paddle-wheel steamer of about 400 tons, designed on the double-bow principle, built from steel supplied by the Steel Company of Scotland, guaranteed to steam 15 knots per hour, and to carry 1200 passengers, for the Port Jackson Steamship Company, of Sydney.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

THE coal and iron industries are in tolerable activity, the total clearances of coal and iron for the week show this: Coal, 180,000 tons; iron, 6200 tons. I hear, however, complaints from a few of the principal coalowners of a slackness of trade. In the placing of the large contracts for the steam companies some collieries had the lion's share, and the result is that one can see a colliery in fullest activity in one part, and a neighbouring one doing little. This applies principally to steam. House coal, especially of the best kind, is in good request, and there is no difficulty found in getting best market quotations. Small coal is in good requirement. Pitwood is very scarce.

The leading subject of comment at present is the number of disastrous failures we have had in Wales, principally amongst the tin-plate men. Since my last Vernon's—D. Morris and Co.—have succumbed, and another small one in the Ystalyfera Valley. Individual suffering in this case may be expected to lead to general good. The tone of the market is much healthier, prices are looking up, and as a lessened output is certain, there has been a greater anxiety to place orders than has been known for some time past. Ironmasters in Wales have suffered severely as well as coalowners from the late failures.

It is expected that in another week the new railway from Cyfarthfa works to the junction with the London and North-Western will be completed, and then the ponderous machinery required for the steel works will be brought from the North. The Dean Forest colliery owners have agreed to give an advance of 5 per cent.

The Duffryn Rhondda Colliery has been reopened. This is situated in the upper part of the Maesteg district, and will employ about 100 men.

The Barry Dock scheme, which is expected to affect the Maesteg, and districts in vicinity, is taking form, directors having been named. The promoters are sanguine of success, and base their opinion on the high railway dividends realised from the quarter through which the new line connecting the docks will run. *Per contra* it may be urged that the strong argument against them will be, "Will not the Bute Dock extension meet all requirements?" This is the nut which will have to be cracked.

The healthy character of the coal trade of Wales is nowhere more strongly shown than at Newport, from which port last week nearly 50,000 tons of coal were sent. This is close upon the total sent from Cardiff ten years ago.

Patent fuel is firm in demand and prices. Foreign ores, principally Bilboa, are coming to hand freely.

IT is proposed to build a new dock at Halifax, Nova Scotia, but as there is no site on which the dock can be wholly excavated, it will be necessary to build out into the water with caisson appliances.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

12*th December*, 1882.

5917. Planing and Milling Machines, W. F. Smith and A. Coventry, Salford.
5918. Dynamo-electric Machines, H. H. Lake.—(*R. H. Mather, Windsor, U.S.*)
5919. Separating Yarn from Paper Tubes or Cops, H. J. Haddan.—(*E. Scheidecker and R. Kohl, Thann.*)
5920. Air Pumps, J. C. Baker, Liverpool.
5921. Compound Engines, &c., H. Dansey and O. Robinson, London.
5922. Brushes, S. Pitt.—(*M. G. Imbach, New York.*)
5923. Sea-going Vessels, J. H. Johnson.—(*D. Ammen, Beltsville, U.S.*)
5924. Decorating Walls, &c., J. H. Johnson.—(*G. Juncker, Paris.*)
5925. Miners' Safety Lamps, W. Morgan, Pontypridd.
5926. Treating, &c., Organic Bodies by an Electropathic Method, H. Haug & A. Wienand, Germany.
5927. Bichromate of Potash, F. C. Glaser.—(*P. Römer, Elberfeld.*)
5928. Tubular Structures, H. N. Maynard and H. J. Cooke, London.
5929. Collapsible Tubes, C. E. H. Cheswright.—(*C. Cheswright, Cognac, France.*)
5930. Wicks, J. Telfer, Glasgow.
5931. Capsules for Bottles, &c., C. E. H. Cheswright.—(*C. Cheswright, Cognac, France.*)
5932. Substitute for Linseed Oil, P. G. Oster, Prussia.
5933. Ornamenting Glass, &c., R. E. Frank.—(*L. Micciullo, Rossano, Italy.*)
5934. Sawing Wood, W. R. Lake.—(*R. S. Greenlee, U.S.*)
5935. Musical Instruments, W. R. Lake.—(*A. H. Hammönd, Worcester, U.S.*)
5936. Leather, W. R. Lake.—(*J. W. Vaughan, U.S.*)
5937. Displaying Advertisements, W. R. Lake.—(*W. Akin, New York, U.S.*)
5938. Boxes and Safes, W. R. Lake.—(*M. Merrill and J. H. Nolan, Boston, U.S.*)
5939. Removing Grease, &c., from Feed-water, A. M. Clark.—(*D. D. Wass, S. Stuart, J. C. Henderson, and T. Motley, New York, U.S.*)

13*th December*, 1882.

5940. Tricycles, &c., W. H. Thacker and J. T. Green, Nottingham.
5941. Surfacing Machine, C. Pieper.—(*H. Friederichs, Hanover.*)
5942. Cigars, &c., O. W. T. Barnsdale, Nottingham.
5943. Spooling Machines, T. Hand and J. T. Wibberley, Blackburn.
5944. Covers or Stoppers for Bottles, &c., E. Edwards, London.
5945. Cup and Screw Hooks, &c., A. H. Adams, Handsworth.
5946. Marking Inks, H. W. Langbeck, London.
5947. Submarine Tunnels, C. G. Clarke and R. St. G. Moore, Kingston-upon-Hull.
5948. Wedges, &c., G. Guthrie, Sunderland.
5949. Safety Apparatus for Ships' Holds, R. C. Scott, Litherland.
5950. Railway Signalling Apparatus, W. R. Sykes, Nunhead.
5951. Watches, A. B. Cole, Coventry.
5952. Pressing Asbestos into Wood, &c., I. A. Timmis, London.
5953. Purifying, &c., Coal Gas, J. F. G. Kromschröder, London.
5954. Furnaces, T. Cocker and J. Ellis, Gildersome.
5955. Controlling aud Measuring Apparatus, A. G. Henderson and J. A. Kelman, London.
5956. Illuminating and other Gases, A. G. Henderson and J. A. Kelman, London.
5957. Tables, A. Thomson, Glasgow.
5958. Combing Wool, &c., J. H. Whitehead, Leeds.
5959. Tanning Skins and Hides, P. Jensen.—(*S. A. Garveri, Stavanger.*)
5960. Combined Ventilating and Fire-extinguishing Apparatus, C. Brothers, London.
5961. Dynamo or Magneto-electric Machines, G. L. Anders and J. B. Henck, jun., London.
5962. Photographic Albums, A. Aron.—(*A. Aron, Paris.*)
5963. Engraving Machines, F. Wirth.—(*L. Limberd and M. Salin, Hanan.*)
5964. Shedding Apparatus for Looms, J. Irving, Barnsley.

14*th December*, 1882.

5965. Slide Valves, C. Pieper.—(*E. Blass, Prussia.*)
5966. Condensing Matters in Gas, J. Jameson, Newcastle-upon-Tyne.
5967. Permanent Way, F. C. Glaser.—(*R. Abt, Paris.*)
5968. Vertical Steam Boilers, A. H. B. Sharpe and F. Palmer, Lincoln.
5969. Valves of Motive Power Engines, W. Hargreaves and W. Inglis, Bolton.
5970. Pentagraph Engraving Machines, J. Mowat, Barrhead.
5971. Covering Stairs with Carpet, &c., H. Hawgood, Richmond.
5972. Igniting Gas, &c., T. Rowan, London, and S. Williams, Newport.
5973. Spinning Fibres, F. Ripley, Bradford.
5974. Looms, D. Eastwood, Luddenden Foot.
5975. Aerated Water, J. Sellers, London.
5976. Keys, J. H. Johnson.—(*E. C. E. Gallois, Paris.*)
5977. Galvanic Batteries, J. Rapieff, London.
5978. Actuating Railway Points, H. Johnson, Eccles.
5979. Fastenings for Gloves, &c., F. R. Baker, Birmingham.
5980. Glass Bottles, &c., H. E. Newton.—(*De Poilly, De Fitz-James, and De Brigode, Paris.*)
5981. Treating Sewage, R. Nicholls, Hendon.
5982. Brackets, T. Smith, Brockley, and J. Drewitt, Peckham.
5983. Bicycles, &c., R. W. Brownhill, Walsall.
5984. Firegrates, &c., J. Shepherd, Manchester.
5985. Polishing Jewels, &c., W. L. Wise.—(*J. T. y Urell and J. T. y Nogues, Barcelona.*)

15*th December*, 1882.

5986. Blasting Explosives, R. Hannan, Glasgow.
5987. Self-recovering Hydraulic Steering Gear, C. Stout, Carnarvon, and C. H. Hillcoat, Liverpool.
5988. Checking the Receipt of Money, T. Wrigley and J. Maynes, London.
5989. Bichromate of Soda, C. D. Abel.—(*F. C. Glaser, Berlin.*)
5990. Heating Water, A. W. L. Reddie.—(*E. Theisen, Lsndenau, Germany.*)
5991. Tricycles, &c., O. Pihlfeldt, Coatham.
5992. Stove Grates, H. Hoyles, Upperthorpe.
5993. Wire Cloth, N. and L. Greening, Warrington.
5994. Propelling and Steering Ships, &c., H. J. Haddan.—(*J. L. F. Barbier. France.*)
5995. Washing, &c., Wool, H. J. Haddan.—(*E. Tremsal, Loth, Belgium.*)
5996. Flushing Apparatus, C. W. Gauntlett, Southsea.
5997. Ironing, &c., Machine, H. Oldershaw, Leicester.
5998. Breaking Stones, &c., L. L. Loizeau, Paris.
5999. New Process of Incrustation, E. Truchot, Paris.
6000. Lighting Apparatus, C. L. A. Baatsch, Clapton.
6001. Wire, &c., O. Schölzig.—(*G. Reinhard, Schwelm.*)
6002. Lighting by Electricity, &c., A. M. Clark.—(*G. Trouvé, Paris.*)
6003. Electrical Conductors, &c., S. H. Emmens, London.
6004. Electrical Installation Fittings, S. H. Emmens and R. I. Barnes, London.

16*th December*, 1882.

6005. Lifts or Hoists, J. T. Donald, Glasgow.
6006. Miners' Safety Lamps, D. Ballardie, Glasgow.
6007. Furnaces, J. Williams, Cardiff.
6008. Obtaining Ammonia, F. Lorenz, Rendsburg.
6009. Locks and Latches, J. M. Hart, London.
6010. Protective Sheathing for Wire Ropes, &c., E. A. Brydges.—(*C. Klauke, Muncheberg.*)
6011. Grinding Apparatus, E. A. Brydges.—(*Schwarz Brothers, Fürth.*)
6012. Excavating Machinery, J. Imray.—(*P. Jacquelin and V. Chèvre, Paris.*)
6013. Amalgamating and Settling Apparatus, J. Patterson.—(*F. Morris, San Francisco, U.S.*)
6014. Collars, R. B. Hayward, London.
6015. Explosive Compound, J. Polkinghorne, Marazion.
6016. Automatically Inserting Pressing Boards between Folds of Cloth, &c., J. C. Mewburn.—(*C. Weisbach, Chemnitz.*)
6017. Glazing Roofs, &c., W. Ferguson, Guernsey.
6018. Audible Signalling Apparatus, J. Steven and T. Burt, Glasgow.
6019. Dynamo-electric Machines, W. Horry, London.
6020. Telephonic Apparatus, G. L. Anders and J. B. Henck, jun., London.
6021. Steam Generator, H. Montgomery, Cleadon.
6022. Monalchoholised Hydric-bases, W. A. Barlow.—(*A. Böhringer, Stuttgart.*)
6023. Telephonic Apparatus, W. R. Lake.—(*G. M. Torrence, Philadelphia, U.S.*)
6024. Screw Nuts, A. S. Paterson.—(*H. A. Harvey, Orange, U.S.*)

18*th December*, 1882.

6025. Sewing Machines, T. Chadwick and T. Sugden, Oldham.
6026. Projectiles for Rifles, H. Simon.—(*The Schweizerische Industrie-Gesellschaft, Switzerland.*)
6027. Latching Bolts of Locks, &c., J. Woodward, Wolverhampton.
6028. Fastenings for Trunks, &c., W. Jones, Wolverhampton.
6029. Coupling Vehicles, H. P. Hoghton, Manchester.
6030. Gas Apparatus, J. W. C. Holmes, Huddersfield, and S. Lindley, South Hylton.
6031. Pianofortes, W. Thomas, London.
6032. Protecting Velocipedists from Wet Weather, A. Tomkins, London.
6033. Ccupling, &c., Vehicles, J. Graham, Abergavenny, and T. J. Graham, Birmingham.
6034. Photometric Apparatus, S. P. Thompson and C. C. Starling, Bristol.
6035. Window Fasteners, G. T. Ball, London.
6036. Steering Apparatus, E. Wimshurst, London.
6037. Finishing Textile Fabrics, L. E. Luzeau-Coudrais —(*A. Vincent, France.*)
6038. Winches, &c., W. Pitt, Bath.
6039. Mosaic Floorcloths, F. Walton, Twickenham.
6040. Wagons, H. C. Bull, Liverpool.
6041. Malting Grain, C. D. Abel.—(*Dr. L. Mautner, Vienna.*)
6042. Clearing Snow, E. Barnet, Ulverstone.
6043. Drying and Roasting Malt, &c., C. D. Abel.—(*Dr. L. Mautner, Vienna.*)
6044. Spinning Fibres, E. Tweedale, Accrington.
6045. Coupling Apparatus, H. H. Lake.—(*W. Johnston, Philadelphia, U.S.*)
6046. Electric Lamps, H. H. Lake.—(*J. Kremenezky, Vienna.*)
6047. Bichromates, J. H. Johnson.—(*O., A., and A. Neuhaus, Elberfeld.*)

Invention Protected for Six Months on Deposit of Complete Specifications.

5922. Brushes, S. Pitt, Sutton.—Com. from M. G. Imbach, New York, U.S.—12*th December*, 1882.

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

5147. Applying Tickets to the Ends of Threads and other Spools, P. J. Livsey, Manchester.—16*th December*, 1879.
5161. Machine Guns, H. H. Lake, London.—16*th December*, 1879.
5165. Pencil, &c., Holders, J. H. Johnson, London. 16*th December*, 1879.
5089. Gleaning, &c., Machines, G. E. Vaughan, London.—12*th December*, 1879.
5095. Jointing Metal Panel Plates, P. A. Thomas, London.—12*th December*, 1879.
5217. Knitting Machines, W. Cotton, Loughborough. —20*th December*, 1879.
5331. Musical Instruments, E. Hunt, Glasgow.—31*st December*, 1879.
5114. Telephonic Apparatus, W. R. Lake, London.—13*th December*, 1879.
5240. Magazine Fire-arms, W. Trabue, Louisville, U.S.—22*nd December*, 1879.
5129. Sugar, &c., Machinery, A. Fryer, Wilmslow.—15*th December*, 1879.
5215. Salvers, Trays, &c., J. A. Rhodes and J. H. Barber, jun., Sheffield.—20*th December*, 1879.
5272. Water-closets, &c., W. P. Buchan, Glasgow.—24*th December*, 1879.
5122. Ovens, A. M. Chambers, Thorncliffe. — 15*th December*, 1879.
52. Mounting, &c., Millstones on their Spindles, J. Comerford, Rathdrum.—6*th January*, 1880.
97. Steam Engines, J. C. Stevenson and J. B. Price, Preston.—9*th January*, 1880.
5169. Carding Wool, &c., E. Fairburn, Cooper Bridge. —17*th December*, 1879.
5173. Cutting Machinery, W. R. Lake, London.—17*th December*, 1879.
5200. Balling Fibrous Materials, J. Bottomley, Buttershaw.—19*th December*, 1879.
5204. Harvesting Machines, W. R. Lake, London.—19*th December*, 1879.
5205. Indicating Speed Apparatus, B. Tower, Blackheath.—19*th December*, 1879.
5279. Portable Forges, &c., A. B. Holmes, Derby.—24*th December*, 1879.

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

4315. Looms for Weaving, T. Singleton, Over Darwen. —13*th December*, 1875.
4335. Soaps, Pomades, &c., F. J. Cleaver, London.—14*th December*, 1875.
4352. Stoppers for Bottles, H. Grauel, Magdeburg.—15*th December*, 1875.
4493. Umbrellas and Sunshades, J. Willis, Malvern Wells.—24*th December*, 1875.
4322. Windlasses, E. Walker, London.—13*th December*, 1875.
4342. Gas Motive Power Engines, E. P. Alexander, London.—15*th December*, 1875.
4443. Self-stoking Furnaces, T. Vicars, sen., T. Vicars, jun., and J. Smith, Liverpool.—22*nd December*, 1875.
4164. Sash Pulleys, J. F. Meakin, London.—2*nd December*, 1875.
4378. Ventilating Apparatus, R. Parker, Bow.—17*th December*, 1875.
4488. Looms for Weaving, R. Yates and G. Brierley, Preston —24*th December*, 1875.
13. Deodorising and Purifying Sewage, C. Rawson and J. W. Slater, London.—1*st January*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, 5*th January*, 1883.)

3811. Cleaning, &c., Windows, C. H. Southall, Leeds. —10*th August*, 1882.
3828. Cast Iron Lining for the Walls of Furnaces, W. H. Beck, London.—A communication from L. Wallet.—10*th August*, 1882.
3829. Ventilating Sewers, &c., T. S. Wilson and H. T. Johnson, Manchester.—11*th August*, 1882.
3837. Brooms, &c., A. J. Boult, London.—A communication from J. Gontier.—11*th August*, 1882.
3843. Working the Pneumatic Levers of Organs, W. Carling, Hitchin.—12*th August*, 1882.
3844. Reed Fabrics for Ceilings, E. A. Brydges, London.—A communication from P. Stauss and H. Ruff.—12*th August*, 1882.
3847. Lamps for Collapsing, &c., into a Small Compass, W. H. Bulpitt, Birmingham.—12*th August*, 1882.
3851. Dressing Grain, G. W. Murray, Banff, N.B.— —12*th August*, 1882.
3853. Closing, &c., Doors of Railway Carriages, F. Pontifex, London.—12*th August*, 1882.
3855. Pneumatic Signalling Apparatus, G. Porter, London.—12*th August*, 1882.
3860. Shuttle Sewing Machines, J. E. Walsh, Halifax.—Com. from J. Kayser.—12*th August*, 1882.
3861. Electric Incandescent Lamps, G. Pfannkuche, London, and A. A. Dixon, Gateshead-on-Tyne.—12*th August*, 1882.
3863. Deodorising, &c., Human Excreta, R. Nicholas, London.—12*th August*, 1882.
3879. Type-setting, &c., Machines, E. W. Brackelsberg, Prussia.—14*th August*, 1882.
3915. Fire-escapes, J. Kennedy, Strabane. —16*th August*, 1882.
3918. Book-holders, H. J. Allison, London.—A communication from R. M. Lambie.—16*th August*, 1882.
3921. Fabrics for Covering Walls, S. Fisher, London. —16*th August*, 1882.
3936. Supporting, &c., the Bottoms of Pantaloons, W. Brierley, Halifax.—A communication from R. Kindler.—17*th August*, 1882.
3948. Looms for Weaving, C. Catlow, Burnley.—17*th August*, 1882.
3970. Spinning, &c., Tobacco, D. and J. Macdonald, Glasgow.—19*th August*, 1882.
3983. Making Bore-holes, J. Waddington and B. Longbottom, Barrow-in-Furness, and J. Ashworth, Dalton-in-Furness.—19*th August*, 1882.
4019. Fire-arms, &c., F. B. W. Roberts and B. T. Moore, London.—22*nd August*, 1882.
4078. Spring Hinges, E. Barnes, London. —25*th August*, 1882.
4157. Tricycles, &c., W. J. Lloyd, Harborne.—31*st August*, 1882.
4183. Railway Vehicles, W. L. Wise, London.—A communication from B. Röber.—2*nd September*, 1882.
4288. Governing Apparatus for Steam Vessels, J. Dewrance and E. Wimshurst, London.—8*th September*, 1882.
4496. Wire Netting, M. A. F. Mennons, France.— Com. from F. H. Monmon.—20*th September*, 1882.
4502. Rigging Boats, G. Hughes, Wolverhampton.— 21*st September*, 1882.
4577. Stowing Bags of Wool, &c., in Vessels, H. M. Whitehead, London.—26*th September*, 1882.
4594. Lamps, W. L. Wise, London.—A communication from F. Besnard.—27*th September*, 1882.
4834. Utilising Distilled or Burnt Shale, T. L. Paterson and T. I. Scott, Glasgow.—11*th October*, 1882.
5084. Treating Coal, &c., W. Young, Peebles, N.B., and G. T. Beilby, Midcalder.—25*th October*, 1882.
5180. Shaping, &c., the Ends of Labels, C. Anderson and T. Cormie, Leslie.—31*st October*, 1882.
5319. Combing Wool, &c., J. H. Whitehead, Leeds.— 7*th November*, 1882.
5337. Mixing, &c., Air and Combustible Vapour, G. A. Schoth, London.—8*th November*, 1882.
5398. Hydraulic Lifts, J. S. Stevens, C. G. Major, and T. W. Barber, London.—13*th November*, 1882.
5449. Rolling Mills, F. Asthöwer and T. Bicheroux, Germany.—15*th November*, 1882.
5484. Preservative Composition for Ships' Bottoms, J. and T. Kirkaldy, London.—18*th November*, 1882.
5493. Bulking or Mixing Tea, &c., B. Tydeman, Erith, Kent.—18*th November*, 1882.
5495. Electric-arc Lamps, W. B. F. Elphinstone, Carberry Tower, N.B., and C. W. Vincent and J. Cottrell, London.—18*th November*, 1882.
5520. Affixing of Flexible and other Tubing to Couplings, J. Hunt and T. E. Mitton, Birmingham. —21*st November*, 1882.
5569. Ribbed Pile Fabrics, J. R. Hutchinson, Bury. —23*rd November*, 1882.
5570. Constructing Chains and Buckets, W. R. Kinipple, London.—23*rd November*, 1882.
5598. Stoves and Fireplaces, F. Greatrex, London.— 24*th November*, 1882.
5618. Fermenting Liquids, N. Lubbock, London.— Com. from F. I. Scard.—25*th November*, 1882.
5688. Screens for Separating, &c., Grain, H. S. Coleman and A. G. E. Morton, Chelmsford, and T. F. Stidolph, Woodbridge.—29*th November*, 1882.
5690. Tramways, H. H. M. Smith, London.—A communication from A. S. Hallidie.—29*th November*, 1882.

(*Last day for filing opposition*, 9*th January*, 1883.)

3830. Drying, &c., Textile Fabrics, W. W. Riddell, London.—11*th August*, 1882.
3886. Spanners, J. Brown, Liverpool.—15*th August*, 1882.
3900. Smoke-consuming Grates, W. I. Henry, London. —15*th August*, 1882.
3901. Fountain Pens, J. Nadal, London.—15*th August*, 1882.
3902. Hoisting, &c., Apparatus, W. R. Lake, London. —Com. from J. H. Lidgerwood.—15*th August*, 1882.
3906. Electric Lamps, W. R. Lake, London.—A communication from P. Tihon and E. Rézard.—15*th August*, 1882.
3907. Cigars, O. W. T. Barnsdale, Nottingham.—16*th August*, 1882.
3909. Constructing Roads, &c., W. P. Thompson, London.—A communication from M. A. C. d'Alma.— 16*th August*, 1882.
3916. Screw Gill-boxes, D., H., and W. Smith, Keighley.—16*th August*, 1882.
3925. Pontoons or Air Vessels, A. H. Williams, London.—16*th August*, 1882.
3932. Fireproof Liquid Compound, W. Astrop and R. Ridgway, London.—17*th August*, 1882.
3933. Safety Apparatus for Rolling Mills, T. Neuray, Liège, Belgium.—17*th August*, 1882.
3934. Ring Spinning, &c., Machinery, J. McGregor, Manchester.—17*th August*, 1882.
3939. Chineeing Textiles by Multichromatic Printing, W. A. Barlow, London.—A communication from M. V. L. Godefroy and L. Lanselle.—17*th August*, 1882.
3941. Secondary Batteries, N. C. Cookson, Newcastle-on-Tyne.—17*th August*, 1882.
3943. Separating Cream from Milk, D. Baynes, Canterbury. — A communication from P. H. McIntosh.—17*th August*, 1882.
3960. Gas Apparatus for Heating Water, &c., M. M. Brophy, London.—18*th August*, 1882.
3997. Solid Cumidine, &c., D. D. Abel, London.—A communication from the Actien Gesellschaft für Anilin Fabrikation.—21*st August*, 1882.
4018. Cleaning and Polishing Tin-plate, B. Williams, Canton, Cardiff.—22*nd August*, 1882.
4051. Preserving Meat, &c., W. H. Northcott, London.—24*th August*, 1882.
4052. Phaeton Gig, H. Lloyd, Liverpool.—24*th August*, 1882.
4074. Heating Baths, D. Jones, Walton, near Liverpool.—25*th August*, 1882.
4144. Caustic Potash and Soda, W. L. Wise, London. —A communication from La Société Anonyme Lorraine Industrielle.—30*th August*, 1882.
4182. Shipping Coal, &c., P. J. Messent, Tynemouth. —1*st September*, 1882.
4340. Knitting Machinery, S. Lowe and J. W. Lamb, Nottingham.—12*th September*, 1882.
4341. Knitting Machinery, J. W. Lamb and E. Attenborough, Nottingham.—12*th September*, 1882.
4356. Globe Holders for Gas, &c., Burners, G. H. Nash, Birmingham.—13*th September*, 1882.
4369. Window-sash Fasteners, W. A. McLeod, Birkenhead.—14*th September*, 1882.
4376. Dynamo-electric Machines, M. Deprez, Paris. —14*th September*, 1882.
4416. Increasing the Illuminating Power of Gases, &c., A. M. Clark, London.—A communication from V. Popp.—16*th September*, 1882.
4488. Hair-pins, F. Kingston, St. John's, Kent.—20*th September*, 1882.
4505. Wheels and Axles for Railway, &c., Cars, W. Morgan-Brown, London.—A communication from G. W. Miltimore.—21*st September*, 1882.
4531. Perambulators, &c., W. J. Ingram, London.— 22*nd September*, 1882.
4678. Regenerating Sulphur from Alkali Waste, W. Weldon, Rede Hall, Burstow.—2*nd October*, 1882.
4956. Steam Boilers, G. C. M. Hardingham, London. —18*th October*, 1882.
5039. Parallel Rulers, C. R. Baillie-Hamilton, Grove Park, Kent.—23*rd October*, 1882.
5360. Hooking and Cutting Cloth, W. Lee, Manchester.—10*th November*, 1882.
5443. Manufacture of Cigarettes, J. Clarkson, Apperley Bridge.—15*th November*, 1882.
5501. Self-acting Buckets, &c., G. M. Key and J. Lowrie, London.—18*th November*, 1882.
5545. Utilising Bye-products of the Soda, &c., Manufactures, J. Mactear, Glasgow.—22*nd November*, 1882.
5556. Breech-loading Guns, W. R. Lake, London.— Com. from W. Gardner.—22*nd November*, 1882.
5566. Exhausting the Bulbs of Incandescent Electric Lamps, &c., N. K. Cherrill, Paris.—22*nd November*, 1882.
5567. Harvesting Machinery, A. C. Bamlett, Thirsk.—22*nd November*, 1882.
5587. Railway Switches, E. N. Molesworth-Hepworth, Manchester.—24*th November*, 1882.
5605. Nails or Spikes, S. Watkins, Wolverhampton— Com. from W. Taylor.—25*th November*, 1882.
5639. Coupling, &c., Railway Vehicles, W. and L. Younghusband and T. Hudson, Darlington.—27*th November*, 1882.
5766. Treating Materials which have been Used in Purifying Coal Gas, J. Walker, Leeds.—4*th December*, 1882.
5772. Fire, &c., Ceilings and Floors, R. W. Hitchins, London.—4*th December*, 1882.
5836. Leather, J. Imray, London.—A communication from J. Shaw.—7*th December*, 1882.
5922. Brushes, S. Pitt, Sutton.—A communication from M. G. Imbach.—12*th December*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the* 15*th December*, 1882.)

5644. Railway Rails, &c., A. J. Acaster, Sheffield.— 24*th December*, 1882.
2868. Cutting or Shaping Stone, J. Thomas, Bangor —17*th June*, 1882.
2873. Producing Pressed Coke, &c., in Coke Furnaces, E. G. Vaughan, London.—17*th June*, 1882.
2874. Umbrellas and Parasols, R. B. Avery, Manchester.—17*th June*, 1882.
2883. Lubricating Apparatus, E. A. Brydges, London. —19*th June*, 1882.
2894. Cloth, T. Isherwood, Westerly, U.S.—19*th June*, 1882.
2896. Shunts or Switches, C. T. Howard, Providence, U.S.—19*th June*, 1882.
2901. Producing a Continuous Current of Air, &c., E. Edwards, London.—19*th June*, 1882.
2902. Electric Meters, J. T. Sprague, Birmingham. —19*th June*, 1882.
2906. Reel Appliances for Reaping Machines, T. Culpin, London.—20*th June*, 1882.
2908. Drying Apparatus, W. Combe, Glasgow.—20*th June*, 1882.
2912. Regulating Electric Currents, S. H. Emmens, London.—20*th June*, 1882.
2913. Secondary Batteries, S. H. Emmens, London. —20*th June*, 1882.
2914. Electric Lamps, S. H. Emmens, London.—20*th June*, 1882.
2918. Obtaining Ferrocyanide of Iron, &c., from the Products of the Manufacture of Coal, S. Pitt, Sutton.—20*th June*, 1882.
2920. Cleaning, &c., the Skins from Potatoes, C. L. Hancock, London.—20*th June*, 1882.
2926. Cooking Ranges, &c., A. K. Robinson, Leeds.— 20*th June*, 1882.
2927. Raising Water for Irrigation, W. R. Lake, London.—20*th June*, 1882.
2928. Mule Spinning Machines, S. Mock, Providence, U.S.—20*th June*, 1882.
2932. Artificial Manure, H. J. Haddan, London.— 20*th June*, 1882.
2938. Actions of Pianofortes, J. Mallinson, Selby.— 20*th June*, 1882.
2942. Bier for Conveying Coffins, C. D. Goldie, St. Ives.—21*st June*, 1882.
2946. Producing Azo Colours on Cotton, &c., C. Holliday, Huddersfield.—21*st June*, 1882.
2948. Valves, W. R. Lake, London.—21*st June*, 1882.
2950. Nailing Heels on Boots and Shoes, W. R. Lake, London.—21*st June*, 1882.
2992. Regulating the Action of Electric Arc Lamps, W. R. Lake, London.—23*rd June*, 1882.
3053. Breech-loading Small-arms, T. W. Webley and T. Brain, Birmingham.—28*th June*, 1882.
3105. Agricultural Elevators or Stacking Machines, R., J., and H. Wilder, Wallingford.—1*st July*, 1882.
3149. Ploughs, T. T. Mallett, Street, Somerset.—4*th July*, 1882.
3186. Recovering Sulphur from Alkali Waste, W. Weldon, Rede Hall, Burstow.—6*th July*, 1882.
3199. Cardboard, &c., J. H. Johnson, London.—6*th July*, 1882.
3254. Knife-cleaning Machines, G. Kent, London.— 8*th July*, 1882.
3255. Incandescent Electric Lamps, J. H. Gardiner, London.—8*th July*, 1882.
3377. Velocipedes, T. Smallwood and E. W. Cooper, Coventry.—17*th July*, 1882.
3384. Cutting Helical Grooves in Twist Drills, &c., H. J. Haddan, London —17*th July*, 1882.
3441. Regulating Electric Lamps, &c., A. and T. Gray, Glasgow.—20*th July*, 1882.
3742. Convertible Sociables, I. T. Townsend, Coventry.—5*th August*, 1882.
3801. Cutlery and Tools, D. Hummel, jun., London. —9*th August*, 1882.
4236. Metallic Fencing, R. J. George, Swansea.—6*th September*, 1882.
4332. Preparing Linoleum, &c., D. Hendry and J. Melville, Kirkcaldy.—12*th September*, 1882.
4378. Gas Engines, J. Atkinson, London. —14*th September*, 1882.
4379. Iron and Steel, J. G. Willans, London.—14*th September*, 1882.
4388. Gas Engines, J. Atkinson, London.—15*th September*, 1882.
4633. Musical Instruments, H. J. Haddan, London.— 29*th September*, 1882.
4637. Steering Gear, E. J. Harland, G. W. Wolff, W. H. Wilson, and W. J. Pirrie, Queen's Island.— 29*th September*, 1882.
4655. Metallic Staircases, R. Hudson, Gildersome.— 30*th September*, 1882.
4735. Secondary Batteries, C. T. Kingzett, London. —5*th October*, 1882.
4785. Treating Linseed, &c., G. G. B. Casero, France. —7*th October*, 1882.
4795. Preparing Fibrous Substances for Spinning, H. J. Haddan, London.—9*th October*, 1882.
4835. Causing more Perfect Combustion in Furnaces, H. J. Haddan, London.—11*th October*, 1882.
4930. Electric Arc Lamp, C. S. Snell, Cornwall.— 17*th October*, 1882.
4992. Fatty Matter, F. C. Glaser, Berlin.—20*th October*, 1882.

(*List of Letters Patent which passed the Great Seal on the 19th December*, 1882.)

2915. HOISTING GEAR, W. J. Brewer, London.—20*th June*, 1882.
2916. CHILDREN'S COTS, G. W. Moon, London.—20*th June*, 1882.
2939. VALVE and PLUNGER or PISTON COCKS, T. S. Truss, London.—21*st June*, 1882.
2941. WHEEL, J. S. Ayton, Stoke-upon-Trent, and T. Floyd, London.—21*st June*, 1882.
2945. SECONDARY or STORAGE BATTERIES, C. Sorley, London.—21*st June*, 1882.
2949. BOXES, M. D. Wood, Stafford, and E. P. Smyth, London.—21*st June*, 1882.
2956. SEPARATING, &c., DUST from AIR, J. F. Stewart, London.—21*st June*, 1882.
2957. IMPREGNATING, &c., SOFT WOOD, G. J. Cross, London.—21*st June*, 1882.
2958. VALVES or COCKS, T. Penn, London.—21*st June*, 1882.
2961. FLUSHING WATER-CLOSETS, &c., J. Harsant, London.—22*nd June*, 1882.
2964. VELOCIPEDES and TRICYCLES, W. Morgan-Brown, London.—22*nd June*, 1882.
2969. COMPOSITION for PREVENTING, &c., INCRUSTATION in STEAM BOILERS, E. Edwards, London.—22*nd June*, 1882.
2970. TREATING SEWAGE, &c., E. Edwards, London.—22*nd June*, 1882.
2973. VENTILATORS, R. Boyle, London.—22*nd June*, 1882.
2977. SUPPLYING FEED-WATER to STEAM BOILERS, E. de Pass, London.—23*rd June*, 1882.
2998. WEIGHING MACHINES or BALANCES, C. D. Abel, London.—24*th June*, 1882.
3003. TELEPHONIC, &c., WIRES, A. Wilkinson, London.—24*th June*, 1882.
3009. FIREPLACES, W. S. Morton, Edinburgh.—26*th June*, 1882.
3091. UTILISING CERTAIN DEPOSITS, &c., J. C. W. Stanley, London.—30*th June*, 1882.
3093. PLOUGHS, J. Howard and E. T. Bousfield, Bedford.—30*th June*, 1882.
3134. GRAIN ELEVATORS, H. E. Newton, London.—3*rd July*, 1882.
3233. ELECTRIC CLOCKS, J. P. A. Schlaeffi, London.—7*th July*, 1882.
3334. DYNAMO-ELECTRIC, &c., MACHINES, R. Matthews, Hyde.—14*th July*, 1882.
3368. FACILITATING the SLICING of BREAD, J. Erskine, Newton Stewart, N.B.—15*th July*, 1882.
4303. ELECTRICAL STORAGE BATTERIES, E. Frankland, London.—9*th September*, 1882.
4399. TREADLES of BICYCLES, J. Buckland, Taunton.—15*th September*, 1882.
4407. GALVANIC ELEMENTS, J. H. Johnson, London.—16*th September*, 1882.
4609. RAISING, &c., PORTABLE RIVETTING MACHINES, R. H. Tweddell, London, and J. Fielding, Gloucester.—28*th September*, 1882.
4625. PLANTE SECONDARY BATTERIES, St. G. L. Fox, London.—28*th September*, 1882.
4647. FASTENERS for SHIPS' SIDE-LIGHTS, R. C. Thompson, Sunderland.—29*th September*, 1882.
4691. GENERATING, &c., ELECTRIC ENERGY, F. C. Phillips, London.—2*nd October*, 1882.
4781. WATCHES, J. A. Knott, Balsall Heath.—7*th October*, 1882.
4797. STEAM and other FLUID PRESSURE ENGINES, C. A. and R. C. Parsons and J. H. Kitson, Leeds.—9*th October*, 1882.
4819. DYNAMO, &c., MACHINES, W. R. Lake, London.—10*th October*, 1882.
4881. LUBRICATING STEAM ENGINES, G. Varley and W. Gregory, Over Darwen.—14*th October*, 1882.
5062. SEWING MACHINES, S. Pitt, Sutton.—24*th October*, 1882.

List of Specifications published during the week ending December 16th, 1882.

1908, 8d.; 1991, 2d.; 2083, 2d.; 2095, 4d.; 2120, 6d.; 2145, 2d.; 2172, 2d.; 2173, 2d.; 2179, 2d.; 2182, 6d.; 2184, 2d.; 2185, 2d.; 2188, 2d.; 2194, 2d.; 2204, 1s.; 2207, 2d.; 2208, 10d.; 2210, 2d.; 2211, 2d.; 2218, 6d.; 2221, 4d.; 2222, 6d.; 2224, 6d.; 2225, 2d.; 2226, 2d.; 2228, 6d.; 2229, 2d.; 2231, 4d.; 2235, 2d.; 2237, 6d.; 2241, 2d.; 2244, 2d.; 2245, 6d.; 2246, 4d.; 2247, 2d.; 2248, 6d.; 2250, 6d.; 2251, 6d.; 2253, 2d.; 2254, 6d.; 2256, 2d.; 2257, 4d.; 2258, 6d.; 2260, 6d.; 2262, 4d.; 2263, 4d.; 2264, 4d.; 2267, 8d.; 2268, 2d.; 2270, 4d.; 2271, 6d.; 2273, 2d.; 2274, 4d.; 2275, 6d.; 2276, 4d.; 2279, 6d.; 2280, 6d.; 2281, 2d.; 2282, 2d.; 2283, 2d.; 2284, 10d.; 2285, 2d.; 2286, 2d.; 2288, 6d.; 2289, 4d.; 2290, 6d.; 2291, 2d.; 2292, 2d.; 2293, 2d.; 2294, 4d.; 2296, 2d.; 2297, 2d.; 2298, 2d.; 2299, 6d.; 2300, 4d.; 2301, 6d.; 2304, 2d.; 2305, 6d.; 2307, 6d.; 2308, 2d.; 2309, 6d.; 2311, 6d.; 2312, 6d.; 2313, 4d.; 2315, 6d.; 2316, 2d.; 2317, 6d.; 2318, 2d.; 2319, 6d.; 2320, 6d.; 2321, 2d.; 2322, 2d.; 2323, 6d.; 2324, 2d.; 2326, 4d.; 2329, 8d.; 2330, 4d.; 2331, 6d.; 2332, 8d.; 2333, 6d.; 2334, 2d.; 2335, 6d.; 2336, 6d.; 2337, 2d.; 2345, 6d.; 2346, 6d.; 2349, 6d.; 2350, 2d.; 2365, 6d.; 2366, 2d.; 2398, 6d.; 2413, 6d.; 2428, 6d.; 2457, 6d.; 2544, 4d.; 2765, 6d.; 4501, 1s.

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

ABSTRACTS OF SPECIFICATIONS.

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

1908. STRAINERS for STRAINING PULP, *G. Tidcombe, jun., Watford.*—21*st April*, 1882. 8*d.*
This relates to improvements in forming the slits in the strainer plates.

1991. TOOLS or APPARATUS for CUTTING PIPES or TUBES, *C. D. Abel, London.*—27*th April*, 1882.—(*A communication from T. J. W. Geerkens, Germany.*)—(*Void.*) 2*d.*
The pipe is inserted between two blocks, and a cutting disc is advanced by screwing the hand rod until it bites into the pipe at the point where it is to be cut, after which the frame carrying the blocks is turned round by means of rod or levers, so as to cause the disc to cut the pipe all round.

2037. IMPROVEMENTS in the MANUFACTURE of ELECTRIC INCANDESCENT LIGHTS, *A. L. Jousselin, Paris.*—29*th April*, 1882.—(*Not proceeded with.*) 2*d*
This relates to the manufacture of carbons, glass globes, &c., for incandescent lamps.

2083. MACHINERY for MAKING EYELETTED LABELS, *C. Keith, Inverness.*—3*rd May*, 1882.—(*Void.*) 2*d.*
This relates particularly to improvements in the folding dies or stamps.

2095. FIRE LIGHTERS and ARTIFICIAL FUEL, *J. Templeman and T. Carmichael, Glasgow.*—4*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to the construction and treatment of wood blocks.

2120. URINALS, *W. McGill, Lambeth.*—5*th May*, 1882. 6*d.*
The object is to construct double-action and flushing urinals that, thoroughly cleansing, shall prevent waste of water, and automatically flush round back or recess and bottom with the action of stepping on and off the treadle.

2136. IMPROVEMENTS in INCANDESCENT LAMPS, *J. Rapieff, London.*—6*th May*, 1882. 4*d.*
The inventor manufactures carbons for incandescent lamps by the carbonisation of collodion—amongst other things—prepared from gun-cotton, &c., and deposited in solution in the shape of sheets, &c., after which carbon in a pure state is deposited thereon from liquid gases. The filaments are preferably of spiral form. The invention also relates to the fixing of the conductors in the globes, &c.

2138. IMPROVEMENTS in APPARATUS for PRODUCING ELECTRIC CURRENTS, ALSO APPLICABLE for ELECTRO-MOTIVE POWER PURPOSES, *A. Millar, Glasgow.*—6*th May*, 1882.—(*Not proceeded with.*) 2*d.*
The improvements consist in the employment of an electro-magnet or a permanent magnet, so constructed that each of the two poles thereof forms circles concentric with or disposed symmetrically to each other, so that the space which separates the two circles is also circular. An armature somewhat similar to the Gramme ring is used.

2145. CABINETS or CASES for CONTAINING ASSORTMENTS or SPOOLS or BOBBINS or THREAD, *A. Black, Paisley.*—6*th May*, 1882.—(*Void.*) 2*d.*
This relates to a box divided by partitions.

2172. VELOCIPEDES, *J. Harrington, Coventry.*—9*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to means whereby each driving wheel is rendered independent of the other and of its driving shaft, thereby facilitating steering, whilst a power is obtained of readily driving either backwards or forwards and of holding the crank or driving axle still, and allowing the machine to run forward or backward for a certain distance by the momentum previously given to it.

2173. CONNECTING and DISCONNECTING APPARATUS for CARRIAGES and VEHICLES, &c., *E. Wright, London.*—9*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to a releasing apparatus, whereby the animal can be released with facility in any position.

2179. SQUEGEES, *A. Foster, Watford.*—9*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to adapting squegees for cleaning windows.

2182. CLOCKS, *A. Harder, Rausen, Prussia.*—9*th May*, 1882. 6*d.*
This relates to improvements in clocks, whereby the horizontally arranged pendulum rotates alternately in each direction, and which only require winding up once a year, once in ten years, or a still longer period.

2184. IMPROVEMENTS in ELECTRO-MAGNETIC, &c., ENGINES, *C. F. Varley, Bexley Heath, Kent.*—9*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to an arrangement of iron cylinders working one within the other, and a cylinder wound with wire so as to form a magnet, by which motion can be produced.

2185. IMPROVEMENTS in ELECTRO-MAGNETIC, &c., ENGINES, *C. F. Varley, Bexley Heath, Kent.*—9*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to the production of rotary motion in magnets by means of electric currents, and the production of currents by rotary motion of magnets.

2188. APPARATUS for OPENING BOTTLES CLOSED by INTERNAL STOPPERS, *P. Murat and A. Motet, Manchester.*—10*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This consists in the use of an instrument for forcing the internal stopper inwards, and at the same time closing the neck of the bottle and preventing the escape of the fluid, except through a tube and spout provided for the purpose.

2194. UNITING PIECES of WHALEBONE, *A. C. Henderson, London.*—10*th May*, 1882.—(*A communication from F. N. Robin, Paris.*)—(*Not proceeded with.*) 2*d.*
The ends are tapered and fastened together by metal plates.

2204. PRINTING MACHINES or PRESSES, *W. R. Lake, London.*—10*th May*, 1882.—(*A communication from J. T. Hawkins, Taunton, Mass., U.S.*) 1*s.*
The object is to combine the following features in one cylinder press, viz.: Equal surface velocities of the impression cylinder and bed; an impression cylinder of comparatively small diameter; absence of all mechanism for causing the impression cylinder to rotate in but one direction, while the bed reciprocates or makes a double stroke; absence of all mechanism for dis-articulating and re-articulating the impression cylinder and bed, peculiar to and distinctive of the stop cylinder press; absence of buffers or buffer-springs for arresting the motion of the bed; the delivery of each sheet of paper upon the fly-board with its last printed side upward, and without the impression thereon having come in contact with any part of the delivery mechanism; entire absence of tapes or cords from any part of the machine, and free access to the forme upon the bed.

2207. IMPROVEMENTS in ELECTRO-MAGNETIC, &c., ENGINES, *C. F. Varley, Bexley Heath, Kent.*—10*th May*, 1882.—(*Not proceeded with.*) 2*d.*
The object of this invention is to generate electricity by means of a conductor moving between the poles of magnets, as, for instance, a stream of mercury flowing between such poles.

2208. PRINTING MACHINES or PRESSES, *W. R. Lake, London.*—10*th May*, 1882.—(*A communication from J. T. Hawkins, Taunton, Mass., U.S.*) 10*d.*
The invention consists in constructing a press with two impression cylinders, one in advance of the other, and a single type-bed carrying two formes, and wherein the first cylinder receives each sheet at its top, and delivers it from its top, head first, to the bottom of the second cylinder, which here receives the sheet, and delivers it from its top, tail first.

2210. MOVEMENTS or ACTIONS for SWING LOOKING-GLASSES, &c., *H. Carter, London.*—10*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to an appliance for securing the glass at any desired angle.

2211. PRODUCING ORNAMENTAL and OTHER DESIGNS upon TIN-PLATES, *C. Johnson, London.*—10*th May*, 1882.—(*Not proceeded with.*) 2*d.*
The object is to produce tin-plates partly crystallised but having ornamental patterns, letters, and other devices, which are not so crystallised.

2218. ELASTIC COUPLINGS for ROPES, CHAINS, &c., *J. Greenwood, Southend.*—11*th May*, 1882. 6*d.*
This relates to couplings provided with volute springs.

2221. CONTRIVANCE for HOLDING the GLOBES of LAMPS, *J. and T. L. Archer, Manchester.*—11*th May*, 1882. 4*d.*
This relates to the employment of a sliding clamp piece with a spring attached to a small stop or catch piece underneath the clamp piece.

2222. TREATMENT of OFFAL, OILS, FATS, &c., *H. J. Haddan, Kensington.*—11*th May*, 1882.—(*A communication from J. N. B. Bond, jun., New York.*) 6*d.*
This consists partly in a process for treating offal, &c., by exposing the same to a high temperature in a comminuted state under constant agitation and in a rarefied atmosphere, so that the noxious gases are carried off, and the material under treatment is readily reduced to serve as a fertiliser.

2224. PRODUCTION of NITROUS VAPOURS, *G. Prim, Mons, Belgium.*—11*th May*, 1882. 6*d.*
The invention is based on the property of electricity of high tension in the form of sparks, or in the form of a continuous current or silent discharge, to cause the combination of the oxygen of the atmospheric air with the proportional part of its azote, so as to form nitrous vapours.

2225. AN IMPROVED DYNAMO-ELECTRIC MACHINE, *T. Floyd, Westminster, and T. Kirkland, jun., Upper Norwood.*—11*th May*, 1882.—(*Not proceeded with.*) 2*d.*
The inventors propose to construct a machine in which the armature and field magnets shall both revolve, the one in an opposite direction to the other.

2226. AN IMPROVED INCANDESCENT ELECTRIC LAMP, *T. Floyd, Westminster, and J. Probert, Walworth-road.*—11*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to the construction of an incandescent lamp by exhausting a glass globe and inserting one or more carbonaceous fibres attached to conducting wires.

2228. FREEZING LIQUIDS, *A. Allworth, London.*—11*th May*, 1882. 6*d.*
This relates to a method of freezing liquids, which contains a substance or substances in solution or suspension.

2229. CANDLESTICKS, *W. Blundell, London.*—11*th May*, 1882.—(*Not proceeded with.*) 2*d.*
The stem of the candlestick is formed of telescopic tubes. Pins are employed for holding the candle.

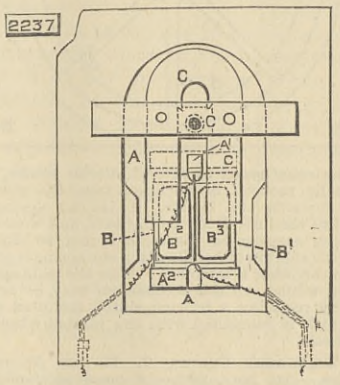
2231. MANUFACTURE of GAS for LIGHTING, &c., *B. Russ, London.*—11*th May*, 1882.—(*Not proceeded with.*) 2*d.*
Gas is produced by the decomposition, in suitable apparatus, of a mixture of hydrocarbon or hydrocarbons, potash, and water, with or without the addition of ammonia or ammoniacal liquor, or soda or other material may be used to facilitate the mixing of the hydrocarbons and water.

2232. IMPROVEMENTS in APPARATUS for GENERATING ELECTRIC CURRENTS, *J. M. Stuart, London.*—11*th May*, 1882. 6*d.*
This relates to improvements in dynamo machines in which two or more armatures are made to revolve in opposite directions. The inventor also claims the application and use, for winding electro-magnets, of a soft iron core wound with and insulated from copper wire.

2233. IMPROVEMENTS in ELECTRIC LAMPS, *J. M. Stuart, London.*—11*th May*, 1882. 4*d.*
This relates to incandescent lamps. The inventor claims the application and use of tubes entering the glass globes, and containing through part of their length the conducting wires. He forms his carbons of animal carbon, preferably horsehair, or a combination of animal and vegetable carbon.

2235. RED COLOURING MATTER, *J. H. Loder, Holland.*—11*th May*, 1882.—(*Not proceeded with.*) 2*d.*
The colouring matter is obtained by the simultaneous reduction of various colour-bearing substances, which are present in a mixture or extract of sorrel and extract of red and yellow wood, or rosewood, or Brazil wood, or fustic.

2237. IMPROVEMENTS in MICROPHONES, *J. H. Johnson, Lincoln's-inn-fields.*—11*th May*, 1882.—(*A communication from Dr. A. D'Arsonval, Paris.*) 6*d.*
The improved microphone is shown in the figure, which is a view of the inner side. To the back of the diaphragm A are attached two grooved blocks $A^1 A^2$, composed of a manganesian agglomerate containing binoxide or peroxide of manganese. These blocks



form supports for two sensitive plates or contacts B B^1 of manganesian agglomerate carrying two metal plates B^2 B^3. The extremities of the two sensitive plates are bevelled on both sides, but at different angles, in order that the amplitude of their vibrations may be different, and these bevelled extremities are lodged in the grooves in A^1 A^2, which are connected with a battery. The pressure of B B^1 on A is regulated by the attraction of magnet C.

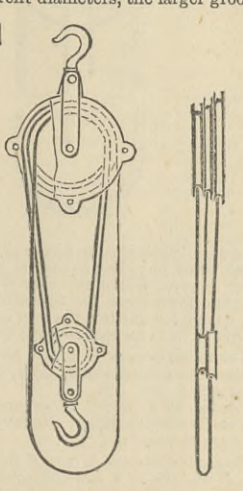
2241. BOILERS, *S. Jones, Wrexham.*—12*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This consists of a boiler egg-ended at one end and Cornish at the other.

2243. CAPSTANS, *A. Kennedy, Marquis of Ailsa.*—12*th May*, 1882. 6*d.*
The object of the invention is to reduce the friction between the block of the capstan and the spindle or axle, around which such block revolves; and it also relates to the means employed for giving motion to the capstan through the medium of the capstan bars.

2244. FLOORS and TREADS of STAIRS, *J. Thallon, London.*—12*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This consists principally of blocks of wood being laid on the old or sub-floor by means of iron rods running through the blocks, and fined to the old or sub-floor with holdfasts or other suitable fixings, or it may be between the blocks as a tongue.

2245. LIFE BUOYS, &c., *J. R. Hodgson, London.*—12*th May*, 1882. 6*d.*
This relates to the construction of lifeboats, the top and bottom halves of which are duplicates of each other, and so made that the top half shall turn back, and the two halves form a double raft.

2246. DIFFERENTIAL PULLEY APPARATUS, *W. R. Lake, London.*—12*th May*, 1882.—(*A communication from F. Roy, St. Etienne, France.*) 4*d.*
A pair of pulley blocks is provided with differential pulleys; that is, with sheaves having two or more grooves of different diameters, the larger groove being



at one side of the sheave and the smaller at the opposite side thereof. An endless cord or rope is wound upon the said sheaves in the manner illustrated in the drawing.

2247. FACILITATING SIGNALLING on RAILWAYS, *J. A. McLaren and H. M. Sherratt, London.*—12*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to an electrical arrangement for signalling on railways by means of the passing train.

2248. AN IMPROVED APPARATUS for MEASURING ELECTRIC CURRENTS, *T. Varley, Walthamstow, and H. B. Greenwood, Monmouth-road.*—12*th May*, 1882. 6*d.*
The object is to provide a meter which shall not be affected by friction. To carry the invention out a disc is provided fixed to a spindle carried in suitable bearings and arranged to be rotated by an electro-motor or other means, its speed being maintained at a uniform rate by a train of wheels and an escapement. In combination with this disc is a roller, carried in a pivotted arm or frame, the roller and frame being arranged to be oscillated by the varying attractive force of an electro-magnet, included in the circuit through which passes a part or the whole of the current to be measured. The shaft of the roller is connected with any suitable indicating and registering mechanism, which is preferably carried by the pivotted arm. A roller or cam is provided in connection with the armature of the electro-magnet for transmitting the movements of the said armature to the frame.

2250. MACHINERY for the MANUFACTURE of CASKS, &c., *S. Wright, Liverpool.*—12*th May*, 1882. 6*d.*
This consists in the use, in conjunction with a barrel-forming machine, of an arrangement of guides and guide rollers, between which the staves are fed on to the barrel form or drum.

2251. ROCK-BORING MACHINES, *J. Urwin, Scotswood-on-Tyne.*—12*th May*, 1882. 6*d.*
The invention consists of an improved ratchet brace, working in connection with a boring machine of the ordinary construction; also of an improved drill to work with or without the said ratchet brace.

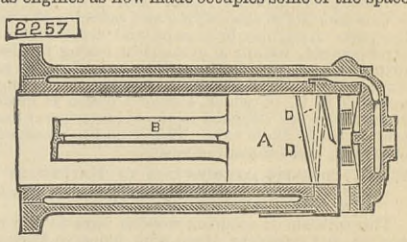
2252. STEEL-PINNED COVERING for RAG and WASTE TEARING MACHINES, &c., *T. R. and T. W. Harding, Leeds.*—12*th May*, 1882. 6*d.*
This consists in steel-pinned covering of rag and waste tearing or grinding and analogous machines, the use of pins comprising an acting or working portion, presenting a reduced thickness in the working direction, and a root portion constructed in such a way as to prevent the pins being drawn through the wooden lay or metal covering when they become loose.

2253. MACHINERY for SPINNING or DOUBLING, *H. Hall, Blackpool.*—12*th May*, 1882.—(*Not proceeded with.*) 2*d.*
The object is to improve the means for supporting the vertical revolving spindles.

2254. MANUFACTURE of FIGURED PILE FABRICS, *T. Anderson, Liversedge.*—13*th May*, 1882. 6*d.*
This relates to the manufacture of that class of figured pile fabrics wherein the figured pile is formed from the weft threads, the object being to facilitate the cutting of the pile, and to enable the knife to pass with greater certainty from the "race" of one figure of weft pile to the corresponding "race" of another figure of the same, without liability to slip out of the race or to trip or catch the edges.

2256. IMPROVEMENTS in APPARATUS for REGULATING and DIRECTING ELECTRIC LIGHT, *H. Wilde, Manchester.*—13*th May*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to improvements in a regulator described in the inventor's patent No. 618, for 19th February, 1873. It consists in the employment of electro-magnetic coils placed in proximity to the arc, so as to prevent its travelling round the carbon point, and so keep it to the front of them.

2257. GAS ENGINES, *O. Mobbs, Northampton.*—13*th May*, 1882. 4*d.*
In the drawing A represents the piston hollowed out at the inner or rear end of the piston-rod B, so as to form a chamber thereat. This chamber receives the explosive charge or mixture of gas and air, which in gas engines as now made occupies some of the space



between the solid end of the piston and the end of the cylinder. D represents a spiral cut through the walls of hollow piston A. The expansion of the end of the piston thus formed—or plain—is sufficient to keep a tight cylinder, and renders unnecessary any piston springs or packing segments.

2258. SHIPS' WINDLASSES and BOW STOPPERS, *W. H. Whettern, Gateshead.*—13*th May*, 1882. 6*d.*
This relates, First, to the employment of a jaw clutch or clutches; Secondly, to the employment of differential gear; Thirdly, to modifications in the usual form of bow stoppers.

2260. MACHINES for PLANING METALS, *G. Richards, Manchester.*—13*th May*, 1882.—(*A communication from J. Richards, San Francisco.*)—(*Complete.*) 6*d.*
This consists, First, in a saddle or tool-carrying carriage, mounted and sliding on a frame, the tools acting parallel to the frame, and at the side being supported by a projecting or overhanging arm, so that one side of the machine is open to receive large pieces and to permit easy access to the tools and to pieces being acted on; Secondly, in the combination of a rolling frictional device connected to and operating by the tool frame or saddle; Thirdly, in the combination of lateral and vertically adjustable tables or supports combined with a travelling and overhanging tool carriage. Other improvements are described.

2261. FERRULES for UMBRELLAS, &c., *W. H. Beck, London.*—13*th May*, 1882.—(*A communication from A. A. Rolland, Paris.*) 6*d.*
The invention consists in manufacturing the ferrules in one piece with extra thickness at the closed end.

2262. MANUFACTURE of "PURL" and "BULLION for EMBROIDERY, *F. and E. Stanton, Lewisham.*—13*th May*, 1882. 4*d.*
This consists mainly in arranging the wire or "plate" as it leaves the bobbin to be spun in spiral order, or to a tapered metal end, which it leaves under the action of a pair of vertical rollers clothed with india-rubber and set to speed to draw the spun wire from the tapered end or mandril as soon as made.

2263. IMPROVEMENTS in SECONDARY BATTERIES, *A. Tribe, Notting Hill.*—13*th May*, 1882. 4*d.*
To prevent the supporting or foundation plates of a secondary battery from being so highly electro-positive to the active materials placed on them as they usually are, and also to prevent the consequent setting up of local circuits, the inventor constructs his plates of lead, more or less converted into sulphides, oxides, or other compounds of an electro-negative character. To accomplish this, according to one method, the lead is brought into contact with molten sulphur and heated to a point below the melting point of lead.

2264. CHEMICALLY ENGRAVING COPPER or ZINC SURFACES, *T. R. Johnston, Edinburgh.*—13*th May*, 1882. 4*d.*
This relates to a combined process for chemically engraving copper or zinc surfaces.

2266. COMBINED LETTER-BOX and NAME-PLATES, *W. Newell and T. Tollett, Birmingham.*—13*th May*, 1882. 6*d.*
This consists in making a blank letter-box plate with openings and frames for containing the name and vocation of the occupier, the same being built up of separate letters.

2267. FASTENING DEVICES for GLOVES, &c., *W. R. Lake, London.*—13*th May*, 1882.—(*A communication from W. S. Richardson and P. K. Dumarsq, Newton, Mass., U.S.*) 8*d.*
This relates to the employment of a spring catch.

2268. Velocipedes, *H. T. Davey and P. A. Holt, London.*—13*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the means or apparatus for the propulsion and fitting of velocipedes.

2269. Harrows, *R., J., and H. Wilder, Wallingford.*—15*th May*, 1882. 6*d.*

The tine and beam section are formed in one piece, the front row of beam sections usually carrying two tines. The beam sections have holes punched or drilled through them, through which are passed iron rods connecting them together, the said sections being kept at their proper distance apart by means of tubes working on the rods and fitting recessed collars also placed and working thereon; or the tubes may be furnished with collars or flanges at their extremities.

2270. Improvements in Galvanic Batteries, *R. H. Simons, Brixton.*—15*th May*, 1882. 4*d.*

The inventor endeavours to obtain greater constancy and increased intensity as follows:—In a porous cell is placed a piece of graphite or carbon, the cell is then well packed with broken pieces of the same material. This cell is then placed in an outer cell, and the porous cell surrounded with cylindrical, spiral, or flat plates of zinc, iron, lead, or other suitable metal. The spiral and flat plates of zinc and carbon are then fastened firmly together alternately with double clamps. The carbon is saturated with one-tenth of lithia and potash and one-fifth of permanganate and hydrofluate acid in solution. The metal plates are immersed in a solution of protoxide of sodium—five parts potash to five parts protoxide—diluted in ten parts water.

2271. Heating Railway Carriages, &c., *J. Imray, London.*—15*th May*, 1882.—(*A communication from A. Morel, Paris.*) 6*d.*

This relates to apparatus for heating railway and other carriages by the circulation of hot water heated by a fire external to the carriage.

2272. Stench Traps, *J. M. Hale, London.*—15*th May*, 1882. 6*d.*

This consists partly of a gulley or trap with the overflow in the upper part, and a conduit leading therefrom to the lower part, so that the outlet may be at the bottom for connection with the pipe or drain.

2273. Syphonic Ventilating Chimney Top, &c., *C. H. von Ullmer, London.*—15*th May*, 1882.—(*Not proceeded with.* 2*d.*)

This relates to improvements on patent No. 2622, A.D. 1879, and consists in the employment of an air expansion chamber and a wind guard.

2274. Flour Milling Machinery, *A. B. Wilson, Holywood, Ireland.*—15*th May*, 1882. 4*d.*

This consists, First, in mechanism to be applied to the feed apparatus having working surfaces running at differential speeds, the difference in speed being determined by belts or friction, as shall regulate the quantity of feed by the difference between the speeds of the rollers; Secondly, in the employment of a comb to the feed apparatus; Thirdly, in the employment of a continuous web of air-filtering surface in motion; Fourthly, in an improved manner of securing silk or other dressing material to the frames supporting same; Fifthly, in improvements in centrifugal dressing machines.

2283. Gold and Silver Thread, &c., *F. Wirth, Frankfort-on-the-Main.*—15*th May*, 1882.—(*A communication from C. O. Harz and W. von Miller, Munich.*) 2*d.*

This consists in covering animal membranes with gold, silver, or other metal, in leaf or powder, or by means of electricity.

2284. Rotary Engines and Pumps, *E. C. Peck, Charlton.*—15*th May*, 1882. 10*d.*

This consists in simplifying and reducing the working parts of engines or pumps, and according to one arrangement, within a cylindrical casing revolves a drum with an opening through it at right angles to its axis, within which works a piston, also having an opening in it, in which a second piston is made to revolve on a pin attached to the cylinder cover excentrically to the drum axis. The drum has passages for supplying and exhausting steam.

2285. Securing Attachments to Mattresses for Use at Sea, *J. W. Watts, London.*—15*th May*, 1882. —(*Not proceeded with.*) 2*d.*

This consists in securing wooden bars to the mattresses, and providing them with holes, so that they can be tied together and form a kind of raft.

2286. Improvements in Electric Lamps, *R. Kennedy, Glasgow.*—16*th May*, 1882. 2*d.*

This relates to arc lamps, and is an improvement on the inventor's patent No. 1199, dated 13th March, 1882. It consists in substituting a tube or core of brass, copper, wood, &c., for the soft iron tube, on which the coil is wound, through which the current is shunted past the arc.

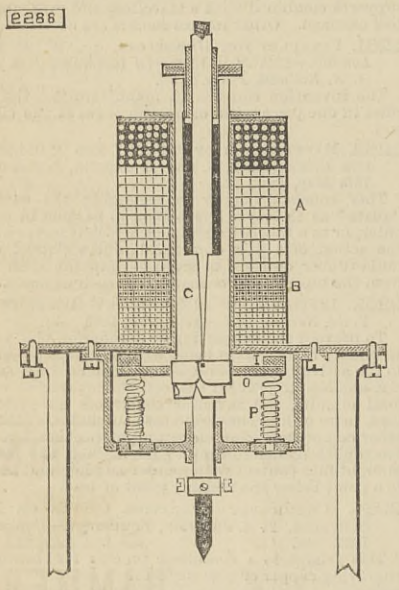
2287. Increasing the Fineness, Lustre, and Softness of Linen, *F. C. Glaser, Berlin.*—16*th May*, 1882.—(*A communication from H. Knab, Münchberg.*) 4*d.*

The invention consists mainly in the consecutive treatment of the fibre, whether in the unspun or the spun condition, with concentrated alkaline lyes and with soap solutions or saponified oils and fats.

2288. Improvements in Electric Lamps, *E. L. Voice, Torrington-square.*—16*th May*, 1882. 6*d.*

This relates to arc lamps. Referring to the figure, C C are iron rods forming the core, O O are extension pieces attached to these rods. When a current passes through main coil A, the tops of rods C C are attracted and consequently the carbon is held between their

2286



lower ends and the arc struck. When the arc gets too long, shunt coil B becomes the stronger, and attracts I I, while the core has a tendency to drop. This, however, cannot take place without its first releasing the carbon, by reason of the combined effect of the upward pressure of springs P P and the increased influence of B on I I.

2305. Registering the Number of Persons Entering and Leaving Vehicles, &c., *J. Morris, Liverpool.*—17*th May*, 1882. 6*d.*

This relates to suitable apparatus which is brought into action by the weight of the person entering or leaving the vehicle, and by means of which a ball is deposited in a closed box as each person enters or leaves.

2307. Earth Closets, *F. Versmann, New Charlton.*—17*th May*, 1882.—(*A communication from H. Kleucker, Brunswick.*) 6*d.*

This relates more particularly to constructing earth closets, so that coarse powder—such as the coarse powder obtained from moss peat, as described in patent No. 2439, A.D. 1881—can be used therein; and it consists in the use of suitable apparatus for ensuring the delivery of a definite quantity of moss peat or other powder every time the closet is used.

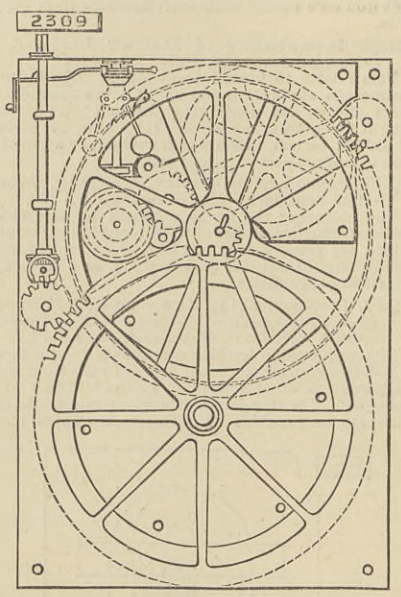
2308. Powders for Absorbing, Fertilising, and Deodorising, *A. E. Robinson, Edgbaston.*—17*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The powder consists of sulphate of calcium, sulphate of potash, a manganese or permanganate of lime, or potash, or soda, or a sulphite of magnesia, or lime, or alumina, or charcoal, animal, vegetable, or mineral, or chlorinated lime, and phosphate of lime.

2309. Spring Motors, *H. J. Haddan, Kensington.*—17*th May*, 1882.—(*A communication from A. Marques and J. Montcenis, Bordeaux.*) 6*d.*

The motor comprises a flat spiral spring enclosed in a cylindrical casing, and attached with the outer end to this fixed casing, while the inner end is fixed to the hub of a movable shaft carrying a spur wheel, from which motion may be transmitted to a shaft by means of intermediate gearing, comprising a ratchet wheel and a pawl. The steel blade forming the main

2309



spring is strengthened by several shorter blades, and is gradually reduced in thickness from the circumference towards the centre. A second spring is attached to the hub of the spring axle, and wound in a direction opposite to the main spring, so that by turning the shaft in either direction one spring is coiled up while the other is uncoiled. After the main spring has been wound up the mechanism may be set in motion by releasing a friction clutch mounted on a shaft, which is connected with the ratchet wheel by tooth wheels.

2312. Children's Chairs, *G. W. von Nawrocki, Berlin.*—17*th May*, 1882.—(*A communication from L. Schmetzer, Germany.*) 6*d.*

The chair can be used as a child's go-cart with castors, for which purpose the seat is fastened to the under framing, so as to be removable therefrom, and the legs swivel on the framing, and are provided with castors which come into action when the chair is used as a go-cart.

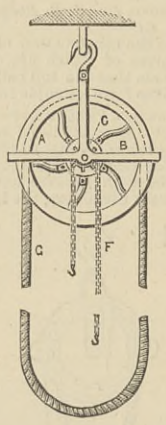
2316. Rolling, Straightening, and Finishing Metal Tubes and Bars, *J. Farmer, Glasgow.*—17*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 4425, A.D. 1877, and it consists in rolling the tubes over a central mandril, by means of skewed or oblique rolling surfaces, the one internal and the other external, so disposed and carried in movable housings hung on a single centre that the obliquity of the axis of the rolls may be varied and reversed during their rotation, the object being to cause the tubes to be traversed over the mandril and return to be delivered from it without stopping the machine.

2317. Power Wheels or Pulleys, &c., *A. W. L. Reddie, London.*—17*th May*, 1882.—(*A communication from E. W. Merrill, Brooklyn.*) 6*d.*

In the drawing A designates the power wheel or pulley, and B the chain wheel, which are both mounted on a common axle C, and connected so as to rotate together. F is a lift chain which runs over the wheel B, and is provided at each end with a hook whereby

2317



it may be readily attached to any article to be hoisted. The power wheel or pulley has in its periphery a deep and taper groove, which receives the endless hand rope G. Another part of the invention consists in a coupling device for uniting the two ends of a rope or round band to form an endless rope or band.

2318. Improvements in Electric Motors, &c., *J. A. Cumine, Clerkenwell.*—17*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a novel arrangement of electro-magnets in an electro-motor, whereby simplicity and efficiency are obtained.

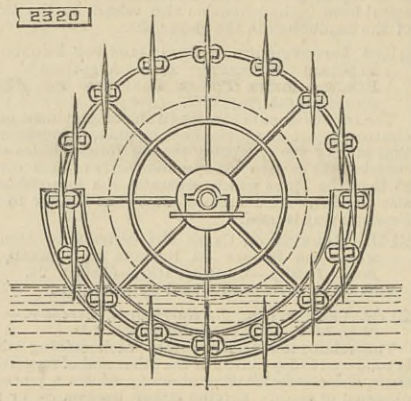
2319. Barbed Fencing Wire, *E. G. Rock, London.*—17*th May*, 1882.—(*A communication from J. Lees, J. W. Rock, and C. G. Moore, New Zealand.*) 6*d.*

This relates to a barbed fencing wire in which the barbs have three or five spikes and are punched out of sheet metal, and suitably bent and enwrapped by three wires twisted into a rope. Suitable machinery is also described for producing such wire.

2320. Water-wheels and Paddle-wheels, *A. Figge, London.*—17*th May*, 1882. 6*d.*

This consists in a water-wheel or propeller arranged to work in combination with guide course or courses, and provided with floats which preponderate on one side of the pivots, and tend to set themselves ver-

2320



tically, and are so held and controlled by guides so long as they are in position for efficient action.

2334. Tramways, *F. C. Glaser, Berlin.*—15*th May*, 1882.—(*A communication from the Bochumer Vereins für Bergbau und Gussstahlfabrikation, Westphalia.*)—(*Not proceeded with.*) 2*d.*

The permanent way consists of a double U-shaped rail, the feet of which embrace a box-shaped longitudinal sleeper, the two being connected by a screw bolt, the head of which lies under the rail heads and nut. The feet of the sleepers take into slots in a vertical flat iron plate.

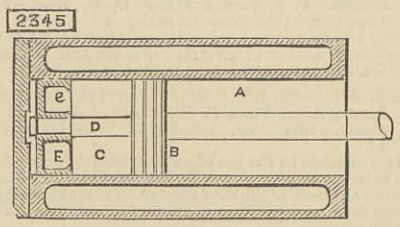
2335. Improvements in Fittings for Electric Lamps, *C. Defries, London.*—18*th May*, 1882. 6*d.*

This relates to a simple construction of circuit controller, whereby the circuit may be made and broken in the lamp with facility; also to an improved construction of holder for incandescent lamps, the advantage of which is that the circuit cannot be broken by the accidental rising of the glass bulb from its socket.

2345. Gas Motor Engines, *S. and H. N. Bickerton, Ashton-under-Lyne.*—18*th May*, 1882. 6*d.*

The drawing is a side sectional view of the cylinder of a gas engine constructed in accordance with the invention. A is the cylinder and B the piston, which latter is shown in the position of its extreme back stroke, the extension C of the cylinder beyond the limit of the back stroke of the piston being designed

2345



to serve as a compression chamber for the gaseous charge. To ensure that this chamber shall be entirely emptied of the products of the explosion, and also to prevent an ignition of the incoming charge, the piston-rod D is arranged to be extended backwards, and on this extension is mounted a disc E, provided with an annular space *e* facing the piston B, this disc being loose and free to slide to and fro upon the rod D.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

267,973. Trap, *R. Clarke, Brooklyn, N.Y.*—*Filed January 25th*, 1882.

Brief.—To prevent the water sinking below pipe B, by evaporation or other causes, and thus rendering the trap inefficient, a ball-float regulating a water supply

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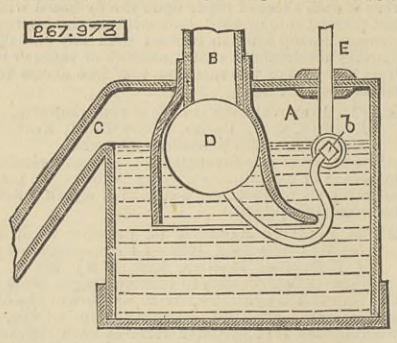

pipe E is placed in said trap and keeps the water up to the required standard. *Claim.*—(1) A trap provided with a ball D, within the casing A, and with an inlet water supply pipe and cock connected to the ball, whereby the supply of water in the trap is maintained and the sealing of the trap secured, substantially as set forth. (2) The combination, in a trap, of the case A, containing the ball-valve D, the inlet and outlet pipes B C, water supply pipe E, and cock *b*, connected to the ball D, substantially as set forth.

268,075. Noise-deadening Insulator, *Gouverneur M. Brown, Woonsocket, R.I.*—*Filed June 26th*, 1882.

Claim.—(1) The rubber block C, having recess D, screw-threads G, and vertical webs F, connecting said

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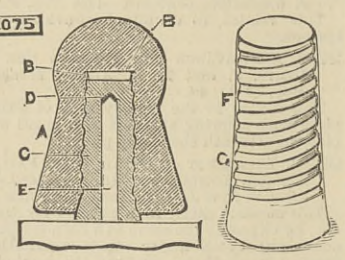
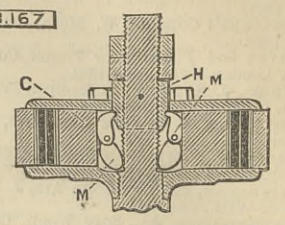


threads, as and for the purpose set forth. (2) The combination of an insulator A, having screw-threaded opening B, a supporting peg E, and an interposed rubber block or cushion having recess D, screw-threads G, and webs F, as and for the purpose set forth.

268,167. Piston, *Samuel Armstrong, Newark, N.J.*—*Filed April 29th*, 1882.

Claim.—(1) In a piston head or pump plunger, the knuckles M and expanding means, arranged, combined, and adapted to operate to expand the packing, substantially as and for the purposes herein set forth. (2) In a piston head or pump plunger, the combination, with the series of knuckle joints M, of sliding segments and expanding mechanism, arranged and operating substantially as and for the purposes as herein set forth. (3) In combination, in a piston head, the collar H, knuckle joints M, segments C, springs E, and packing, arranged and combined substantially as herein set forth. (4) In combination, in a piston head or pump plunger, the collar H, the knuckle

268.167

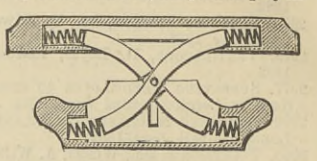


joints engaging therewith, the segments, the springs E, the spring bands D F, and the packing, the whole being arranged and combined substantially as herein set forth and shown.

268,193. Vehicle Spring, *Nelson B. Cooper, Liberty, Ind.*—*Filed June 22nd*, 1882.

Claim.—The combination, with the recessed bolster and body-supporting box or recessed bar, of the levers, pivotted together by a fulcrum pin, adapted to play in

268.193.

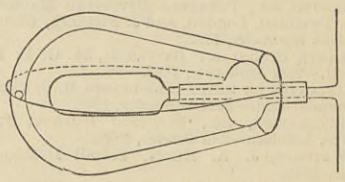


vertical guide grooves, and the springs fitted in the respective recesses and to the shouldered ends of the levers, substantially as specified.

268,206. Incandescing Electric Lamp, *Thomas A. Edison, Menlo Park, N.J.*—*Filed October 12th*, 1882.

Claim.—(1) The combination, with the enclosing globe and carbon filament, of an incandescing electric lamp, of means for neutralising the static attraction between the carbon and globe, substantially as set forth. (2) The combination, with the enclosing globe and the carbon filament, of an incandescing electric lamp, of a body or bodies of metal surrounding said filament, or placed at different points around said filament, and connected to one of the conductors leading to said filament, substantially as and for the purpose set forth. (3) The combination with the

268 206



carbon filament of an incandescing electric lamp, of a wire cage placed over and around said filament, and connected with one of the wires leading to said filament, substantially as set forth (4) The combination, with an incandescing electric lamp, of a metal ring encircling the lower part of said lamp, and connected to one of the conductors leading to the lamp, and two or more wires bent over the top of the lamp, with their ends attached to said ring, substantially as set forth.

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