THE IRON AND STEEL INSTITUTE AT VIENNA.

The meeting hall in the Eschenbacher Strasse of the Austrian Union of Engineers and Architects is a handsome apartment, with ample, not to say luxurious accommodation for about 250 persons. The rooms of the Scientific Club in the same building were placed at the disposal of the members of the Iron and Steel Institute as reception and writing rooms, post and local secretaries' offices, so that the visitors were spared as much trouble as possible in connection with travelling arrangements, receipt of correspondence, and such like.

We have already partially reported the proceedings of the opening meeting on the 19th. After the complimentary proceedings and a short address from Mr. Bell, the reading of papers was proceeded with. An abstract of the first of these, by the Nestor of the Austrian iron trade, Hofrath Peter Ritter von Tunner, upon the present position of the iron industry in Styria and Carinthia, appeared in our last impression. The author dealt mainly with economic rather than technical questions, pointing out the difficulties arising from the isolation of the ore deposits from mineral fuel, or more particularly from coking coal, and therefore the necessity of using charcoal, which is and always must be expensive. Other difficulties were to be found in the comparatively high rate of wages consequent upon the necessity of importing a large proportion of the provisions and supplies required for the support of the hands employed in the mines and smelting works; the mineral districts being at such heights that the climate was too uncertain to produce grain in any quantity; and the religious spirit of the people—the ordinary Church holidays being kept for thirty-six instead of twelve hours as in other countries. Finally, the extreme subdivision of the property in different ironworks led to the intensification of personal interests in a manner that had made it difficult for a long time to promote economy of manufacture by consolidation of the smaller works; but latterly this had been done on the great scale by the formation of the Austrian Alpine Mining Company, in which all the chief ironworks of Styria and Austria have been amalgamated into one undertaking. A new feature of the trade, namely, the development of an export trade of ore from the mountains to the flat lands of Moravia and Bohemia by rail, with return freights of coke, was spoken of somewhat hopefully, but the best and most consolatory circumstances were that good iron ore is as valuable as ever in the world's trade, and that the demand for high-class charcoal iron, judging from American experience, is one not likely to cease. This paper, being merely a description of local trade conditions, did not lead to any discussion; but the author stated, in explanation, that a special description of the works to be visited would be prepared for the members who intended going on the Styrian excursion, and further dwelt on the economy of fuel obtained by raising the blast furnaces and increasing their dimensions, the consumption of charcoal being thus reduced from 17 cwt. in a 28ft. furnace to 13 cwt. in a 50ft. furnace, with a proportionate increase in blast temperature up to 200 or 300 deg. Centigrade. After a few graceful words from Mr. Bell in recognition of the veteran author's services to scientific metallurgy, and more particularly to the studies on the working of blast furnaces, the second paper, by A. Ritter von Kerperly, of Buda Pesth, was read,

On the Iron Industry of Hungary.

This was descriptive of the distribution of the works, but it is to be regretted that so much attention was paid to questions of fuel that the ores received but scanty treatment, the members being referred to the author's work on this subject published in 1876. There seems, however, to be in Hungary, as in Styria, a preponderance of spathic ores, though probably these are not of the same irreproachable purity as that of Eisenez. Brown and red ores are also numerous, and large irregular masses of magnetite form the principal supplies for the furnaces in the Banat. The total production of Hungary is, however, not large, being 167,600 tons of pig iron and castings, and 112,271 tons of steel and various kinds of malleable iron, the bulk of the steel, 21,000 out of 22,717 tons, being produced by the State Railway Company at their works at Reselitza and Anina in the Banat. The author of this paper not being present it was not discussed, and the third was then taken, that by Herr Kurzweinhart

On the Use of Lignite in the Manufacture of Steel Rails by the Bessemer Process at Teplitz, in Bohemia.

This was one of the most practically interesting communications made to the meeting, although the circumstances are somewhat special, the combination of very cheap fuel and equally cheap water carriage allowing English pig iron to be carried into the heart of the Continent for conversion into steel.

In the discussion that followed, Mr. Gilchrist stated that he recently visited the author's works and found that they were now turning out more steel using the basic process than they did with the original process two years previously from the same plant, the production from two converters being about 3000 tons per month. Using inclined tuyeres and the arrangement of bricks known as the Holley joint, the bottoms in the basic process lasted about forty blows, while in the previous practice as many as 110 blows had been got. As regards composition of the pig iron, it was stated that the German manufacturers like it to approximate as closely as possible to that of Ilseder in the Huz, which contained 3 per cent. of phosphorus and 2 to $2\frac{1}{2}$ per cent. of manganese. That used at Teplitz contained $\frac{3}{4}$ per cent. of the latter metal, and about $\frac{1}{2}$ per cent. of silicon. Sulphur should not exceed 0·45 per cent., but a maximum of 0·2 per cent. was better. Another point of interest in these works was the very large amount of cold scrap that was introduced into the converter during the blowing of the charge, from 12 to 16 cwt. being added without any previous preparation to a charge of $6\frac{1}{2}$ tons.

Mr. Windsor Richards considered the statement as to the large number of blows obtained from each converter bottom as somewhat misleading, there being a progressive replacement of the tuyeres singly or in pairs during the whole time that the bottom was in use; whereas in Cleveland, where eleven blows were got, there were no such renewals.

Herr Paul Kuppelwieser, of the Wittkowitz Works in Moravia, which it was intended should be visited by members returning *viâ* Silesia, explained that an accident had occurred which would unfortunately prevent them from seeing the process at work. Whereupon Mr. Jeremiah Head gave an account of his visit to Wittkowitz, and especially mentioned the arrangements for rolling steel plates, which was done by the use of ordinary re-heating furnaces, steel blooms and malleable piles being rolled indiscriminately in the same mill. The ingots in piles were bloomed down in a universal or Belgian mill, and after re-heating at a waste heat in the plate mill. A peculiar feature of the latter was the adoption of a special steam engine for manipulating the set of the rolls which was under the control of a separate workman and not of the forge roller, the latter having only to reverse his mill and attend to the passage of the metal, the screwing down necessary to give the proper reduction in thickness being done by the man in charge of the engine overhead. A larger number of passes were required in reducing a steel bloom than from iron to the same thickness.

The author of the paper, in closing the discussion, stated that the amount of sulphur in the pig iron should not exceed 0·1 per cent., and that the number of forty blows taken from a single bottom was exceptional; the average might be from twenty-five to thirty; and in reply to Mr. Richards, he said that there was no regular rule as to the reversal of the tuyeres, but that it might average one per blow, there being seven tuyeres in the bottom.

With the reading and discussion of Herr Kurzweinhart's paper the business of the first day of the meeting was concluded, but before the adjournment of the meeting an interesting and gratifying testimony to the value of the Thomas and Gilchrist process, and the more so as being unexpected, was made by the presentation of a casket in iron, partially damascened and enriched with gold and silver, by the director of the Prague Iron Society, to Mr. Thomas, in the name of the Iron Trade of Bohemia, who, by the use of the process, have been enabled to introduce the steel manufacture into districts where no facilities exist for obtaining supplies of ores free from phosphorus. The side panels, in perforated and *repoussé* work, are steel plates, 2 millimetres in thickness, which were produced from the pig iron of Kladno, containing 1·86 per cent. of phosphorus, the central group of figures on the top, as well as four gnomes carrying shields of arms at the angles of the base, being cast in the latter metal. Unfortunately, Mr. Thomas was unable, on account of illness, to be present to receive the casket himself, but in his absence Mr. Gilchrist returned thanks for him. With this incident the first day's proceedings terminated with an adjournment to luncheon in the Volksgarten, after which a large number of the members went by omnibuses to the Imperial Arsenal on the south-eastern side of the town, where they were received by the Commandant, Field-Marshall Lieutenant von Tiller, attended by a numerous staff of artillery officers, under whose guidance they were conducted first through the magnificent historical collection of weapons and armour arranged with other trophies in the more ornamental part of the establishment, and then through the various workshops both in the artillery and laboratory or small-arms ammunition departments. The chief objects of interest in the former were the numerous bronze field and siege guns in different stages of preparation, but owing to the delay that took place in the arrival of the party and the necessity of returning at an early hour to the city, the inspection was only a hurried one. The foundry in which the Uchatius gun bronze is prepared remained closed, as is the invariable practice, and the press whereby the metal is squeezed up to its hard condition was seen, but no sufficient time remained for its explanation. In the same shop with the press was a section of a built-up bronze gun of 40 centimetres calibre, intended to fire a projectile of 1650 lb. with a charge of 230 lb. of powder, the weight being 72 tons; but this has not yet been carried out, the largest guns made being of 30 centimetres calibre. This arsenal is entirely intended for the supply of land service artillery, whether for field, siege, or the defence of fortresses, and a large number of mountain guns seem to be required in the rough country on the north-eastern borders and the newly-occupied provinces. The necessity of service over bad roads is abundantly evidenced by the heavy character of the wood and ironwork of the travelling carriages and their wheels, and a large number of cast iron guns are still made, though no doubt, being of Styrian charcoal iron, their quality is higher than those of similar metal in other countries. The annual dinner of the Institute was held in the Cur *salon* of the municipal park in the evening, and closed a long day's programme.

On Wednesday morning the first paper taken was that by Geheimrath Dr. Herman Weddig, of Berlin,

On the Experimental Testing Institutions Established by the Prussian Government in Berlin.

The author stated that the testing institutions are three in number, and are distinguished as (1) the Royal Testing Station for Building Materials; (2) the Royal Mechanico-Technical Experimental Institute; (3) the Royal Chemico-Technical Experimental Institute. The first and second of these is under the direction of Dr. Böhme, and the latter under that of Professor Dr. Finkener. The building materials investigated are chiefly stone, cement, mortar, and wood, and in the period of eleven years, from 1871 to 1882, 1828 separate investigations, involving 46,584 separate experiments, have been carried out. The Mechanical Technical Institute is only three years old, and during this time 1038 determinations of different elements of the strength of materials have been made, some of the most interesting series being that of the collective examination of round and flat ropes, on the welding qualities of different kinds of iron and steel, and on the properties of rivetted joints in the materials used for bolts and rivets. The Chemical Institute appears to be an adjunct of that of the Mining Academy, and does the ordinary work of an analytical laboratory, partial or complete analyses of substances sent in for examination being made according to a scale of prices which vary from 5s. to 50s., the fees in the mechanical departments not being stated in the paper.

This communication, as might be expected, led to the expression of considerable diversity of opinion as to the propriety or otherwise of the State undertaking the testing of iron and steel, such a proceeding being generally deprecated by the greater number of the speakers, who included Messrs. Roberts, Kennedy, Snelus, Adamson, Bauerman, Head, and the President. Professor Kennedy considered that the elaborately prepared test pieces shown by the author were unnecessary, and that when merely the elastic limit and the ultimate tensile strength were required, that pieces cut from the bars without special preparation were sufficient. Mr. Head objected to the prescription of tests by engineers, and considered that the maker should be allowed to supply material to satisfy the requirements of the structure in his own way. He instanced samples sent in that were so badly prepared that the testing had been refused, and that specifications were often unsatisfactory for the vagueness of the wording. He made the most practical suggestion, namely, that of the formation of a committee, under the auspices of the Institute, to investigate the possibility of establishing a system of standard dimensions of test pieces, &c., by international consultation. He was of opinion that these should bear some relation to the shape of the objects they represented. Thus a different kind of sample would be required to show the quality of a large plate to that of a narrow one; but in any case he thought that they should be allowed to use what they liked, instancing the value of cheap plates in the production of cheap ships.

Dr. Weddig, in reply, did not deny that the results obtained by private investigators were valuable, but considered that the tests made by a public institute must be of yet more value. In answer to a question by one of the speakers, he stated that the improved chemical analytical methods were all published. The President thought the subject was one worthy of the fullest investigation, and especially advocated uniformity of measurement. On the North-Eastern Railway, with which he was connected, it was their practice to analyse every steel rail that broke in service, and access to the results might be had by those interested. A paper followed, "On the Manufacture of Compact Steel Castings," by Mr. A. Pourcel, of Terre Noire. An abstract of this appeared in our last impression. It will be remembered that the author described the results obtained in the production of special steel castings for large cylinders, to stand a pressure of forty-five atmospheres, and dwelt on the manufacture of hoops for guns, the essential point being the use of alloys containing manganese and silicon with a minimum of carbon in the final drying of the bath before casting. In the end the author combated the views of Dr. Müller as to the function of hydrogen in producing blow holes in steel ingots. The discussion of this paper was taken on the third day of the meeting, the hour of adjournment being specially early on the second, on account of the excursion by steamer through the newly-cut channel of the Danube to the Kahlenberg, with its rack railway, which took up the greater part of the day. Mr. Richards stated that he had made experiments by boring ingots in the way described by Dr. Müller, and was of opinion that the hydrogen obtained was due to the decomposition of water owing to the friction of the tool. Mr. Snelus hoped that M. Pourcel's method would be applicable not only to special castings, but that it might be used in the ordinary practice of Bessemer rail making. Mr. Bauerman considered that the existence of hydrogen had been proved in different ways by other experimenters than Dr. Müller, instancing Mr. Robert Parry and the paper subsequently read by Mr. Gjers. Mr. Webb stated that he was now casting locomotive wheels in steel of exactly the same shape as those in wrought iron, by placing the mould on a turntable feeding from the centre, and setting it in rotation at from forty to fifty revolutions per minute.

M. Pourcel, in reply, stated that the proper amount of silica to be added to the steel in casting was a matter of experience, and he dwelt especially on the importance of keeping the carbon in the alloy at a minimum, in which case a slight increase of silicon did no harm, it not having the same hardening power as carbon.

A paper by the President of the meeting was then read,

On Comparative Blast Furnace Practice.

The paper is a very elaborate arithmetical argument, giving the reasons for the small amount of charcoal required to make the same weight of pig iron as compared with that of coke. The leading fact adduced by the author appears to be that the actual work done by coke is greater, owing to the extra amount of flux and earthy matters that have to be turned into slag, for which purpose a greater proportional expenditure of heat is required than in a charcoal furnace smelting such pure ores as those of Vordernberg. The paper is too long for reproduction here, and will not bear abstracting. We may, however, reproduce the following passage with advantage, bearing as it does on the enormous output claimed for some furnaces:—The usual produce of a coke furnace smelting Cleveland stone is about 30 tons of grey iron per 1000 cubic feet of capacity per week. The Luxembourg furnaces, using ore of the same geological position as those of Cleveland, run as much as 50 tons of white iron per 1000 cubic feet of capacity, and this up to 55 tons is about the rate of working on English or Spanish hematite. It would be observed, however, in the two Vordernberg charcoal furnaces that we have a make of 73 and $93\frac{1}{2}$ tons of white iron per week per 1000 cubic feet of capacity, and the author had met in America charcoal furnaces running 100 tons of grey metal per 1000 cubic feet. It is clear that the facility with which an ore is acted on by the reducing gas in the furnace must necessarily affect the rapidity with which the furnace can be driven. By actual experiment he ascertained that at a temperature of 770 deg. Fah. when exposed to carbonic oxide, while calcined Cleveland stone lost about 20 per cent. of its combined oxygen, Lancashire ore parted with 2½ times this quantity. Under such circumstances it is not surprising that charcoal furnaces using rich hematites should make much more iron than coke furnaces using clay ironstone. As a rule, however, up to a certain date the make per 1000 cubic feet was notably larger in charcoal furnaces than in those using coke, even when smelting the same class of ore. He had recently learnt that the furnaces at the Edgar-Thomson Works near Pittsburg, 80ft. high, with a capacity of 15,000 to 16,000 cubic feet, are producing 100 tons per 1000 cubic feet per week of rich Bessemer iron. There is no question whatever that driving furnaces at any such rate leads to their rapid destruction, so that three years is a pretty long life for one which is turning out so large a quantity, whereas a furnace making a third of this produce, even from the poorer Cleveland iron, lasts three or four times as long. Now, when it is remembered that blowing engines, hot-air apparatus, indeed almost every expense attending the cost of manufacturing iron except the mere furnace itself, bears a direct proportion to the quantity of iron produced, it seems doubtful whether there is any saving in these extraordinary rates of production, which necessarily entail blowing out, and standing three months every third instead of every twelfth year.

This paper should have stimulated an interesting discussion, but unfortunately, Geheimrath von Tunner was unable to go into the subject without further study, and expessed his intention of writing his views upon it. At this point the continuity was interrupted by the President of the Danube Regulation Commission, who gave a general description of the works undertaken for the improvement of the channel at Vienna, with some details as to the dimensions and results of the work, and stated that it was ultimately intended to improve the navigation of the river up to the Fraulein at Passau. Subsequently very little more was said on Mr. Bell's paper, Mr. Whitworth instancing the high yield of 60 tons per day from a charcoal furnace, 55ft. high by 12ft in diameter.

A paper by Mr. Snelus on the composition and testing of steel rails, which is the same as that left over from the last meeting, with some additions, was then read, and the discussion adjourned to the next London meeting, when we shall give an abstract of it; after which was taken Mr. Gjers' paper

On the Successful Rolling of Steel Ingots with their own Initial Heat by means of the Soaking Pit Process.

The author pointed out that in the fluid steel poured into the mould there is a larger store of heat than is required for the purpose of rolling or hammering. Not only is there the mere apparent high temperature of fluid steel, but there is the store of latent heat in this fluid metal which is given out when solidification takes place. It had, no doubt, suggested itself to many that this heat of the ingot ought to be utilised, and, as a matter of fact, there have been, at various times and in different places, attempts made to do so; but hitherto all such attempts have proved failures, and a kind of settled conviction has been established in the steel trade that the theory could not possibly be carried out in practice. The difficulty arose from the fact that a steel ingot when newly stripped is far too hot in the interior for the purpose of rolling, and if it be kept long enough for the interior to become in a fit state, then the exterior gets far too cold to enable it to be rolled successfully. The author introduced his new mode of treating ingots at the Darlington Steel and Iron Company's Works in Darlington early in June this year, and they are now blooming the whole of their make, about 125 tons a shift, or about 300 ingots every twelve hours, by such means.

A number of upright pits—the number, say, of the ingots in a cast—is built in a mass of brickwork sunk in the ground below the level of the floor, such pits in cross section being made slightly larger than that of the ingot, just enough to allow for any fins at the bottom, and somewhat deeper than the longest ingot likely to be used. In practice the cross section of the pit is made about 3in. larger than the large end of the ingot, and the top of the ingot may be anything from 6in. to 18in. below the top of the pit. These pits are commanded by an ingot crane, by preference so placed in relation to the blooming mill that the crane also commands the live rollers of the mill. Each pit is covered with a separate lid at the floor level, and after having been well dried and brought to a red heat by the insertion of hot ingots, they are ready for operation. As soon as the ingots are stripped they are transferred one by one, and placed separately by means of the crane into these previously heated pits—which the author calls "soaking pits"—and forthwith covered over with the lid, which practically excludes the air. In these pits, thus covered, the ingots are allowed to stand and soak; that is, the excessive molten heat of the interior, and any additional heat rendered sensible during complete solidification, but which was latent at the time of placing the ingots in the pit, becomes uniformly distributed, or nearly so, throughout the metallic mass. No, or comparatively little, heat being able to escape, as the ingot is surrounded by brick walls as hot as itself, it follows that the surface heat of the ingot is greatly increased; and after the space of from twenty to thirty minutes, according to circumstances, the ingot is lifted out of the pit apparently much hotter than it went in, and is now swung round to the rolls, by means of the crane, in a perfect state of heat for rolling, with this additional advantage to the mill over an ingot heated in an ordinary furnace from a comparatively cold, that it is always certain to be at least as hot in the centre as it is on the surface. During the soaking operation a quantity of gas exudes from the ingot and fills the pit, thus entirely excluding atmospheric air from entering; this is seen escaping round the lid, and when the lid is removed combustion takes place. This gas is entirely composed of hydrogen, nitrogen, and carbonic oxide, so that the ingots soak in a perfectly non-oxidising medium. Hence loss of steel by oxidation does not take place, and consequently the great loss of yield which always occurs in the ordinary heating furnace is entirely obviated. Experiments made by Mr. Stead showed that after making corrections for the heat remaining in the steel ingot, in the ingot mould, and in the bricks, it was found that for every 100 units in the heated steel there are 154 in fluid steel.

It is necessary to state that the steel ingot was heated to as high a temperature as it was capable of bearing without being burnt.

This, by far the most important of the papers read at the meeting, was received with the greatest interest. Some amusement was caused by the President announcing that he had received a telegram from Mr. Wilson stating that he had patented a similar process some years previously, but that he did not attach the slightest value to it. Mr. Snelus spoke of the extreme value that the process had been at the finest Cumberland works, where it was first adopted to meet a strike of the heating furnace men. In thirteen days the pits were ready for work, and now, with ten pits and one ingot crane, 1500 tons per week were being passed through them, and the latest return was 170 tons in one shift of twelve hours. The number of heating furnaces fired was now reduced from six to two. The pits were placed close to the cogging mill, and the ingots remained in them from twenty to thirty minutes. With a plant expressly laid out for the process with a sufficient number of cranes, it might be worked more advantageously. It was essential that the pits should be lined with very heavy fire-bricks to stand the wear caused by the falling ingots. The author's results were confirmed by Messrs. Richards, Whitwell, and Head. The latter considered that where there was a great distance between the ingot mould and the rolling mill the pits might be placed upon a bogy, and then heat might be equalised during the time required for the passage from the casting pit to the rolling mill. A curious method adopted by the men for cooling off the pits when the walls became too hot was alluded to by the same speaker and explained by the author, the gasification of the coal absorbing some of the heat.

A paper by Mr. Maddick, on a new fire-brick stove, having, at the author's request, been adjourned to the next London meeting, the necessary vote of thanks to the various authorities, imperial and municipal, as well as to the local committees in Vienna, Pest, and Leoben, for the excursion arrangements, and to the Union of Engineers and Architects for placing their house at the disposal of the Institute, were passed by acclamation, and the very pleasant meeting came to an end. Although not distinguished as some of its predecessors have been by the announcement of great discoveries or the discussion of important principles, there can be no two opinions as to its having been a very successful meeting, a fair amount of work having been done, while the hospitable tendencies of the most pleasure-loving capital in Europe have been fully and freely exercised.

ELECTRICAL ACCUMULATORS OR SECONDARY BATTERIES.

By Professor Oliver Lodge.

No. VII.

In the last article I described a few typically instructive experiments that could be made with two clean lead plates immersed in dilute sulphuric acid, and connected at pleasure with a battery or a galvanometer or both. Before going on to the subject of coated plates, it may be well to draw attention to the consequences which a series of observations on plain plates will bring home to the experimenter.

If the surface of the plates are in the ordinary dull condition, he will find, on applying two Grove cells to them through a galvanometer, that the charging current at first is considerably stronger than it is after a few seconds. He will notice that oxygen rises from the + plate before any hydrogen rises from the — plate, and that as soon as both gases are freely given off the charging current is exceedingly small. In other words, the opposition electromotive force of the cell in this condition is very little below that due to two Groves; it is, I believe, about 3 volts. If the plates are brightened up just before insertion in the acid, the charging current will be weak from the beginning, and hydrogen will at once be given off. The stronger charging current observed for a few seconds in the first case was therefore due to the absorption of the first-formed hydrogen by a coat of oxide on the — plate; and if for this plate we use a purposely oxidised piece of lead, the absorption of hydrogen, and the consequent small opposition force and strong charging current, will continue for some time. The same thing would, no doubt, be observed in connection with the + plate if it ordinarily coated itself with an absorbent of oxygen; but as this is not the case, no particular effect is noticed when its surface is varied, unless, indeed, it be purposely coated with some oxidisable substance. To some extent minium and litharge act both as oxidisable and as reducible substances; and we have, therefore, the very important fact that it is much easier to send a current through two lead plates coated with litharge or minium than through two plates without any coating at all. The electromotive force of two Groves, which is almost overpowered by two clean plates, is amply sufficient to send a strong charging current through a cell with coated plates; at least, until the coatings are fully acted on, the gases no longer absorbed, and the cell full. As this state of things is approached the electromotive force of the cell gradually rises in a very decided manner.

With regard to the effect of amalgamating either or both of the lead plates with mercury, my experience leads me to conclude that amalgamation of the + plate is worse than useless. A coat of oxide of mercury is formed, which acts very fairly well as long as it adheres, or at any rate does not much obstruct the action of the peroxide of lead; but there is a certain point in the discharge when this coat falls off in a sheet, carrying with it apparently whatever peroxide of lead is present too, for the discharge current suddenly falls to zero whenever this happens. Of course the fall may be prevented mechanically, but the film still becomes electrically non-adherent, and therefore useless. Amalgamation of the — plate does, however, appear to help the occlusion of hydrogen, and is therefore so far advantageous.

The experiment of Professor Herschel, detailed in the last article, is capable of further elucidation. It consisted in observing the current produced by a piece of quite clean lead as the — plate, and a piece newly coated with peroxide as the + plate: the current is very weak, and hardly able to ring a bell. But it will be found on careful repetition that this feebleness of current is only arrived at after a second or two; the current at the first instant is quite strong. The real cause of the feeble current is a non-conducting film of sulphate or protoxide of lead, which forms on the clean lead plate the instant it is used to produce a current, and effectually screens it from the liquid. It causes, in fact, a sudden increase in the internal resistance of the cell. This can be proved in a variety of ways; such as observing that the lead plate so run down is incapable of giving a strong current when opposed to hydrogenised lead, zinc, or anything. Wiping removes the film, and restores the full power to the cell. Allowing the plate to remain in the acid for some time also removes the film to some extent, but slowly. As long as any hydrogen is present in the lead it appears to sustain oxidation alone, and the lead is unclouded; but as soon as the lead itself is attacked, the scum forms and the discharge current almost stops. By using amalgamated lead the scum is made plainly visible, and it can be seen to be wiped off when a cloth is used. The changes in the strength of the cell, according to the presence or absence of this scum, are very interesting and striking. The scum never forms when the plate is merely left in the acid, it is only when it is put into electrical contact with the + plate. In the case of lead exposing a large spongy surface, no doubt this film would take longer to form, especially as a larger amount of hydrogen would be then occluded. A short connection to the charging battery speedily removes the scum, not apparently by reducing it, but by making it peel off. Violent short-circuiting of the cell forms the scum much more quickly than when only a moderate discharge current is permitted. The picking-up of the cell during standing is closely connected with the formation and removal of this non-conducting film.

It may be asked whether this insoluble film cannot be avoided by immersing the plates in nitric or acetic acid instead of in sulphuric, so that no insoluble salt need be formed when the — plate is attacked. Certainly, if plates charged in sulphuric are removed to nitric acid to be discharged, the discharge current lasts strong a much longer time; but the + plate now suffers a seriously rapid deterioration, owing to the absence of a coating which is to it protective. It is, moreover, impossible to charge up the battery properly in any such substance which forms soluble salts of lead; and the whole beauty of the secondary battery is gone if its liquid has to be changed between charge and discharge.

The reasons why lead is pre-eminent among metals for accumulator purposes are, that both its oxide and sulphate are quite insoluble in dilute $H_2 S O_4$, that its peroxide is easily formed, and that it is conducting. The only other metal which satisfies these conditions is silver; but its sulphate is only partially insoluble, and, possibly for this reason, it does not answer. It would make a very light accumulator for some purposes, if it would work; but, for some reason or other, its power falls off with great rapidity, whether it is tried in $H_2 S O_4$ or in $H Cl$. The latter does rather the best, and it may be that its fall is only due to a rapidly formed scum of chloride, which speedily reduces both plates to the same condition. A chloride, moreover, not being a conductor, could never take the place of a peroxide.

A curious experiment may be tried with copper, showing the necessity for a conducting, and at the same time an insoluble, substance as a coating to the plates. Take two slips of copper, say 5 centim. by 1½ centim.; immerse them in dilute sulphuric acid or sulphate of copper, and send a charging current from three Groves through a dead-beat galvanometer—such as Ayrton and Perry's. It will be found that the current, which at first passes easily, is gradually and rapidly weakened, until at length the needle, which was at first deflected 20 deg. or 30 deg., has returned to within 1 deg. of zero.

If the current be now stopped for a few seconds and then renewed, the needle jumps up to 10 deg., say, but rapidly and almost suddenly comes down to 1 deg. again. If the current be interrupted for a longer time, it will take longer to come down again when renewed. But scarcely any discharge current can be got from the cell. The reason of the weakening of the current must be a coating of pulverulent material on one or both of the plates, which resists the passage of the current. A small amount of waiting dissolves a good deal of this off, and accordingly the charging current rapidly picks up again. Instead of a galvanometer an ordinary gas voltameter will serve for this experiment; the changes in the strength of the current are most striking. A certain *intensity* of current is, however, necessary, and nothing of the kind is observed when *large* copper plates are used.

If a cell such as a Sutton cell, where the salt of the — plate is soluble (which, considered by itself, and without reference to the + plate, is, as we have seen, an advantage) if such a cell is violently short-circuited and made to produce too strong a current, it is probable that oxide is formed on the — plate faster than it can be dissolved, and that accordingly a protective film is formed, which temporarily stops the action. If such a cell permanently falls off, it must be owing to the deterioration of the + plate by local action, which is very difficult indeed to avoid when soluble salts, such as sulphate of copper and sulphate of zinc, are present in the cell. In fact, the requirements of the — plate are, unfortunately, somewhat in antagonism to the requirements of the + plate, and what benefits the one is usually fatal to the other.

O. J. L.

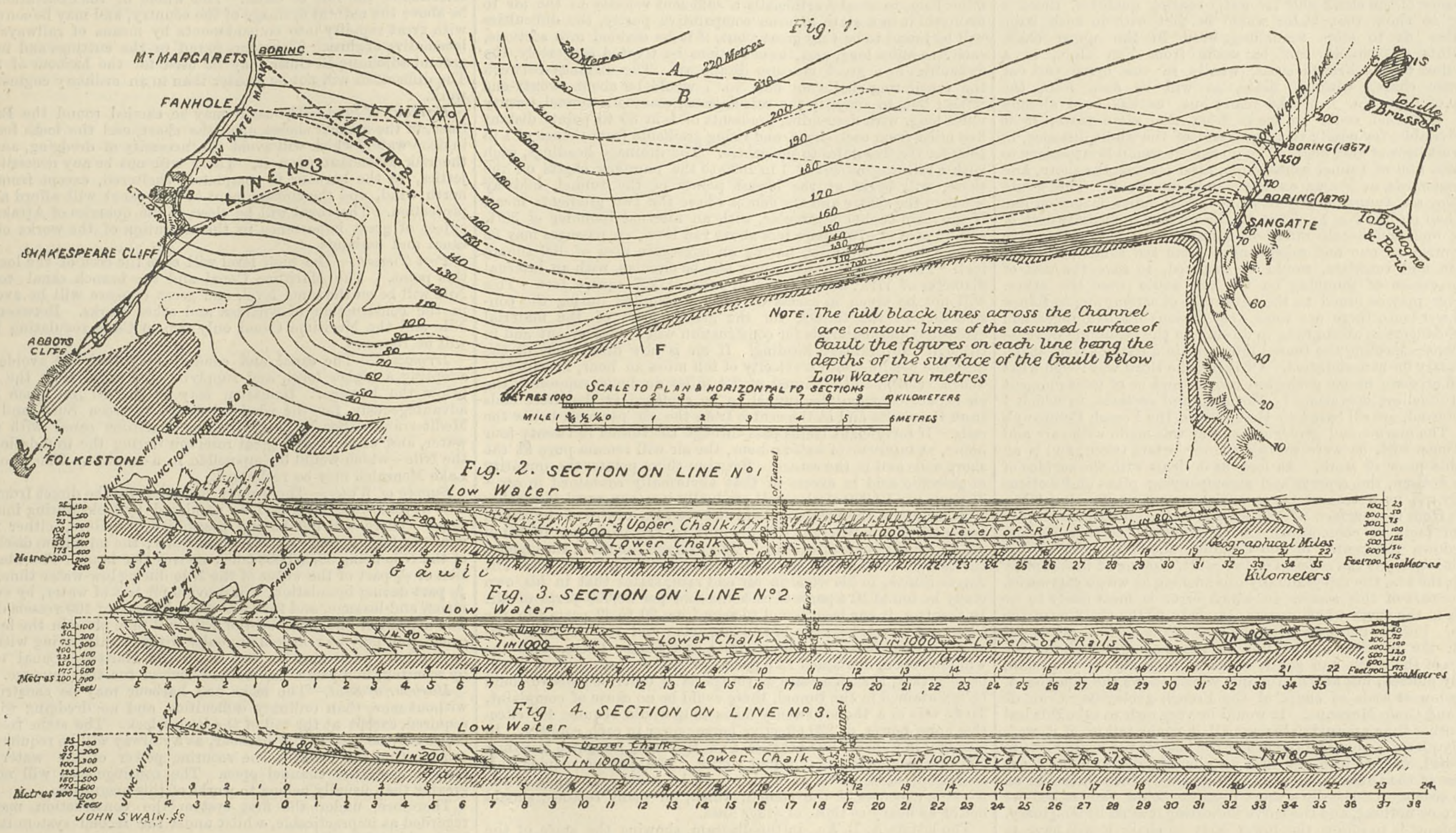
Liverpool.

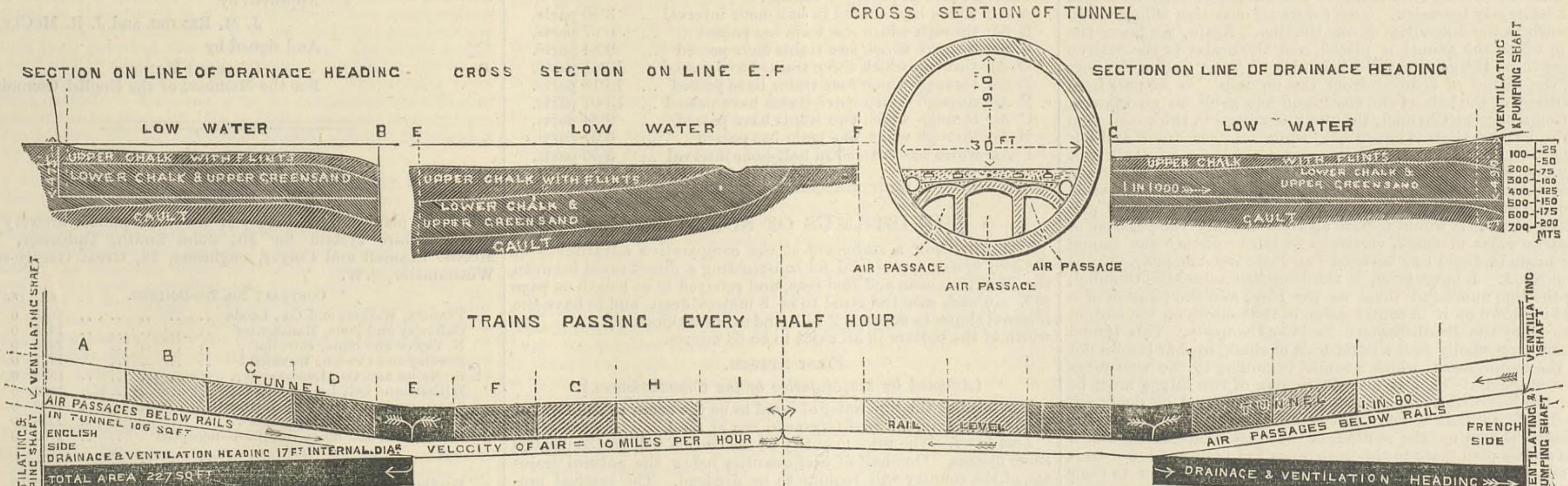
THE CHANNEL TUNNEL.*

By Mr. J. CLARKE HAWKSHAW, C.E., M.A., F.G.S.

[*Concluded from page 193.*]

IT has not only been asserted that very little, or no water, will be met with in the lowest beds of chalk, but also that so much will be met with in the higher beds as to make it impracticable to tunnel through them. Large numbers of wells have been sunk all over the country, and other excavations have been made at all depths and in all parts of the chalk formation for the purpose of obtaining water, and our knowledge of the mode in which water occurs in that formation is fairly complete. Much has been written on the subject. Professor Prestwich treats of it in his work on the water-bearing strata of London,* and gives references to earlier writers, but much information has been gained on the subject since the date of Professor Prestwich's work. In the proceedings of the Institution of Civil Engineers, from the year 1839 down to the present time, numerous papers on the water-bearing qualities of the chalk may be found, and in the discussions which followed them the most eminent geologists of the day, Dr. Mantell, Dr. Buckland, Professor Ansted and others, took part. The following are, I believe, well established facts on the subject in question. Solid chalk absorbs a large amount of water, but it parts with it with extreme slowness, so that it cannot be said to be truly permeable. It is only from the fissures which traverse the chalk formation, and from the cavities found along its planes of stratification, that water can be obtained. At a variable depth below the surface of the land the body of the chalk is saturated, and such fissures and cavities as may occur there are full of water, not stationary, but slowly flowing from the higher ground inland, towards the river valleys and sea-shore, where the water can find an outlet. Thus, there is a circulation of water underground, just as there is above ground on other less porous formations. Moreover, as the streams and watercourses on the surface are independent of one another, so are the underground channels in the chalk. If, in excavating chalk, a fissure is cut across, a certain supply of water may be obtained; if a second fissure is cut through, a further supply may be obtained; and generally it will be found that if the water is pumped from one fissure, it does not immediately diminish the flow from adjoining fissures; and, in like manner, if the flow of water from one fissure is checked, it does not necessarily increase the flow from those adjoining. In course of time, lowering the water level at any fissure will affect the supply to adjoining fissures, inasmuch as all draw their supply from the same saturated mass of chalk; but as a consequence of the extreme slowness with which chalk gives up its water, unless there is direct communication between two fissures, operations at one do not generally affect the others. Now this property of the chalk is of the greatest importance in carrying out engineering works which require excavations to be made through the water-bearing levels in it, for it enables the engineer to deal with the water in detail. Fissure after fissure may be cut through as long as the water flowing from them leaves a sufficient margin of unused pumping power; as soon as the yield of water becomes so great as to diminish that margin unduly, some of the fissures may be blocked up with temporary or permanent work. Thus it will be seen that, in tunnelling through chalk, a very large volume of water might be dealt with if it entered the work by separate channels. A very large body of water entering at one point might give trouble, and I shall accordingly select some facts from the very large number available, to show that from no one area of chalk, even of considerable extent, much less from one fissure, has a supply of water been derived larger than could easily be dealt with, or which at all approaches the volumes which have been dealt with on works completed or now in progress. At Goldstone Bottom, one of the pumping stations of the Brighton Waterworks, a greater quantity of water is obtained than at any other locality known to me. Mr. Edward Easton, the best authority on this subject, has kindly furnished me with some particulars respecting these works. There are engines at Goldstone Bottom capable of raising 300,000 gallons an hour, or 5000 gallons a minute, but it has been necessary to make a length of 1800ft. of tunnels to obtain the required supply. These are at right angles to the fissures, which here, as is so often the case, are at right angles to the shore-line. At Lewes-road, another of the Brighton pumping stations, there are engines capable of lifting 280,000 gallons an hour, or 4666 gallons a minute, to supply which 2400ft. of tunnels have been made. Mr. Easton tells me, and this is the important point, that the water in those tunnels is under complete control, so that any one of them can be laid dry at any time of the year. The work which has tested to the fullest our power to tunnel through the wettest parts of the chalk is the Brighton intercepting sewer, for which Sir John Hawkshaw was engineer. The main sewer is more than 7 miles long. The outfall is placed on the coast, about 4 miles to the east of Brighton; and, throughout a distance of about 4½ miles, a tunnel, from 9ft. to 10ft. in diameter, was excavated in the upper chalk, along the base of the cliff, and close to the shore. Being below high-water level, it cut through all the fissures which discharge the drainage of a large tract of inland chalk country. Large fissures were cut through, which I had frequent opportunities of inspecting, and, moreover, of seeing the permanent work successfully carried across them. The greatest quantity of water pumped at one time was 10,000 gallons a minute, or 600,000 an hour; many other examples might be given, but none so striking as the above. It may be urged that, by going below the levels reached by the above works, more water would have been obtained, but that by no means follows. The Brighton sewer works must have intercepted most of the land drainage; by going deeper, some water, stored in cavities below sea-level, might have been pumped. But the supply depends not on the quantity stored, but upon the rate at which the fissures can deliver it. Fissures there are, or there have been, at all depths; but, as the circulation is not so rapid in the deeper ones, they are more liable to be choked by sedimentary and crystalline deposits. Deep mines are often very dry ones. As an example of water supply, obtained from deep down in the chalk, we may take the supply drawn from the London basin. Below London we have a great thickness of both the upper and the lower chalk, amounting together to more than 600ft. in places. As this chalk, so far as we know, rests in a basin of gault clay, and rises in continuous beds to form the high ground to the north and south of the London basin, it is in the best position to be saturated with water, and such was its condition before it was made use of as a source of water supply for London and its neighbourhood. As the supply from the shallow wells made in the tertiary beds became exhausted, deeper wells were sunk into the chalk beneath, and water was obtained in plenty. But the supply soon ceased to be equal to the demand; the level of the water in the chalk was depressed, so that wells had to be deepened, and new adits made to cut new fissures. In 1838 the quantity pumped* in London was estimated at 6,000,000 gallons a day; in 1850 the quantity had increased to not more than 12,000,000 gallons a day. In the meantime the level of the water in the chalk had been depressed in some places 50ft. Thus the larger quantity could only be obtained at a greater depth, and by increasing the fall in the fissures delivering the water to the pumps. Now this chalk, from which only a limited supply could be obtained at a given depth over a large area, was connected on all sides with an unexhausted reservoir, at a much higher level, formed by the saturated masses of chalk round the London basin, and yet the water-level in it was reduced by a comparatively small amount of pumping.†





Before leaving the subject of the quantity of water found in carrying out particular works, I will refer to two tunnels now in progress, although they are not being made in the chalk formation. The Mersey Tunnel, which is being made under the direction of Mr. Brunlees, one of the engineers of the Channel Tunnel Company, will connect Liverpool and Birkenhead by means of a railway. It is two and a-quarter miles long, of which nearly three-quarters of a mile is beneath the Mersey. Shafts have been sunk, and a heading has been driven for a quarter of a mile, and the main tunnel for 600 yards through the pebble beds of the New Red Sandstone. Mr. Brunlees tells me that the greatest quantity of water pumped amounted to 6000 gallons a minute. This quantity is being gradually reduced by lining and tubbing. The Severn tunnel is in a more advanced state; and as it illustrates many of the points to which I have referred, and as I have been continually on the works during the last three years, I shall refer to it at greater length. The Severn tunnel will be the longest railway tunnel in England, in all four and a-half miles in length; and it is the only railway tunnel which can claim to be submarine.

* "A Geological Enquiry respecting the Water-bearing Strata round London," by Joseph Prestwich, junior, F.G.S. London, 1851.

* Minutes of "Proceedings" of Institution of Civil Engineers, vol. ix., p. 161 (Homersham).

† Minutes of "Proceedings" of Institution of Civil Engineers, vol. ix., p. 165 (Braithwaite), p. 155 (Clutterbuck), and p. 168 (Braithwaite), states Messrs. Combe bored 300ft. into chalk, and only obtained twenty-five gallons a minute; Meux and Co. bored 160ft., obtaining only ten gallons a minute; Messrs Reid and Co. laid open an area of 1600ft. of chalk, and only obtained 200 gallons a minute; p. 172 Homersham admits depression of water-level under London; p. 175 Taberner admits depression of water-level under London; p. 176 Horne says water at St. Luke's depressed 21ft. between 1841 and 1850.

It passes, for two and a-half miles, below a tideway where there is a rise of tide of 40ft., and a depth of water at high water of 90ft. in the deepest part of the channel. It passes, for a considerable portion of its length, through the Permian red marl, which has many points of resemblance to the chalk. The marl, which is in nearly horizontal beds, is much fissured, and from these fissures, as well as from spaces between the planes of bedding, much water is discharged. At the English end of the submarine part of the tunnel, for some distance, there is only from 35ft. to 40ft. of this open-jointed red marl above the brickwork of the tunnel, which is already finished where the cover is thinnest. Salt water flows freely into the work, and, to show how the water channels are disconnected, salt and fresh water have, in some cases, flowed from adjoining fissures, and the fresh water has been allowed to flow, for drinking purposes, through pipes built in the brickwork. The largest quantity of water has been met with on the land portion of the tunnel; and the largest spring met with was in the land tunnel. It discharged 5000 gallons a minute, and burst suddenly into a heading, which had been driven for over 1000ft., in millstone grit, without meeting with any water. If the heading had been driven at a level of 10ft. lower the spring would have been avoided in the heading, but would have been met with when it was enlarged to the full size of the tunnel. The total quantity of water now being pumped is between 7000 and 8000 gallons a minute. The examples I have given show that engineering works need not be stopped, even by large quantities of water; and, much as we know of the chalk and its water-bearing qualities, there is nothing to show that water would be met with in such large quantities as to stop tunnelling, even in the upper chalk with flints. A tunnel can be made from Fan Hole, in a direct line to the French coast, wholly in the upper part of the lower chalk, without flints, as will be seen from the section of line No. 1 of the plan; but, as has been already stated, a tunnel could be made from the same place, if it were advisable, for nearly three-quarters of the whole distance, in the lowest beds of grey chalk. To do this, it would be necessary to curve the line of tunnel southwards, after leaving the shore, and then eastwards, as shown on the plan in line No. 2. This would make the sea tunnel nearly one and a-half miles longer on line No. 2 than on line No. 1. That is, the certain immediate cost of making one and a-half miles of tunnel, with the prospective disadvantage of one and a-half miles more sea tunnel, to work, maintain and ventilate, would be incurred, to save the cost of possible excess of pumping on the one route over the other. Whatever may be urged as the advantage of attempting to follow these lower beds, there are some very obvious disadvantages and positive dangers in attempting to do so. In the beginning of these discussions respecting the tunnel line, certain questions were given as necessary for consideration. Of these, the third was :—On what line will an error in our geological calculations be of least moment to our tunnelling operations? The map and sections, to which I have referred, are all based on the result of the French Company's work. The marine and geological survey was made with care and precautions, such as were probably never before taken, and is an admirable piece of work. As long as it deals with the surface of the sea bottom, the reports and accompanying plans and sections probably tell us a true story, on which we may rely. But when we pass from the surface of the sea bed to the strata beneath, we go from facts to conjectures. A longitudinal section—section E, F—down the centre of the Channel, shows the chalk from where it begins, at the outcrop of the gault, dipping at first rapidly beneath the sea, the dip gradually diminishing as we go eastwards. Now the part of this section in which error is most likely to be found is in the curve which denotes the base of the chalk near the outcrop. For the curve showing the base of the chalk depends not only on the position of the line on the map which shows the junction of the chalk and gault, which is, probably, in the main, correctly plotted, but also on the line which shows the junction of the two lowest beds of chalk of the French geologists—Craie de Rouen and Craie Moyenne. It would be very rash to take this last line as other than approximate; yet all it could tell us, if it were correctly plotted, would be the dip of the base of the chalk close to the sea bed, and, even to get that we should have to assume the thickness of the Craie de Rouen from its ascertained thickness on the two coasts. Of the dip a short distance below the sea bed we really know nothing, and the curve indicating it must be imaginary. If the tunnel is to follow the lower beds of chalk it will have to be near this curve line; and any variations in the curve will necessitate deviations in the line of the tunnel, so that its length might be largely increased. This continual deviation of line would add much to the difficulties of construction. Again, the lower the beds in which the tunnel is placed, and the nearer to the outcrop of those beds, the greater will be the risk of water finding its way along the planes of bedding from the outcrop. As we pass from the outcrop of the base of the chalk and the gault, in an easterly direction along the Channel, the chalk increases in thickness. On line No. 1 the chalk is 480ft. thick, while on lines Nos. 2 and 3 it is only 235ft. thick; and, with the same thickness of chalk over the tunnel, there would, on line No. 1, be 245ft. more below the tunnel. An error which would necessitate a considerable deviation in the line of tunnel on lines Nos. 2 and 3 would not in any way affect No. 1; for it would require an error altering the position of the whole mass of chalk, vertically 245ft., to disturb the tunnel line if made in direct line between Fan Hole and Sangatte, that is on line No. 1. I have given a third section across the Channel, along the line numbered three on the plan, and the position of a tunnel is shown on it in continuation of that shown on the section deposited by the South-Eastern Railway Company. This tunnel does not keep wholly in the lower beds of chalk, so that it does not fulfil the requirements which a tunnel beginning to the westwards of Dover should. That it may do so, one of two things must be done : the line of the tunnel shown on the plan must be depressed some 150ft. so that it may follow the lowest beds across the depression shown on the section, or we must bend the line No. 3 shown on the plan more to the west, so as to follow the lower beds of chalk, where they are found at a higher level nearer to their outcrop. The first course would render it impossible to make a drainage heading to the shore in the chalk; for the tunnel would be so low, at its lowest point, that it would not be practicable to obtain a fall in the chalk to the shore. This drainage heading has been already stated to be a necessity. The alternative remains, but it would make the submarine tunnel at least one mile longer than line No. 3, which is already three miles longer than line No. 1 from Sangatte. That is to say, to avoid passing for a few miles out of the lowest beds of chalk, the total length of tunnel would be increased by nearly four miles, besides incurring the other disadvantages of the Folkestone route. Four miles of sea tunnel would not cost far short of a million, an amount which would pay for 4000-horse power at work, night and day, pumping for nearly seven years—a power which would raise more than 40,000,000 gallons each twenty-four hours. In deciding on the best line for the Channel Tunnel, the quantity of water which may be met with is but one of many factors to be taken into account. The Folkestone route would sacrifice all those of known value for the one of which the value is least certain. No tunnel will ever be driven under the Channel without meeting with some water, and an attempt to make one without ample preparations for dealing with a large quantity of water will only lead to waste of money and, perhaps, failure. The following is a summary of the advantages to be obtained by making the tunnel in a direct line from Fan Hole to Sangatte :—The shortest sea tunnel. As short a land tunnel as by any line. A greater thickness of chalk through which to tunnel. The best termination for effecting junctions with the existing English railways. A termination affording facilities for defence at a less cost than elsewhere. No certain advantage can be claimed for the Folkestone route, and, as compared with the route to the east of Dover, it has the following disadvantages :—The sea tunnel must be at least three miles longer. The land tunnel must be four miles longer, unless the mouth is placed in the Folkestone landslip. The chalk on the line of tunnel will be only half the thickness—in round numbers, 250ft. against 500ft. It will emerge near no fortifications, nor can it be connected with the London, Chatham, and Dover Railway Company's line at Dover. Further, this tunnel must be made for a great part of its length near the outcrop of the beds through which it is driven, which should be avoided.

Ventilation.—One of the requirements to be fulfilled by the tunnel, which was mentioned early in the discussion, was that it should be so designed as to be capable of being worked by ordinary locomotives. A machine may be invented which will be capable of carrying on the traffic economically and expeditiously, through a tunnel such as the Channel tunnel; but no machine is known, or has been tried up to the present time, that is capable of doing the work so economically or so conveniently as the ordinary locomotive. Until such has been tried and proved equal to the work, it would not be prudent to spend some millions of money in making a tunnel which could not be worked by the ordinary means. It may be taken as an accepted fact that a Channel tunnel worked by an ordinary locomotive would require artificial ventilation. The matter was discussed at some length at a meeting of the Institution of Civil Engineers in 1876, when Mr. Morrison read a paper on the subject. Most extravagant estimates were then made of the number of horse-power required to ventilate the tunnel. The paper itself, and an account of the discussion which followed, will be found in the "Minutes of the Proceedings" of the Institution of Civil Engineers. If the attempt be made in a tunnel twenty miles long, to create artificially a sufficient velocity in the air to maintain it in a state of even comparative purity, the difficulties will be found to be very great; but, if it be divided into sections, each five miles long, and these sections be treated separately, the difficulties in a great measure disappear. The distance between the ventilating shafts on line No. 1 would be about twenty-one miles; but, to simplify the calculations, assume a tunnel twenty miles long, with descending gradients of 1 in 80 to points distant five miles from each shore, and rising gradients from thence of 1 in 1000 for the five miles to the centre. The drainage headings, each with a falling gradient of 1 in 1000 to the pumping shafts on the shore, will begin at the lowest points of the tunnel, midway between the centre and the shores where the two gradients meet. If the main tunnel be circular, with an internal diameter of 30ft. and an area of 470 square feet above rail level, air passages may be formed below the rails, having an aggregate area of 106 square feet. The drainage heading may also be circular, with an internal diameter of 17ft., and a sectional area of 227 square feet. This will not be much in excess of what is required during the construction of the tunnel, for the greater part of the material excavated and materials for construction will be taken out and in through the drainage heading. If air is now drawn out of the drainage heading with a velocity of ten miles an hour, it will produce a velocity in the tunnel of 2·4 miles an hour, supposing the air exhausted from the tunnel to be replaced at the shore ends from the shafts and at the centre from the air passages below the rails. If forty-eight trains pass through the tunnel in twenty-four hours, at intervals of half-an-hour, the air will remain pure at the shore ends and in the centre. Between those points, the quantity of carbonic acid in excess of that abnormally contained in air—3½ parts per 10,000 of air—will gradually increase, until it reaches a maximum at the points midway between the centre of the tunnel and each shore, where it will amount to 12¾ parts per 10,000 in excess, or 16¼ parts altogether. The average condition throughout the tunnel will be 6·34 parts in excess, or 9·84 parts in all. Dr. Angus Smith, in his work on air and rain, states that in his own study he found 10·4 parts of carbonic acid per 10,000 parts of air. In theatres, it has been found to vary from 20 to 32 parts; in the Chancery Court, between 19 and 20 parts; and the air in a first-class carriage, between Gower-street and King's Cross, with the windows open, contained 22·5 parts per 10,000 of air. Thus it will be seen that, if such a state of things as is described above could be maintained in the tunnel, there could be no cause of complaint. To do this in a tunnel twenty miles long would require 460 effective horse-power, or 230 effective horse-power in each country. In a tunnel in a direct line between Fan Hole and Sangatte less than 500 effective horse-power would suffice. The cost of keeping this amount of horse-power at work would be a mere fraction of the working expenses of the tunnel, which, for many reasons, should not be as heavy as those of other lines.

The letters A, B, &c., in the diagram, showing the state of the air in the tunnel every half-hour, indicate the following proportions of carbonic acid in parts per 10,000 :—

A Air which has entered in half-hour interval ...	3·50 parts.
B Air through which one train has passed	6·67 parts.
C Air through which two trains have passed ...	9·84 parts.
D Air through which three trains have passed ...	13·01 parts.
E Air through which four trains have passed ...	16·18 parts.
F Air through which three trains have passed ...	13·01 parts.
C Air through which two trains have passed ...	9·84 parts.
H Air through which one train has passed	6·67 parts.
I Air which has entered in half-hour interval ...	3·50 parts.

THE ISTHMUS OF SUEZ CANAL.

We give below a statement of the comparative advantages of the two systems, proposed for constructing a direct canal between the Mediterranean and Red seas, and referred to at length on page 239. In each case the canal to be 8 metres deep, and to have the internal slopes in cuttings 2 to 1, and in embankments 3 to 1. The width of the bottom in all cases to be 68 metres.

First System.

(*Adopted by the Majority of the Commissioners.*)

The level of the top water of canal to be the same as the level of the low water of the Mediterranean Sea at Said.

Low Level.—The total quantity of excavation will be 130,000,000 cubic metres. One-half of that quantity below the natural drainage of the country will require to be dredged. The method proposed of forming a small canal first, and afterwards enlarging it, is impossible, unless Lake Timsah and the Bitter Lakes are avoided. The stone found in the cutting cannot be made available for the harbour of Said until the canal is opened throughout. The difficulties arising from stone and running sand, forming part of the material, may be great; the former at Suez, the latter in Lake Menzaleh.

Harbour of Suez.—There will be considerable difficulty in forming a channel 400 metres wide and 3000 metres in length by dredging engines, and every probability of meeting with coral reefs and indurated sands, or conglomerate similar to the rocks at Suez.

Port Timsah.—The cost of establishing a port in Lake Timsah will be considerable, and much dredging will be required.

Irrigation.—A canal is proposed between the Nile branch canal and Suez, for the purposes of irrigation and fresh water supply, and a conduit from the same branch to the Mediterranean for similar purposes. Steam engines of 500-horse power, at a working cost of £27,000 per annum, are to be erected.

Supply of Water.—The canal will depend for a supply of water on tides of the Red Sea. Unless there is a current out of the Bitter Lakes, as well as into them, the evaporation of 5,000,000 cubic metres of salt water daily during three months in the year will form deposits; as nearly 3 per cent. of salt will be deposited after a certain time, or 150,000 cubic metres daily.* At the present time the water is salter at Suez than in the Pacific, and were it not for the constant outgoing current of brine at Babelmandel, the Red Sea would fill up with salt. The tidal observations do not give the simultaneous condition of the tides at Suez and in the Mediterranean, nor the variation of each half hour of low and ebb, so that it is impossible to estimate the velocity of the currents through the proposed canal. One great difficulty will be to fill the Bitter Lakes. If the sea is freely admitted, the velocity into the lakes, even at low water, will be 6ft. per second, which would completely destroy the channel. Even supposing them to be filled, the tides will barely be sufficient to supply the waste arising from evaporation and absorption, and a current will flow from both seas, until the channel gradually becomes filled up.

Harbour of Said.—Two jetties, one of 3000 metres and the other 2500 metres in length, will have to be constructed, and the space, 400 metres between, dredged and conveyed away in barges. The stone must be brought from the islands in the Mediterranean Sea. No dredging can take place until a temporary harbour has been constructed, as it is a lee-shore during nine months of the year. There will be no back-water to keep the channel open; on the contrary, there will be a gradual flow into the canal, which will tend to form a new beach in the harbour and canal. There will be no certainty that the work will ever be finished. It will altogether depend on contingencies over which the engineer has no control, and which cannot be estimated.

* *Vide* Maury, "Physical Geography;" and Lyell, "Elementary Geology," p. 347.

Second System.

(*Proposed by the English Members of the Commission.*)

The level of the top water of the canal to be 7 metres above the low water of the Mediterranean Sea.

High Level.—The total quantity of embankment will not exceed 70,000,000 cubic metres, and may be much reduced by a judicious selection of the line of canal. The whole of the excavation will be above the natural drainage of the country, and may be conveyed with great rapidity into embankments by means of railways and locomotive engines. The stone found in the cuttings and in the ground adjoining El Guisr may be used for the harbour of Said. The difficulties will not be greater than in an ordinary engineering work.

Harbour of Suez.—The canal may be carried round the Bay of Suez, in the manner shown upon the chart, and the locks formed in deep water, which will avoid the necessity of dredging, and all the risk attendant upon it. There will not be any necessity for jetties, as the harbour is completely sheltered, except from the north wind, and the embankment of the canal will afford ample protection. The canal will be close to the quarries of Attaka, an object of great importance in the execution of the works of the canal and harbours.

Port Timsah.—The high level will save the cost of the locks at this point. The Maritime Canal and the branch canal to the Nile will be on the same level, and great expense will be avoided in the construction of wharves and other works. Between the Nile and the Maritime Canal only two or three regulating locks will be required.

Irrigation.—The canal and conduit may both be avoided by adopting a higher level, and supplying the canal from the Nile below the barrage. Irrigation may be carried on much more advantageously for the whole distance between Suez and the Mediterranean Sea by supplying the maritime canal with fresh water, and using it as a great reservoir during the inundations of the Nile—which would be impossible in a conduit. The whole of Lake Menzaleh may be reclaimed.

Supply of Water.—The supply of water will be direct from the Nile at its lowest level, and be regulated by locks during inundations. There will not be any possibility of failure, either from winds or from scarcity during dry seasons; the minimum discharge of the Nile being 50,000,000 cubic metres per hour. The abstraction of $\frac{1}{25}$ part of the water of the Nile during low-water time, and $\frac{1}{50}$ part during inundation, will provide for loss of water, by evaporation and leakage, and for an average lockage of 100 vessels daily. The deposit of the limon of the Nile will take place in the branch canal, and may be removed annually without interfering with the navigation; or it may be sent down the Maritime Canal to sea by scouring, in a particular method devised for that purpose.

Harbour of Said.—The locks and harbour may be constructed without more than ordinary difficulties, and no dredging will be required, except at the tail of the lowest lock. The stone from El Guisr may be used in the harbour, as a railway will be required for constructing the banks. The scouring power of the water will always keep the channel open. The contingencies will not be greater than usually belong to works of this magnitude.

Therefore, under the first system the construction may be regarded as impracticable, whilst under the second system it may be considered feasible.

Approved by
J. M. Rendel and J. R. McClean,
And signed by
Charles Manby,
For the Members of the English Commission.

TENDERS.

BREWERY.—YORK.

For the plant and machinery of a new 60-quarter brewery upon the Yorkshire system for Mr. John Smith, Tadcaster, York. Messrs. Scamell and Colyer, engineers, 18, Great George-street, Westminster, S.W.

Contract No. 3.—Boilers.	£	s.	d.
Tannett, Walker, and Co., Leeds	1685	0	0
Galloway and Sons, Manchester	1470	0	0
R. Taylor and Sons, Marsden	1440	0	0
Bradley and Craven, Wakefield	1407	0	0
G. Waller and Co., London	1399	0	0
Witham and Co., Leeds	1350	0	0
Thornewill and Warham, Burton	1290	0	0
Piggott and Co., Birmingham	1258	0	0
Holdsworth and Sons, Bradford—accepted	1162	0	0
Contract No. 4.—Millwrights.			
Bradley and Craven, Wakefield	8673	0	0
Oxley, Frome	7100	0	0
Thornewill and Warham, Burton	7095	0	0
H. Wood and Co., Manchester	7010	0	0
G. Waller and Co., London	6693	0	0
Wilson and Co., Frome	6223	0	0
Pontifex and Wood, London	6065	0	0
Contract No. 5.—Coppers.			
H. Pontifex and Sons, London	4073	0	0
Shears and Sons, London	3264	0	0
Bennett and Sons, London	3225	0	0
Wilson and Co., Frome	2794	0	0
Siddeley and Co., Liverpool	2770	0	0
Bindley and Briggs, Burton	2750	0	0
Pontifex and Wood, London	2715	0	0
Ramsden and Co., London—accepted	2636	0	0
Contract No. 6.—Slate Merchant.			
Braby and Co., London	2100	0	0
J. and J. Sharp, London	1975	0	0
Carter and Co. Liverpool	1960	0	0
Ashton and Green, London	1950	0	0
J. Stirling, London	1930	0	0
Brindley and Co., London	1929	0	0

Note.—No fermenting tuns included in this contract.

Contract No. 7.—Pipes.	£	s.	d.
Bennett and Sons, London	5725	0	0
Thornewill and Warham, Burton	5656	0	0
Bindley and Briggs, Burton	5350	0	0
Wilson and Co., Frome	5269	0	0
Pontifex and Wood, London	4009	0	0
Contract No. 8.—Refrigerators.			
Lawrence and Co., London—accepted	716	0	0

Note.—The result of No. 1 Contract, Buildings, &c.; and No. 2 Girders, &c., have been previously announced, viz.:—No. 1, Armitage and Hodgson, Leeds, £22,103; No. 2, Dawson and Mumeley, Leeds, £10,699.

RAILWAY MATTERS.

AT midnight on Saturday two passenger trains came into collision in the Walsall Station, and the travellers by one of them—the other was empty—were severely shaken. Two carriages were telescoped.

DURING the year 1881, 239 miles of new railways were opened for traffic in Prussia, of which 147½ miles were built and worked by companies, 14½ miles were corporation roads, but worked by the State, and 77 miles were owned and work by the State.

ACCORDING to the report of the North British Railway Company, the total train mileage by the company's engines, goods and passenger, was 5,229,768 during the half-year ending the 31st July. The total cost for locomotive power, including all charges, during the same period, was £137,227 7s. 10d.

MESSRS. KRAUSS AND CO., locomotive builders at Munich and Linz, recently completed their thousandth locomotive. The corner-stone of the Munich works was laid June 1, 1866, and the first locomotive was turned out and sent to the Paris Exhibition March 15, 1867, where it won the great gold medal.

A FEW copies of a very interesting pamphlet of thirty-three pages, entitled a history of the Manchester railways, and consisting of a series of articles reprinted from the *Manchester City News*, have been published. It contains a great deal of information attractive to those interested in the history of railway rise and development.

THE light engines on the Dewsbury and Batley Leeds line have, we are informed, been doing excellent work of late, each engine drawing two cars and upwards of 160 passengers. There is some talk of working halfpenny stages, equal to carrying the people at halfpenny per mile. The Stockton and Darlington tramways, worked by seven of Merryweather's engines, have been running two cars to each engine with 160 passengers. One of the gradients on which these engines run with this load is 1 in 18, with a number of inclines of 1 in 20.

THE agitation in the Cannock Chase district, in favour of the reintroduction into Parliament of the Birmingham, Walsall, and Cannock Chase Railway Bill, continues. The leaders wish to induce the promoters of the Bill to provide an additional line for passenger traffic across Cannock Chase. They urge that the Cannock Chase Colliery Company, which owns a mineral line running through the heart of the district, is willing to concede running powers to the London and North-Western Railway or the Midland Railway Company.

OUR Birmingham correspondent writes :—The people of Dudley and its neighbourhood are much inconvenienced by a dispute over the right to construct that portion of the South Staffordshire Steam Tramways System which runs to Dudley. This system is being built under an order obtained in September, 1881, which stipulated that all the work was to be finished within a year from the issue of the order, and that in default it was to be handed over to the Dudley and Stourbridge Steam Tramways Company. Finding that the system was not completed within the time, this company has applied in the Chancery Division for power to take over the work, and has obtained it.

IN concluding a report on the collision which occurred, on the 28th July, near Balado station on the North British Railway, when a passenger train from Milnathort, *viâ* Kinross and Stirling, to Glasgow, was proceeding on its journey, and just after having stopped at Balado station, its rear vehicle was run into by the 2 p.m. goods train from Ladybank, *viâ* Kinross, to Stirling, Major-General Hutchinson says :—"The automatic brake with which the passenger train was fitted appears to have done good service. The train was severed into two portions between the second and third vehicles by the force of the collision, and the guard in the rear van having been knocked down, it is most probable that the rear part would have run into the front part and produced a second collision, had not the automatic action, brought into play by the severance of the couplings, promptly stopped the rear portion."

THE Legislature of Vancouver's Island during last session granted a charter for the construction of a railway connecting Esquimalt harbour with Nanaimo and the coast of Johnston's Straits, on liberal terms to a committee of local and American capitalists, who are required to make a deposit of 250,000 dols., as a guarantee for the faithful performance of the contract. A grant of land has been ceded to the promotors of nearly two million acres, with a right to all coal and minerals. It is assumed that area includes coal lands to an extent of about 300,000 acres. The entire length of the road will be about 150 miles, running nearly for the whole distance through exceedingly fertile lands. The section from Esquimalt harbour to Nanaimo must be completed, according to the terms of the contract, by July 1, 1886; the other section, from Nanaimo to Seymour on Johnston's Straits, must be in working order by July 1, 1890.

ON a wooden bridge leading over the Drave at Essegg, in Croatia, a terrible railway accident occurred on the 24th inst. While a train was crossing the bridge one of the piers suddenly gave way, and the engine, four baggage wagons, and two passenger carriages were precipitated into the high and swollen floods of the Drave. Fortunately the couplings broke, so that the rest of the passenger carriages of the train remained standing uninjured on the undamaged part of the bridge. The two passenger carriages which fell into the Drave were filled with soldiers. They were Hussars returning from Bosnia, and were on their way to their homes on furlough. When after the catastrophe the ranks of the rescued were counted, twenty-seven men were missing, who had perished in the waves. Of the pier not a vestige remains. In the forenoon of the same day a technical commission examined the bridge, and declared it to be safe.

OWING to the differences that have arisen between the Bristol Port and Pier and Railway Company and the Great Western and Midland Companies respecting the running powers of the two last-named companies over the line of the former, a dead-lock, which has been a source of great inconvenience to shippers and ship-owners, has taken place, the result of which is that the railway goods traffic from Avonmouth Dock has been completely stopped. On the 25th inst. the train from Avonmouth Dock was duly presented for passage over the Port and Pier Company's line; but the decision previously arrived at not to allow the traffic to be resumed until a satisfactory settlement of the various matters in dispute had been made was adhered to, and, on the necessary permission being refused by the officials, the train was compelled to return. It appears that the notice of this total arrest of the traffic was served on the two larger companies by Mr. J. Read, who was appointed by the Court of Chancery as the receiver for the smaller line.

THE number of railways to be worked by electricity is now considerable. Those which are working, authorised, or in course of construction, show a total length of about 100 miles. The lines actually at work are those of Lichterfelde, 1·56 miles, and that from the Spandauer Bock to Charlottenberg, near Berlin; the Port Rush to Bush Mills, in the North of Ireland, about 6·5 miles, and also in Holland, one from Zandvoort to Kostverloren about 1·3 miles long. Among lines authorised or in construction, the following are noted :—In Austria, the Mœdling line, near Vienna, 1·5 miles, to be constructed by the Southern Railway Company there. In Germany, the line from Wiesbaden to Nürnberg, 1·3 miles, and that from the Royal mines of Saxony to Zankerode. The line under the Thames connecting Charing-cross and Waterloo stations will be about three-fourths of a mile; also a line in South Wales thirty-seven miles, for which the power will be derived from fall of water. In Italy, Turin, and Milan, will soon begin the construction of electric tramways. In America the Edison Company have arranged for the working of 80 kilometres on one of the great lines from New York. Another small line, 1·1 miles, is to be made at St. Louis, in Missouri, by Mr. Heisler.

NOTES AND MEMORANDA.

THE lime mud, formed as a waste product is caustic manufacture is converted, according to a recent patent, into a useful product in the following way :—It is put into a chamber provided with a stirrer and a movable filtering bottom. Steam is let in, and passing through the mud drives out the moisture and alkali through the filter bottom. The bottom is then lowered and the dry cake of carbonate of lime tilted into a wagon and used in place of limestone in the black ash furnace.

THE report of the British Association Committee on "Underground Temperature," shows how impossible it is to give a mean rate of increase. It states that the result of fourteen years' observation shows that the increase of subterranean temperature varies in its rate of increase downwards, amongst other places, from 1 deg. Fah. per 130ft. at the Bootle Waterworks, Liverpool, 1392ft. deep, to 1 deg. Fah. every 34ft. at the Slitt Mine, Weardale, Northumberland, 660ft. deep. A mean increase of temperature per foot is found from these figures to be ·01563, or 1 deg. Fah. in 64ft.

HERR WASUM, according to the *Journal* of the Society of Chemical Industry, gives, as a result of many experiments, the opinion that copper is not so active in rendering steel "red short" as has been hitherto stated. Indeed, he finds that 0·862 per cent. of copper only causes a slight trace of "red shortness," on this point differing from Eggertz, who condemns as useless steel with but 0·2 per cent. As regards sulphur, he places the minimal limit at 0·15 per cent., but opines that even 0·1 per cent. is sufficient to cause "red shortness" in a soft steel, or one poor in manganese. The degree of "red shortness" in steel containing both copper and sulphur does not appear to be greater than that which would be caused by the latter alone.

IN a report on the syphonage and ventilation of traps to the American National Board of Health by Messrs. E. W. Bowditch and E. S. Philbrick, and published in the American *Sanitary Engineer*, one conclusion is that "the best and most simple remedy for the syphoning of traps, in most cases, is undoubtedly to be found in the introduction of air at the normal pressure at the crown of the trap. No definite rules can be given for the size or length of vent pipes. Yet it may be said that it is not safe to trust to a vent pipe of less size than that of the trap it is to serve until we get above two inches diameter, except they be of only a few feet in length, before they join those of a larger size. The greater efficacy of a vent applied directly at the trap, as compared with the air supply through the top of the main soil pipe, is shown by experiments which are set forth in the report."

A CORRESPONDENT of the *Times*, writing from the Cape, says :—"From the explorations set on foot by the Cape Government, and recently reported upon, it would seem as though the great Stormberg range of mountains contained an indefinite amount of coal. The Stormberg coal beds have been locally worked for some time past with very poor appliances. A coal mine, called the Molteno, is about to be opened some sixty miles north of Queenstown, in which the principal seam extends over an area of 200 acres. Though intercalated by beds of shale, it contains about 2½ft. of workable coal, the section being thus given :—(1) Sandstone roof; (2) coal, 6in.; (3) grey shale, 5in.; (4) coal, 10in.; (5) black slate, 9in.; (6) bottom coal, 14in.; (7) shaly sandstone. No. 2 coal is described as soft but bright, burning easily, with a white ash. No. 4 is a highly bituminous and a good house coal. No. 6 is a hard, compact, and excellent steam coal."

THE use of sulphur has been proposed by Ebell as an indicator for the alkalinity of glass, with which, when it is fused, a yellow or brown colour results, if there be an excess of alkali present. Herr W. Seleznew finds that all kinds of glass behave similarly when so treated, the depth of colour produced being dependent, not so much on the quantity of alkali, as on the time of fusion. The colour very often becomes quite black, and this Herr W. Seleznew ascribes to the formation of sulphide of iron, and not to that of an allotropic form of sulphur, as Péligot maintains. Equivalent amounts of potassium or sodium silicate, heated for two days in a sealed tube to 500 deg. Cent., with sulphur, are completely decomposed, with formation of an alkaline sulphide and separation of silica. Ebell's test for the alkalinity of glass, by formation of an alkaline sulphide recognised by its colour, is, therefore, in Herr W. Seleznew's opinion, valueless.

AT the recent meeting of the French Association for the Advancement of Science, Dr. Brard, of La Rochelle, read a paper describing a method of generating electricity by the combustion of a double fire-brick, consisting of carbonaceous matter and nitrate of soda or nitrate of potash. "A carbon brick is formed of about 100 grammes of coal dust kneaded into a paste with tar or molasses, and shaped into a mould by heat. The mould gives the brick a pitted surface above, and perforates it with holes through and through from the upper to the under side. Strips of brass or copper are also imbedded in the underside of the brick to serve as an electrode for the carbon pole of the electro-generative element. The other brick consists of a mixture of three-parts ashes and one part nitrate of potash or soda, melted together and poured upon the pitted surface of the carbon, which, however, is first covered with a layer of asbestos paper. Strips of brass are also imbedded in this compound to serve as an electrode. The slab thus formed constitutes a generator of electricity when wrapped in asbestos and placed in a furnace or fierce fire. In such an element the carbon forms the negative plate, and is oxidised just as zinc is oxidised in the ordinary voltaic cell, the nitrate of potash being the oxidising substance. The slab becomes a thermo-chemical battery, and Dr. Brard states that an electric current is obtained strong enough to actuate an ordinary electric bell. By connecting up several of these elementary slabs after the manner of a voltaic battery, a more powerful current is the result, three or four cells being sufficient to decompose water." These slabs must be costly to produce, the current obtained very small, costly to renew, and troublesome to keep going.

IN an article in *Good Words* on "Raindrops, Hailstones, and Snowflakes," Professor Osborne Reynolds says :—A cause may be assigned for the difference between the solid ice granules which constitute the hailstone, and the open lace-like snow crystal. When a cloud of water particles already formed is cooled by subsequent elevation to a temperature below 32 deg., the fog becomes frozen but the particles retain their spherical shape, and the downfall from such a cloud is hail. But when clear air, at a temperature below 32 deg., is further cooled, the steam condenses at once into ice; and, as is well known, it is by this mode of condensation that crystals are formed. Both these actions may be seen on a window during a sharp frost. As the window cools, its lower portion becomes covered with dew, deposited first in the form of water; as the cooling proceeds, this dew becomes frozen into an opaque coating of ice, but without showing any crystalline forms, and thus corresponds to the hail granules. But the dew deposited, particularly on the upper portion of the window, after freezing has commenced, takes the beautiful crystalline shapes so well known, and which correspond in all particulars to the crystals in the snowflake. This cause for the difference which results in snow and hail fits perfectly to the conditions under which snow and hail are observed to occur. Snow occurs during frosty weather when the general temperature of the air is below 32 deg. But hail hardly ever falls when the temperature of the lower air is low, and generally when it is high. It is the suddenly formed dense cloud of higher temperature which sends down hail. When a body of heavily saturated air, at a temperature of 60 deg. or 70 deg., ascends, as it rises it forms into a cloud, three-fourths of its steam being condensed before its temperature falls to 32 deg. If then no further elevation of the cloud takes place the downfall will be rain; but if the temperature is further lowered, the water particles are frozen into ice particles of the same shape, and it is these frozen spheres which aggregate to constitute hailstones.

MISCELLANEA.

ON Saturday, the 16th, over £900 was taken in shillings for admission to the North-East Coast Exhibition at Tynemouth.

THE prizes gained by the students of the Metropolitan Drawing Classes will be distributed at the Guildhall on Thursday, the 12th October, by the Baroness Burdett Coutts.

SUCCESSFUL experiments in the use of the telephone in diving operations have been made by Mr. Wake, engineer to the River Wear Commissioners, and Mr. Irish, of the Northern Telephone Company.

AN American paper says that to every 400 lb. bale of cotton there are 1200 lb. of seed. The annual cotton crop is 6,000,000 bales, giving 2,500,000 tons of seed. This seed made into oil would be worth £15,000,000 to £20,000,000.

AN English mechanic of Pittsburgh, named Taylor, is reported to have invented a machine for cutting nails from steel wire, which was recently put in operation in that city, cutting steel nails at the rate of 15,000 to 40,000 per hour.

IT is stated that Mr. Werdermann, whose name was most prominently before the public during the rapid rise of electric lighting immediately after the Paris Exhibition, 1878, has devised a new incandescent lamp, the peculiarity of which consists in the use of silicium in place of carbon, and in dispensing with a vacuum.

THE sixtieth session of the Birkbeck Literary and Scientific Institution will commence on Monday next. The evening classes are open to both sexes, and afford ample opportunity for the study of ancient and modern languages, mathematics, natural, applied, and mental science, art, law, history, literature, music, &c. The plans of the new building have been approved, and it is intended shortly to lay the foundation-stone.

OUR Birmingham correspondent says :—The light machinery engineers of Bristol are drawing supplies of airy pulley wheels from some of the bicycle makers in this district. They are built upon the spider principle, with a U shaped steel rim, wire spokes, and gun-metal hub, and it is understood that they are fitted into machinery that is sent abroad by the Bristol engineers, and are run with catgut. The sizes ordered vary from 12in. to 50in. diameter, and the demand is increasing.

IT is stated that the German Government intends now to devote its attention to the execution of the project for the construction of the canal connecting the North Sea with the Baltic. Several officers of the General Staff have recently visited the districts through which the canal will pass, in order to make inquiries, and the Chief of the Staff has now been instructed to make a report on its maritime importance. A commission, composed of members of the Staff and officials from the War and Admiralty Departments, has also been appointed with a view to making the necessary preparations for the execution of the project.

AN immense flagstone, which is said to be the largest ever quarried in America, has been sent to New York for the sidewalk in front of R. L. Stewart's new brownstone residence, Fifth-avenue. The great slab is of river bluestone, and measures 26ft. 6in. by 15ft. 6in. It is 9in. thick, and weighs over 30 tons. If raised on edge it would make one side of an average sea-shore cottage. The stone was cut from a quarry in Sullivan county, and was taken down the Hudson on the deck of a barge; there it was unloaded, the *Scientific American* says, by being raised high enough with screw jacks for two heavy flat-stone wagons to be placed under it, when it was drawn to its destination by eighteen powerful horses.

SOME important trials have recently been made in the Keyham Basin, Devonport, with the Audacious ironclad, the new flagship for the China station. Booms had been rigged out from the starboard side of the ship, varying in length from 30ft. to 40ft., and from these were hung wire nets protecting the whole side of the vessel. When the booms were lowered there were 18ft. of netting submerged, enough to defeat the action of any torpedo, as from experiments it has been found that the destructive radius of torpedoes does not exceed 10ft., and that when they are exploded at a greater depth the weight of the water takes the explosion downwards. The working of the booms was most satisfactory, demonstrating that the nets afford effectual protection.

FROM the report on the Metropolitan water supply, by Colonel Frank Bolton, it appears that all the companies are at present voluntarily moving in the matter, and giving constant supply under the provisions of the Metropolis Water Act, 1871, in some portion of their districts. The Act provides power to compel the companies to give constant supply, as and when the public authorities may see fit to demand it; but no company is compelled to give such constant supply if it can be shown by them that after the expiration of two months from the time of service of the requisition more than one-fifth of the premises in such district are not provided with the proper fittings, in accordance with the regulations made under the above-mentioned Act.

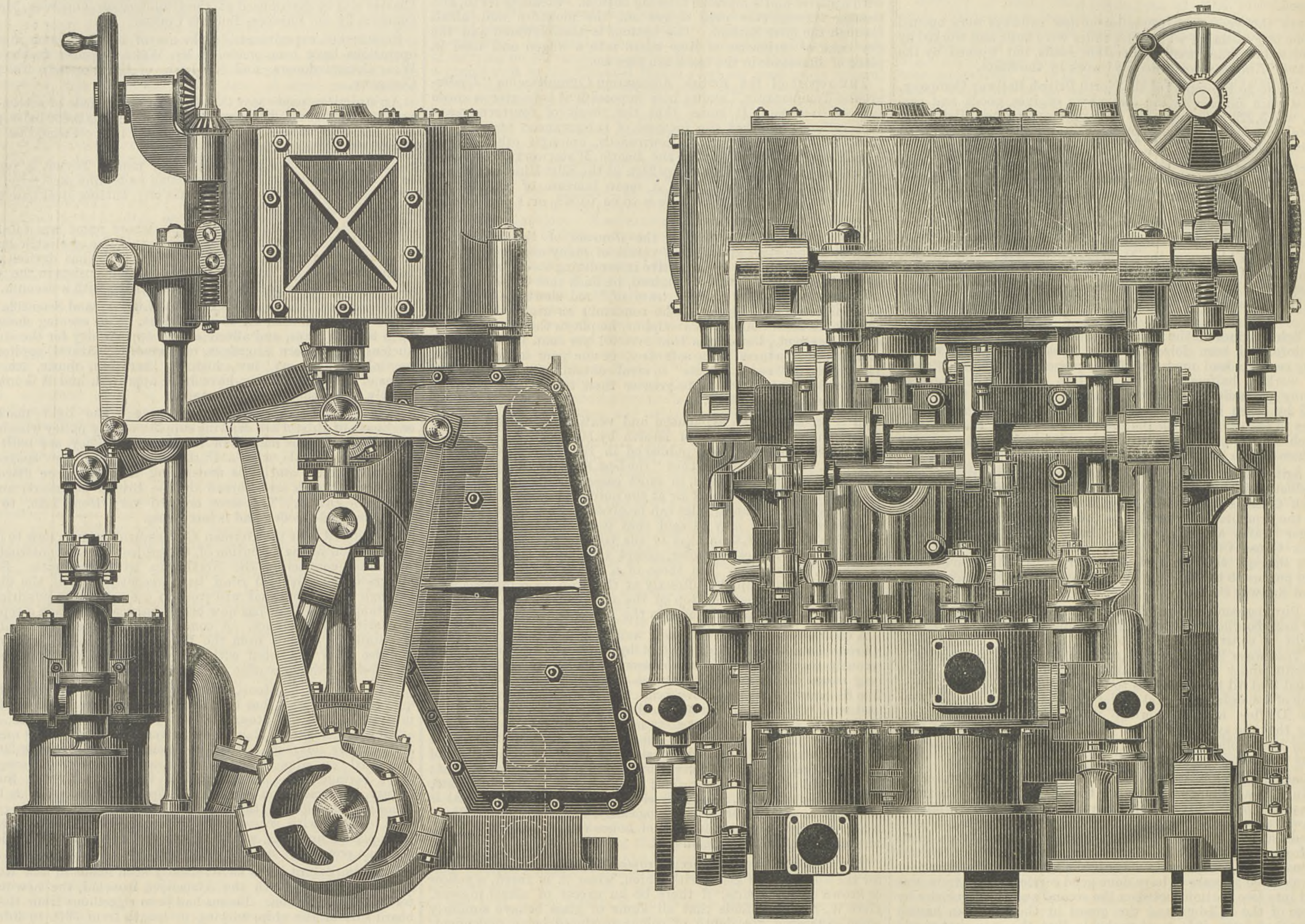
THE sanitary appliances in the residence of Mr. W. K. Vanderbilt are described and illustrated very fully in the American *Sanitary Engineer*, and are worthy of consideration by our sanitary appliance fitters. The arrangements for carrying the various pipes in the building in such a way that they may be easily inspected and renewed are particularly worthy of attention, and though it may be well to hide these pipes as much as possible from general view, it is very desirable that they should not be placed so that walls and plaster have to be pulled to pieces when repairs are necessary, and admitting this, those who have designed the arrangements in Mr. Vanderbilt's house have made special brackets and hangers for the pipes so that they may be taken out and repaired with the same facility as pipes in a well-arranged system of pipes in a testing house.

ON the 12th inst. Messrs. Edward Finch and Co., of Chepstow, made a highly successful trial trip of the new iron screw steamer Rougemont, built by them for Messrs. John Cory and Sons, Cardiff. After a careful run down the tortuous river Wye, the vessel proceeded down the Bristol Channel to off Ilfracombe, where her sea-going capabilities were fairly tested. An average speed of 10½ knots was obtained with 80 revolutions and 75 lb. steam pressure. The following are the general particulars :—Length over all, 250ft.; beam, 37ft.; and depth of hold, 18ft. 3in., and has a carrying capacity of 2000 tons. She is constructed with five water-tight compartments, and adapted for carrying grain cargoes. Her engines are compound surface condensing, 140 nominal horse-power, and her boilers are of large dimensions, with Fox's patent corrugated furnaces, the machinery having been fitted by the builders.

IN a letter to the editor of the *Berkshire Chronicle*, on "The Stack Driers," a correspondent, Mr. Herbert Simmons, says :—"Some of the hay cut out is worth £4 or more per ton, and the rest if shaken into a large stack and submitted to the steaming process, will be worth £3 or £3 10s. per ton. The hay that is sold for £4 and £5 per ton will pay the cost of improving the other. Apart from the cost of pumping the stacks, a process of weeks and weeks, together with the coal, engine driver, and supervision, it appears to me that the society will lose something like £4 per ton, and this on the part of inventors to teach us how to make hay, when on the adjoining farm of Mr. M. H. Cundell, whose stackyard I took the liberty of inspecting, I find four stacks containing about 120 tons of the finest meadow hay that can be produced, made at the same time and off the same kind of land without artificial means, and all worth £5 per ton or more. What the barley may be when it has been submitted to another artificial drying I cannot say, but what it was valued at by two of the best judges in Reading Market, without their knowing where it came from, was 27s. per quarter. At the same time I submitted a sample of barley grown on the adjoining farm of Mr. E. Hobbs, which was valued at 42s. per quarter. He had no artificial assistance, the same weather, the same kind of land, and a good crop of barley. The land on both farms is adapted to the growing of the finest barley.

COMPOUND MARINE ENGINE.

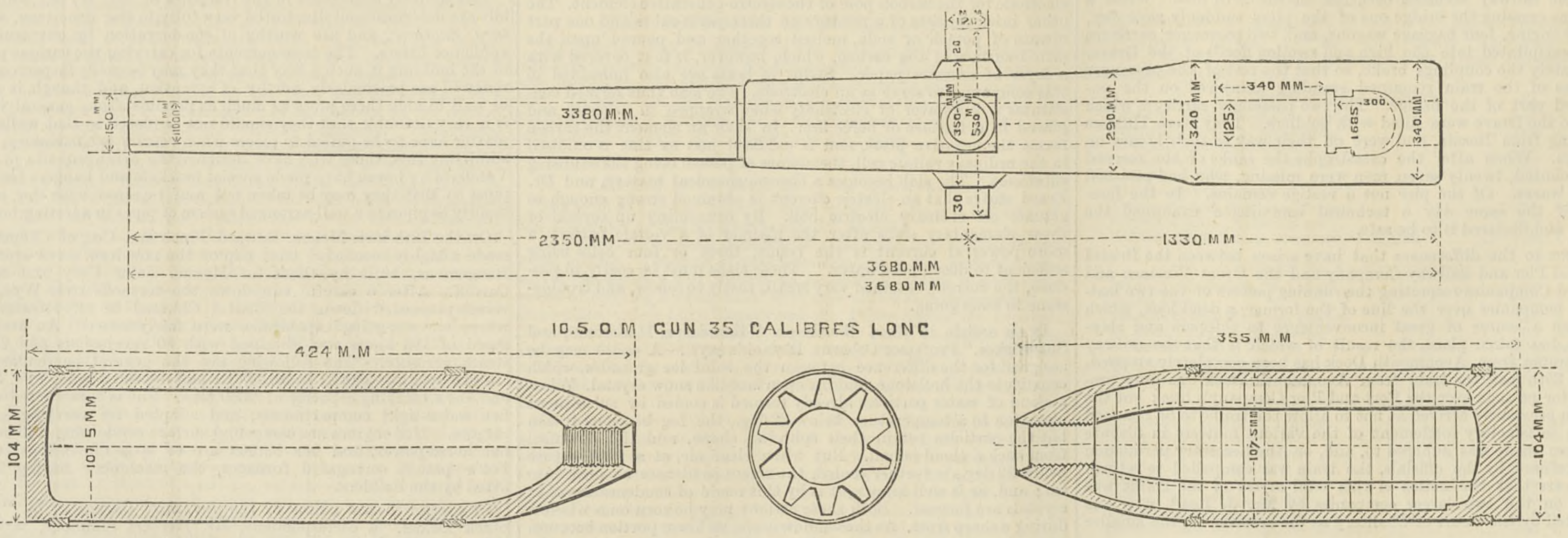
MR. F. J. HARKER, STOCKTON-ON-TEES, ENGINEER.



THE accompanying engraving illustrates a compound launch engine with cylinders 7in. and 12in. diameter by 8in. stroke, constructed by Mr. Harker, of Norton-road, Stockton-on-Tees. This engine has been designed with the intention of bringing the complete machinery into as small space as possible, and at the same time to give as much access to the working parts as may be with a small job. The pair of cylinders along with their steam chests, and all thoroughfares, cylinder bottoms, brackets, and branches, are cast in one, thereby saving weight, loose parts, &c.; the cylinder covers and valve chest lids are the only joints requiring making. In the present case reversing is effected with a wheel and double thread screw, and the rod connection carried on deck to enable the engine to be worked either above or below. This answers the purpose well.

Another feature is the guide below the bar link, which makes the reversing much easier and saves bent spindles and also leaking down the spindle glands. The air pump connection to the condenser is through the bed plate under the centre bearing, and the circulating pump connection through the bed plate under the after bearing. In running these engines at a high speed—600 per minute —Mr. Harker states that he found no heating in the crank bearing, and the after bearing is perfectly cold through the action of the circulating water under it. The size of crank shaft is 3in. diameter, and the main bearings and also crank pins are each 3in. diameter by 4in. long. The condenser has 170 tubes ⅝in. diameter, and the tubes are packed with screw ferules and cotton. An average vacuum of 27in. is easily maintained, and no variation is found under varying pressure or speeds. The pump rocking shaft works in adjustable bearings in the front columns. These bearings are set up with screw wedges. The sizes of pumps are—air pump, 6in.; circulating pump, 5in.; feed and bilge pumps, 1¾in.; all 3½in. stroke and all single acting. The weight complete is 14 cwt. The extreme length is 2ft. 9in., extreme breadth over condensers, &c., 2ft. 9in.; height from crank shaft centre to top of cylinder, 3ft. 2in. This is a compact and handy engine.

10·5 CENTIMETRE KRUPP GUN.



THE sections herewith show the long 10·5 centimetre Krupp gun, with which important results have been obtained this year at Meppen, as well as a short pattern of steel common shell and ring shell. A remarkable experiment was made with this gun for theoretical purposes recently. A shot of 4 kilogrames weight—about 9 lb.—was discharged with a charge of 4½ kilograms of powder with a velocity of 915 metres—about 2745ft. It was found that at very high velocities the resistance of the air did not continue to increase.

THE NEW PUTNEY BRIDGE.

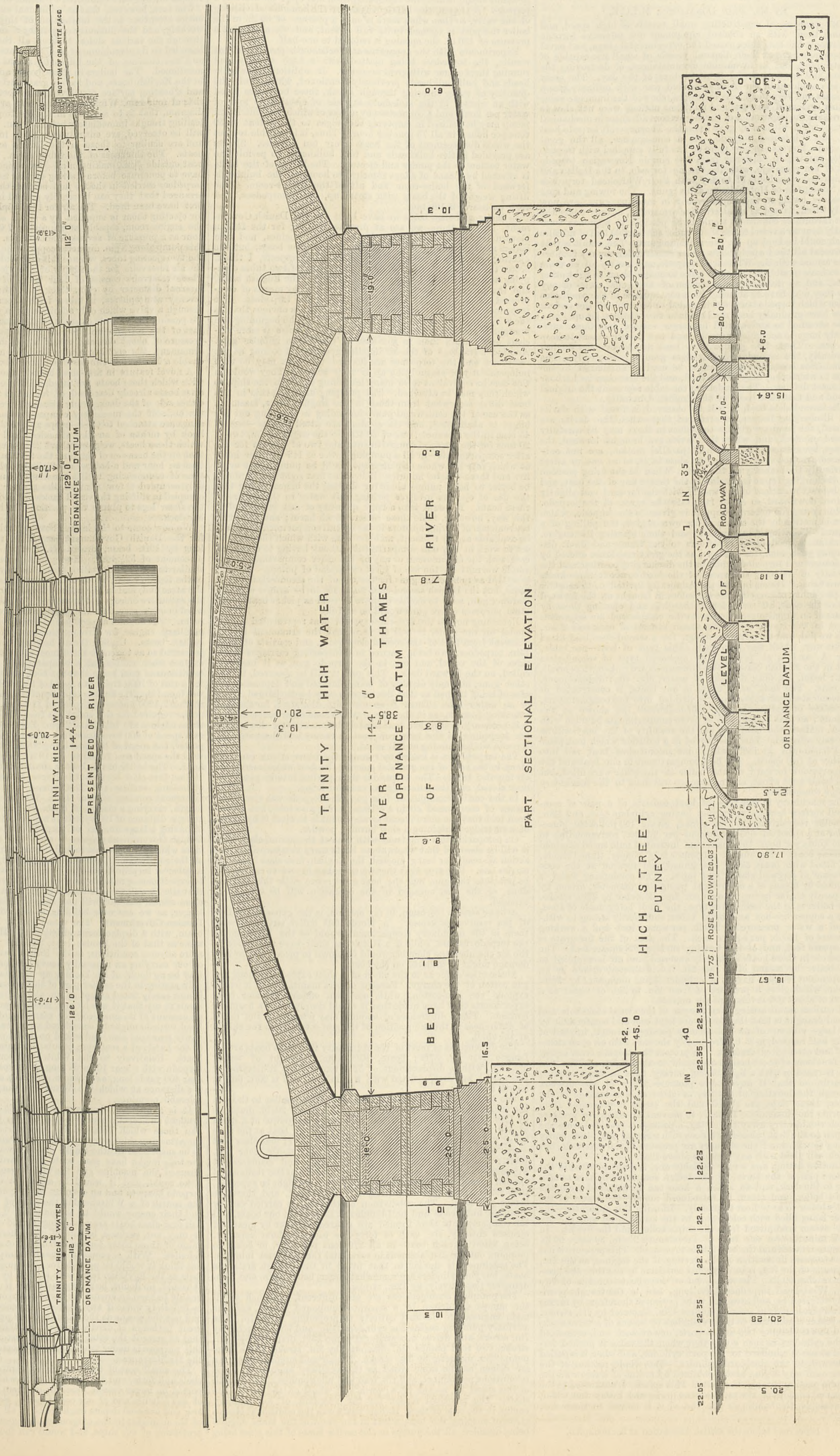
ON page 235 we give the first of a series of engravings of the new Putney Bridge, to be erected under the instructions of Mr. Ed. Bazalgette, who has been appointed bridge engineer under Sir Joseph Bazalgette, the chief engineer to the Metropolitan Board of Works. The bridge is a return to masonry construction, and its granite elevation will no doubt have a very pleasing effect. We shall describe these and other engravings in a future impression.

AMERICAN PATENTS.—The number of American patents issued up to the last day of August was 263,669. The following is the proportion of one week's issue of patents to inventors belonging to the various States:—New York, 74; Massachusetts, 42; Pennsylvania, 32; Illinois, 31; Ohio, 21; Indiana, 19; California and Connecticut, each 14; New Jersey, 12; Wisconsin, 11; Missouri, 9; Iowa and Kansas, each 8; Rhode Island and Maryland, each 7; Georgia and Michigan, each 6; Minnesota, Texas, and Virginia, each 5; Arkansas, Nebraska, New Hampshire, and North Carolina, each 3; Maine, Tennessee, and Vermont, each 2; and one each for Colorado, Delaware, Columbia District, Idaho, Nevada, Oregon, and West Virginia. More interesting than the actual figures is the relation of the physical character of the State and its people to the general groove in which the inventions run. New York, for instance, deals principally with mechanical applications and scientific discoveries, and especially in matters relating to railways, machinery, and hardware. In New England States the tendency is almost entirely in favour of labour-saving machinery and particularly as applied to small and apparently trifling things. Again, in the west and south, the bulk of inventions relate to agricultural machinery, while in the Pacific States and among the Rocky Mountains they are almost entirely confined to mining matters. In fact, the Patent Office of a great country like America becomes, as it were, a kind of geographical index to the wants and requirements of the people. In the week ending August 29 there were also twenty-one patents taken out by inventors belonging to foreign countries, of whom twelve were English, four from Canada, two from Germany, and one each from Denmark, France, and Switzerland. With all this profusion of inventive talent, it is sad to state that from well-founded calculations it has been proved that not more than one inventor in a hundred gets any returns for his trouble.

THE NEW BRIDGE OVER THE THAMES AT PUTNEY.

SIR JOSEPH BAZALGETTE AND MR. E. BAZALGETTE, MM. INST. C.E., ENGINEERS.

(*For description see page 234.*)



TORPEDO BOATS.*

By Mr. JOHN DONALDSON, M.I.C.E.

THE problem of constructing small vessels of high speed, and arming them with an efficient equipment for offensive torpedo operations, has long since passed the experimental stage, and naval officers now have at their disposal vessels of small size capable of outstripping, and in favourable circumstances, of destroying the fastest and most powerful fighting ships of the day. The great services rendered in the American civil war with ordinary steam launches and very inefficient torpedoes, showed the immense value of this system of warfare, and maritime nations were not slow to appreciate the importance of the more recent advances in mechanical science, which ultimately gave them the Thorneycroft torpedo boat and the Whitehead torpedo. As a consequence, all the great European Powers are now more or less fully supplied with torpedo boats, varying in efficiency from the simple Norwegian torpedo boat of ten years ago, with its towing torpedo, to the Italian and Danish first-class boats of to-day with their Whitehead torpedoes and Nordenfelt or Hotchkiss machine guns. The towing and spar torpedoes, owing to the improvement in machine guns, are now rarely fitted, except as an alternative armament, as only under the most favourable conditions would it be possible to approach sufficiently near to a vessel to use them under the terrible hail of missiles which could be kept up by her machine guns. The result is that at present all the torpedo boats under construction by my firm are to be armed with the Whitehead torpedo, and nearly all of them are to have in addition machine guns to enable them to fight other boats, and to distract the attention of the guns' crews of any ship they may have to attack. As a consequence of the conditions under which torpedo boats are intended to be used, all the various types have gradually been resolved into two distinct groups, viz., those attached to and carried by larger vessels, and those sufficiently large to act independently, and to a certain extent to keep the sea. These two groups have been named by the English Admiralty, the second and first-class groups respectively. The second-class boats are intended to be used as auxiliaries to the ships to which they may be attached, and the first-class for harbour and coast defence. The models on the table represent the original second and first-class boats of the English Admiralty.

The second-class boat, it will be observed, is fitted with davits and discharging frames, so arranged that when the davits are inboard, the frames with the torpedoes in them may be carefully housed on deck, and when the davits are brought forward, the frames, by means of a system of parallel motion, are not only lowered over the side, but are kept close to it, so as not to affect injuriously the stability of the boat. When in the firing position the discharging frame is parallel to the centre line of the boat, and 2ft. below the surface of the water, with the forward end slightly inclined downward, so as to facilitate the egress of the torpedo. In this system no external impulse is given to the torpedo, which is set in motion by the action of its own engine, the pulling of a lanyard liberating the torpedo, and then starting its engine. There are a good many objections to the frame and davit discharging gear, such, for example, as the great resistance offered by the frames and torpedoes when in the discharging position, and the necessity of reducing the speed of the boat to about three knots before firing. Hence in 1880 the Admiralty invited us to consider the possibility of carrying the torpedoes in troughs on the forward part of the deck, all ready for discharging, and ejecting them by means of an impulse gear similar to the compressed air apparatus in use in the Navy, but using steam instead of compressed air. This we did, and submitted a design for a second-class boat fitted in this way, which was approved. This type of boat—see table, type A—and is at present the approved type of second-class boat in the English Navy. The dimensions are :—Length over all, 63ft.; beam, 7ft. 6in.; draught of water, 3ft. 4in.; displacement, 12½ tons. The hull, as is usual in our boats, is constructed of Bessemer steel galvanised, and is divided into ten compartments, by means of bulkheads and half-bulkheads, as shown in the diagram; so that should one of these compartments be filled with water, neither the buoyancy nor the stability of the boat will be seriously affected. This was proved in a collision which took place at Portsmouth in 1880, when one second-class boat ran into another at full speed. The bow compartment in one boat and the compartment forward of the boiler in the other were filled, but both boats kept afloat, and no damage was done to the machinery or pipe connections.

The machinery in this type of boat consists of a pair of compound surface condensing engines having cylinders 8¼in. and 13in. diameter respectively by 8in. stroke, giving 150 indicated horse-power at a speed of 653 revolutions per minute, corresponding to 17·65 knots per hour, the maximum measured mile speed attained by these boats. The surface condenser is of copper, tinned inside, and fitted with brass tubes, also tinned, and secured at the ends by means of screwed glands and tapes. The condensing water is supplied by means of a centrifugal pump 8in. diameter, driven by a separate engine having a cylinder 2in. diameter by 2½in. stroke. The boiler is of the locomotive type, the shell being made of steel, with a copper fire-box and brass tubes, sufficiently strong to withstand a water pressure of 260 lb. per square inch and a working pressure of 130 lb. per square inch. The area of the fire-grate is 6·6 square feet, and of the heating surface 268 square feet. The stokehole in these boats is entirely enclosed, and air is supplied to the boiler by means of a fan 2ft. 3in. diameter, driven by an independent engine having a cylinder 3¼in. diameter by 2½in. stroke, which gives a pressure of from 2in. to 3in. of water at a speed of about 800 revolutions per minute.

A curious result arising from the use of the closed stokehole and forced draught is that the stokers are kept cool and comfortable by the large volume of air continually passing through, instead of being half roasted, as is too frequently the case with an open stokehole and attenuated draught. To protect the stokers from injury the fire-doors of these boilers are made to shut tight, and the ashpan is cased in with a light casing having flaps in front opening inwards, so that if any undue pressure arises in the fire-box through the bursting of a tube, or other sudden leakage in the boiler, these flaps are closed and the steam is prevented from entering the stokehole. In order to prevent an excessive pressure which would carry away the casing, a passage is provided from the ashpan to the deck, closed by a door with a spring catch sufficiently strong to withstand the ordinary air pressure in the stokehole, but which will yield with any pressure above that.

Another fitting, and a very valuable one, is a nozzle fitted in the bottom part of the barrel of the boiler, connected by means of a pipe to the deck, and to which a hose can be attached from the ship's boiler, and steam be introduced among the water in the boat's boiler so as to heat it quickly. In using this apparatus—the boiler being filled with cold water to the usual level and the fire laid—steam is admitted from the ship's boilers and the fire lit. In a few minutes—on one trial at Portsmouth 9 min. 36 sec.—60 lb. pressure is raised and the boat is able to proceed. This pressure is not liable to much fluctuation on the starting of the engines, as the fire, by means of the fan, is in very good condition by the time the pressure reaches 60 lb. The armament of these boats consists of two 14in. Whitehead torpedoes 14ft. long, laid in the troughs previously referred to, and arranged to be projected therefrom by means of two piston rods in steam cylinders 4¾in. diameter by 7ft. stroke. The steam is admitted to these cylinders by means of a valve working on a face having two steam ports, one at each end, connected to the cylinders in such a way that when the valve is pushed forward steam is admitted to the port cylinder, and when it is pulled backward, to the starboard cylinder. The whole motion of the valve each way is ¾in., and is obtained by means of a screw on the spindle passing through the valve. This spindle is connected to the stops on the sides of the torpedo troughs in such a way that when, for example, the handle on the end of it is moved to starboard, the starboard stop is withdrawn and the valve pulled backward so as to admit steam behind the starboard piston and eject the starboard torpedo. A stop on the handle regulates the amount of opening of the valve, so that when there is only a pressure of 60 lb. in the boiler the port is opened to its full extent, and when there is a pressure of 130 lb. the opening is reduced to one-half.

Experiments with the apparatus at Portsmouth gave excellent results, the torpedoes being ejected with a high velocity and running their course with great accuracy. In addition to the bulkheads and half bulkheads previously mentioned, which limit the quantity of water entering through a leak, these boats are fitted with an ejector in the stokehole capable of ejecting 45 tons of water per hour, and a connection by means of which the centrifugal pump may be utilised in emptying the bilges to the extent of 30 tons per hour—in all 75 tons per hour. Thus, it is possible to eject the whole displacement of the boats every ten minutes. Sluices are provided in the bulkheads and half bulkheads to permit the water to flow to the pumps and ejectors. The lifting of the boats is effected by means of slings attached to hoops on the bulkheads forward of the boiler-room and aft of the engine-room. The lifting weight of the boats with steam up, coals, torpedoes, and crew on board, is 12½ tons.

In the second-class boats we have built for the Danish Government, and in those we are at present building for the Italian Government—see table, type B—the hulls, engines, and the boilers are the same as in the English second-class boats, but the ejecting apparatus is different, and is in many respects, I think, better than the steam impulse gear. It consists of two tubes occupying nearly the same position as the troughs in the English boats, and the torpedoes placed in them are ejected by means of compressed air admitted to these tubes behind the torpedoes. The torpedoes thus form their own pistons, and it is obvious that as there are no pistons and rods to be started at the beginning and brought to rest at the end of the stroke, the impulse is more efficient and certain than in the case of the steam impulse gear. Another advantage of the air impulse gear is that so long as the reservoirs and the torpedoes are charged, the boats may be used independently of steam being up in their boilers. They would in this case be equivalent to so many launching tubes on the ships to which they may be attached. The pumping arrangements in this boat differ somewhat from those in the English boats, inasmuch as the use of the centrifugal pump for aiding in pumping out the bilges is abandoned, and six ejectors are fitted instead—one of 45 tons in the stokehole, one of 20 tons in the engine-room, two of 20 tons for the forward compartments, and two of 20 tons for the after compartments—in all a pumping power of 145 tons per hour, at which rate the whole displacement could be pumped out every five and three-quarter minutes. It looks at first sight as if it would be better to have pumps alone for clearing the bilges, seeing that the use of ejectors involves putting salt water in the boilers of these boats. It would take a large quantity of salt water used in this way, however, to do these boilers much harm; and the great convenience of having ejectors in the several compartments, so as to be available at any moment, and the ease with which they may be set to work in any one compartment without having to communicate with the engine-room or any of the other compartments, give ample warrant for the use of ejectors instead of pumps. Nothing is settled as to machine guns for the use of the second-class Italian boats, but the Danish second-class boats are to be armed with the Gardner gun, so as to enable them to be used as picket boats or for other purposes where guns would be useful.

Returning now to the first-class type of boat represented by the model on the table, it will be seen that the armament is very different from that of the second-class boats, and consists of three 14in. torpedoes, two being carried in transporting carriages on the sides of the vessel, and one in the torpedo gun, as it has been called, on the forward deck. This gun, it will be observed, is, like other guns, not only capable of being elevated and depressed, but also of being trained so that the torpedo may be discharged ahead or on either side. There is no necessity, therefore, for the boat attacking bows on, as in the case of the second-class boats, neither is it necessary to stop her immediately before or after discharging her torpedoes, as she may run past an enemy and discharge the torpedo whilst running at full speed.

The torpedo gun is loaded by running the transporting carriages along to the rear of the gun and opening the door which carries the air impulse tubes. The torpedo is then pushed into its place, the door closed, and the gun is again ready for firing.

In the earlier examples of this gun, the torpedo was ejected by means of compressed air in a telescopic impulse tube, but I have been told that the more recent arrangement is to eject it by means of a cartridge containing a slow burning powder.

On comparing this armament with that of the second-class boats it will be observed that where these boats carry two torpedoes into action all ready for being ejected, the English first-class boat only carries one. It is true that the two torpedoes in reserve can readily be put into the gun, but the boat must retire while this is being done, or the men engaged in the operation will be very much exposed.

A more serious objection, in my opinion, is the exposed position of the reserve torpedoes. A Nordenfelt bullet striking one of them in the machinery compartment would at the least render the torpedo useless, while if a Hotchkiss shell were to explode in the air chamber, the chamber would be blown to pieces, and serious damage might be inflicted on the boat.

Authorities differ as to the effect of a shell exploding among the gun cotton of the charge. Foreign officers maintain that it would explode the gun-cotton, while our own officers consider from experiments they have made that it would simply cause a harmless ignition. These differences of opinion may possibly be the result of differences in the composition of the gun-cotton or in the charge of the shell.

The dimensions of most of the Admiralty first-class boats are :—Length over all, 87ft.; beam, 10ft. 10in.; draught of water, 5ft. 2in., with a displacement of 32·4 tons. That illustrated by the model, however, is fitted with a ram bow, and is 90ft. 6in. in length over all.

The engines are compound surface condensing similar to those in the second-class boats, with cylinders 12¾in. and 20⅞in. diameter by 12in. stroke, and give out 469 indicated horse-power at a speed of 443 revolutions per minute, the speed of the boat at the time being 21¾ knots per hour. In the Italian type of first-class boat—see table, type C—the dimensions are :—Length over all, 100ft.; beam, 11ft. 8in.; draught, 5ft. 5in.; and displacement 34½ tons. The hull is somewhat similar to those of the Italian and Danish second-class boats, with the exception, as might be expected, that the torpedo gear is entirely inside the hull, and therefore better protected. The subdivision of the hull is carried out by means of bulkheads and half-bulkheads as usual in our boats, and the compartments thus formed are cleared of water by means of ejectors entirely, six, each of forty-five tons per hour capacity, being fitted in each boat—in all 270 tons per hour, or equal to pumping out the displacement in seven and three-quarter minutes. The machinery is similar to that fitted in the English first-class boats, but the cylinders are somewhat larger, being 13½in. and 22in. diameter respectively, by 12in. stroke.

The pumping arrangements are also different, inasmuch as all the pumps are driven by a separate compound engine, and the main engines are devoted entirely to propelling the ship. The auxiliary pumping engine has cylinders 5½in. and 9in. diameter by 7in. stroke, and drives a centrifugal pump 15in. diameter by 3½in. stroke, two feed pumps 4in. diameter by 3in. stroke, and a bilge pump 2¾in. diameter by 3in. stroke. The air and circulating pumps are driven at the same speed as the auxiliary engine, viz., 450 revolutions per minute, and the feed and bilge pumps at one-fourth of this speed by means of a worm and wheel on the end of the shaft. The principal reason for the adoption of an auxiliary engine in the case of these Italian boats was the additional chance given of keeping the boat afloat in the event of the main engines being disabled, all the pumps in the earlier boats of this class being arranged to pump from the engine-room bilge, to which the other compartments were connected by means of sluices.

The fact, however, that an additional engineer has to devote his entire attention to the lubrication of this engine and its proper working, and the difficulty of getting a sufficient supply of water through the various sluices to keep all the pumps fully occupied, have led to its abandonment in all the later boats we are building, and the clearing of the bilges by means of ejectors, as already mentioned. The boilers in these boats are somewhat larger than in the English boats, and have a grate surface of 19·4 square feet, and a heating surface of 698·8 square feet. The armament consists of four 14in. Whitehead torpedoes, arranged as shown in the diagram, that is to say, two in the ejecting tubes and two in the loading troughs immediately behind them. The ejecting tubes, it will be observed, are entirely enveloped in the hull of the boat, and are similar to those in the Italian and Danish second-class boats. The thickness of the tubes is ⅛in., and the plating of the boat outside $\frac{3}{32}$in., making in all $\frac{7}{32}$in. which a bullet or shell would have to penetrate before getting at the torpedo. The two spare torpedoes carried in shoots just behind the ejecting tubes are so arranged that they can be readily pushed into them after the two first have been fired. The air for the supply of the torpedoes and for ejecting them is supplied by a small air-compressing pump in the engine-room, capable of supplying 7·06 cubic feet of air per hour at a pressure of seventy atmospheres. The air is taken from this pump along a ⅝in. diameter copper tube to a stand-pipe between the two ejecting tubes, whence it is distributed to the torpedoes or to the air reservoirs for the supply of the ejecting tubes as required. These reservoirs consist of four tubes of steel 10ft. long, 3⅞in. internal diameter by $\frac{3}{16}$in. thick, and the air, at a pressure of seventy atmospheres, is taken from them to the ejecting tube, through a valve which only admits a given volume at this pressure. On passing the valve it expands in the space surrounding the after part of the torpedo, and pushes the torpedo out with a reduced pressure of about one and a-half atmospheres. As an additional armament, the conning towers have been strengthened so as to enable a Nordenfelt two-barrelled gun to be mounted on them.

A novel feature in first-class boats is the permanent lifting gear with which these boats are fitted. This consists, as in the second-class boats already described, of four steel rings or hoops, two on either side of the deck, firmly attached to each of the bulkheads at the ends of the machinery compartments. Four steel wire rope slings are attached to these hoops and to the shackle on the crane hook by means of smaller shackles; and such is the ease with which these boats, weighing about 28 tons each, can be lifted about, that on the occasion of shipping the first pair of them it was found that an hour and a-half was sufficient to ship both boats from the time of commencing to lift the first of them. The actual lifting only occupied a few minutes, the greater part of the time being occupied in shifting the vessel backward and forward so as to enable the shear legs to plumb the positions the boats were to occupy on her deck.

We now come to the largest boat yet built by us, viz., that built for the Danish Government—see table, type D. She is 110ft. long by 12ft. beam, draws 6ft. 3in. of water, and has a displacement of 52½ tons. Her general arrangement is somewhat similar to that of the Italian boats, the principal differences being in the topedo room, which is larger and has the conning tower at the after end, and in the cabins, the after of which is set apart for the executive officers and is entered from the deck, while the forward one is reserved for the engineer and is entered from the engine-room. The engines are compound surface-condensing, and have an auxiliary engine for driving the pumps, similar to that in the Italian boats. Unlike them, however, the cylinders are steam jacketted so as to secure the utmost economy in the working of the engines when running at a comparatively low speed; one of the conditions of trial being that the boat should carry sufficient coal for a run of 1000 knots at a speed of about 10 knots. On the trial it was found that the bunker capacity of 10 tons was sufficient to propel the boat 1200 knots at a speed of 11 knots. The indicated horse-power required for this speed was found to be 68. The cylinders of these engines are 14½in. and 24¼in. diameter by 14in. stroke, which at a speed of 400 revolutions per minute gave 750 indicated horse-power, the speed of the boat being 20¾ knots. On the three hours' trial the speed was found to be 19·91, or practically 20 knots per hour. The boiler of this boat is similar to those in the English and Italian first-class boats, but is larger, having 1014 square feet area of heating surface and 27·4 square feet of grate surface. The armament consists of four 15in. Whitehead torpedoes 19ft. in length, carrying a charge of 80 lb. of gun-cotton, and capable of going a distance of 1000 yards at a speed of 18 or 19 knots. Instead of having a large number of torpedo boats round the coast, the Danish Government propose to carry this boat, and others of her class which they propose to build, from point to point of the coast, on their railways. Thus an enemy, although he might know the number of torpedo boats the Danes had, would never know where to expect one or more to turn up. I believe I am right in saying that the Danish torpedo boat is larger than any other vessel of its class afloat, but she will not occupy this proud position much longer, as we are now building a somewhat larger boat for the Russian Government. This vessel will be 113ft. long by 12ft. 6in. beam, with a displacement of 58½ tons. Her contract speed is the same as that of the Danish boat, but she will do it under much more adverse conditions, as the Russian authorities have insisted on our carrying an unusually heavy load on the trial, so that there may be no doubt of her keeping up her trial speed on service.

In stating in the earlier part of this paper that the spar torpedo is now rarely fitted except as an alternative armament, I did not mean to say that it was by any means obsolete, as it is well suited an account of its small cost for many countries where the Whitehead torpedo might be considered an expensive luxury. It is more easily managed also, and would no doubt prove a valuable weapon in the hands of a seafaring population trained to the use of torpedo boats. Relatively to the Whitehead torpedo, however, it is a torpedo with a spar 10 yards long as compared with one having a spar 400 yards long, as it is now generally conceded that 400 yards is a distance at which the Whitehead torpedo can be used with tolerable certainty.

It is a question, however, whether it would not be the more prudent and certain course to use the spar torpedo in circumstances like those which obtained in Alexandria the other day, when the attacking ships were so enveloped in smoke that the firing had to be suspended till the smoke cleared away. The midshipman in the tops might have seen boats 400 yards off, and might have directed the machine gun fire upon them, but close in, I question if he could, and it would be easier for the commanders of the torpedo boats to find an opening for a spar torpedo than to direct the course of a Whitehead in the mass of smoke with which they and their enemy would be surrounded. I may say that the English first-class boats are now being armed with the spar torpedo. It may not, perhaps, be out of place here to urge the immense value of these boats for the defence of our coasts and those of our colonies. With a properly organised torpedo boat service, I do not think it would be possible for an enemy's fleet to treat English forts as the Egyptian forts were treated by our fleet at Alexandria. It would, no doubt, be a very sad thing if our English navies were unable to keep an enemy far away from our shores, but it would be infinitely worse if any disaster happened to our fleet, and we had not the means at the mouths of our principal rivers and in our great harbours of driving him off. I think I am right in saying that at present the total number of first-class boats available for this purpose is under two dozen, and some of these are away in the Mediterranean.

The small cost of these boats, as compared with that of iron-clads and forts, and the readiness with which they may be transported on larger vessels, recommend them specially for the defence of our colonies and of our coal depôts. Scattered as our colonies are, and our coal depôts ought to be in all parts of the ocean, some of them might, in the exigencies of a great war, be bereft of the protection of our ships, and would run the risk of falling a prey to

* Paper read before the British Association at Southampton.

any adventurous captain who might be employed to harass them. I fancy, however, that his movements would be somewhat paralysed if he knew that torpedo boats were in his neighbourhood, a successful shot from one of which would at least cripple his ship and might send her to the bottom. Of course I do not propose for one moment that these boats should take the place of forts, but since forts are stationary and torpedo boats are able to go many miles from shore and to attack a ship in her most vulnerable part, I think they would prove most valuable auxiliaries to forts in any scheme of colonial defence. To facilitate reference I have prepared a table—given below — in a condensed form the principal dimensions, arma ment, &c., of the boats I have described :—

Dimensions, Armament, &c., of Torpedo Boats, described in Mr. Donaldson's paper.

Group.	Type.	Illustration.	Length, extreme.	Beam.	Maximum draught.	Displacement, tons.	I.H.P.	Speed, knots.	Torpedo armament.	Ejecting apparatus.	Machine gun armament.	Diameter and weight of projectile.	Pumping power in tons per hour.	Time required to pump out displacement.
			ft. in.	ft. in.	ft. in.									minutes
Second-class	English	Model	60 6	7 6	3 4	10·9	150	17·65	Two 14in. Whitehead	Side frames	None	—	75	8½
	English	Type A	63 0	7 6	3 4	12·5	150	17·53	Two 14in. ,,	Steam impulse	None	—	75	10
	Danish & Italian	Type B	63 0	7 6	3 4	12·5	150	17·35	Two 14in. ,,	Air impulse	2-barrelled Gardner	1½in. dia.	145	5¼
First-class	English	Model	90 6	10 10	4 5	32·5	469	21·76	Three 14in. ,,	Torpedo gun	None	—	147	13¼
	Italian	Type C	100 0	11 8	5 5	34·5	446	21·36	Four 14in. ,,	Air impulse	2-barrelled Nordenfelt	1in. dia., 7¼ oz. wt.	270	7¾
	Danish	Type D	110 0	12 0	6 3	52·5	750	20·75	Four 15in. ,,	Air impulse	5-barrelled Hotchkiss	1½in. dia., 1lb. 2oz. wt.	180	17½

LETTERS TO THE EDITOR.

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

WISWALL'S TILTING WEIR.

SIR,—I have pleasure in replying to Mr. Olive's second letter on the above-named subject, and in doing so I will endeavour not to go further afield than a full and definite reply requires. I will try to follow *seriatim* the questions as they are raised. Mr. Olive's first point is that "one would have judged that no observations or experiments would be necessary to determine whether the principle is correct." I quite agree with Mr. Olive in this, and I do not see how any of my statements can be construed into a contrary expression of opinion. My contention was, and is, that the circumstances under which this particular weir is placed should be known in order to judge whether or not the axis in this individual instance has or has not been placed at a sufficiently low point in the gates to cause them to tilt automatically under the head of water at which it was desired they should. That these circumstances were not known to Mr. Olive in the first instance is witnessed by the drawing he contributed, in which he shows the tail water of the weir only raised by a flood, equally with the head water. However, as he is willing to accept my data hereon, this need not be dwelt upon. Mr. Olive then proceeds to put a hypothetical case, under which the weir, he states, would not act. Unfortunately, however, for his *exempla gratia*, another of my observations steps in to answer this. The highest flood on record in the Irwell—that of 1866—only flowed 6ft. over the crest of Throstlenest weir. Had it been otherwise, I should probably have made a different provision. After stating this it is almost superfluous to point out that long before 9ft. could be reached the weir would have tilted over. I must, nevertheless, say that I do not agree with Mr. Olive that there is the least probability of a 9ft. flood over Throstlenest weir.

The next question asked is, Why the draw chains are provided if the gates are automatic? This has already been explained in your journal—see p. 153, column 1, lines 130 to 135; also p. 196, column 2, lines 78 to 83 and 100 to 102—and it need not be reiterated. There are, however, still other reasons which make it of value to be able to open out the weir at any time, such as the power obtainable thereby to scour out the bed of the stream, and thus dispense—wholly or partially—with dredging. At Howley Quay, on the lower reach of the river, such action has in two years deepened the river from 4ft. to 8ft., no small thing; but this may be deemed a digression.

I now come to the weir on the Medlock, and here again Mr. Olive errs, but it is perhaps due to an ambiguity in my letter, for which I apologise. The sentence, "2ft. head of water" should read, "2ft. head of flood water." This only means 4in. running over the gate, the crest of which is 1ft. 8in. above the built sill. The sectional area of the water passing over the weir is thus 70ft. × 2ft. = 140, and over the gate 10ft. × 0⅓ft. = 3⅓; total, 143⅓, with a velocity of 12ft. per second. The capacity of the vertical shaft at such time is 78·8 square feet, with a velocity of 23ft. per second. Thus the discharging capacity of the weir = 1720 cubic feet per second, and of the shaft = 2152 cubic feet per second. This will explain the seeming inconsistency which would be presumed from Mr. Olive's concluding remarks.

FRANCIS WISWALL.

Bridgewater Navigation Offices, Manchester,
Sept. 25th.

SHEAF-BINDING REAPERS.

SIR,—In your issue of the 15th inst. we notice a letter from Messrs. J. and F. Howard, which has for its avowed object the desire to prevent the public from being misled as to the completeness of the recent trial of sheaf-binders by the Highland and Agricultural Society of Scotland; and whilst they deny the contention that a more prolonged trial would have led to different results, they think that a more prolonged trial would unquestionably have inspired greater confidence, and been more satisfactory to the public.

We certainly think that Messrs. Howard need not in such a letter have reminded your readers that they exposed themselves to the usual remarks applied to "disappointed exhibitors;" and we have only heard one opinion expressed upon that matter by those who have drawn our attention to their letter. We think, however, some of the wrong impressions calculated to be created by the letter in question ought to be removed.

Anyone unacquainted with the facts, upon reading Messrs. Howards' remarks would gather that the trial was begun and ended in one day, and as they profess to give the "facts" we think they ought to have mentioned that the judges spent about two hours at each of the competing machines on the day before the machines were worked in the crops and the early part of the next morning, when all the points of mechanical construction were minutely gone into, under five or six different heads, including the careful weighing of each machine. Next, as to the soddened and unsuitable condition of the crops, we venture to assert that many thousands of acres have, in most years in Scotland, to be cut in a condition in no respects more favourable than that of the corn on the day of the trial, and we think the judges were wise in putting the machines to so severe a test. But perhaps Messrs. Howard more especially refer to that part of the barley where their machine and Mr. Wood's failed to cut through, and where our machine went through without a stoppage. If so it was undoubtedly an unfortunate thing for Messrs. Howard that that part of the crop was not in a better condition.

Messrs. Howard think it will be obvious to your readers that the trial was necessarily of a hurried character; but we do not think more time is generally spent upon each machine at any of the great trials than was devoted to the three machines in competition at Bishopton last month. The Royal Agricultural Society of England have decided upon the merits of several dozens of machines of various kinds in one week, and here the five judges devoted two days to only three.

Do you not think, Sir, that some of your readers may possibly be led by Messrs. Howard's letter to suppose that the judges had no very difficult task to perform in judging as to the comparative merits of the three machines on trial?

The most surprising thing, however, to us in Messrs. Howard's letter is that they should, in writing to your paper, announce that a report sent to a local paper by one reporter would indicate the opinion of those who witnessed the trial, it being a most easy matter, if we thought you would care to reprint so many extracts from other papers, to show that the general opinion of those who witnessed the trials was not by any means in accord with that of the reporter who furnished the article for the local paper referred to.

Of course we are content with the result of the Bishopton trial, inasmuch as under seventeen different headings we were awarded 833 points, as against 789 to the second, and 770 to Messrs. Howard's machine. The judges on the occasion were, Thomas Mylne, Niddrie Mains, Liberton, Edinburgh, chairman of the Society's Machinery Committee; James Biggar, jun., of Chapelton, Grange, Dalbeattie; John Findlay, Springhill, Baillieston; and James Shaw, Skaithmuir, Coldstream; engineer, Wilson Hartnell, M. Inst. M.E., Bensons-buildings, Park-row, Leeds, of whom the *North British Agriculturist* speaks as having been judiciously selected as men having a good practical knowledge, and in whose judgment the agricultural community can repose confidence; and as this paper in its report of the trial errs in two or three instances in favour of Messrs. Howard's machine, including a statement giving the weight of Messrs. Howard's machine as being 2 cwt. less than it really was, we think Messrs. Howard, as well as the general public, may fairly admit that the Bishopton trial was sufficiently long to decide, beyond dispute, that the competing machines were justly placed as Hornsby first, Wood second, and Howard third, and that such award being a just one, the public may have every confidence in it.

RICHARD HORNSBY AND SONS, Limited.

Grantham, September 27th.

BUCKET DREDGERS AND EXCAVATORS.

SIR,—With reference to your notes last week on "Excavators at the Marine Engineering and North-East Coast Exhibition," we do not intend to enter into lengthy correspondence, but think it needful only to say: First, that in the practical working of our dredgers, excavators, and elevators the counter-weight for bringing back the opening chain does not, as implied, act against the falling of the bucket or grab, but the whole energy of the grab or bucket in its descent is made available upon the material to be excavated, equally the same as in the other arrangement therein referred to. Secondly, the small engraving, as shown, of the combined bucket or grab cannot, we contend, be claimed under the patent referred to.

We shall be very glad to further explain the matter to anyone who wishes to have further information if they will communicate with us.

PRIESTMAN BROS.

52, Queen Victoria-street, London,
September 28th.

PRESSURE OF GRAIN IN BINS.

SIR,—The letter signed "Higginbottom and Stuart," which appeared in your issue of the 22nd inst., needs no answer on its merits, but as it is typical of popular fallacies concerning the pressure and movements of grain, a few remarks may be useful. The increase of pressure on the bottom of large bins caused by the vibrations communicated to heavy walls is exceedingly small, and is fully taken into account in my experiments. The assertion that "grain moves like a fluid throughout its whole mass from bottom to top" is an error, and your correspondents may convince themselves if they will examine the top of the wheat after some of it has been withdrawn, and also watch it whilst being withdrawn from a bin. They will see that the top surface is considerably depressed at the point which is over the outlet. They will see the grains of wheat gently sliding down the slope of the angle of repose, which is about 25 deg., until they reach the vortex column which travels vertically through the body of the wheat towards the outlet. The vortex column is approximately equal to the size of the outlet, and the column, together with the surface grains that slide down the slopes, constitute the moving portion of the wheat within the bin. The remainder, which is the bulk, is at rest.

In March last I tried the following experiment:—A bin measuring about 12ft. by 12ft. had wheat stored in it to the height of 48ft. The outlet was in the bottom, and measured 10in. by 7in. clear aperture, closed by an iron slide valve. I placed a board over the aperture and then opened the slide valve, and found the pressure against the board so small that I could easily support it with one finger. I then allowed the wheat to flow through the full aperture of 10in. by 7in. with the head of 48ft., and could easily stop the flow with a slight pressure by placing the board against the aperture.

If your correspondents still think that the rules which are applicable to hydraulics apply to grain, let them ignore all formulæ and make a cell 60in. in height, with a bottom area of 41·57 square inches, then fill it with water and weigh the pressure upon the bottom. If they find the pressure to be only 7½ lb.—the pressure of a similar bulk of wheat plus the difference in specific gravity—their "exceptions" will be justified, but the laws of hydraulics will be sadly discredited. Or, let them make a heap with grain on a smooth table and prove the correctness of their assertions by making a similar heap with water.

Intelligent criticism will receive my most respectful consideration.

ISAAC ROBERTS.

Maghull, September 25th.

SIR,—I have read with interest Mr. Isaac Roberts' paper on above subject at the meeting of British Association recently held at Southampton, and although the paper is a useful one, it seems to me that his experiments are not quite conclusive, as they refer to bottom pressure only, and were made in small sized cells with wheat, which I think was too large in the grain for the purpose. This will be apparent when we consider the relative proportions of the grains used in the experiments, and the area of the receptacles which held them, and the same wheat when stored in bins, say, 12ft. square and 80ft. high. The pressure of grain against such high walls does not appear to be generally understood—some people—myself among the number—preferring the formula for water pressure, but reducing the result by 25 to, say, 33 per cent., to allow for friction of the particles.

The bottom pressures in Mr. Roberts' models were no doubt satisfactory under the circumstances, but I am afraid the rules he deduced from them may not be reliable when applied to large structures, as the conditions are so much altered, and for the same reason any similar model experiments which may be carried out to ascertain the amount of side pressure in grain tanks will be equally defective. As experiments on a full sized scale are hardly obtainable, it would give some definite means of calculating the strength of wood, stone, or brick walls, as well as weight on bottom, in actual practice, if some of your readers at home or abroad would kindly contribute to your journal particulars of those immense grain cells so much used in America, and perhaps the data which guided their designers is estimating thickness of walls, &c. Until this is done we shall have to trust to formulæ, which at best are only empirical.

J. W. C. H.

September 25th.

THE IMPROVEMENT OF PERMANENT WAY.

SIR,—Your journal has been issued thrice since the publication of your leader on this subject, and yet, important though the subject is, your commendably sarcastic article has had about the same effect as the suggestion of the "Railway Engineer" to which you refer therein. In one sense this absence of result must be gratifying to you, as proving—only too sadly—how well within the bounds of truth are your stirring accusations. This is, however, but a grim consolation, and with a view of keeping the ball rolling in spite of a correspondent's attempt to stop it, I would again ask a question or two concerning home practice. Some three years ago a somewhat heavy system of iron way was put down in the Stratford yard of the Great Eastern Railway Company. It would be of interest to know with what result; and if that result be satisfactory, whose patent it is. I understand that Mr. Chas. Wood has increasing inquiries for his rolled steel system for use *at home* as well as abroad, and that the continental output under his license is between 40,000 and 50,000 tons per annum. If such is the case, especially what I have italicised, how is it he is "unable to point to any extension" of his system at home?

You will have observed that your sole correspondent on this matter attaches so little value to the making of sleepers and rails equally durable to avoid frequent and alternate renewals—which you are ignorant enough to call "an important improvement"—that he says his chief is not paid his salary for thinking out and applying such an obviously economic principle (!), and his directors would gain nothing by such economy. Perhaps not, if they are all Baltic timber merchants.

After this, one can but fear that, so far from the grandmothers of the profession not happily living for ever, they will become immortal through their progeny, whom they are evidently nourishing on the same diet wherewith they seek to sustain their own impaired vitality, to wit, the time-honoured creosote sop and Baltic crusts. How hopeless, therefore, to suggest a tonic course of steel and Bower-Barff patent medicine.

It is kind of Herr Haarmann to put us on the track before the Railway Union, but if that Union realised our permanent way of treating permanent way, they would be tempted to give us a kick somewhere else, and bid us "wake up."

C. W. VINCENT.

St. Leonards, Exeter, September 23rd.

THERMOMETER SCALES.

SIR,—In your issue of September 15th, page 197, under the head of "Notes and Memoranda," you give some particulars of thermometer scales. You state that the Swedes use that of "Leslie, an Englishman, or rather a Scotchman." During my twenty-one years' stay in that country I never saw one of Leslie's scales. I only saw one of Sir John Leslie's differential thermometers, but I saw a few of De Lisle's thermometers, in which 0 deg. is the boiling point. It strikes me that the scale is the invention of M. Joseph Nicolas De Lisle, a French astronomer, and the differential thermometer the invention of Sir John Leslie. I should be glad if any of your readers would kindly put me right if I am wrong.

Leeds, September 25th. PHILIP R. BJORLING.

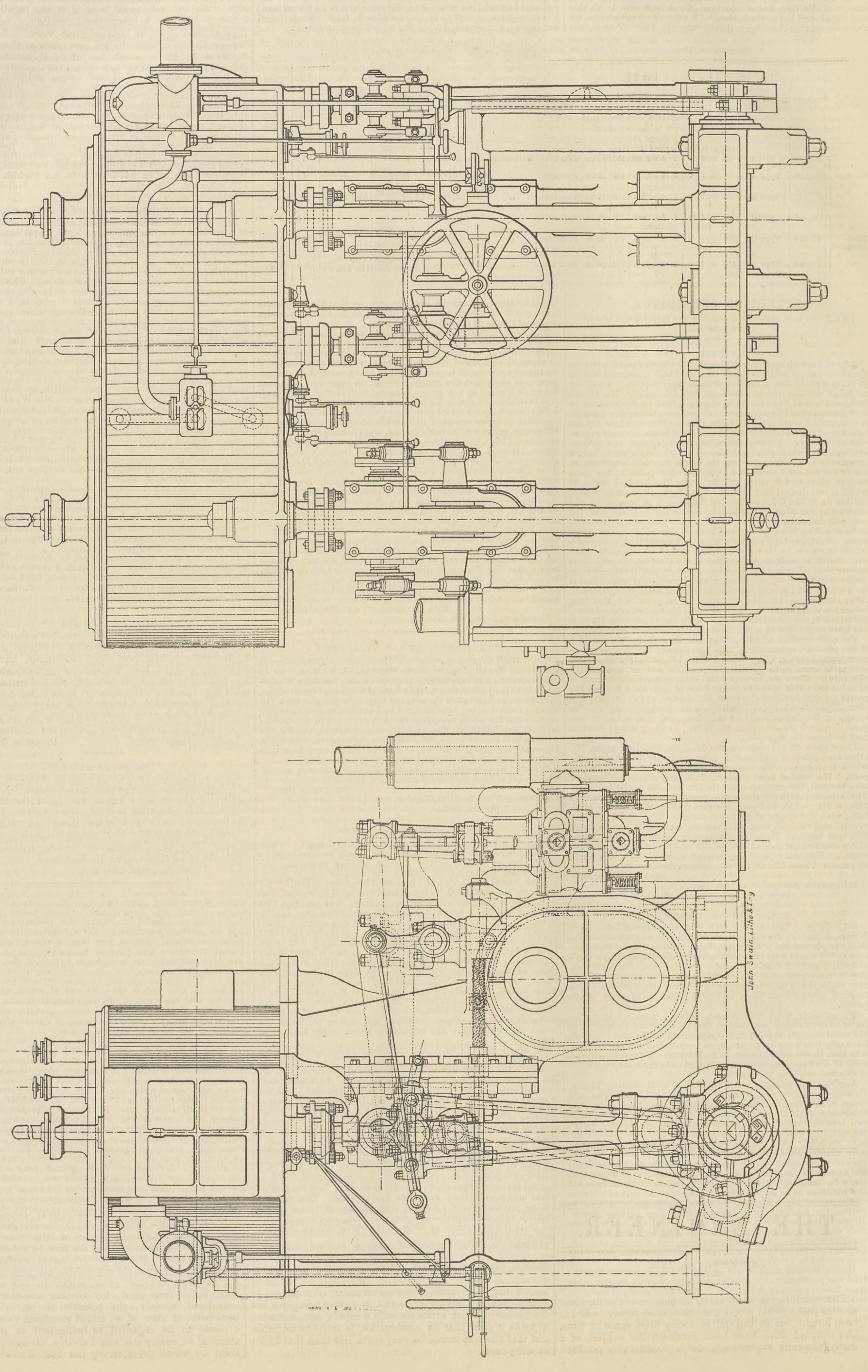
SPENCE'S METAL.

SIR,—As much attention is now being devoted to the generation of zymotic diseases caused by the leakage of gases from the sewers, and which has to some extent threatened the character of Brighton, it is interesting to know that the South Metropolitan Gas Company have just had the ground opened in several places to see if any leakages arose from the joints of the pipes laid in 1879, and they have found them perfectly tight. The material used for this purpose was Spence's metal.

G. BARTLETT, Secretary.

Spence's Metal Company, 31, Lombard-street,
London, September 21st.

THE MANCHESTER SHIP CANAL. — The proposed Manchester ship canal has now been fairly launched before the public. The engineers selected to make the preliminary investigations as to the practicability of the scheme presented their reports, a definite scheme has been adopted, and the provisional committee who have so far had charge of the project have been authorised to raise funds to enable them to obtain the necessary Parliamentary powers for carrying out the undertaking. The scheme adopted is, however, not the one which has been so long before the public of Manchester, and which, identified with the name of Mr. Hamilton H. Fulton, was really the pioneer of the present movement. An alternative scheme proposed by Mr. E. Leader Williams, of Manchester, who was selected as the second engineer to carry out the preliminary survey, has, on the recommendation of Mr. James Abernethy, who was retained as the consulting engineer, secured the unanimous approval of the committee, and with it have disappeared the cherished hopes of a free tidal river from Manchester to the sea. The scheme which Mr. Fulton proposed was to deepen and widen the Irwell and Mersey rivers between Trafford Bridge, Salford, and Liverpool, so as to allow ocean-going steamers at all times to reach Manchester. Mr. Leader Williams, however, is in favour of a ship canal in preference to tidal navigation, and proposes to continue the tidal river to Latchford, above Warrington, and from that point to Manchester, a distance of fifteen miles, and to construct a ship canal with locks to raise the water to near its present height at the proposed site of the docks at Manchester. This is the scheme which has been adopted, and the estimated cost of the undertaking, which, however, can at present be scarcely more than mere speculation, is £5,400,000. The project has at length certainly assumed some tangible shape, but the difficulties of the promoters may be fairly said to have now only commenced. Already their selected scheme has been condemned by a correspondent in one of the local journals, and the opposition they will have to encounter, not only from the vested interests of Liverpool, but of the powerful railway companies, whose present carrying business it is the avowed object of the promoter to attack, will not be slow to show itself. Even now there are muttered threatenings of retaliation, one form of which is that Liverpool should itself commence cotton manufacturing as a set-off against the injury that city might possibly receive should the canal project be carried to a successful termination. With all these difficulties no doubt the promoters have fully prepared themselves to contend, and should the construction of the proposed canal be capable of practical realisation the business interests of Manchester will not fail to secure the enormous benefits which would be conferred upon the local trade.



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(For description see page 241.)

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TO CORRESPONDENTS.

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

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IRONFOUNDER.—*See Spretson's "Casting and Founding," published by Messrs. E. and F. N. Spon, Overman's "Moulders' and Founders' Guide," and the volumes of the "Practical Mechanics' Journal," which was discontinued about* 1869. *To see modern foundries with the best arrangement of cranes and other plant, you must go to the northern parts of England.*

DISTILLING PLANT.

(*To the Editor of The Engineer.*)

SIR,—Can any reader oblige me with the names and addresses of makers of distilling plant for Indian corn? W. H. H.

Santa Justa, Coimbra, September 23rd.

LOCOMOTIVE DRIVERS IN AUSTRALIA.

(*To the Editor of The Engineer.*)

SIR,—Can any reader give me through the medium of your valuable paper some information as to the wages of locomotive drivers and firemen in Australia, and in what part they are mostly needed?

Swansea, September 20th. A LOCOMOTIVE ENGINEER.

THE DAGENHAM DOCKS.

(*To the Editor of The Engineer.*)

SIR,—Twelve months ago, in your issue of Sept. 23rd, 1881, there appeared a very interesting account of the proposed new docks on the Thames situated at Dagenham and at Tilbury respectively. Since that time a great deal has been written about the latter dock, and I believe the works have been already commenced in connection with it, but I have seen nothing more about the Dagenham Dock scheme. Can any of your readers inform me if anything more has been done in the matter, or has the whole scheme collapsed? ENQUIRER.

September 26th.

ENGINEERING IN AUSTRALIA.

(*To the Editor of The Engineer.*)

SIR,—I am going to Melbourne—Australia—as an engineer and iron-founder. Can any of your readers advise me as to the advisability of taking out plant, such as a lathe, drilling machine, engine, boiler, foundry boxes, cupola, and nuts, bolts, stocks, dies, &c.—I have all above already, and would have to sell them or take them—or could they be bought as cheap there after carriage and freight is paid—and duty, I believe, is chargeable on the above—also as to moulders' wages. Can any reader tell me the price of pig iron there? Any advice I should esteem a special favour. ENGINEER.

Bristol, September 25th.

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MEETING NEXT WEEK.

SOCIETY OF ENGINEERS.—Monday, Oct. 2nd, at 7.30 p.m., a paper will be read "On the Fell Engines on the Rimutakai Incline, New Zealand," by Mr. R. F. Alford, the leading features of which are as follows:—General remarks on the construction of light railways by the Government in a new colony; the necessity for steep incline on cheap lines; various methods of taking trains up inclines. Points in which these engines follow the general run of locomotive engines, such as boilers, tanks, &c., and most of work for outside engines. Points of special interest:—Arrangement of blast and reversing handles; inside valve motion; vertical axles with gripping wheels; rolling discs; sand injectors; slipper brakes; proposed alteration to vertical crank shaft; performance of engine on the incline.

DEATH.

At Barassie Bank, Ayrshire, on the 25th inst., D. Y. STEWART, iron-founder, Glasgow, in his seventieth year. Friends please accept this (the only) intimation.

THE ENGINEER.

SEPTEMBER 29, 1882.

A SECOND SUEZ CANAL.

THE word Egypt has been in all men's mouths for some months past. What might have been an expensive war has been fought out to the end in a very brief space of time. Our ironclad ships have been rendered the subject of a costly practical experiment, and a considerable addition has been made to the income tax. It is extremely doubtful if we should have taken all this trouble about, and felt all this interest in, Egypt if the Suez Canal had had no existence. It is true that long before the canal existed the Isthmus of Suez stood in our highway to India; but it will not be disputed that the value to Great Britain of the railway which united the Red and Mediterranean seas for strategic, commercial, and political purposes was as nothing compared to the worth of the Suez Canal in the same sense. That we have fought for the Khedive, for the Egyptian bondholders, for justice, for prestige even, in Egypt may be admitted; but the existence of the Suez Canal supplied a far more powerful stimulant to exertion. Yet the Suez Canal is not ours. We possess nothing but a right of way through it, which may be, it seems, disputed or endangered at any moment. Its waters may be held in time of peace to be neutral; but in time of war the value of such a proviso becomes so extremely doubtful that it is worth nothing. Let us, to put an extreme case, suppose that we were at war with Russia. Our enemy would push us hard in India. Is it likely that she would permit any scruples to prevent her from taking possession of the canal? Or is it conceivable that other nations would make the act a *casus belli*? They might remonstrate; but we certainly should suffer. Again, to all intents and purposes the Suez Canal is a French institution. It is true that Lord Beaconsfield, when in power, purchased shares enough in the Suez Canal Company to make Great Britain a part owner. It is true that a good deal of English money was employed in its construction; but the canal was invented by a Frenchman, and it was carried out by French engineers, diplomatists, and financiers. France will always claim a vested interest in it, and such a claim may cause us an infinity of trouble at any moment. To argue that we must have ready access to India would be sheer waste of time. Recent events in Egypt have, however, demonstrated that a rebellion possessing so little substance that it collapsed almost at the first touch of British force, seriously endangered the canal. Had Sir Garnet Wolseley delayed the fall of his final blow but eleven hours, the sides of the canal would have been destroyed at one place, and weeks might have elapsed before a single steamer could have gone through it. With a really important foe the risk would have been very much greater. We are vulnerable in the Isthmus of Suez, and we must remain so, unless we have a canal of our own which we can take proper precautions to protect against the whole world.

It may be said that the construction of a second canal would be impossible; and that it would not pay as a speculation. To both statements we have not the least hesitation in taking exception. As regards the first point it would be necessary for England to obtain a strip of territory about four or five miles wide, extending from the Mediterranean to the Red Sea. As this strip would pass for the most part through desert of no value for cultivation, Egypt would really suffer no loss from its appropriation. In dealing with this point, however, precisely the same course should be followed as that adopted by railway companies possessing Parliamentary powers in this country—the land is taken compulsorily, whether the owner likes it to be taken or not, and he is paid the value of the land so taken in money. England has at this moment an admirable opportunity of acquiring the territory she needs. There is no one to say her nay. It is to the last degree unlikely that France or Germany or Russia would take any active steps to interfere with the acquisition from the Porte of the land needed. It requires but a little resolution, and the thing is done. Nor would it be necessary, having obtained the land, to commence the canal immediately; the construction of it would follow in due course. In fact, it could be made at any time; but the land cannot be obtained at any time save now.

As to the route to be taken by the new canal, two courses are open to us. It may either run side by side with the existing canal, but at some distance from it, or an old scheme may be revived. A short statement of historical events will make the latter point clear. In the year 1855 M. Ferdinand de Lesseps, acting for Said Pasha, since dead, the then Viceroy of Egypt, invited Mr. M'Clean, Mr. Rendel, and Mr. Manby to form part of an international commission, for the purpose of considering and reporting on the practicability of forming a ship canal across the Isthmus of Suez. These gentlemen were joined by M. Conrad, of Holland; M. M. Rénaud and Lieusson, of France; and M. Negrelli, of Vienna; and proceeding to Suez they there met M. de Lesseps, Mongel Bey, and Linant Bey, engineers in the employ of the Viceroy; and in the months of December, 1855, and January, 1856, very careful examinations were made, and the Commission agreed unanimously that it was possible to make a ship canal between the Gulf of Pelusium in the Mediterranean and the Red Sea near Suez; but concerning the route to be taken and the nature of the canal there was a difference of opinion. The English engineers held that the canal should be raised 25ft. above sea level, and should communicate with the seas at either end by locks. The canal would be a fresh water one fed by the Nile. The foreign members held, however, that the canal should be cut 27ft. below the sea level, from sea to sea, by dredging and excavating, and, as we all know, the latter course was that adopted. At first sight it may appear that the English engineers were wrong, and that the proposal to use locks would be fatal to the scheme. But on closer examination it will be found that Messrs. M'Clean, Rendel, and Manby could urge very powerful arguments, not the least being that the cost of the canal would be reduced by about one-half, and a further and most important saving would be effected in maintenance. In another page will be found a statement of the comparative advantages of the two systems. We cannot now go at length into the details of the construction of a second or English canal. Our object is at this moment to point out the necessity which exists for such a canal; and, secondly, to make it clear that its construction is quite practicable, and that the cost would be very much less than that of the existing canal.

We cannot do more now than glance at the value of the canal as a speculation. There is no room to doubt that the cost of a new canal, even if it ran parallel to and was made like the existing canal, would be very much less than that of M. de Lesseps' great work. If the cost were less, then the rates charged for passage through the new canal might be much less than those charged on the existing one. The new water-way would therefore get the lion's share of the profit. Few of our readers who are not shipowners can realise the enormous prices now charged by the de Lesseps Company. To make this readily intelligible, we may say that a large steamer will burn from 1800 to 2000 tons of coal on the voyage to Australia. This coal will cost from £750 to £1000 in England; but the passage money which the ship will have to pay for going through the canal will be much more than twice as much. If we include all expenses connected with the engine-room and boiler-room of the ship, it will be found that these do not nearly amount to the toll which has to be paid for going through the canal. For this and various other reasons, a scheme for the construction of a second Suez Canal would meet with warm support among shipowners in this country; and however audacious the idea of constructing such a canal may appear at first sight, it will be found to be well worth that careful examination which we trust it will receive from our readers.

MERCHANT STEAMERS AS WAR SHIPS.

MORE than thirty years ago a Select Committee was appointed by Parliament to inquire into the fitness of merchant steamers to carry guns and act as auxiliary war ships. The report of the Committee was favourable to the scheme. At various periods since, the subject has been revived; indeed it can hardly be said to have been completely dropped at any time. Mr. W. H. Smith, when he was at the head of the Admiralty during the last Administration, took up the idea warmly, and for the first time reduced it to practical shape. His successors have followed in his steps, and it has been decided that large numbers of merchant steamships are fit to play the part of men-of-war, in the sense that they can carry moderately heavy guns, and beat off an enemy, or even attack one. The Admiralty, however, decided that some special strengthening, and certain modifications in the arrangement of bulkheads were desirable in ships intended to fight; and they offered a reward for the introduction by shipowners of these modifications. The reward is simply a preference in letting contracts for the ships fitted to satisfy Admiralty conditions over those not so arranged. It appears that a great many shipowners have seen their way to comply with the wishes of the Government in this respect. It is clear that should war break out suddenly our colonies would be most in need of protection; and also that large steamers abroad might not be able to get home. It is therefore evident that foreign ports should be provided with armaments for merchant steamers, available at a moment's notice, and the Government have, we understand, ordered the despatch of armaments for twelve steamers to be at once sent off, six to Bombay, and six to Hong Kong. As action of a very decided character is thus being taken at last, it is worth while to consider briefly how matters really stand, and one or two questions exercising important influences on the scheme.

In the first place it will be well to avoid mixing up the existing scheme with that which sprang into existence just after the Crimean war. Thirty years ago we had no ironclad ships; the heaviest gun afloat weighed only 95 cwt.; the highest speed attained under steam by ships of the line did not exceed seven knots. There were, it is true, a few paddle steamers carrying from two to six guns; but even these were slow ships, about ten knots being their maximum velocity. Under such circumstances it will be seen that a fleet of merchant steamers, capable of running at twelve to thirteen knots an hour, and fitted each with a couple of 68 lb. guns, besides a couple of long 32-pounders, would constitute a most formidable auxiliary force. Even a line-of-battle ship might think twice before she dared to attack a steamer capable of selecting her own distance, and playing a game at long bowls with all the advantage of position on her side. In the present day the merchant steamer would possess not one of the advantages which were special to her thirty years since, save exceptional speed; and even this would not belong to any save the full-powered passenger ships of our great ocean lines. Indeed there are very few men-of-war afloat which could not with great ease outsteam the fastest vessels in the cargo trade. It is for these reasons evident, we think, that the part which an armed merchant steamer could play in the present day would be very different from that she might have played at the close of the Russian war. It is not to be assumed, however, that nothing is to be gained by arming merchant steamers. Such vessels would possess this great advantage, that they would meet the light unarmoured steamers of an enemy on an equality, and might, if attacked, beat off, or sink, or capture a foe. The celebrated Alabama, for example, could not have carried on her depredations had she encountered steamers carrying a few heavy guns and able to fight them. But that an armed steamer would either have to run away from an ironclad, or strike to her, is very certain, for it does not appear that any guns she would carry would be of much utility against armour. In old times a flying sailing ship always had a chance of dismasting her pursuer, and so of escaping; and this chance may be said to have remained in force until the enemy was alongside. Indeed, small vessels lying under the lee of large men-of-war have by skilful evolutions escaped ere now by getting to windward by a ruse. But in modern naval warfare the flying merchant steamer could not disable her pursuer by shooting at her; and her guns might in one sense do far more harm than good, for another question has to be considered, namely, the position in an internationally legal point of view of an armed merchant vessel. Is such a vessel to be regarded as belligerent or not? If she attacked an enemy she would clearly infringe the arrangement by which privateering has been abolished. Up to the present moment no definite statement concerning the legal position of armed merchant steamers has been made public. It is time that the shipowning world knew exactly what they would lose and what they would gain by carrying guns.

We may now deal with another question which deserves very careful consideration. If war were to break out to-morrow, and shipowners were to fit their ships with guns, as the East India Company fitted their ships of old, for self-defence—and for something more, for merchant vessels have fought considerable naval engagements ere now, and won them, too—it is open to doubt if they could provide skilled gunners to work them. The modern British crew is a very motley lot, the number of Englishmen on board a merchant steamer being, as a rule, very small. Lascars, Norwegians, Greeks, Danes, Poles, Germans, Austrians, Russians, are all to be found at sea in such ships. In time of war the Government would require all the trained seamen gunners to be had, and the merchant captain would have no reserve to fall back upon. To put a couple of 40 lb. Armstrongs or a 6½-ton gun on board a steamer would be mere waste of good ordnance unless some competent men were also shipped to work them. This is no novel statement. There has always been a paucity of skilled gunners, and though it is quite true that H.M.S. Excellent has done much, and artillery volunteering a little, to supply the deficiency, there would still be the utmost difficulty met with in obtaining efficient men. In a report of a Committee on Gunnery respecting captains of guns, dated July, 1858, we find the following:—"The Committee consider it their duty *at once* to call their lordships' serious attention to the necessity of supplying a *certified qualified* captain for every gun put on board a ship in time of peace, as they are unanimously of opinion that without this arrangement no positive amount of proficiency in fighting guns can be calculated upon. Men may be quickly trained to work guns, but the captains cannot be efficient without careful training and a certain amount of actual practice." This is the class of men which it would be almost impossible for shipowners to obtain in the present day.

It is, however, perhaps hardly worth while to speculate at length on this point, as it is morally certain that at the first outbreak of a great war with a naval Power, our mercantile marine would leave the open sea as soon as possible, and seek the shelter of neutral ports or else remain in British waters. Only a few of the more adventurous spirits would venture to make a long voyage alone. Convoying might be resumed under somewhat different conditions from those which once obtained, but we venture to say that very few merchant steamers would ever mount a gun. The risk incurred; the difficulty of obtaining trained gunners; and the timorousness of capital, would all act in the same direction. If merchant steamers are to be made use of as fighting ships they must be used for the time being for that purpose and no other. Indeed, we believe that this is the conclusion at which the present Board of Admiralty have arrived. They look on merchant vessels as an auxiliary war fleet; and the ships which they propose to arm would be used for fighting and for nothing else. It is open to question, however, of what their crews would consist. There would certainly be a nucleus of blue jackets. The vessels would be commanded by naval officers, and skilled guns' crews would be shipped; but the staff of engineers and stokers at all events would in all likelihood be retained on terms sufficiently satisfactory. On this and similar points, however, it does not appear that the minds of those in authority are made up. We search in vain in the speeches of various Lords of the Admiralty, past and present, for any information as to the course to be pursued with merchant steam vessels. We are told time and time again that such ships could not fail to be useful if fitted with guns; but, as we have tried to show, the mere putting of a big gun or two into such a ship as the Orient or the City of Berlin is comparatively a small matter. Neither the guns nor the ships will prove self-sufficing; they must be used by competent men, and it does not appear that the Admiralty have any competent men who could be spared from men-of-war, or that any one has any very clearly defined ideas concerning the organisation of a fleet of merchant war ships. The sending out of armaments for half-a-dozen steamers to Hong Kong, and a similar number to Bombay, is perhaps a laudable act. But it is not quite clear how the armaments in question could be used. If the authorities anticipate that they will find on board every steamer competent seamen gunners, they are mistaken. It is not possible that they can have fallen into such an error as this. It would, however, be worth while to explain for the benefit of those outside Whitehall what it is proposed to do with the guns and munitions of war sent to Bombay and Hong Kong in case war should break out. The Admiralty may have very clear ideas on this; but they have hitherto been very successful in concealing the circumstance.

THE TOWER BRIDGE.

The need for crossing places over or under the Thames east of London Bridge grows continually, and the intervals at which the question excites public attention become shorter. Below the port, at Greenwich and elsewhere, tunnels or subways will afford the only practicable relief, but for the traffic above the highest dock entrance, namely, at or near the Tower, a bridge is urgently required. After the abandonment of the scheme for a high-level bridge as promoted by the Metropolitan Board of Works in 1878, the matter appeared to sleep for a while, and this one authority which controls the public works of the metropolis having failed with its remedy, there was apparently no more to be done. It is, however, no secret that the engineer of the Board is once more considering his scheme with a view to obtaining new Parliamentary powers, and as we have never hesitated to express our own disagreement with the official view of the case, we take the present opportunity of again urging, even at the risk of wearisome iteration, what we believe to be the solution of the difficulty. We are the more disposed to do so, because Sir Joseph Bazalgette may possibly be assisted by a healthy expression of opinion and be induced to adopt, sooner than he otherwise would, the remedy which will have eventually to be accepted.

It is from the endeavour to reconcile opposing interests by a compromise satisfactory to no one that failure has hitherto arisen. The design for a high-level bridge, beneath which masted vessels can pass, has been condemned because of its steep and tortuous approaches. A tunnel, which finds many advocates, will be found on examination of the levels to present precisely the same objection, with the added unpleasantness of a subterranean passage. A steam ferry, such as serves at New York or Philadelphia, is practically impossible because of the great range of tide; and once more we have to face the inevitable low-level bridge with or without openings for the passage of masted vessels. If the choice lay only between a low-level bridge with an opening, and a high-level bridge, we certainly should prefer the former, because, as has been long ago demonstrated in this journal, the time occupied in waiting while the bridge is unavailable for traffic, —one of the objections urged against it—is much better spent in the enforced resting of horses at a "lay-by" at the approaches than in the arduous ascent of a gradient. But a bridge of this sort, which allows vessels to pass only at intervals, will doubtless be considered such an obstruction to navigation as to induce claims for compensation, perhaps not much less than those which would be set up if masted vessels were stopped altogether. If, after due inquiry, this is found to be the case, then let the engineer of the Metropolitan Board be bold, and commit himself to the heroic remedy of the low-level non-opening bridge. If, however, the difference in compensation proves too great to be disregarded, and the saving be deemed not too dearly bought by the inferiority of the accommodation, then let a low-level bridge be made with an opening, not as an engineering scheme of which anybody may be proud, but as a cheap compromise, or as a sop to the opposing interests, and as the best step towards a complete bridge later on. For our own part we believe that the complete bridge *now* is the proper scheme to adopt. It is unnecessary for our present purpose to anticipate the many arguments which may be put forward when the time comes to attenuate the wharfingers' estimate of loss, and so to moderate their compensation, to dwell on the fact that seagoing vessels can be so constructed as to pass under a bridge—in proof of which statement we may point out that screw colliers, carrying 1000 to 1500 tons of coal, now go up the river to the Battersea Gasworks. These vessels run from the Tyne to London, and are in every sense of the word seagoing. They present no peculiarities of construction, save that they are fitted with telescope chimneys, and either have no masts or strike them in the river. Nor need we consider at length the circumstance that as the proposed bridge is above the highest dock entrance, London as a port would be but little affected —that the whole tendency of the port is to move lower down the river—that much of the present trade of the wharves between London Bridge and the Tower is, and can after a bridge is erected, be carried on by lighters—and that the trade of the wharves, even though somewhat changed, must in such a central situation be of hardly less value than at present—all these considerations may be left on one side, for we assert that even with a liberal compensation, the low-level non-opening bridge ought to be built.

In this scheme, as in all others for improving a crowded city, the question is one of balancing the advantages and disadvantages. Of the advantages little need be said. A million of inhabitants on either side of the river, with all the trade and movement which such a population involves, are at present separated. The disadvantages do not touch London, but merely the vested interests of a few private inhabitants. If the great outlay for making Queen Victoria-street, the Thames Embankment, and Holborn Viaduct was justified by the advantages gained, and if it is worth while to contribute, as the City and Metropolitan Board are pledged to do, a million sterling towards the new street now commenced for the completion of the Metropolitan Railway, the construction of the new bridge is also justifiable, even if twice a million has to be paid. If, instead of a river, a dense block of houses separated Whitechapel from Bermondsey, would the cost hinder the construction of a new street? If not, why should a similar expense be deemed prohibitory for purchasing a right of way across the Thames? But the cost need not all fall upon the ratepayers. The crossing place can be also utilised by the railways north and south of the river, who can so obtain a much-needed connection, either by constructing the bridge in the first instance with an upper platform suited to the existing levels of the railways, or, if the time is not ripe for this, by designing the bridge for the addition of the upper part hereafter. The railway companies would probably see the wisdom of seizing the opportunity and sharing in the cost of a joint undertaking; but even if they did not do so, parliamentary powers might be taken by the Board to demand from the railways when the time comes, as it must eventually do, for their crossing the river, a toll or other contribution to the outlay which rendered the crossing available. We shall be curious to see how the Metropolitan Board and their engineer escape the dilemma in which they are placed by any other course than that we have indicated. One thing is certain; the cost of compensation and construction will grow the longer the work is postponed.

THE PRESSURE OF GRAIN IN BINS.

The paper read before the British Association by Mr. J. Roberts on the pressure of wheat stored in elongated cells or bins, which we published on the 15th inst., described a number of experiments of an original character, and which should provide engineers with information on a subject on which nothing is known. The question has often been asked, What is the pressure due to a certain head of wheat in a bin or cell either on the bottom or the sides? but it is perhaps not too much to say that the question has never been answered. Of the strains on retaining walls much has been written, and a good deal of experimental study has been devoted to the solution of many apparently anomalous cases of experience. The result of experiments has, however, so far indicated that the actual lateral pressure on retaining walls can only be approximately assigned theoretically. The conditions to be embodied are sometimes so numerous as to render nearly useless the experimental observations on lateral pressure by the different materials with which in different states the pressure has been obtained. The engineer is thus thrown back upon practical experience for his guidance, and generally endeavours to secure stability by adopting very ample dimensions for his wall. Many ingenious investigations of the pressure which, upon theoretical assumptions, would be exerted against a wall by discrete solids in the dry state have been made, one of the most elaborate being by M. J. Boussinesq, as published by the Belgian Academy in 1876, and entitled "Essai théorique sur l'equilibre des massifs pulverulents, comparé à celui de massifs solides et sur la poussée des terres sans cohesion." Directly, however, the engineer turns to these investigations he finds that the conditions assumed do not obtain in his case, and he goes to practical experience, and imitates that which has been done by others without failure. At this day it is questionable whether the information exists upon which the necessary dimensions of a circular embankment of earthwork could be satisfactorily assigned, nor could it be shown at what height the liquid lava must rise in the crater of a newly-formed volcanic cone before the circular embankment of pulverulent material would give way and allow the lava to spread over the surrounding country. Similar observations apply to so common a thing as the lateral and vertical pressure exerted by stored wheat in warehouses and bins. Mr. Roberts' paper, to which we have referred, affords very considerable help towards a satisfactory determination of one of these pressures, namely, the vertical, and it would be a pity that the adverse criticism in the letter of Messrs. Higginbottom and Stuart, which appeared in our columns last week, should pass without reply. We should not like to say that the constant deduced by Mr. Roberts from his experiments would remain true for all sizes of bins or cells, for it is not impossible that for sizes considerably larger than that used in his fourth set of experiments, the constant would have to be increased in value. At the same time there is no reason to suppose that it would ever be equal to the height of the cell.

It is almost useless to treat this subject except from an experimental basis, but in order to reply to the objections made in the letter referred to, we may remark that with solids as mobile as marbles or billiard balls of perfectly uniform diameter, it is conceivable that in a cell with truly parallel sides, these balls would exert no lateral pressure against the containing walls of the cell, and in such a case the pressure on the bottom of the cell would be that due to the column of balls. On the other hand we may conceive the cell filled with small homologous masses, with which Mr. Roberts' constant might be reduced to a very small fraction, and, indeed, it might be shown that a cell might be filled with solids of small and irregular dimensions which would pack in such a manner as to effect the same result. From this, and from a consideration of Mr. Roberts' experimental results, it may be seen that the first objection has little or no force, inasmuch as the comparatively small pressure on the bottom of the cell is not materially affected by frictional contact of the wheat on the sides. This is shown by the fact that the pressure on the weighing scale remained proportional to the diameter, which would not be the case if frictional contact was brought into play, for its effect would be most marked with the smallest cells. Thus the vibration to which Messrs. Higginbottom and Stuart refer would not materially affect the pressure on the bottom of a cell, though by causing the grains to shake together somewhat, vibration might add a little to the lateral pressure with which Mr. Roberts' experiments as far as yet published are not yet concerned. The second objection really forms part of the third, and rests on the assumption that the pressure on the bin has some relation to the angle of repose of wheat grain, and that the movement of the wheat when being drawn off from the lower part of the cell affects the pressure. Here it must be remarked that a cell full of wheat may be considered as filled with a mass of granules of tolerably regular dimensions and form, each granule being capable of receiving pressures of unequal magnitude from several directions and of transmitting these in a resultant pressure and direction. Hence it will be seen that wheat in a cell behaves in a manner similar to that observed of sand in a sand box employed for lowering bridge centering. A piece of paper stuck over the small hole in the box will prevent the sand from running out, though the pressure upon the sand may be many hundredweight per square inch. Each grain of sand in the box is the keystone of system after system of arches of irregular form, and it is only necessary to prevent the fall of one or a few of these keystones to prevent the escape of the sand. Similarly in the wheat bin; each grain in the ring of grains at the bottom periphery gives support to from one to two grains, and so on until those grains whose superincumbent pressures are resolved into outward pressures against the cell walls reach a height at which an arch is formed, which protects that within it from the pressure of the superincumbent mass. At the same time, the arch is not self-supporting, but needs the small help from the material within it to keep the keystones or key-grains from moving. The conditions which obtain in a wheat bin are thus not at all similar to those which determine the angle of repose of a free body of wheat, and that angle gives no clue to the pressure on the bottom of a bin. It may be pointed out, moreover, that the angle of repose of a free heap of wheat subject to vibration gradually becomes infinite.

Mr. Roberts is thus not in error when he says that rules applicable to fluid pressures will not apply with respect to grain pressures. It may be safe to treat grain as a mobile fluid like water, but this is not the only safe way, as the writers of the letter referred to assert; and like some rule-of-thumb methods it may lead to a waste of materials, and there is no reason why Mr. Roberts' formula for the pressure on the bottom of a wheat bin should lead to the construction of badly designed bins. The pressure per unit of area may not be, as Mr. Roberts puts it, simply the total pressure divided by the area; but upon the exact accuracy of the second formula we need not enter, as Mr. Roberts intends, we believe, to continue his experiments with a view to settle this point, as well as to ascertain the lateral pressures due to different heads.

THE VALUE OF COLLIERY PROPERTY IN SOUTH YORKSHIRE.

NEVER, perhaps, in the history of the coal trade of Yorkshire or any other county has such an astounding depreciation of property been manifested as was revealed at the King's Head Hotel in Barnsley on Wednesday, and that in the presence of some of the most influential South and West Yorkshire, Derbyshire, and Lancashire colliery proprietors. It may be stated that the extensive and valuable collieries at Dodworth and Higham, owned by the Dodworth and Silkstone Coal and Iron Company, Limited, has passed into the hands of Mr. Robert Whitworth, of Manchester, for the modest sum of £2000. The company was floated in 1872 and 1873 with a nominal capital of £300,000 in 6000 shares of £50 each. The collieries were purchased in 1872 by Manchester gentlemen for £34,500, and the company floated as stated. They are amongst the best laid out and finest in South Yorkshire, and at one time gave employment to 2000 men and boys, but for some time they have been entirely closed. There are no fewer than six shafts, the Dodworth Silkstone pit shaft being 210 yards deep and 12ft. in diameter; the Parkgate pit shaft is 110 yards deep and 12ft. in diameter; and the Flockton pit shaft, 53 yards deep and 10ft. in diameter. At Higham, the Silkstone pit shaft is 210 yards deep and 11ft. in diameter. The Parkgate pit shaft, at the same place, is 110 yards deep and 11ft. in diameter; and the Flockton pit shaft 54 yards deep and 10ft. in diameter. The surface plant ranks amongst the finest in Yorkshire. There is at the present time 668 acres of Silkstone, 400 of Flockton, and 754 of Parkgate seams, or 1824 acres of coal still to get. The purchaser has also the advantage of £11,000 which has been overpaid for coal rents. There are in connection with the pits above and below ground thirty-two engines, giving nominally 1068-horse power, and twenty-five boilers of 1000-horse power. There are 134 newly erected coke ovens, a gas plant, manager's house, with offices, &c., together with fifty miles of tramways and sidings. The collieries have access to the Manchester, Sheffield, and Lincolnshire, and Lancashire and Yorkshire Railways, and the coal is known throughout the country. The surface lands of the two collieries covers about sixty-five acres. The royalties for the Flockton bed at the two pits vary from £100 to £120 per acre; Parkgate, from £120 to £150; whilst Silkstone is £250 per acre. There is, however, a minimum rent of about £7000 per year to pay, and for this three gentlemen are held liable as guarantors. The attendance, as stated, was very influential, and the auctioneer in the course of an able address sketched the rise and fall of the coal trade in South Yorkshire during the past twenty years, referring very particularly to the changes at the collieries in question. The biddings, to the astonishment of all present, opened at £1000, and proceeded as under—£1000, £1200, £1300, £1400, £1500, £1550, £1600. At this stage there was a pause, and the auctioneer then broke open an envelope, and stated that there was no reserve, consequently the property was in the open market. The bidding was therefore resumed as follows—£1700, £1800, £2000. At the last bid the auctioneer very patiently pleaded for an advance, but there being none, the collieries, to the astonishment of all present, were knocked down to Mr. Robert Whitworth, of Manchester, for £2000. Every person present seemed surprised at the result, and a great sensation was caused. The auctioneer, it may be stated, was acting under an order of the Court of Chancery, and pursuant to an order of the Chancery Division made in the action of Gartside and others of the Silkstone and Dodworth Coal and Iron Company, Limited, which has been in liquidation. There was great rejoicing in Barnsley, Dodworth, and the district at the prospect of the collieries being re-opened. No parallel in the history of the Yorkshire coal trade can be found to this sale. The Thorpes Gawber Hall Collieries, floated with a capital of £100,000, were offered for sale in 1880, and were withdrawn at £18,000, and the South Kirby Colliery, on which £77,000 had been expended, was offered and did not elicit a single bid in the same year.

WAGES IN THE SHIPBUILDING TRADE.

ATTENTION has been drawn of late to the very great increase in the wages of the workmen employed in the shipbuilding yards, more especially on the Clyde. It is stated that during the past two years the wages of the rivetters and fitters in the shipbuilding yards on the Clyde have risen twenty-five per cent., whilst there has been an equal and even a greater advance in the rate of wages of some other classes of workmen. On piece-work, it is stated, that rivetters now earn on the average of a large number of workmen about £4 10s. to £4 19s. per week on the Clyde, and that the platers earn on an average £5 5s. 9d. to £7 6s. 3d. on the same river. On the Tyne, too, we find that there has been a marked advance, and a rough average gives £4 to £4 10s. as the weekly average of the rivetters, and £4 10s. to £5 for platers. These are handsome wages if they are properly used and husbanded on the part of the earners. The increases to which we have alluded must, however. have an effect on the price of the vessels, and tend in a very considerable degree to check the great demand that has existed for a year or more for new vessels, the more especially as it is accompanied by an increase in the cost of the material used in the construction. That increase has not been so heavy in proportion, but it is one that has had its effect in enlarging the prices paid for new ships; and there is now, possibly in consequence of the very large tonnage of vessels that have been of late launched, a reduction to some extent in the rate of the freights, so that with the increased cost and the lessened earning power, it may be looked upon as tolerably certain that there will be a check to the enormous production of shipping that has been of late attained—that is, unless there should be an unexpected change in the freight market. As yet, it is evident that the attempts to introduce machine rivetting into some of our shipyards have had no effect in the reduction of the rate of the wages of the rivetters, but it may be that it has prevented the increase from being still more rapid.

LITERATURE.

Hydrographical Surveying. By Capt. W. G. L. WHARTON, R.N. London: J. Murray and Co. 1882.

THE fact that the author of this book has been a prominent man in survey work for many years will itself commend anything that he writes on the subject. The work is itself thorough and practical, and it is, we suppose, calculated to become a standard book. Captain Wharton keeps the purpose in view steadily before him. Where he finds that he can recommend an existing work, like "Heather on Mathematical Instruments," he does so in preference to supplying detailed information already in the reach of those who wish for it. His experience justifies him in giving the general advice and directions contained in his preliminary remarks. These, we think, are very good, and might have been extended with advantage. For example, when he insists on the thorough honesty that will ensure nothing being entered by guess, he might have added a word which we think important—namely, that a man who has performed work in this way ought not to be alarmed at any strange discrepancy that may present itself. Honestly done work, however wild it may look, generally admits of explanation, and comes right at last. We would sooner have such to deal with than the best work in which operators had yielded to the temptation to throw out discordances without very sound reasons, and without noting that they had done so. In the "Decline of Science," we think, will be found a relentless mathematical analysis of work which appeared to be admirable until a different value was found for level graduations than had been assigned to them. The application of the corrected reading and all the results are worked out with cruel severity by Babbage, who finally calculates the chances against such work having had such a peculiar series of mistakes as to appear so good when it was so bad, ending, of course, in the moral certainty that "fudging," or "cooking," had taken place.

We may add that we are not prepared to accept the corrected reading applied and condemn the officer thus attacked, but it equally serves as a beacon to show what might befall. The temptation to cook a little in some classes of work arises from the following fact:—In observations there will exist a number of causes tending to produce small errors. These will generally more or less neutralise each other, but now and then will act so far in the same direction that an observation as well and carefully made as the rest of the series is found to differ considerably from them. There exists a temptation to reject it as abnormal, whereas in reality it should give its effect to the whole, and it is more important to keep it than any one of the others which tell less. It looks ugly, but it will be found in its degree in the best Greenwich work, and at Greenwich, work would almost be suspected where it was not found. Captain Wharton refers to the care necessary in deciding to reject a bad chronometer result on page 223. The directions on instruments and fittings are practical and valuable to those actually engaged in nautical survey work, but the succeeding chapters possess a higher and more general interest. The book is consistently shaped to the wants of naval officers; but a good deal of what is said, for example, on exchange of telegraph signals to obtain longitude, topography, and taking heights and levelling, is of more general use. In the use of chronometers to obtain longitude, Captain Wharton had peculiar experience when making runs in the Shearwater with all Lord Crawford's large collection of chronometers employed in the transit of Venus expedition in 1874, which was a very complete operation. We may mention, by the way, that Russians whenever they carry many chronometers, remove the compensation from one of them, retaining it as an index of the effects that are telling on the rest. Captain Wharton very properly abstains from immediately turning his longitude in time into the arc, a habit that is unnecessary and inconvenient. Without going further into details, we may commend the work as a capital combination of theoretical and practical information, from Lieusson's formula for chronometer work, and the trigonometrical proof of the systems of survey, to the directions as to winding the web off a spider, and the advice to have all angles in a sextant rounded to prevent injuries to the face when using it in a boat in a lively sea.

FLOATING FIRE ENGINE FOR THE BRAZILIAN GOVERNMENT.

A NEW self-propelling floating steam fire engine, designed and constructed by Messrs. Shand, Mason, and Co., to the order of Mr. O. Da Costa, agent for the Brazilian Government in London, and for use by the Fire Brigade of the port of Rio de Janeiro, was tested on Monday. As a matter of course, this engine offers a great contrast to the one still in use by the Metropolitan Fire Brigade, designed and constructed by the same makers just thirty years since. In the latter case the boat is 106ft long, with a breadth of beam of 15ft., and is capable of discharging 1140 gallons of water per minute, while the Rio boat, which is made of steel, is 51ft. long, with a breadth of beam of 11ft., delivering 900 gallons at fire engine pressure, a quantity out of all proportion to the dimensions of the two boats.

The machinery consists of one of the makers' well-known Equilibrium steam fire engines, with their patent inclined water tube boiler, and a pair of inverted steam engines working direct on the screw shaft; both propelling and fire engines being supplied by the same boiler. The whole is placed between two water-tight compartments, with ample space for fuel, and water tanks, containing 4½ tons of fresh water for feeding the boilers, and 2 tons of coal. There are two hose reels on deck, and additional space for hose in the engine-room. This hose is made of double canvas, and was proved to 400 lb. on the square inch, the engines being constructed so as to deliver water at a pressure of 220 lb. to the square inch, and delivers it with a strong jet one mile distant from the boat. In designing this floating fire engine, convenience of handling, with sufficient space for the machinery, and a high rate of speed, have been considered. At the trial trip at the measured mile, a speed of ten miles per hour was obtained, which, considering the necessary large midship section, as compared with the length, shows a highly satisfactory result.

The trials, which took place on Monday, were carried out under the supervision of the representatives of the Brazilian Government. The boat left the wharf at Blackfriars as soon as the tide served, and steam was raised at the following rate:—Smoke issued from the chimney at 11 hours 5 min. 25 sec., a.m., a pressure of 5 lb. was obtained at 11 hours 11 min. 30 sec., 10 lb. at 11 hours 12 min. 7 sec., 20 lb. at 11 hours 13 min. 15 sec., 30 lb. at 11 hours 13 min. 55 sec., 40 lb. at 11 hours 14 min. 17 sec., and 100 lb. at 11 hours 15 min. 8 sec., or in 9 min. 41 secs. from the time the fire was lighted, a very excellent performance when the large size of the boiler is considered.

The float then proceeded to one of the shot towers on the bank of the river, and a 2in. nozzle, with a triple branch, being fitted on, a splendid jet 150ft. high was thrown. The boat then went down the river to the metropolitan steam float lying close to Southwark Bridge, where various experiments were carried out, jets being thrown first from two 1¼in. nozzles and then from four ⅞in. nozzles. The performance was throughout admirable, steam being kept with the utmost ease, and the pumps working without noise or shock.

Subsequently the boat made a speed run from Westminster Bridge to Vauxhall Bridge, a distance of just one mile. The up run, against a very strong tide, occupied 7 min. 5 sec., and the return run with the tide took 4 min. 21 sec., giving an average speed of very nearly 10·5 miles per hour.

THE NORTH-EAST COAST EXHIBITION OF MARINE ENGINEERING AND NAVAL ARCHITECTURE.

No. III.

THE Wallsend Slipway and Engineering Company exhibits a pair of inverted direct-acting surface condensing screw engines of 500-horse power indicated. The cylinders are, high-pressure, 26in. diameter; low-pressure, 52in., and have a stroke of 33in., the working pressure being 80 lb. per square inch. This engine is a favourable example of the ordinary modern type of marine engine. The design which we illustrate is simple, and the wrought iron columns in the front of the engines render the working parts especially accessible for examination or repair. This company has adopted in its smaller engines, for the same reason, the use of these wrought iron columns. In the construction and design of the engine exhibited no special peculiarities or expensive refinements have been adopted, but the result is a plain, substantial piece of workmanship, of excellent finish in all its parts, and such as is supplied by the Wallsend Company to its customers in the ordinary way of business. The next exhibit of the same company is a furnace front plate of steel, manufactured by the Landore-Siemens Steel Company, for a boiler which is to have a working pressure of 150 lb. It was flanged by Tweddell's patent hydraulic flanging and stamping machine, in the works at Wallsend. Close beside this is a dome end plate, stamped at Wallsend by one of Tweddell's machines. These pieces of workmanship will be interesting to all boiler manufacturers, as they have been produced from a machine which is one of the latest results of mechanical effort in the direction of economy of labour. The flanging and stamping machine alluded to was designed by Mr. Tweddell and Mr. Boyd, managing director of the Wallsend Company, and photographs of it are shown by the company and also by Mr. Tweddell, at his own exhibit, which has been noticed in these pages. The leading idea has been to produce a machine of moderate cost, which shall accomplish in piecemeal the same results as are obtained from more expensive pieces of machinery in one operation. This tool is within the reach of all boiler makers, where the larger machine is not, and we understand that the results obtained by Mr. Boyd's company, both in cost of manufacture and finish of workmanship, are most satisfactory.

The next notable exhibit on the same stand is Mr. Boyd's patent furnace mouth drilling machine, which is shown, as when working, applied to furnaces. This machine has been designed with a view of saving manual labour. The rivet holes, into which the rivets are put for attaching the furnace tube to the front plate of the boiler, cannot be reached by an ordinary drilling machine, and are usually drilled by hand. This machine when once fixed in place will drill the holes in two furnaces in about six hours, and is therefore a valuable addition to boiler shop plant. Messrs. Butterfield, of Keighley, are the makers. A model of the slipways and works of the company at Wallsend is also exhibited. The slipways are each 1000ft. long, and are capable of taking up vessels 350ft. long and 3000 tons register. The sheer legs at the wharf are capable of lifting over 80 tons. With this model is also shown an interesting series of photographs of damaged vessels and other heavy works which have been carried out on the premises, which include a photograph of a pair of inverted direct-acting surface condensing engines of 1000-horse power indicated, cylinders 34in. and 66in. diameter, 42in. stroke. A photograph of Union Steamship Company's s.s. Spartan, being lengthened on the slipways, September, 1880; s.s. W. J. Taylor, during reconstruction, after being sunk in the river Tyne, March, 1880; s.s. Elphinstone, after collision; s.s. Redewater, after collision; s.s. South Tyne, after a storm in the Atlantic; and many more. A large drawing, showing the general arrangement of a pair of triple-expansion condensing engines, 550-horse power indicated; first cylinder, 15¾in. diameter; second cylinder, 22in. diameter; third cylinder, 44in. diameter; stroke of all, 33in.; working pressure, 150 lb. per square inch; and a steel boiler, being constructed for Messrs. Dixon, Robson, and Co., Sunderland, under the superintendence of Mr. Alexander Taylor. is also shown.

The Landore-Siemens Steel Company, exhibit a series of specimens of steel-plates, angles, and section bars principally tests to demonstrate the quality of their material. There are a large number of sections of bars, such as are used in the construction of ships and bridges, including an ⊢⊣ section, the first we believe ever rolled in steel in this country, and which is now being used in the Oude and Rohilkund railway bridge over the Ganges. The whole of the steel for this bridge is being made by the Landore Company. The cold bend tests comprise twisted angles, steel wire 34 B.W.G. rivets, and sundry other interesting specimens. There is also a ⅜ steel-plate, flanged cold in a hydraulic press at one operation, and a hemisphere of ¼-plate, 2ft. 7in. diameter and 1ft. 3½in. deep, such as are used for the ends of electric mines.

Messrs. Vickers and Son, Sheffield, show a double-throw crank shaft in two pieces, made by them of cast steel in 1871 for the Allan Line s.s. Caspian. It remained in this steamer for many years, and during the time she was engaged in making 134 voyages across the Atlantic, representing a mileage of 450,000, and was eventually taken out when the ship was being refitted with new engines. This firm also shows a large propeller blade of cast steel, which is intended for a steamer of 5000-horse power belonging to the Peninsula and Oriental Company. It is all finished and ready to bolt on to the boss, and we may add that its back is coated with sheet brass to prevent corrosion, according to the arrangement of Mr. Manuel, superintending engineer to that line.

Mr. Davis, of Lewisham, shows a steering propeller for increasing the handiness of screw vessels at low speeds or when under stern way. The action consists in each blade being made to pass edgewise through the water when above the line of shafting and flatwise when below, or *vice versâ*, the differences of pressure being available for turning the vessel in either direction, according to the position of the helm. The means of adjustment or alteration are provided for by the application of the universal or Hooke joint, although the same result can be obtained by other means should more than two blades be fitted. In the particular case under notice the blades are on a pivot common to both and free to turn—in fact, forming one of the axes of the Hooke joint, the other being a plain knuckle joint prolonged so as to engage in gear, and free to revolve in the same axis as the propeller shaft when not in action. This gear, which we may term the controlling gear, is worked by a shaft passing down the forward side of the rudder-post, and by means of a lever with a swivel joint at its end is capable of giving a transverse motion to a round revolving lever—the prolongation before alluded to—so altering the pitch of the blades as they pass above or below the line of shafting. For example, if the helm is ported and the screw a right-handed one running ahead, then each blade as it passes above the line of shafting is flattened in its course through the water, and when below the shaft is passed edgewise, or nearly so, through the water, so materially assisting the helm, especially if the rudder is comparatively powerless at first starting, or if under order "Full speed astern." The whole arrangement is ingeniously designed, and the only question to be answered is, Is the object aimed at worth the trouble of the complication?

Messrs. Galway, Bainbridge, and Co., of Warrington, show one of Sturgeon's patent dry cold-air machines, which they had prepared to exhibit in action. The difficulty of arranging steam for the exhibitors, which had been undertaken by the managing committee of the Exhibition, proved too great to be surmounted. Messrs. Galway and Bainbridge were therefore compelled to show their machine at rest. It has two compressors, each of 6in. diameter and 9in. stroke; one expansion cylinder of 6in. diameter and 9in. stroke; and one steam cylinder of 8in. diameter by 9in. stroke, and is capable of delivering some 5500 cubic feet of air per hour at a temperature of 40 deg. below zero Fah. The Sturgeon patents cover an appliance for draining off most of the natural moisture drawn into the compressors with the air, called the purifying chamber, and in this chamber are trays filled with coke or other purifying absorbent.

FISHERY AND LIFE-SAVING APPLIANCES AT THE NORTH-EAST COAST EXHIBITION.

The exhibits belonging to these departments are placed in the Aquarium, usually a rather gloomy portion of the building situated below the Winter Garden, from which it is approached by a flight of stone steps, but rendered considerably more cheerful at the present time by the many coloured flags, banners, and other decorations, illuminated by the Pilsen arc lamps, which are kept burning throughout the day. Though hardly coming strictly within the category of engineering exhibits, much of the apparatus is so intimately connected with the engineer in one way or another, that we make no apology for presenting our readers with a brief description of what is to be found at some of the principal stands.

In the ante-room, reached by the visitor after descending from the Winter Garden, is displayed a splendid collection of models of fish, specimens from the Buckland Museum. These have been lent by the Science and Art Department, and though far too few in number, attract great attention from the perfect manner in which they are executed.

Within the Aquarium, Mr. Richard Cail, of Newcastle-on-Tyne, shows a model of his well-known lock pass, which enables the heaviest spawn-laden salmon to swim in unbroken water from the lower to the upper water, even to a height of 100ft. or more, without fatigue or having to leap. It is stated that a very small quantity of water will work this system, which being self-acting, suits itself to any height of water in freshes or floods.

A patent handy hauler for drawing in fishing nets and lines is exhibited by Messrs. W. L. Mitchell and Son, of Kirkcaldy, N.B. Over 1500 of these machines have been supplied during the last four years, and they appear to give entire satisfaction. As the working gear is all enclosed within a hollow casing, only the two revolving heads being exposed, there is no danger of damaging the nets, and protection against risk of accidents is also afforded to the fishermen.

Submarine diving apparatus, which formed such an important series of exhibits at the Naval Exhibition in the Agricultural Hall, is shown only by Mr. E. Easthope and Messrs. Siebe, Gorman, and Co., of London. The latter firm has sent several beautifully finished sets of both single and double gear, besides air pumps, a portable diving apparatus, submarine electric lamps, and numerous models and relics.

A large patent life buoy, built of steel, and weighing some 16 cwt., is exhibited by Messrs. H. S. Edwards and Sons, of South Shields. It is somewhat in the form of a pear, about 7ft. 6in. high, and 8ft. diameter, and is fitted with seats to accommodate sixteen persons. Below the deck and seats are places constructed for holding provisions, and three oars put together in lengths, so that they can be taken to pieces and stowed away inside, are provided for propelling and steering. It is intened to be carried in such a manner that in case of a ship sinking it would be floated from the deck or bridge, and in very heavy seas it could be launched over the side of the vessel, when it would be impossible to make use of an open boat.

An interesting exhibit is made by the Royal National Lifeboat Institution, which sends models of lifeboats, cork belts, and a number of special appliances for saving life.

The Board of Trade show a complete set of rocket apparatus, which was put to a practical test on the 12th inst, by men of the Tynemouth Volunteer Life Brigade. Rockets were fired from the Long Sands, opposite the Aquarium, to a lighter moored a short distance from the shore. The drill, which was witnessed by thousands of spectators from the sands, banks, and terraces, could scarcely be called successful, as none of the rockets actually struck the lighter. Those on board, however, managed, after some little time, to lay hold of one of the lines, and eventually, amid considerable amusement, several persons were hauled to-and-fro in the jacket.

Patent automatic detaching gear for ships' boats is shown by nine firms, who all profess to have obtained the *ne plus ultra*. Certainly most of the apparatus is exceedingly simple, and in nearly all the gear is so arranged that one hook cannot detach without the other, and that instantly the boat is water-borne, no matter in what position, both hooks are simultaneously disengaged.

At other stands will be found numerous examples of life-rafts and patent ships' boats, models of fishing cobles, guns, and every conceivable appliance in the way of fishing tackle and life-saving apparatus.

COAST LIGHTING AND SUBMARINE ENGINEERING AT THE NORTH-EAST COAST EXHIBITION.

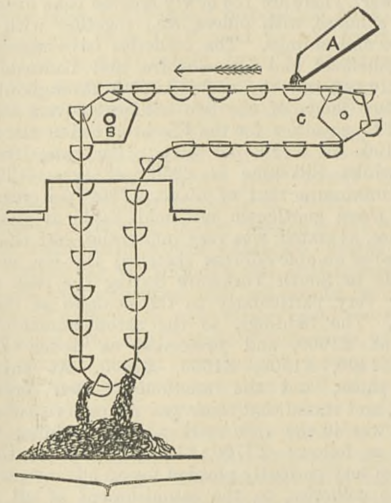
In addition to the ships' models shown in the Winter Garden under the head of naval architecture, a number of miscellaneous models are exhibited in the same building under sections 5 and 6 in the catalogue, and attract considerable attention.

The Master and Brethren of the Trinity House, London, furnish a large number of models and appliances of peculiar interest. Among them will be found a painting of Winstanley's Eddystone tower, completed in 1699, and four years later destroyed by a storm, on which occasion both Winstanley and the keepers perished; a model of Rudyerd's lighthouse built in 1709 and destroyed by fire in 1755; and comparative models of Smeaton's Eddystone and the new tower just erected by Sir James Douglass, the last stone having been laid by H.R.H. the Duke of Edinburgh on the 1st of June last year, less than two years after its commencement. There are also models of the Maplin Iron Pile Lighthouse, supported on piles screwed 14ft. into the sand by Mitchell's patent screw; of the old and new Goodwin light vessels, and of several ancient men-of-war. The Trinity House has also contributed a large collection of lamps and other fittings for lighthouses, specimens of a 21in. reflector and lamp used first at Liverpool about the year 1763 and afterwards at Lowestoft and other places; a plano-convex lens used at Portland in 1789; and a cata-dioptric apparatus. One of a set of polygonal lenses made in 1836 by Messrs. Cookson and Sons, of Newcastle, and fixed in the Start Point Lighthouse in Devonshire are shown. Among lighthouse burners are several Fresnel first order oil lamps, six and eight wick Douglass burners for consuming vegetable or mineral oils, and capable of giving respectively 750 and 1300 candles, and six and ten ring Douglass gas burners of an intensity of 600 and 1500 candles with 16-candle gas, and giving out $5\frac{1}{2}$ to 6 candles per cubic foot, besides a new double Argand-Douglass gas burner with 21in. parabolic reflector giving a beam of light of 5000 candles intensity. There are also lamps and reflectors as used in English floating lights about the year 1809, the surface of the reflectors being spherical, as well as gimballed reflectors of 12in. and 21in. apertures with Argand and Douglass lamps for floating lights, three or four of these being generally used together in one group.

The Commissioners of Northern Lighthouses, Edinburgh, have furnished six exhibts. There is a model of Bell Rock lighthouse designed by the late Robert Stevenson, commenced in 1807 and finished in 1811; also one of the Dhu Heartach tower, situated on a rock on the west coast of Scotland, fourteen miles from Iona, and exposed to the full force of the Atlantic Ocean. They also show a model of Stevenson's apparent light, for indicating the position of a beacon on an inaccessible rock at night; and of Mr. Thomas Stevenson's azimuthal condensing ships' light, designed to distribute the whole light equally over ten points of the compass, in accordance with Board of Trade requirements, and first applied in 1866.

The River Wear Commissioners exhibit fifteen photographs of the new Sea Lock, South Dock, Sunderland, designed and carried out by their engineer, Mr. H. H. Wake; photographs of iron coal staithes, erected at Hendon Dock, and various panoramic views and engravings of several of the most important works recently carried out at the mouth of the Wear. They also show a complete set of drawings of their elaborate chain, cable, and anchor testing works, constructed by Messrs. John Abbot and Co., Limited, of Gateshead, and working models of dredgers driven by an electric current from a set of batteries in the pedestals on which they are supported. The largest of these dredgers is capable of lifting 600 tons per hour, and is of the Wear single-ladder open-ended type—its length is 130ft.; breadth, 32ft.; depth, 10ft. 6in.; and draught about 6ft. 6in. The ladder works through a well in the centre of the hull, which is quite open at the bow end. The machine is capable of dredging in its own draught of water and also down to any depth to 31ft., and the dredged material can be discharged on either side. The constructors were Messrs. Hawks, Crawshay, and Sons, of Gateshead-on-Tyne.

The models sent by the River Tyne Commissioners occupy a prominent position in front of the platform. The most conspicuous is a working model of the mammoth crane now being erected for extending the north pier at the mouth of the Tyne, from the designs of Mr. P. Messent, the Commissioners' engineer. It is intended to set blocks and bays of concrete weighing 40 tons at an overhang of 75ft., and is partly being constructed by the commissioners themselves at their Howden Works, and partly by Messrs. Stothert and Pitt, of Bath. The crane will be capable of being moved to any part of the pier, and the jib will have a turning motion through one complete revolution. A very interesting working model of the new swing bridge at Newcastle is shown in connection with a portion of the quays and buildings at each side of the river, and the famous high level road and railway bridge designed by Stephenson. The foundations of the swing bridge consist of clusters of large cast iron cylinders sunk by the pneumatic process, and upon which the granite piers are built. This portion of the work was executed by the Commissioners, while the superstructure, consisting of four fixed and one swing span, the latter, when open, giving a clear way on each side of the centre pier of about 95ft., was erected by the firm of Sir W. G. Armstrong and Co. A new method of loading coal, designed by Messrs. Messent and Ward, is illustrated by a series of three drawings and a large working model, and is viewed with great interest by coal shippers and others acquainted with the great loss from breakage resulting from the fall from the hatchways into the holds of vessels. To obviate this loss it is proposed to deliver the coals from the shoot into a series of buckets fixed close together on an endless chain, and travelling past the mouth of the shoot, and then round a tumbler down to the bottom of the vessel, where they would be tipped and returned again to be refilled. In the annexed sketch the shoot A delivers



the coal into the buckets, which, travelling over the tumbler B, are let down through the hatch into the hold, tipped, and returned over tumbler C. The links of the chain are intended to be made with a pin and hook eye, so that as the vessel is loaded and the heap of coal rises the length may be reduced as required.

There is a large number of photographs, drawings, and models sent by the Clyde Trust, through their engineer, Mr. James Deas. These chiefly relate to the machinery and works in connection with the construction of the new docks at Stobcross.

Sir W. G. Armstrong and Co., of Newcastle, exhibit a model of a hydraulic hoist and train of boats in use in the Aire and Calder Navigation for shipping coals. This system was devised by Mr. W. H. Bartholomew and carried out by Sir W. G. Armstrong and Co., and consists of a train of boats hinged together and propelled by steam. Each boat carries about forty tons of coal, and is lifted bodily out of the water by a hydraulic hoist, and its contents tipped directly into the vessel to be loaded. It was in referring to this plant at the recent meeting of the Institution of Mechanical Engineers at Leeds that the president, Mr. Percy Westmacott, suggested the possibility of ocean-going vessels of the largest size being loaded and discharged in a similar manner.

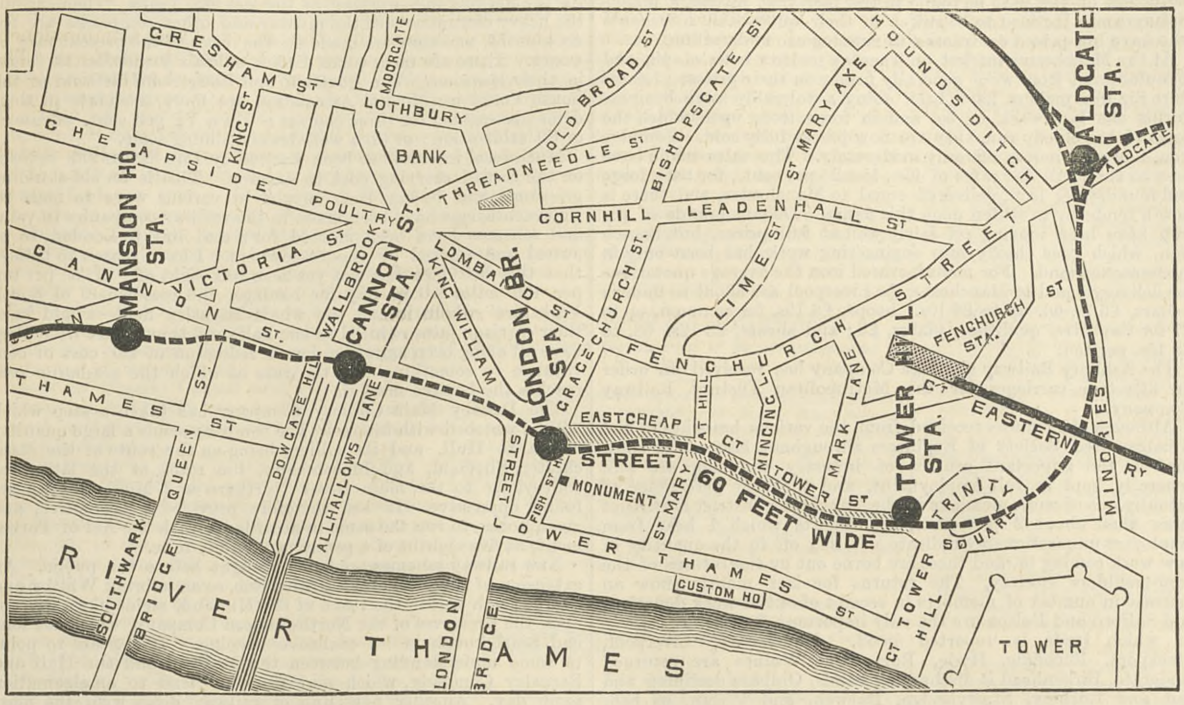
Dioptric lenses are shown by Messrs. Chance Brothers, of Birmingham, one a holophotal lens of the sixth order, as used in connection with the electric lights on ships of war and forts for defence against torpedoes and other purposes, while others are ships' lights of new design and great power, comprising two side lights, mast head light, and anchor light.

Messrs. W. Simon and Co., of Renfrew, exhibit a model of a twin screw patent hopper dredger to carry 1500 tons of spoil, and to dredge in from 5ft. to 35ft. depth of water. The engines are of 150-horse power, and are capable of propelling the vessel at a speed of eight miles per hour.

Messrs. Durham, Churchill, and Co. exhibit some of their patent velometers and universal marine governors; Webster's patent log detector, an ingenious little instrument for detecting any fouling or undue twisting in the log line; Durham's patent automatic steam fog whistles which we shall illustrate and describe more fully in another impression; and Thomson's patent air extractor. The governors are made in two patterns, the "Velometer" and the "Universal," but the principle involved, that is the combination of a water or fluid cylinder with a steam cylinder, is identical to both.

Among other exhibitors may be mentioned Mr. W. Batho, Messrs. Clark and Stanfield, and Messrs. Thomas Meik and Sons, all of whom send models, and besides these the visitor will find much to interest him in the many engravings, photographs, charts, and other exhibits, which it is impossible to enumerate in detail.

THE INNER CIRCLE COMPLETION RAILWAY.



Trains have been running regularly since Monday on another portion of the connecting link between the Metropolitan and District Railways, known as the inner circle completion railway. The new extension carries the Metropolitan Railway Company's line southward to a point on Tower-hill, as indicated on the accompanying map, where it will meet a connecting length of the Metropolitan District Railway, which, after many delays, is about to be pushed eastward from the Mansion House Station. The short extension thus completed from Aldgate to Trinity-square, is about three-eighths of a mile in length, and will carry passengers from the west and central parts to within a few minutes' walk of Mark-lane, Mincing-lane, Billingsgate, the docks, and the Thames Subway, affording a ready means of reaching the Tooley-street warehouses and the district of Bermondsey, and it will deliver passengers arriving at Paddington, Euston, King's Cross, or St. Pancras, in a very short time after they have reached the metropolis, at the gates of the Tower. Continuously from the Aldgate Station, which may be looked upon as the first link in the short, but important, completing chain, the new line passes under the main thoroughfare, through Chequer-yard, and then, curving to the right, under the roadway of the Minories between George-street on the right and Church-street on the left. In this, the only piece of tunnelling on this section of the Metropolitan, the experiment is to be tried of lighting the line with the incandescent electric lamps of the Swan United Electric Light Company, with a view to determining whether sufficient illumination could not be obtained in this way without lamps in the carriages. At present the electric lamps are in use, but so also are the carriage lamps, so the experiment has not yet been made. After running along the line of the Minories as far as Goodman's-yard, the railway begins to bend slightly westward, and passing under the Blackwall line, which can be seen high overhead, it goes under the Crescent, its course being marked by the disappearance of the houses on the south side between Hahn's and Zambrzycki's hotels. From here it continues in the open to the temporary station on the eastern side of Trinity-square, where, for the present, passengers must alight. The line, however, will be driven under the gardens to to the west side of the square, where the new street to be made by the widening of Tower-street and Eastcheap, will open upon Tower-hill, just to the northward of All-hallows—Barking—Church. Soon after leaving the station at Aldgate there appears on the left the opening for a branch line, which, passing beneath High-street, Whitechapel, will connect this system with the East London line, and so afford the means of communication by the Thames Tunnel with the south suburban railways. The High-street, Aldgate, is carried over the line by a bridge with a span of 82ft., constructed of heavy wrought iron plate girders, with special details to bear the gas mains of the Gas Light and Coke Company. The railway here is sufficiently wide to allow four lines of way and two platforms to be used. The tunnel further on is 25ft. wide, with vertical side walls and a segmental arch, the side walls and retaining walls of the open cutting being made of Portland cement concrete, and thick and strong enough to bear any buildings that may be erected above them. The arch is of stock bricks laid in mortar, and in some places is 3ft. thick. In passing under the Blackwall Railway it was necessary to underpin the abutments of the arch, and much care had to be exercised in making this portion of the line, as the traffic from Fenchurch-street had to be carried on without interruption, and trains were continually passing and repassing on the archways of the railway, beneath which the new line was being made. The temporary station at Tower-hill is a wooden building placed across the two lines, with a single staircase for the platforms, which are 300ft. long by 12ft. wide, and, like the stairways, covered with an ornamental iron roof. After passing under the High-street, Aldgate, the line runs for seventy yards in an open cutting, then through the tunnel under the Minories, through another piece of open way, next by a covered way beneath the Crescent, whence it emerges into the open-air station, so that in this portion of the Metropolitan Railway the passenger will get more fresh air than in some parts of the line. As the ceremony of turning the first shovelful of earth in the construction of the extension was performed by Mr. Alderman M'Arthur, then Lord Mayor, on the 5th of September last year only, it will be seen that much has been accomplished in a short time. Mr. Tomlinson has had a very difficult piece of work to carry out, not the least of the difficulties being caused by the numerous large sewers which had to be passed, and by the traffic which could not be stopped. The thoroughfares under which the line passes have been kept open during the whole time the works were in progress, a temporary bridge having been laid along the Minories while the tunnel under that street was being made. No serious accident has happened to any of the workmen employed, and although some of the houses below which the work was going on are among the oldest in London, none show any signs of damage. The soil proved to be made ground to the depth of from 12ft. to 14ft., and under this was found a clean gravel of a bright yellow colour, which has been used for ballast.

WESTON'S IMPROVED DIFFERENTIAL PULLEY BLOCKS.

Our illustrations show two styles of these blocks manufactured by Messrs. John Crowley and Co., of Sheffield. Fig. 1 is the plain differential block with its details modified in accordance with the inventor's latest plans. Fig. 2 is a new geared differential block having the double purchase gearing so placed within the differential sheave, that nothing projects beyond its circumference. The operating sprocket wheel is not larger in diameter than the main sheave, and it turns upon the same axis. A considerable saving of friction over that of ordinary differential blocks is gained, owing to the fact that the mechanical power is due largely to the two pairs of plain spur wheels used; the effect being that of a double

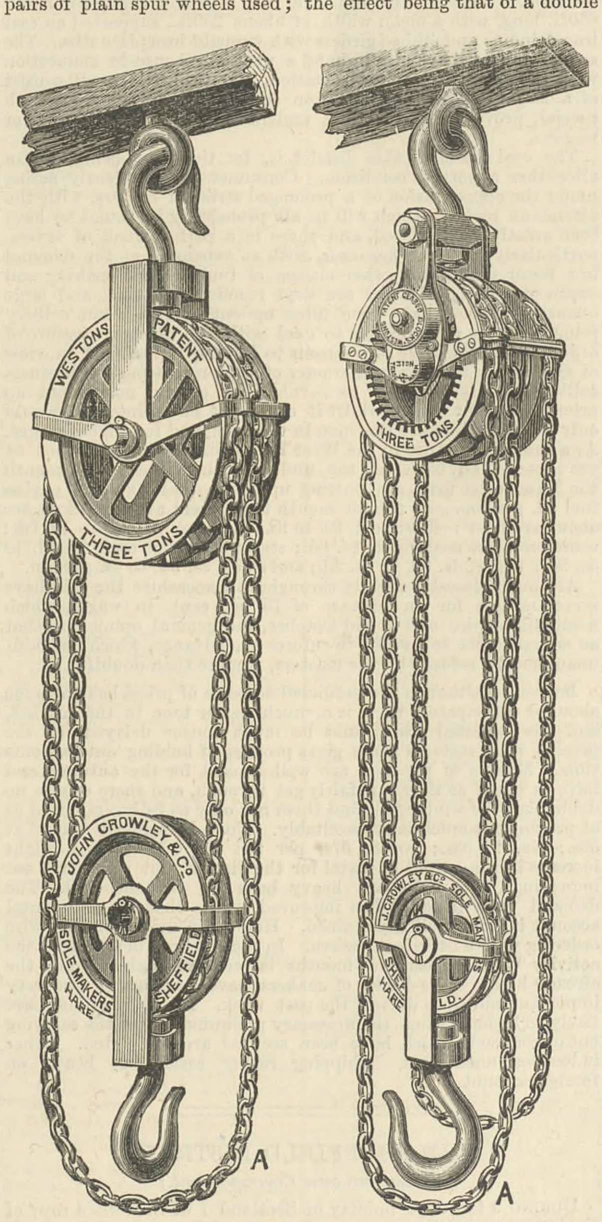
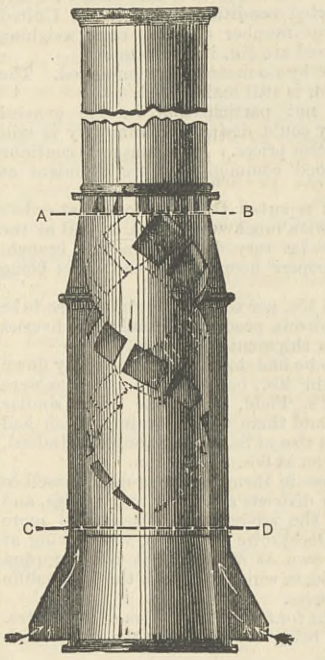


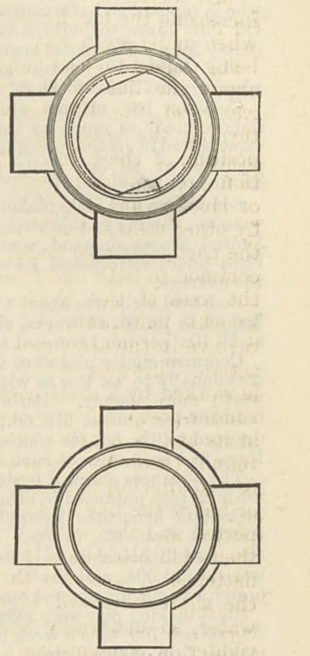
Fig. 1. Fig. 2.

purchase crab, but in the small space and usual form of a block. Bronze bushes and bearings of ample area are provided. The main or differential sheave turns upon a hollow stay uniting the side frames and containing the sprocket wheel shaft. The first pair of gear wheels occupy the box-casting affixed to that side of the block outwards in the cut. The large wheel of the second pair is an annular one, cast upon the inner surface of the main sheave, and shown plainly in the cut. The cuts show the relative dimensions of the two styles, viz., a plain 3-ton differential block and a 3-ton "geared," the latter being 27 lb. the lighter in weight.

THE WERY FUNNEL.

The accompanying engraving illustrates a new form of chimney funnel made by Messrs. Livet and Co., Short-street, Finsbury Pavement. It is the invention of M. Wéry, of Paris, and has been adopted by Messrs. Livet and Co. for use in combination with their arrangement of boilers, boiler flues, and for any furnace having their fire bars. The funnel can be applied at the top of any furnace, or in the uptake or chimney. It is merely put on entire as a part of the chimney, and in the case of a brick flue or shaft can be built into it at any vertical part. It consists of an inner funnel with an outer jacket closed in upon the funnel at top, and leaving ports or openings to the atmosphere at the bottom. In the inner funnel passages are constructed projecting into the interior in a spiral form, and increasing in size upwards. Openings at intervals in these passages admit the air from the jacket into the interior of the funnel. The air passes in through the ports or openings, and becoming heated by contact with the inner funnel—the chimney proper—expands and rises upwards, forcing its way in so doing through the openings in the spiral grooves into the inner funnel in such a direction as to produce an upward rotary motion increasing and steadying the draught. When the funnel is fixed upon a flue of any description a strong



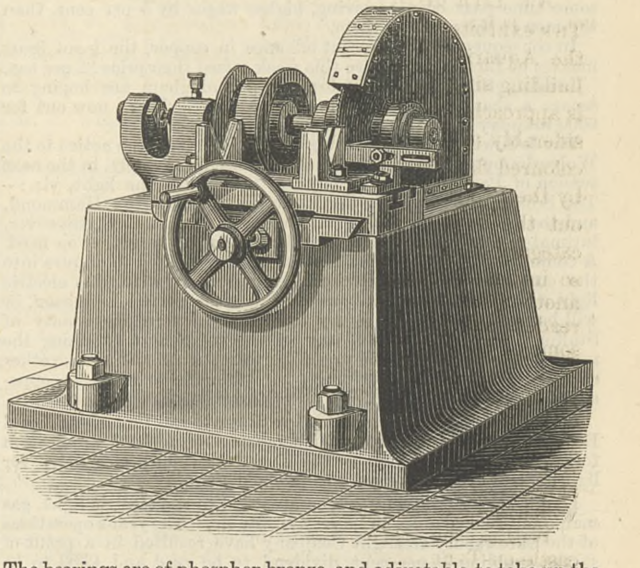


rotary motion of the gases takes place, which, it is argued, extends downwards to the furnace, this being made evident by the centrifugal ejection of the flame when the fire door is opened. This increased efficiency of a boiler fitted with the fuel suggests that stirring action seems to cause a more rapid combination of the carbon and oxygen of the fuel and air, and thus more complete combustion of the whole of the fuel, and that passing through the furnace, the incandescent gases are, as in vertical boilers for instance, directed into much more effective contact with the vertical heating surfaces.

At the London Smoke Abatement Exhibition trials, the funnel was fitted upon a vertical boiler having thirteen vertical tubes $2\frac{1}{2}$in. diameter, and the evaporation by this boiler, according to the official trials, was increased about 57 per cent. per lb. of coal, the consumption of coal—hard steam—being reduced 29 per cent. at the same time, and the actual increased evaporation being $29\frac{1}{4}$ per cent.

HOT SAW FOR SMITHS' WORK.

We illustrate below a hot saw largely used in smiths' shops, and manufactured by Messrs. Thwaites Bros., Bradford. It is a simple and handy tool. These saws are made in different sizes, 21in., 24in., and 30in. diameter; the 21in. diameter is most generally in use. The saw is mounted upon a cast steel spindle, and run at a speed of from 1500 to 2000 revolutions per minute.



The bearings are of phosphor bronze, and adjustable to take up the wear; the saw runs in a water trough, which is formed in the bed. For sawing bars to dead lengths a moving slide is provided. The saw is covered in with a wrought iron guard. The bar is fed up to the saw on the slide rest by the hand wheel and the quick-threaded screw. The whole is very compact and occupies small space.

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

(*From our own Correspondent.*)

The near approach of the quarterly meetings, which will come off in Wolverhampton on October 11th, and in Birmingham on the following day, has not perceptibly checked the inflow of orders on our exchanges this week. Herein is gratifying evidence of the belief of buyers in the soundness of the present revival. It is clear that they are of opinion that the upward tendency of prices will continue.

The tone of the market as to heavy sections of finished iron alike yesterday and this afternoon certainly afforded ample cause for this view. Urgent offers to buy sheets for Russia met with scarcely any response from makers. At yesterday's market indeed it was impossible to place such orders. The full state of producers order books makes it difficult for buyers to get further contracts accepted. Galvanisers as well as merchants gave this same report. Even for early deliveries makers were strong in demanding a 5s. per ton advance on the month, making doubles £9 to £9 5s. and lattens £10 to £10 10s.

The galvanisers reported themselves very busy for South America, the Australias, Canada, and South Africa. They were very firm in price at £14 10s. for 22 w.g. to 24 w.g. delivered at outports. Some merchants continue their attempts to "bear" the market for galvanised sheets, but unsuccessfully.

Nine of the principal firms in Birmingham, Wolverhampton, Walsall, and elsewhere have taken the unusual course of uniting in a public protest against the quotation of a trade circular, in which it had been stated that the prices of galvanised sheets had declined. Makers state that this attempt by merchants is due to their having sold forward without having covered themselves, and that now they find the market has taken an upward turn against them.

Plates were again brisk and prices firm at £8 to £9 per ton at the works. Additional information was forthcoming touching the visit to this side of a Pittsburgh tank-maker to buy plates, to which reference was made last week. The buyer is a Mr. James Cuddy, who is reputed to have contracted conditionally with the United Oil Pipe Lines to build a large number of tanks each weighing ninety tons. The plates required are ⅜in. in thickness.

The marked bar makers are by no means fully employed. The standard of £7 10s. to £8 2s. 6d. is still maintained.

Common bar makers are not participating in the general improvement so much as they could desire, and difficulty is still experienced in getting much better prices. Minimum sorts continue plentiful at £6 5s., while good common bars are abundant at £6 10s. per ton.

Some hoop and strip makers reported this afternoon that orders were not coming in this week with much vigour. A revival in the United States demand would be very welcome in this branch. Firm prices were asked for coopers' hoops, £7 at the works being the average.

Bedstead strip was about £6 15s. per ton. Nail strips were to be had at £6 2s. 6d. at works, and one producer is making deliveries at £6 10s. per ton Liverpool for shipment to Canada.

Common cinder pigs were to be had to-day and yesterday down occasionally to as low as within 40s., but all-mine qualities were worth more money. Barbor's, Field, and some other similar brands were quoted 67s. 6d., and there were all-mines which had dropped to 62s. 6d. for which a rise of 3s. 9d. was sought. Indeed, there had been sales of such iron at 66s. 3d. per ton.

The advances checked business in Birmingham to-day, as well in medium pigs produced in other districts as in best native pigs, and high-class hematites secured the advantage. These sold more freely at from 65s. to 70s. Derbyshire iron, also, was moving at 50s., and Lincolnshire held its own at 52s. 6d.; but Northampton was slow at 50s., and the 62s. 6d. to which last week the Thorncliffe brand was put up stopped business.

Steel-making pigs were sought for from the vendors of hematites. At present 700 tons a week is being consumed by the chief steel-making firm of this district.

Ores were plentiful from the Northampton mines for blast furnace use at about 6s. per ton delivered to consumers' sidings. Purple ore for fettling was as high as 18s. 6d. per ton.

Coal was worth more money all round. The rise of 1s. per ton for household samples is well maintained upon Cannock Chase; and now the producers of good forge and also mill sorts are requiring a similar rise. To-day and yesterday the quotations for deliveries to the end of the year were for good mill coal 8s. and for good forge coal 7s. per ton, boat weight.

Consequent upon the absence as yet with the other members of the Iron and Steel Institute, at Vienna, Mr. Fisher-Smith, the chairman of the Coalmasters' Association, has been unable to respond to the request of the colliers to call a meeting of the trade, to consider their application for an advance of 10 per cent. in wages. Doubtless there will be a meeting so soon as the chairman has got back; and the impression in Wolverhampton yesterday was that the masters may be able to see their way to attempt a declared rise of 1s. per ton in coal, making the maximum quotation for furnace sorts 11s. per ton. Such an advance would carry a rise of wages to the extent of 2d. "per day" or stint in the thin, and 4d. in the thick coal seams, which would mean a rise of about 5 per cent. in wages. With such an advance it was believed that the men would be content. In that event there would be no repudiation of the sliding scale, nor any suspension of operations.

About one-fourth of the 22,000 colliers and ironstone miners employed in North Staffordshire have given notice for a 10 per cent. advance. There is no agitation at present south of Tunstall, as the men employed in that district are receiving, and have for some time past been receiving, higher wages by 5 per cent. than the men to the north of them.

In consequence of the recent advance in copper, the ingot brass makers of Birmingham have this week raised their price £2 per ton.

Leading tin-plate-making firms in Birmingham are hoping to secure a share of the Government orders which are now out for 6000 infantry mess-tins and 5000 cavalry mess-tins.

The following electric lighting companies have given notice to the Wolverhampton Corporation that they intend to apply, in the next session of Parliament, to supply the town with the light, viz.:—The Edison, the South Staffordshire, the Gulcher, the Hammond, and the Jablochkoff companies. The latter company has, moreover, intimated that it will apply for a license for its lamps to be used. A committee of the Corporation has been appointed to inquire into the cost and other particulars in connection with the electric light as it is used in other towns. The same notices have been, or will be, given to nearly every local authority in the county of Stafford, and the effect of any of the companies obtaining the provisional order it desires would be the debarring of all the other companies and the local authority itself from introducing an opposition light into the town.

A proposition will be submitted to an early meeting of the Local Board of Smethwick, near Birmingham, authorising application for powers that will enable the Board to supply electricity for lighting and other purposes within the district.

Despite the increasing favour accorded to the electric light, gas manufacture continues to be very profitable. The year's operations of the Shrewsbury Gaslight Company have resulted in a profit of £6300, enabling 7½ per cent. dividend to be paid and £500 to be added to the reserve fund. The company has had a new gasholder in operation since November, and attributes no little of its prosperity to the greater facilities for manufacture which this confers.

Since the meeting of gas consumers at Halesowen, reported in my last, when it was resolved to invite the Birmingham Corporation to supply the town with gas at 1s. 9d. less per 1000 cubic feet than the local gas company, a vestry meeting has been held at which, by a majority of twenty-nine to seventeen, the gas consumers' previous determination was approved.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron market here is in a somewhat anomalous condition. With the recent activity in some of the principal local iron-using branches of industry slackening off rather than showing any signs of enlargement, and local consumers in the engineering branches of trade not as a rule at all eager buyers, the iron market exhibits a decidedly stronger tone, and during the week there has been a fair amount of business stirring. The source of this improvement in the iron market is to be found mainly in the present activity in the shipping trade, which to a large extent is keeping the local forges busy, and as a consequence bringing forward a demand for forge qualities of pig iron. The pressure to complete shipments for the Baltic and Canada before the ports are closed to some extent accounts for the present push; but in addition to this there is a very fair export trade being done which is not dependent upon the season of the year. Finished iron of all descriptions is going off in large quantities, and manufacturers of sheets especially are finding it very difficult to keep up the required deliveries. The home trade is, however, not of very extensive proportions, and an indication of this is to be found in the fact that although manufacturers are inclined to be stiffer in their quotations, merchants who have low-priced contracts still running are underselling.

At the Manchester market on Tuesday makers both of pig and manufactured iron were generally firmer in their prices. Lancashire pig iron makers have been doing a tolerably large business during the last week or so, and in forge iron, upon which the demand has chiefly run, they are now pretty fully sold. Foundry iron, however, moves off only moderately. The sales made have been at their full list rates of 46s., less 2½ per cent., for both forge and foundry pig iron, delivered equal to Manchester, and there is now a tendency to stiffen upon this figure. Distant brands of pig iron have been moving off fairly well at full prices, but Scotch iron, which goes chiefly into engineering work, has been only in moderate demand. For manufactured iron the average quotations for delivery equal to Manchester or Liverpool are about as under:—Bars, £6 7s. 6d. up to £6 10s.; hoops, £6 15s. for common, up to £7 for the better qualities; plates, £8; and sheets, £8 12s. 6d. to £8 15s. per ton.

The Ashbury Railway Carriage Company has received an order for fifty-four carriages for the Metropolitan District Railway Company.

Although the returns received from the various branches of the Amalgamated Society of Engineers throughout Lancashire show that in the important centres of industry the men are still generally kept in full employment, and that the percentage of actually out-of-work members in the Manchester district is still not more than about 2 per cent., the reports which I hear from employers unquestionably indicate a falling off in the quantity of new work coming in, and these are borne out by the returns of the Iron-moulders' Society. The returns for last month show an increase in number of members in receipt of out-of-work donation, and Salford and Bolton are the only important Lancashire centres in which trade is reported good. Manchester, Liverpool, Stockport, Rochdale, Hyde, Bury, and Widnes are returned moderate, Birkenhead is discharging hands, Oldham declining and bad, and Burnley, Staleybridge, Darwen, and Wigan, as bad. During the last week or two there has been a considerable increase in the number of men seeking employment, and there have been more applications for work in Manchester than has been known for a very considerable time past. Moulders are of course the first to feel any falling off in trade, but when they are short of employment it is an infallible sign that there is not much new work in preparation for the engineering and fitting shops, and although these trades may still be kept busy working off the orders they have on hand, it is evident that there is a falling off in weight of new orders to follow, which will in all probability before long make itself felt amongst engineers.

The work on the superstructure for the extension of the Lancashire and Yorkshire Victoria Station at Manchester is now commencing. This will consist of a roof over the extension about 650ft. long, with a mean width of about 250ft., supported on cast iron columns and arched girders with wrought iron plate ribs. The same company have also in hand a new warehouse in connection with the North Mersey goods station, Liverpool, which will consist of a large building supported on columns above the rails, with special provision for loading underneath either from carts or wagons.

The coal trade of this district is, for the time being, in an altogether abnormal condition. Consumers are evidently acting under the apprehension of a prolonged strike of colliers, with the attendant results, which will in all probability be found to have been greatly exaggerated, and there is a perfect rush of orders, particularly for house fire coals, with an expansion of the demand in a lesser degree for other classes of fuel for iron-making and steam purposes. The pits are kept running full time, and large quantities of coal have been filled up out of stock, but colliery proprietors are quite unable to deal with the present pressure of orders. The tendency of course is to force up prices, but in view of the purely temporary character of the present push of business colliery proprietors have, as a rule, been careful not to put up prices to a point which, whilst it could not be maintained, would only tend to stimulate the men in their demand for higher wages. As a rule the advance in the West Lancashire districts has not as yet exceeded 6d. to 1s. per ton, and with the close of the month the Manchester firms are putting up house coal 10d. and engine fuel 5d. per ton. At the pit mouth the present average prices are about as under:—Best coal, 9s. to 9s. 6d.; seconds, 7s. to 7s. 6d.; common house coal, 6s. to 6s. 6d.; steam and forge coal, 6s. 3d. to 5s. 9d.; burgy, 4s. 3d. to 4s. 9d.; and slack, 3s. 3d. to 4s. per ton.

Although almost generally throughout Lancashire the men have served notices for an advance of 15 per cent. in wages, which nominally expire on the 2nd October, the general opinion is that an actual resort to a strike to enforce the advance, which has been unanimously refused by the masters, is more than doubtful.

Barrow.—Although the predicted advance of prices has not come about as anticipated, there is a much better tone in the market, and the expected rise cannot be much longer delayed, as the present brisk state of trade gives promise of holding out for some time. Makers of pig iron are well booked for the autumn, and have as much as they can fairly get through, and there can be no doubt that the winter will find them not only as fully employed as at present but much more profitably. No. 1 Bessemer is quoted at 59s.; No. 2. 58s.; No 3, 57s. per ton net. There is a slight increase in the output of metal for the district, but stocks are not increasing. Deliveries are heavy both by sea and rail. The demand from America has improved, while that on continental account is being well maintained. Home consumers are likewise ordering with a little less reserve. In the steel rail department the activity of the past few months is well maintained, and the already heavy order-books of makers have had one or two very important additions during the past week. Iron shipbuilders are likely to be busy when the necessary preliminaries for the carrying out of contracts which have been secured are completed. Other industries unchanged. Shipping rather easier but heavy on foreign account.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

During a few days' holiday in Scotland I was shown a copy of the last report of the directors of the Steel Company of Scotland. It has several interesting items, especially in Sheffield, for English readers. At Hallside Works £7763 has been expended in additions to machinery and plant, including a system of electric lighting, enabling work to be more efficiently performed at night. At Blochairn Works the amount expended in outlay has been £19,415. The make of steel has been at Hallside 91,481 tons, and at Blochairn 66,197 tons—a total of 157,678 tons, which is considerably in excess of the total estimate of production as stated in last report. The whole of the production has been disposed of "at fairly remunerative prices, notwithstanding the keen competition which obtains in this branch of industry." The profit for the year, after making allowances for general charges, feu duties, rates, and taxes, amounts to £65,427, from which have to be deducted for depreciation £13,961—interest, £17,107; leaving £34,359, which, with balance from last year, admits of a dividend of 7 per cent., the addition of £5000 to the reserve fund, and the carrying forward of £3686 to next year.

The attitude of the colliers is causing some uneasiness. Union officials are doing their utmost to make the Manchester Conference resolution a reality. The general gathering has at length been held, and it is said to have been attended by delegates representing 27,000 colliers of Yorkshire. It was resolved to insist upon 15 per cent. advance in wages, or strike work. There is no doubt that the time taken for this step is about the worst that could have been adopted for the coalowners. Winter is approaching, and there was some prospect of the rise in values recouping them in some measure for the unprofitable working of the last two years. Then, again, the heavy contracts with the railway and other companies are for six months, and they are made on the basis of the present rate of wages. These are facts which Union officials remember to forget in their speeches. The Sheffield and Rotherham districts of the South Yorkshire Miners' Association are more moderate in their demands—asking for three courses:—(1) a 7½ per cent. advance; or (2) arbitration; or (3) a well-devised sliding scale.

Much local interest has been excited by The Engineer articles on the cost of carrying coal to London. This is an old-standing grievance, and it has been sought in various ways to meet it. Representations have been made to the railway companies in vain, and schemes have been mooted for a coal line to London, to be owned and worked by the coalowners. I have reason to believe that this last idea has not yet been lost sight of. If 2s. per ton per 100 miles would pay for haulage, the coalowners of South Yorkshire—which means the whole Barnsley field—would have their carriage rates reduced to one-half, and thus secure what they have all along been agitating for—a reduction of the cost of conveyance to something like the rate at which the sea-borne coal reaches the London market.

The Denaby Main Colliery Company has taken a step which will be watched with interest. The company sends a large quantity of coal to Hull, and its colliery being on the route of the Manchester, Sheffield, and Lincolnshire, the rates of the latter for conveyance to the main Great Northern and Midland lines are found oppressive. It has therefore provided a locomotive, and given notice to run the same in accordance with the Act of Parliament, at five-eighths of a penny per ton per mile.

New railway schemes are being brought before the public. An extension of the Hull and Barnsley line, so as to bring Whitby and Scarborough within the reach of the Midland, seems like a descent upon the preserves of the North-Eastern Company, which has long had Scarborough in its exclusive keeping. It appears to point to some understanding between the Midland and the Hull and Barnsley Company, which may probably lead to amalgamation some day. Another new line of railway deals with the most fertile and important district of the Isle of Axholme, from Crowle station to Haxey station. This route will open the line to Tickhill and the limestone quarries in that parish. It will also enable the farmers, market gardeners, as well as the Lincolnshire potato growers, to find a direct route to the markets of Rotherham, Sheffield, Doncaster, and the other leading centres of the West Riding.

There is no particular change to report in the staple trades of Sheffield. Steel rails are firmer, and quotations for new contracts are higher. A brisk winter business in iron is anticipated. Steel keeps very active, especially for the United States and Australian markets.

A meeting of delegates of the Derbyshire collieries has been held at Chesterfield. A resolution in favour of the 15 per cent. advance was passed, and a committee was appointed to wait upon the masters to make the request. A further meeting is to be held next Saturday. At the Haughton Colliery a similar resolution was passed, and the movement is rapidly spreading.

An order for 10,000 tons of steel rails has been received by the Barrow Hematite Iron and Steel Company. This is one-third part of the 30,000-ton order recently received from Australia, the larger portion of which has gone to Belgium. Sheffield is entirely "out" of these Australian contracts.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

There was only a poor attendance again on Tuesday last at the Cleveland iron market at Middlesbrough, but business was much brisker, especially for pig iron, buyers being more anxious to purchase than they have been for some time past. This, to some extent, is owing to the better feeling which exists here, and to the improved tone of the Glasgow market. The best brands of Scotch iron having become scarce have risen in price, and warrants have also gone up.

A good deal of business was done by merchants and some of the makers at 44s. 3d. per ton for No. 3 g.m.b., prompt f.o.b. deliveries, which is 3d. per ton advance on last week's price. The leading firms of producers, however, were firm at 44s. 6d. per ton, in the expectation that there will be a heavier demand.

Holders of Cleveland warrants were not so eager to dispose of their iron, there is a pretty good demand, and every prospect of a still better state of things, so they are holding back in the hope of realising higher prices. Last week Connal's No. 3 warrants could be had for 43s. 9d. per ton; on Tuesday they were the same price as makers' iron, viz., 44s. 3d., and very few lots were sold for less than that.

The shipment of pig iron from the Tees still continues in the most satisfactory manner. The amount shipped during this month up to Monday night was 80,658 tons, whilst in August the exports during the corresponding twenty-five days only reached 74,602 tons, and that was considered to be exceptionally heavy. Since last week's report, the stock of Cleveland pig iron in Connal's Middlesbrough stores has decreased 1183 tons, being now 110,048 tons.

In the manufactured iron trade things are not so bright as in the pig iron department, and producers who are in want of orders have to take lower prices than what they have been quoting during the last two or three weeks. Ship-plates may now be had at from £6 12s. 6d. to £6 15s. per ton for large lots, but for small quantities 2s. 6d. more than the latter figure is being asked, and firms who are well booked will not take less.

For common bars in quantity £6 is quoted, and for shipbuilding angles £5 17s. 6d. to £6, all f.o.t. makers' works less 2½ per cent. Puddled bars are £4 per ton, and fish-plates £5 5s. net.

The steel trade continues to be very dull. Coal is still in great demand, large quantities being required for export; the prices are consequently stiffening.

The North of England iron and coal trades' quarterly market will be held at Middlesbrough on Tuesday, the 10th proximo.

The Clay Lane Iron Company, at South Bank, have just put in blast another furnace. They have now five out of their six furnaces working.

Mr. David Dale has just issued his award *in re* the claims of the puddlers at three of the Stockton ironworks for 6d. per ton extra for every half pig of hematite used in making better-class puddled bars. It will be remembered that Mr. Dale heard the evidence for and against the claims at a special meeting of the Board of Arbitration which was held at Darlington on the 1st inst., and fully reported at the time. The conclusions Mr. Dale has arrived at are as follows:—"(1) That the evidence bears out the employers' contention that for about thirteen years it has been the custom at the North of England Ironworks to include in the puddling furnace charge one, two, or three half pigs of hematite without extra payment. (2) That this mixture is very largely used, and that any change in the mode of payment would therefore affect a considerable amount of the puddling done in the North. (3) That if an extra payment were awarded, unaccompanied by any reduction in the price paid for puddling Cleveland pig iron alone, the result would be to raise the general rate for puddling. (4) That my powers do not extend to reducing the rate for puddling Cleveland pig iron alone, nor, if I had the power, would I think it expedient to do so. On the other hand, I do not feel justified in raising the general rate of wages for puddling as the result of local and special claims. Changes in the general rate of wages should, in my opinion, only be made as the result of variations in the condition of trade or of the labour market. I am of opinion that it would not be equitable or expedient to vary the long-standing district custom, and I therefore award and direct that it remain unchanged; and I accordingly disallow the three claims which were left to my decision."

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Glasgow iron market has become very strong since last week. There has been rather more speculation in warrants, the values of which are now seen to be materially improving. Prices of warrants have advanced very decidedly, and the increase in makers' iron amounts in some cases to as much as 3s. per ton on the week. The scarcity of makers' special brands, formerly noticed, is now felt in a remarkable degree; so much so, indeed, that there are certain brands which it is all but impossible to purchase in the market at any price. The demand for these brands is fully as pressing at home as on the Continent. For the United States there are fair inquiries, and prices are hardening. The unsettled condition of the labour market has tended greatly to produce the present condition of the trade, it being felt by merchants and consumers that there is a possibility of values being considerably enhanced should there be a general advance of wages in the mining trade. The stock in Messrs. Connal and Co.'s stores has decreased fully 1000 tons in the course of the week, and altogether the position of the trade is very encouraging.

Business was done in the warrant market on Friday at from 50s. 2½d. to 50s. 5d. cash. On Monday the market was very strong, with transactions in the forenoon at 50s. 3d. to 50s. 7d. cash, and 50s. 6d. to 50s. 9½d. one month; the afternoon quotations being 50s. 7½d. to 50s. 9½d. cash, and 51s. 0½d. one month. Business was done on Tuesday morning at 50s. 10½d. to 51s. 1d. cash, and 51s. 3d. to 51s. 4d. one month; in the afternoon transactions were effected at from 51s. to 50s. 10½d. cash. On Wednesday business was at 50s. 10d. up to 51s. 2½d. cash, and 51s. to 51s. 5½d. one month. The market was again strong to-day —Thursday—at 51s. 7d. cash, and 51s. 10d. one month.

As indicated above, the values of makers' iron have very materially advanced since last week, and the tendency of the special brands is apparently still upwards. The quotations are as follow:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 65s.; No. 3, 55s.; Coltness, No. 1 unquoted; No. 3, 55s. 6d.; Langloan, 67s. 6d. and 56s. 6d.; Summerlee, 64s. 6d. and 54s.; Calder, 63s. 6d. and 54s.; Carnbroe, 57s. and 52s. 6d.; Clyde, 55s. and 52s. 6d.; Monkland, Quarter, and Govan, each 52s. 6d. and 50s. 6d.; Shotts, at Leith, 66s. and 56s. 6d.; Carron, at Grangemouth, 53s.—specially selected, 56s.—and 52s.; Kinneil, at Bo'ness, 51s. and 49s. 6d.; Glengarnock, at Ardrossan, 57s. 6d. and 52s. 6d.; Eglinton, 53s. and 51s.; Dalmellington, 53s. and 51s.

The imports of Cleveland iron are larger considerably this week, and will likely increase in bulk now for a succession of weeks.

Malleable iron is in request, at an advance of 5s. to 10s. per ton.

The directors of the Steel Company of Scotland have a highly favourable report to present to the shareholders for the year ending 31st July last. At the Hallside Works £7763 15s. 1d. had been expended in various additions to machinery and plant, as well as other requisites, including a system of electric lighting, enabling work to be performed more efficiently at night. The amount expended on the Blochairn Works had been £19,415 16s. 9d., which nearly completed the alterations contemplated when the company began operations; but it may be necessary to make some further additions to the works. The make of steel at Hallside for the twelve months was 91,481 tons, and at Blochairn 66,197 tons, which is considerably in excess of the total estimate of production. This steel had been finished in all the various products for which the company has appliances—blooms, rails, plates, sheets, angles, channels, bars, strips, hoods, rods, forgings, and castings. The directors state that the machinery has been fully employed, and the production disposed of at fairly remunerative prices, notwithstanding the keen competition in this branch of industry. After adding to the reserve fund, and making provision for depreciation, interest, &c., there remains a balance of profits amounting to £27,753 12s., out of which a dividend of 7 per cent. is to be paid, carrying £3686 forward to the account of the present year.

The coal trade is active, and prices are a shade firmer. The past week's shipments have been a good average. Coalmasters and consumers are somewhat anxious with reference to the movement which has now commenced among the miners for an advance in wages. Were all parts of the country united and agreeable to advance wages, there could be no difficulty in the matter. Coals have been cheap for a long time, and it is not believed that any industry would suffer materially by the prices being so far advanced as would admit of the miners obtaining their demand of 6d. a day. But if the increase is granted in one district and not in others, that district immediately suffers by competition. The whole question is surrounded with difficulty and doubt, even the miners themselves being not quite agreed on a strike. Their union funds are very low, and they naturally are expected to hesitate before pushing matters to extremes. A conference of delegates of Scotch miners was held in Glasgow on Wednesday, when it was agreed to request an increase of 15 per cent., to come into force on the 4th October.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

The coal and iron trades maintain their prosperous condition, and in addition to a brisk trade being done by house and steam collieries, I note that the anthracite collieries of Carmarthen and Pembrokeshire are busy. Coal trucks from a distance find their way down to Sandersfoot for the anthracite, and I see Llwynypia trucks from the Rhondda up as far as Tenby. There has been a partial resumption of work at Landore, some concession having been made by the manager. The melters are at work at the new works, and only a section of the hammermen are out. I am glad to hear that the prospect is good of a general settlement, as trade is decidedly looking up, our American rail business being healthier than I have seen it of late.

In coal the average export, foreign or coastwise, has been maintained. The port of Cardiff in particular has been very busy. Signs of an advance of wages are forthcoming. The collieries outside of the Association are meditating this course, and doubtless it will be followed by the others.

The Ocean colliers have agreed to cancel the six months' notice, and a revised scale will soon be in operation. The proposals to base averages on other coals as well as the Oceans have been withdrawn. The principal feature of the new scale is to split the 9d.; that is, instead of waiting for prices to advance 9d. before wages advance, to give 2½ per cent. as soon as 4½d. increase has been attained.

In the Forest of Dean a probable advance of wages to colliers is only a question of a few days. The industries of the Forest, in coal particularly, are active.

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.

19th September, 1882.

4437. Fastenings, &c., for Blinds and Wires, S. C. C. Currie, London.
4438. Blind Roller Furniture, J. W. Andrews, Whittlesea.
4439. Printing Fabrics, J. Ingleby.—(*R. Anke, Germany.*)
4440. Freeing Ferruginous Solutions of Salts from Iron, C. Semper, Philadelphia, U.S.
4441. Coupling, &c., Railway Vehicles, C. C. Braithwaite, London.
4442. Air Gas, H. J. Haddan.—(*D. H. Martin, Queensland.*)
4443. Combined Spade and Pick, H. McC. Alexander, Castle Rowe, Ireland.
4444. Nails and Screws, S. Beaven, Brazil.
4445. Lighting, &c., Gas Chandeliers, E. Horton, Birmingham.
4446. Electrical Meters, T. J. Handford.—(*T. A. Edison, New Jersey, U.S.*)
4447. Treatment of Bark, &c., W. M. Riddell, London.
4448. Hermetically Sealed Vessels, W. A. Barlow. —(*A. Luger, Vienna.*)
4449. Combined Range and Register Stoves, W. Y. Stevens, Bristol.
4450. Porcelain Insulators, W. E. Langdon, Derby, and J. C. Fuller and G. Fuller, London.
4451. Ventilating Railway Carriages, G. W. von Nawrocki.—(*Messrs. Dorn and Co., Hamburg.*)
4452. Guard Rails for Boats, J. Gunn, Golspie.
4453. Revolving Chairs, R. Cruikshank, jun., Denny.
4454. Transmitters for Telephones, W. P. Thompson. —(*G. F. Milliken, J. W. Brown, and H. D. Hyde, U.S.*)
4455. Feed Cups for Lubricants, R. Baird, Glasgow.
4456. Harvesting Sugar Cane, &c., T. D. Stetson. —(*W. C. Dollens & G. H. Zschech, Indianapolis, U.S.*)
4457. Connecting Lamps to Shafts of Bicycles, &c., J. Lucas, Birmingham.
4458. Carbon Conductors for Electric Lamps, W. R. Lake.—(*E. Weston, Newark, U.S.*)
4459. Treatment of Middlings, W. R. Lake.—(*C. Brown, St. Louis, U.S.*)
4460. Batteries for Generating Electricity, G. G. Skrivanow, Paris.
4461. Dynamo-electric Machines, J. W. Swan, Newcastle-upon-Tyne.
4462. Chimney Tops, J. McPhail, London.
4463. Buttoned Boots, C. Chambers, London.
4464. Driving Screw Piles, T. Wrightson and W. Clark, Stockton-on-Tees.
4465. Biscuits, G. Baruch, Podgorze, Austria.
4466. Closing, &c., Window Frames, E. Edwards.— (*A. Descaves and D. Halut, Paris.*)
4467. Joining, &c., Ends of Rails, E. Talbot, London.
4468. Nut Locks, C. A. Snow.—(*L. Triplett, jun., U.S.*

20th September, 1882.

4469. Vases, F. Barford, Hemel Hempstead.
4470. Tricycles and Bicycles, D. Pidgeon, Putney.
4471. Absorbing, &c., Grease from Tin and Terne Plates, T. N. Pickford, Newport.
4472. Working Tram-cars by Ropes, C. Hinksman, London.
4473. Bicycles and Tricycles, C. Clarke, London.
4474. Washing, &c., China Clay, J. F. Lackersteen, New Cross.
4475. Preventing Noise of Sewing Machines, I. Hain. —(*J. B. Hain, Newark, U.S.*)
4476. Wheels for Railway Carriages, G. W. von Nawrocki.—(*R. Sydow, Germany.*)
4477. Soap, J. Glover, Silcoates.
4478. Self-acting Tackle Hooks, J. T. Roe, Wandsworth.
4479. Securing Windows, W. McNicol, Leith.
4480. Tablet Diaries, J. W. Cochrane, Glasgow.
4481. Decoration of Ceramic Ware, A. Wenger, Hanley.
4482. Handles for Cutlery, H. Hall, Wetherby, and T. W. Hall, Sheffield.
4483. Spring Packings for Metallic Piston Rings, J. Duffield, Dore.
4484. Resistance Coils, J. Johnson.—(*P. Uzel, Paris.*)
4485. Shields for Protecting, &c., Buttons, W. P. Thompson.—(*Messieurs D. Sauget and N. A. Aubertin, and Madame V. Grangier, Paris.*)
4486. Biscuits, &c., T. C. S. Cook, Reading.
4487. Treatment of Phosphorites, J. Imray.—(*General L. Dandenart, Brussels.*)
4488. Hair Pins, F. Kingston, St. John's.
4489. Gas Engine Motors, F. W. Crossley, Manchester.
4490. Secondary, &c., Voltaic Batteries, A. Khotinsky, London.
4491. Drip Course Bricks, W. H. Cooper, London.
4492. Producing, &c., Electric Currents, A. R. Sennett, Worthing.
4493. Registering Padlocks, W. R. Lake.—(*R. G. Usher and C. C. Dickerman.*)
4494. Grape Sugar or Glucose, W. R. Lake.—(*W. T. Jebb, Buffalo, U.S.*)
4495. Bricks, W. R. Lake.—(*H. R. Dickinson, U.S.*)
4496. Manufacturing Wire Netting, M. A. F. Mennons.—(*F. H. Monmon, Paris.*)

21st September, 1882.

4497. Gas Lamps, I. Spielmann, London.
4498. Sugar Mills, E. Death & J. Ellwood, Leicester.
4499. Stitching Machines, B. Hague, Nottingham.
4500. Doubling and Winding Machines, J. and J. Horrocks, Manchester.
4501. Embroidering Machines, A. M. Clark.—(*J. A. Groebli, New York, U.S.*)
4502. Rigging of Boats, &c., G. Hughes, Wolverhampton.
4503. Governing Electric Currents, J. S. Beeman, W. Taylor, and F. King, London.
4504. Measuring Electric Force, &c., J. S. Beeman, W. Taylor, and F. King, London.
4505. Wheels and Axles, W. Morgan-Brown.—(*G. W. Miltimore, Chicago, U.S.*)
4506. Nut Crackers, W. Brown and D. Robertson, Glasgow.
4507. Leather Paring Machines, E. G. Brewer.—(*H. Mayer, Paris.*)
4508. Steel or Iron Ingots, P. M. Justice.—(*A. Cooper, Vienna.*)
4509. Drain Pipes, F. H. Noott, London.
4510. Lamps Burning Mineral Oils, J. Imray.—(*R. Ditmar, Vienna.*)
4511. Storing, &c., Electricity, J. D. F. Andrews, Glasgow.
4512. Portable Voltaic Batteries, J. Mackenzie, London.
4513. Potato Planting Machines, H. Gardner.—(*R. Wuensche, Herrnhut, Saxony.*)
4514. Forming Partitions, &c., J. W. Cook, London.
4515. Looms for Weaving, W. Smith, Heywood.
4516. Fire-arms, W. W. Greener, Birmingham.
4517. Hay Bogie, R. Swann and J. Batie, Bedlington.
4518. Shipping, &c., Rudders of Ships, M. Horsley, Hartlepool.

22nd September, 1882.

4519. Ventilating Saloons of Ships, J. and J. K. Leather, Liverpool.
4520. Button-hole Attachment to Sewing Machines, I. Nasch, London.
4521. Sizing Machines, W. Whalley, Amsterdam.
4522. Spring Mattresses, J. Lokie, Glasgow.
4523. Malted Farinaceous Food, J. Schweitzer, London.
4524. Gas, &c., Stoves, J. S. Willway, Bristol.
4525. Secondary Batteries, F. M. Lyte, London.
4526. Preventing Shocks to Ships, &c., B. C. Le Moussu, London.
4527. Electro-magnetic Engraving Machines, B. J. Carter.—(*G. McK. Guerrant, New York.*)
4528. Frosted Glass, W. H. Beck.—(*G. Bay, Paris.*)
4529. Paper Pulp from Plants, W. R. Lake.—(*E. V. J. L. Gorges, Paris.*)
4530. Coupling Apparatus, A. W. L. Reddie.—(*Compagnie des Appareils Automatiques pour Accrocher et Décrocher les Wagons des Chemins de Fer, Paris.*)
4531. Perambulators, W. J. Ingram, London.

23rd September, 1882.

4532. Regulating Currents from Voltaic Cells, W. E. Ayrton and J. Perry, London.
4533. Ships, J. Scott, Helensburgh.
4534. Railway Couplings, R. Lansdale, Halewood.
4535. Dynamo-electric Machines, F. C. Glaser.—(*C. Zipernowsky and M. Deri, Buda Pesth.*)
4536. Stop Watches, H. J. Haddan.—(*O. F. Domon, Belfort, France.*)
4537. Folding Cases, H. J. Haddan.—(*A. Collin, Rouen, France.*)
4538. Purifying Illuminating and other Gas, H. Symons, Totnes.
4539. Iron, W. Clarke, Birmingham.
4540. Harvesting Machines, J. Paul, Birmingham.
4541. Breech-loading Fire-arms, H. and E. Hammond, Winchester.
4542. Pumps, J. S. Sawrey, A. Attwood, and H. Woodburne, Ulverston.
4543. Producing Electric Currents, F. Swift, West Drayton, and A. J. M. Reade, Slough.
4544. Compound Atmospheric Funnels, E. Wery.— (*G. E. Wery, Paris.*)
4545. Manufacturing, &c., Gas, J. Coley-Bromfield, Hove, and G. Symes, London.
4546. Extracting Moisture from Air, W. R. Lake.— (*R. S. Jennings, Baltimore, U.S.*)
4547. Dynamo-electric Machines, R. Barker, Seacombe.
4548. Mechanism for Transporting Goods, &c., F. Jenkin, Edinburgh.

25th September, 1882.

4549. Metal Hurdles, S. Bayliss and W. Bailey, Wolverhampton.
4550. Indicating the Presence, &c., of Water in Cisterns, J. Shaw and F. Milan, Lockwood.
4551. Railway Wagon, &c., Couplings, T. Archer, jun., Dunston.
4552. Paints, &c., for Coating Ships' Bottoms, A. B. Rodyk.—(*N. B. Dennys, Singapore.*)
4553. Injectors, H. J. Haddan.—(*W. E. Macdonald, U.S., and J. Morrison, Canada.*)
4554. Loading, &c., Carts, F. Wheeler, West Cowes.
4555. Dynamo-electric Machines, A. Lalance and M. Bauer, Paris.
4556. Tobacco Pipes, E. Lorge, St. Claude, France.
4557. Looms for Weaving, H. Lomax, Darwen.
4558. Dividing, &c., Dough, R. Abercromby, Glasgow.
4559. Steam Boilers, T. Gilmour, Kilcattan, and J. Gilmour, Glasgow.
4560. Machines for Composing, &c., Type, E. G. Brewer.—(*I. Delcambre & Madame V. Riesz, Brussels.*)
4561. Secondary Batteries, &c., F. C. Hills, Deptford.
4562. Producing Relievos, L. H. Philippi, Hamburg.
4563. Brake Mechanism for Carriages, A. Oliver, Hawkhurst.
4564. Supports for Revolving Chairs, J. Unger, Cannstatt, Germany.
4565. Bottles, &c., A. Pullan, London.
4566. Governing Apparatus for Steam Engines, B. Fowler and W. Daniel, Leeds.

Inventions Protected for Six Months on Deposit of Complete Specifications.

4407. Galvanic Elements, J. H. Johnson, Lincoln's-inn-fields, London.—A communication from A. Bernstein, Berlin.—*16th September*, 1882.
4428. Artificial Leather, E. Fischer, Kaltwasser, Prussia.—*18th September*, 1882.
4440. Freeing Ferruginous Solutions of Salts from Iron, C. Semper, Philadelphia, U.S.—*19th September*, 1882.
4442. Air Gas, H. J. Haddan, Kensington, London.— A communication from D. H. Martin, Ipswich, Queensland.—*19th September*, 1882.
4465. Biscuits, G. Baruch, Podgorze Gallice, Austria. —*19th September*, 1882.
4468. Nut Locks, C. A. Snow, Washington, U.S.—A communication from L. Triplett, jun., Shenandoah, U.S.—*19th September*, 1882.
4501. Embroidering Machines, A. M. Clark, Chancery-lane, London.—A communication from J. A. Groebli, New York, U.S.—*21st September*, 1882.

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

3765. Lid for Feeding Holes of Oil-cans, J. Kaye, Kirkstall.—*19th September*, 1879.
3740. Coupling, &c., Railway Vehicles, J. Brown and J. Esplen, Barrow-in-Furness.—*18th September*, 1879.
3756. Tricycle, W. W. Brereton, Oughtenard, and J. W. Brereton, Reading.—*18th September*, 1879.
3848. Retorts for Coal Gas, W. Grice, Birmingham. —*24th September*, 1879.
4521. Handles of Trowels, G. Heaton, Oldbury.— *5th November*, 1879.
4715. Getting, &c., China Clay, T. Stocker, St. Austell.—*20th November*, 1879.
3760. Producing Designs upon Metal Surfaces, W. B. Woodbury, South Norwood.—*19th September*, 1879.
3804. Caustic Soda, W. J. Menzies, St. Helens.—*22nd September*, 1879.
3797. Band-sawing Machinery, J. A. Brophy, London.—*22nd September*, 1879.
3836. Producing Motive Power from Bisulphide of Carbon, W. R. Lake, London.—*23rd September*, 1879.
3873. Heels for Boots and Shoes, F. Richardson, Providence, U.S.—*25th September*, 1879.
3992. Expressing Liquids from Substances, J. H. Johnson, London.—*4th October*, 1879.
3798. Construction of Ceilings, J. Imray, London.— *22nd September*, 1879.
3811. Tawing of Skins, W. E. Gedge, London.—*22nd September*, 1879.
3800. Spring Rollers for Blinds, G. D. Peters, London.—*22nd September*, 1879.
3827. Manufacture of Gas, H. Reeves, Camberwell.— *23rd September*, 1879.
3900. Looms for Weaving, O. Pickles, B. Smith, and C. Slater, Burnley.—*27th September*, 1879.
3904. Hydrocarbon Stoves, &c., W. B. Woolley, Birmingham.—*29th September*, 1879.
4102. Securing the Wheels of Pit Corves, G. H. Dixon, Sheffield.—*10th October*, 1879.
4104. Concentrating Acids, H. E. Newton, London. —*10th October*, 1879.
3843. Electrical Signalling Apparatus, A. M. Clark, London.—*24th September*, 1879.
3844. Hydrocyanic Acids, &c., J. Imray, London.— *24th September*, 1879.
3849. Springs for Seats of Bicycles, J. Harrington, Ryde.—*24th September*, 1879.
3869. Stopping Bottles, H. Codd, London.—*25th September*, 1879.
4069. Shrapnel Shell, Sir W. G. Armstrong, Newcastle-upon-Tyne.—*8th October*, 1879.

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

3280. Sewing Boots, &c., J. H. Johnson, London.— *18th September*, 1875.
3340. Galvanic Battery, J. C. and G. Fuller, London. —*24th September*, 1875.
3471. Machinery for Rolling Iron, &c., J. O. and A. E. H. B. Butler, Leeds.—*6th October*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 13th October, 1882.

2200. Apparatus for Indicating a Ship's Position, A. W. Tuer & J. Cleminson, London.—*10th May*, 1882.
2288. Electric Lamps, E. L. Voice, London.—*16th May*, 1882.
2305. Apparatus for Registering Number of Persons Entering, &c., Theatres, &c., J. Morris, Liverpool. —*17th May*, 1882.
2309. Spring Motors, H. J. Haddan, London.—A com from A. Marquès and J. Montcenis.—*17th May*, 1882.
2310. Reversible and Combined School Desk, Seat, and Table, W. R. Thomas, Peterborough.—*17th May*, 1882.
2312. Children's Chairs, G. W. von Nawrocki, Berlin. —A com. from L. Schmetzer.—*17th May*, 1882.
2313. Tables, G. W. von Nawrocki, Berlin.—A communication from L. Schmetzer.—*17th May*, 1882.
2314. Roofs for Carriages, &c., G. W. von Nawrocki, Berlin.—A com. from L. Schmetzer.—*17th May*, 1882.
2315. Apparatus for Marking out the Lines on Lawn Tennis Courts, W. Burrows and G. Dawson, Leeds. —*17th May*, 1882.
2327. Attaching Knobs to Spindles, T. H. P. Dennis, Chelmsford.—*17th May*, 1882.
2329. Gas Engines, W. B. Hutchinson, London.—*18th May*, 1882.
2342. Gas Engines, W. Watson, Harrogate.—*18th May*, 1882.
2346. Overmantels of Chimney-pieces, G. H. Haywood, London.—*18th May*, 1882.
2355. Machinery for Cutting Teeth of Files, P. Ewens, Cheltenham.—*19th May*, 1882.
2361. Velocipedes, G. D. Macdougald, Dundee.—*19th May*, 1882.
2364. Dynamo-electric Machines, R. Werdermann, London.—*19th May*, 1882.
2376. Preparing Claret for Combination with Lemonade, J. Prosser, London.—*19th May*, 1882.
2377. Gullies, H. Kelly, Hampstead.—*20th May*, 1882.
2378. Composition for Preserving Leather, W. Gedge, London.—A com. from J. Granger.—*20th May*, 1882.
2380. Velocipedes, A. Phillips, South Birmingham.— *20th May*, 1882.
2386. Drawing Apparatus for Continuous Spinning Machines, L. A. Groth, London.—A communication from R. Sohrke.—*20th May*, 1882.
2437. Telephonic Apparatus, W. R. Lake, London.— A com. from C. E. Chinnock.—*23rd May*, 1882.
2438. Cases for Millstones, E. Edwards, London.—A com. from F. D. C. Iwand.—*23rd May*, 1882.
2441. Machinery for Compressing Fodder, J. Wetter, London.—A com. from M. Laporte.—*23rd May*, 1882.
2457. Determining Geographically the Situation of Vessels at Sea, P. M. Justice, London.—A communication from J. J. Oginaga.—*24th May*, 1882.
2467. Cotton Presses, W. R. Lake, London.—A communication from S. B. Steers.—*24th May*, 1882.
2469. Shuttle-boxes for Looms, W. P. Thompson, London.—A com. from E. Lepainteur.—*24th May*, 1882.
2474. Fluid Meters, C. D. Abel, London.—A communication from C. Schreiber.—*24th May*, 1882.
2483. Universal Embroidering Machines, W. Gedge, London.—A com. from E. Cornely.—*25th May*, 1882.
2556. Window Screens, G. L. Reynolds, Oakland.— *30th May*, 1882.
2660. Carbon Burners for Electric Lamps, J. Wetter, New Wandsworth.—A communication from W. Stanley.—*7th June*, 1882.
2682. Treating Carbonaceous, &c., Substances, H. Aitken, Falkirk.—*8th June*, 1882.
3366. Smoke-flues of Metallurgical Works, H. J. Haddan, London.—A communication from Mechernicher Bergwerks-Actien-Verein.—*15th July*, 1882.
3426. Dust-collecting Flues, H. J. Haddan, London. —A communication from Mechernicher Bergwerks-Actien-Verein.—*19th July*, 1882.
3643. Ammonia, A. Feldman, Bremen.—*1st August*, 1882.
3710. Electric Lighting, T. Parker, Coalbrookdale, and P. B. Elwell, Wolverhampton.—*4th August*, 1882.
3738. Chalk Holder for Use of Tailors, &c., C. E. Bryant, London.—*5th August*, 1882.
3740. Chemical Product for Bleaching, J. C. Mewburn, London.—A communication from J. Vercruysse-Degraeve.—*5th August*, 1882.
3765. Spools for Sewing Thread, E. Hunt, Glasgow. —A com. from I. C. Davis.—*8th August*, 1882.
3774. Repeating Fire-arms, J. Imray, London.—A com. from F. Mannlicher.—*8th August*, 1882.
3791. Extinguishing Fire, P. M. Justice, London.—A com. from V. Vankeerberghen.—*9th August*, 1882.
3805. Apparatus for Hardening Steel Wire, S., M., and A. Wood, Brighouse.—*10th August*, 1882.
3867. Ironing Machine, H. Podger and W. H. Davey, London.—*14th August*, 1882.
3913. Baking Ovens, J. R. Chibnall, Hammersmith.— *16th August*, 1882.
3919. Coffins, S., J., and R. Turner, Rochdale.—*16th August*, 1882.
4005. Non-conducting Tubes, J. C. Marsh and R. J. Smith, London.—*21st August*, 1882.
4428. Artificial Leather, E. Fischer, Kaltwasser.— *18th September*, 1882.
4440. Freeing Ferruginous Solutions of Certain Salts from Iron, C. Semper, Philadelphia, U.S.— *19th September*, 1882.

Last day for filing opposition, 17th October, 1882.

2152. Apparatus for Consuming Smoke, W. Beasley, Birmingham.—*8th May*, 1882.
2379. Consuming Smoke, H. C. Paterson, London.— *20th May*, 1882.
2395. Fireplaces, H. Greenhous, Worcester.—*22nd May*, 1882.
2401. Agglomerating Minerals, J. Wetter, London. —A com. from A. Simon & V. Petit.—*22nd May*, 1882.
2402. Tubes, B. Rhodes, London.—*22nd May*, 1882.
2405. "Knocking up" Sheets Delivered from Printing Machines, T. Hewson, London.—*22nd May*, 1882.
2406. Tricycle, H. Hazard, London.—*22nd May*, 1882.
2413. Lawn Mowers, R. Kirkman, jun., Cosby.—*22nd May*, 1882.
2425. Incandescent Electric Lamps, J. J. Barrier and F. T. de Lavernède, Paris.—*23rd May*, 1882.
2439. Machines for Pasting Together Shoe Uppers, A. J. Boult, London.—A communication from S. L Wiegand.—*23rd May*, 1882.
2446. Stems for Fusees, &c., F. H. V. Byrt, Peckham. —*24th May*, 1882.
2449. Treating Spent Lyes of Soap Works, F. H. T. Allan, Warrington.—*24th May*, 1882.

2453. HUBS for WHEELS, H. A. Bonneville, London.—A communication from J. Lajeunesse and E. Armant. —24th May, 1882.
2454. ROTARY CUTTERS, H. A. Bonneville, London.—A communication from E. Salomon and E. Armant. —24th May, 1882.
2459. MACHINE for SWEEPING STREETS, B. W. Stevens, Birmingham.—24th May, 1882.
2460. THRASHING MACHINES, P. Gibbons and A. S. F. Robinson, Wantage.—24th May, 1882.
2468. BELL ALARMS, W. P. Thompson, London.—A communication from F. N. Cottle.—24th May, 1882.
2473. PIANOS, &c., F. C. Glaser, Berlin.—A communication from A. Battes.—24th May, 1882.
2475. REAPING MACHINES, T. Culpin, London.—24th May, 1882.
2477. DOMESTIC FIREPLACES, J. Smith, Liverpool.—25th May, 1882.
2505. AXLE-BOXES, H. Simon, Manchester.—A communication from La Société Anonyme des Ateliors de la Dyle.—26th May, 1882.
2514. APPARATUS for RAILWAY SIGNALLING, J. White, Bermondsey.—26th May, 1882.
2515. HAY-MAKING MACHINES, S. H. Dening, Chard.—26th May, 1882.
2520. MACHINES for BREAKING COKE, H. J. H. Thomas and J. Somerville, London.—27th May, 1882.
2525. APPARATUS for MAKING HATS, J. C. Bramall, Woodley, and W. G. Bywater and J. Teale, Holbeck. —27th May, 1882.
2530. DOMESTIC STOVES, H. Ransford, Brighton.—27th May, 1882.
2582. MEASURING, &c., SPEED of TRAINS, F. C. Glaser, Berlin.—A communication from the Werkzeug und Maschinenfabrik Oerlikon.—31st May, 1882.
2592. QUICK-ADJUSTING VICES, P. Lawrence, London. —1st June, 1882.
2593. WRENCHES, P. Lawrence, London.—1st June, 1882.
2670. PLUGS for GAS, &c., MAINS, C. J. T. Hanssen, Flensburg.—7th June, 1882.
2676. FORMING ELECTRODES for SECONDARY BATTERIES, A. M. Clark, London.—A communication from J. M. A. Gérard-Lescuyer.—7th June, 1882.
2684. SHIPS' STEERAGE BERTHS, A. Nickels, Liverpool. —8th June, 1882.
2941. WHEELS, J. S. Ayton, Stoke-on-Trent, and T. Floyd, London.—21st June, 1882.
3339. ARC REGULATOR LAMP, R. E. B. Crompton, London.—14th July, 1882.
3340. SECURING GLASS to SASH BARS, A. Drummond, Edinburgh.—14th July, 1882.
3384. CUTTING HELICAL GROOVES, H. J. Haddan, London.—A com. from J. Martignoni.—17th July, 1882.
3398. PRODUCING TRANSPARENT PATTERNS on GLASS, D. Reich, Berlin.—17th July, 1882.
3642. APPARATUS for SCULLING BOATS, T. J. Edwards, London.—1st August, 1882.
3664. SECURING TARPAULINGS, T. Marlborough and J. Cunningham, Sunderland.—2nd August, 1882.
3668. LUBRICATING MACHINERY, B. A. Dobson, Bolton. —2nd August, 1882.
3672. FIGURED CLOTH, J. Kirkman, R. Smith, and P. Entwistle, Bolton.—2nd August, 1882.
3752. TRANSMITTING ELECTRICITY, T. J. Handford, London.—A com. from T. Edison.—5th August, 1882.
3755. ELECTRICAL METERS, T. J. Handford, London.—A com. from T. A. Edison.—5th August, 1882.
3756. DYNAMO-ELECTRIC MACHINES, T. J. Handford, London.—A com. from T. Edison.—5th August, 1832.
3814. ELECTRIC LAMP APPARATUS, H. J. Haddan, London.—A com. from C. F. Brush.—10th August, 1882.
3949. SUPPLYING ELECTRICITY, T. J. Handford, London.—A com. from T. A. Edison.—17th August, 1882.
3950. ELECTRIC GENERATORS, S. Z. de Ferranti and A. Thompson, London.—17th August, 1882.
3955. INCANDESCING ELECTRIC LAMPS, T. J. Handford, London.—A com. from T. Edison.—18th August, 1882.
3961. SECONDARY BATTERIES, T. J. Handford, London. —A com. from T. A. Edison.—18th August, 1882.
3991. INCANDESCING CONDUCTORS, T. J. Handford, London.—A com. from T. A. Edison.—19th August, 1882.
3995. UNDERGROUND CONDUCTORS, T. J. Hanford, London.—A com. from T. A. Edison.—21st August, 1882.
4091. WIND MOTORS, H. Lübben, Hanover.—26th August, 1882.
4185. STOPPERS for BOTTLES, N. Thompson, London.—2nd September, 1882.
4442. AIR GAS, H. J. Haddan, London.—A communication from D. H. Martin.—19th September, 1882

Patents Sealed.

(List of Letters Patent which passed the Great Seal on the 22nd September, 1882.)

1396. PURIFYING, &c., SEWAGE, G. J. Andrews and F. H. Parker, London.—22nd March, 1882.
1407. AUTOMATIC GEAR for PREVENTING OVERWINDING, W. T. Lewis, Aberdare, and W. H. Massey, Henley-on-Thames.—23rd March, 1882.
1422. UMBRELLAS, J. Minière, Paris.—24th March, 1882.
1429. RAISING and FORCING ACIDS, C. T. Wordsworth, Leeds, and J. Wolstenholme, Radcliffe.—24th March, 1882.
1436. ADAPTING SHIPS' FURNITURE for SAVING LIFE, J. Z. Cressy, Glasgow.—25th March, 1882.
1442. MAKING BEATER BARS for THRASHING MACHINES, C. Green, Lincoln.—25th March, 1882.
1443. MEASURING RATE of MOTION of a SHIP, J. Armstrong, New Swindon.—25th March, 1882.
1444. ELECTRIC INCANDESCENT LIGHTING APPARATUS, R. Werderman, London.—25th March, 1882.
1452. CHUCKS, &c., J. M. Alling, London.—25th March, 1882.
1454. APPARATUS for RAISING WATER, G. Macaulay-Cruikshank, Glasgow.—27th March, 1882.
1459. PORTABLE FIELD FORGE, L. A. Groth, London.—27th March, 1882.
1460. APPARATUS for PRODUCING ICE, C. D. Young, London.—27th March, 1882.
1463. DRESS of DIVERS, W. H. Skipper, London.—27th March, 1882.
1464. ELECTRIC PILES, F. de Lalande, Paris.—27th March, 1882.
1468. FIRE-PROOF PLATES, C. D. Abel, London.—27th March, 1882.
1469. TUBE BEADERS, J. A. Frieake and T. McCormick, London.—27th March, 1882.
1471. METALLIC PACKING for STUFFING-BOXES, W. V. Ley, Liverpool.—27th March, 1882.
1473. MOREEN FABRICS, E. H. Wade, Bradford.—27th March, 1882.
1492. FOLDING BEDS, J. Rycroft, Manchester.—28th March, 1882.
1506. APPARATUS for MAKING ICE, J. J. Coleman, Glasgow.—29th March, 1882.
1536. BEDSTEADS, &c., J. Reynolds, Worcester.—30th March, 1882.
1540. CLUTCH, F. W. T. C. Cordua, London.—30th March, 1882.
1541. OBTAINING BENZOLE from COAL GAS, J. A. Kendall, Dalston.—30th March, 1882.
1543. CAPSULES for BOTTLES, &c., C. Cheswright, London.—30th March, 1882.
1566. LOOMS for WEAVING, J. Wade, Wortley.—31st March, 1882.
1567. CONCENTRATED MILK, E. Kunkler, London.—31st March, 1882.
1585. SEPARATING the PRODUCTS of COMBUSTION of COAL GAS, &c., J. F. Allan and W. B. Adamson, Glasgow. —1st April, 1882.
1598. MACHINERY for GRINDING SPINDLES, G. Ryder and M. Fielding, Bolton.—1st April, 1882.
1606. APPARATUS for WORKING the BLOCK SYSTEM, H. J. Haddan, London.—3rd April, 1882.
1632. HYDRAULIC CRANES, &c., E. Priestman, Sheffield. —4th April, 1882.
1681. BRAKES, &c., J. P. Davies, Chester.—6th April, 1882.
1689. ELECTRIC LAMPS, G. S. Young, Blackwall, and R. J. Hatton, Stratford.—6th April, 1882.
1716. APPARATUS for WASHING COAL, T. Bell, jun., Saltburn-by-the-Sea, and W. Ramsay, Tursdale Colliery. —11th April, 1882.
1720. LETTER FILES, W. P. Thompson, London.—11th April, 1882.
1742. PREPARING BEVERAGES, F. P. Beck, Brussels.—12th April, 1882.
1806. CASING for TORPEDO BOATS, A. L. S. Leighs, London.—15th April, 1882.
1808. APPARATUS for PICKLING METAL PLATES, J. R. Turnock, Dafen.—15th April, 1882.
1830. MECHANISM USED for TRANSPORTING GOODS, &c., F. Jenkin, Edinburgh.—17th April, 1882.
1895. ELECTRIC LIGHTING, P. M. Justice, London.—20th April, 1881.
1928. RENDERING MINERAL OILS UNINFLAMMABLE, E. de Pass, London.—22nd April, 1882.
2142. PLOUGHS, C. A. Snow, Washington, U.S.—6th May, 1882.
2204. PRINTING MACHINES, W. R. Lake, London.—10th May, 1882.
2208. PRINTING MACHINES, W. R. Lake, London.—10th May, 1882.
2584. DRIVING, &c., SEWING MACHINES, A. D. Pentz, Elizabeth, U.S.—1st June, 1882.
2729. STEEL INGOTS, I. Beardmore, Glasgow.—10th June, 1882.
2730. TREATING WASTE LIME, G. R. Hislop, Paisley.—10th June, 1882.
2872. DISTILLATION of SPIRIT, J. T. Board, Bristol.—17th June, 1882.
3240. PLATES for ELECTRIC ACCUMULATORS, T. S. Sarney and J. M. Alphovidge, London.—8th July, 1882.
3250. WORKING FURNACES, J. Burch, Stockport, and R. Allen, Manchester.—8th July, 1882.

(List of Letters Patent which passed the Great Seal on the 26th September, 1882.)

1486. BOTTLES, D. Rylands, Stairfoot.—28th March, 1882.
1498. METALLIC SHINGLES, W. R. Lake, London.—28th March, 1882.
1505. PAPER FILES, A. Ellis, Lewes.—29th March, 1882.
1513. TAPS and VALVES, F. Robinson, Bradley.—29th March, 1882.
1519. CHAIRS for RAILS, W. J. Boaler, London.—29th March, 1882.
1526. TRANSMITTING TELEGRAPHIC MESSAGES, W. R. Lake, London.—29th March, 1882.
1532. FURNACES, A. J. Boult, London.—29th March, 1882.
1533. EXTRACTING GASES from METALS, &c., R. Aitken, London.—29th March, 1882.
1549. STEELYARDS, A. J. Boult, London.—30th March, 1882.
1551. CONTROLLING, &c., VALVES, J. S., T. A., and E. R. Walker, Wigan.—30th March, 1882.
1556. GENERATING, &c., ELECTRICITY, J. S. Williams, London.—30th March, 1882.
1562. REGISTERING NUMBER of PERSONS in PUBLIC CONVEYANCES, H. Lyon, London.—31st March, 1882.
1571. SCREW BUTTONS, E. A. Brydges, London.—31st March, 1882.
1755. METALLIC ROOFING SHINGLES, W. R. Lake, London.—31st March, 1882.
1576. SEPARATING TIN from SCRAP, W. A. Barlow, London.—31st March, 1882.
1578. ADMINISTERING ANÆSTHETICS, W. R. Lake, London.—31st March, 1882.
1583. ELECTRIC BELL and BATTERY, H. Binko, London. —1st April, 1882.
1584. FIREPLACES, &c., G. L. Shorland, Manchester.—1st April, 1882.
1603. PIANOS, W. Fischer, Dresden.—3rd April, 1882.
1617. CUTTING MATCHES, &c., F. Wirth, Frankfort-on-the-Main.—3rd April, 1882.
1639. ELECTRO-DEPOSITING COPPER, &c., W. H. Walenn, London.—4th April, 1882.
1645. ROLLING BARS, &c., A. Riche, London.—5th April, 1882.
1651. FIRE-ESCAPES, W. R. Lake, London.—5th April, 1882.
1655. WATER-CLOSETS, H. Conolly, London.—5th April, 1882.
1659. UTILISING ACTION of WAVES for DRIVING MACHINERY, R. J. Scott, London.—5th April, 1882.
1662. UNDERFRAMES of WAGONS, R. Hadfield, Sheffield. —5th April, 1882.
1663. ARRANGING CIRCUITS, F. D. Goold, London.—5th April, 1882.
1669. TIPPING FRAME for WAGONS, R. Hadfield, London.—6th April, 1882.
1688. PACKING CASES, D. Nicholl, London.—6th April, 1882.
1713. ELECTRIC ARC LAMPS, J. Brockie, Brixton.—11th April, 1882.
1714. STEAM WHISTLE, J. Cran, Leith.—11th April, 1882.
1731. BEVELLING GLASS, T. Parsonage, London.—12th April, 1882.
1864. TRANSMITTING MOTION, A. M. Clark, London.—18th April, 1882.
1919. ELECTRIC ARC LAMPS, J. Lea, London.—22nd April, 1882.
2032. LOCKS, A. M. Clark, London.—29th April, 1882.
2082. IRON and STEEL, T. Lishman, West Hartlepool.—3rd May, 1882.
2087. SPONGE FISHING NETS, H. J. Haddan, London.—3rd May, 1882.
2124. LOCKS for RAILWAY CARRIAGES, J. M. Hart, London.—5th May, 1882.
2147. TOBACCO POUCHES, B. L. James, Wanstead.—6th May, 1882.
2203. PRINTING MACHINES, W. R. Lake, London.—10th May, 1882.
2455. RAISING, &c., WINDOWS, R. J. Iron, Dover.—24th May, 1882.
2679. ATTACHING HANDLES to CUTLERY, T. and J. Brooke, Sheffield.—7th June, 1882.
2980. MANUFACTURE of HORSESHOES, J. C. Mewburn, London.—23rd June, 1882.
3025. DYNAMO-ELECTRIC MACHINES, E. A. Sperry, Cortland, U.S.—27th June, 1882.
3094. WASHING, &c., WOOL, J. Petrie, jun., and F. W. Petrie, Rochdale.—30th June, 1882.
3231. BUNDLING, &c., LETTERS, F. A. R. Russell, London.—7th July, 1882.
3281. ELECTRICAL CONDUCTORS, F. Jacob, London.—11th July, 1882.
3383. MAKING ICE, H. J. Haddan, London.—17th July, 1882.
3419. DYNAMO-ELECTRIC MACHINES, S. Z. de Ferranti and A. Thompson, London.—18th July, 1882.
3445. DRYING and COOLING, H. J. Haddan, London.—20th July, 1882.
3519 EXCAVATING MACHINERY, W. E. Gedge, London, —25th July, 1882.

List of Specifications published during the week ending September 23rd, 1882.

1502*, 4d.; 2909***, 6d.; 3062*, 4d.; 329, 2d.; 333, 6d.; 408, 4d.; 463, 4d.; 471, 2d.; 504, 6d.; 537, 6d.; 609, 6d.; 645, 6d.; 676, 4d.; 695, 2d.; 703, 10d.; 704, 2d.; 726, 6d.; 735, 6d.; 746, 6d.; 775, 4d.; 780, 6d.; 785, 6d.; 787, 4d.; 789, 6d.; 791, 2d.; 792, 6d.; 796, 2d.; 797, 6d.; 799, 6d.; 805, 4d.; 809, 4d.; 813, 8d.; 816, 2d.; 317, 2d.; 820, 2d.; 824, 6d.; 826, 6d.; 827, 2d.; 828, 10d.; 829, 2d.; 830, 2d.; 831, 6d.; 835, 4d.; 836, 2d.; 837, 2d.; 840, 2d.; 841, 6d.; 843, 6d.; 844, 2d.; 846, 2d.; 847, 4d.; 848, 6d.; 849, 6d.; 850, 6d.; 851, 6d; 852, 10d.; 853, 6d.; 854, 4d.; 857, 2d.; 858, 8d.; 859, 2d.; 860, 2d.; 861, 2d.; 862, 2d.; 863, 1s. 6d.; 865, 2d.; 866, 2d.; 868, 6d.; 868, 6d.; 871, 8d.; 873, 10d.; 874, 6d.; 875, 2d.; 876, 6d.; 878, 2d.; 879, 6d.; 882, 4d.; 883, 2d.; 884, 6d.; 885, 4d.; 886, 6d.; 887, 10d.; 888, 8d.; 890, 6d.; 893, 6d.; 894, 2d.; 895, 2d; 896, 6d.; 898, 8d.; 809, 6d.; 901, 2d.; 903, 6d.; 904, 6d.; 905, 4d.; 907, 6d.; 908, 6d.; 919, 6d.; 913, 6d.; 915, 2d.; 916, 6d.; 917, 6d.; 919, 2d.; 921, 6d.; 922, 8d.; 925, 6d.; 927, 6d.; 928, 2d.; 929, 2d.; 932, 6d.; 934, 2d.; 935, 2d.; 236, 4d.; 945, 4d.; 946, 2d.; 947, 2d.; 952, 8d.; 553, 6d.; 957, 4d.; 958, 6d.; 968, 6d.; 987, 6d.; 1024, 8d.; 1472, 6d.; 2644, 10d.; 2690, 4d.; 2744, 6d.

*** 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.

408. COOLING AND MOISTENING PAPER, *F. C. Glaser, Berlin.—26th January, 1882.—(A communication from H. F. Schöller, Duren.)* 4d.

The inventor claims the construction and use of apparatus for cooling and moistening paper, consisting of a cylinder cooled internally by water, and an endless blanket surrounding the cylinder, such blanket being supplied with water from a bath, and subjected to regulated pressure by rollers for removing excess of moisture therefrom.

463. TANNING OF HIDES, &c., *W. R. Lake, London.—30th January, 1882.—(A communication from C. Vanderstraten, Belgium.)* 4d.

This consists essentially in the process comprising the three successive operations of the vegetable tanning, the mineral tanning, and the treatment with gelatine.

471. FURNACES AND BOILERS OF STEAM ENGINES, *H. L. Williams and J. T. Sinuett.—31st January, 1882.—(Provisional protection not allowed.)* 2d.

This consists especially in the employment of perforated steel plates or fire-brick for the bridge.

504. RAILWAY BRAKE APPARATUS, *H. H. Lake, London.—1st February, 1882.—(A communication from A. Rudolff and M. R von Pichler, Vienna.)* 6d.

The apparatus works by the action of two weights supported by levers, which are connected in such a manner that the one which has to perform the actual braking freely supports the lighter one, which merely gives movement to the brake shafting and the blocks, and causes the approach of the brake blocks to the wheels.

537. BURNER FOR GAS FIRES, *B. Verity, St. Pancras. —3rd February, 1882.* 6d.

This consists in constructing the burner (whether it have one internal chamber as hitherto, or two) of a number of sections or parts fitted together, and it also consists in constructing the burner with two chambers, an upper and a lower one, each extending the whole length of the burner, and communicating with one another at the ends.

609. CRIMPING AND CORRUGATING METAL CARTRIDGE CASES, *W. W. Greener, Birmingham.—8th February, 1882.* 6d.

This consists in the crimping or corrugating of metal cartridge cases from the mouth of the case to the wad over the charge by means of longitudinal furrows, made after the cartridge case is charged, and the construction and combination of parts of a machine necessary to produce such corrugation.

645. MECHANISM FOR PUDDLING, &c., IRON, *R. Thompson, Wigan.—10th February, 1882.* 6d.

This relates to improvements on Hale's patent No. 1852, of 1879. It consists in working the stirrer, which is preferably a single radial blade driven from above, by means of a vertical shaft carried by radial arm and driven by gearing. This radial arm and its pedestal resemble the hydraulic cranes used in Bessemer works or a radial drilling machine, and can be raised and lowered by hydraulic power or otherwise and swung

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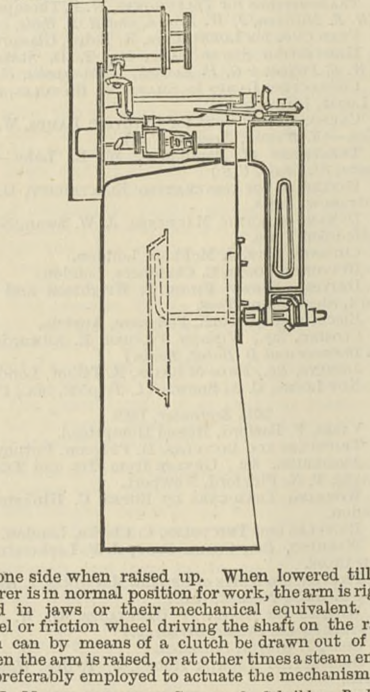

to one side when raised up. When lowered till the stirrer is in normal position for work, the arm is rigidly held in jaws or their mechanical equivalent. The bevel or friction wheel driving the shaft on the radial arm can by means of a clutch be drawn out of gear when the arm is raised, or at other times a steam engine is preferably employed to actuate the mechanism.

676. MANUFACTURE OF SUGAR, *C. Scheibler, Berlin.—11th February, 1882.* 4d.

This consists partly in the separation or purification of the juices of beet and other sugar-containing plants by means of sugar baryta.

695. TOBACCO PIPES, *C. Morris, Maida Vale.—13th February, 1882.—(A communication from L. Jessurun, Hamburg.)—(Void.)* 2d.

This relates to the construction of a pipe in which a plug or disc is moved up or down on the tobacco in the tube to compress it to any consistency.

703. GAS ENGINES, *C. T. Wordsworth, Leeds, and H. Lindley, Salford.—14th February, 1882.* 10d.

The improvements relate, First, to the methods of transferring the compressing charge from the compression cylinder to the working cylinder; Secondly, to means whereby two working cylinders and the combustion chamber in the case, when such a chamber is used, are flushed and cooled by the injection of a body of pure air, and consists in the utilising the compression cylinder for the double purpose of such flushing and compression of the gaseous charge, and in the valves and mechanism connected therewith.

704. UMBRELLA FURNITURE, *J. Knott, Sheffield.—14th February, 1882.—(Not proceeded with.)* 2d.

This relates particularly to the top notch and the method of connecting the ribs thereto.

726. MACHINES FOR BLOCKING THE FRONTS OF BOOTS, *S. Hudson, Leicester.—15th February, 1882.* 6d.

The invention consists in causing the centre plate to be made in the form of a revolving wheel or disc, or to be attached to a revolving wheel or disc, the side cheeks being stationary, or, if preferable, in causing the side cheeks to be made in the form of revolving wheels or discs, or to be attached to revolving wheels or discs, the centre plate being stationary.

735. SECTIONAL WARPING AND BEAMING MACHINES, *R. Hall and J. Walmsley, Bury.—15th February, 1882.* 6d.

The inventors claim, First, the mechanism for traversing a friction bowl that drives a friction plate on the section shaft; Secondly, the mechanism whereby they are enabled to ascertain the number of teeth required in the change wheel.

746. VENTILATING APPARATUS, *T. F. G. Wintour, Bloomsbury,—16th February, 1882.* 6d.

This relates to the construction of ventilating apparatus, and comprises several modifications which are respectively applicable to varied uses.

775. PHOTOGRAPHY, *R. T. Wall, Longfleet.—17th February, 1882.* 4d.

This consists in making a new glutilising solution from white pepper and its analogues, macerated with and in ether, turpentine, alcohol, naphtha, chloroform, or spirit of tar and such like; or by essential and volatile oils, oils, acetic, carbolic, tannic, or other acids, mastic, crystal copal or other varnishes.

780. ENGINE GOVERNORS, *D. Greig and M. Eyth, Leeds.—17th February, 1882.* 6d.

Any ordinary governor is employed, except parabolical or approximately parabolical governors, with the following combination:—The moving sleeve of the governor is connected with two clutch halves mounted in preference on the governor spindle itself. The corresponding clutch halves are fixed to or are parts of two bevel wheels loose on the same spindle and gearing both into a third wheel, one gearing with it at

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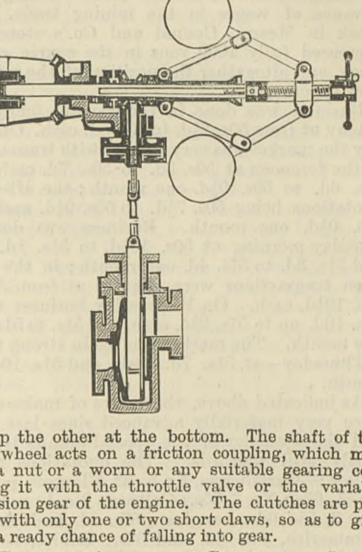


the top the other at the bottom. The shaft of the third wheel acts on a friction coupling, which may work a nut or a worm or any suitable gearing connecting it with the throttle valve or the variable expansion gear of the engine. The clutches are provided with only one or two short claws, so as to give them a ready chance of falling into gear.

785. REMOVING, APPLYING, OR BRIGHTENING COLOUR IN TEXTILE FABRICS, *J. B. Hutcheson and J. J. Dobbie, Glasgow.—18th February, 1882.* 6d.

This relates to the treatment of textile fabrics and materials in order to bleach or remove colour, or to apply or brighten colour, generally or topically by means of an electric current or currents.

787. GUARDING AND PPOTECTING SHIPS, *W. H. Duncan, Coalbrookdale.—18th February, 1882.—(Not proceeded with.)* 4d.

This relates to an air-tight boat for the purpose of going before ships, guarding and protecting same, and to sound or ascertain the depth of water in the ship's course, &c. &c.

789. POTATO-PLANTING MACHINE, *G. W. Murray, Banff.—18th February, 1882.* 6d.

This relates to improvements on patent No. 2197, dated June 1st, 1878, the object being to make the machine more perfect in its construction and action, and suitable under varying circumstances for different soils and width of planting.

791. EXHIBITING BUTTONS AND SHOW CARDS, *W. Willeringhaus, London.—18th February, 1882.—(Void)* 2d.

This relates to a method of and show card for exhibiting buttons of different colours or shades of colours.

792. PLOUGHS, *E. G. Lakeman, Modbury.—18th February, 1882.* 6d.

This relates partly to the method of suspending one or more sets of ploughs on each side of the carriage by means of cranks, the said carriage being mounted on wheels. It also relates to the means of lifting the ploughs.

796. TRICYCLES, &c., *J. Harrington, Coventry.—18th February, 1882.—(Not proceeded with.)* 2d.

This relates to improvements in the gearing of machines known as double drivers, so that they may be d.iven in either direction.

797. APPARATUS FOR DISTRIBUTING ARTIFICIAL MANURES, &c., *F. Robinson, Bradley.—18th February, 1882.* 6d.

The inventor claims the arrangement for sowing or distributing grain, sand, artificial manures, and the like.

799. ORGANS AND HARMONIUMS, *J. B. Hamilton, Greenwich.—18th February, 1882.* 6d.

Means are provided for regulating and adjusting a column or body of air, below or preceding each reed or sounding part of the instrument.

805. ARTIFICIAL TEETH, *B. J. Bing, Paris.—20th February, 1882.—(Not proceeded with.)* 4d.

This relates to a means of procuring a more secure and commodious setting of artificial teeth than heretofore.

809. WATER FILTERS, *F. O. Ross and A. S. C. Buxton, London.—20th February, 1882.—(Not proceeded with.)* 2d.

This relates to the construction of a filter, in which asbestos is tightly packed in a box made of fire-clay or other refractory fire-resisting material.

813. APPARATUS FOR DISCONNECTING AND CONNECTING BOATS FROM AND TO SHIPS, *E. J. Evans, Sudbury.—20th February, 1882.* 8d.

The object is to connect both thwarts of the boat to the lowering tackle in such a manner that they are disconnected simultaneously by one pull of the hand, but can be connected independently of each other, and cannot be disconnected by accident.

816. CIGARETTE MACHINES, *F. Davis, London.—20th February, 1882.—(Not proceeded with.)* 2d.

This relates to a machine in which two half tubes or cylinders are connected by a hinge, which extends their whole length, and are so constructed that when closed or laid together they form a tube or cylinder to contain the filler.

817. STEREOTYPING FOR PRINTING MACHINES, *C. Parsonage, Liverpool.—20th February, 1882.—(Not proceeded with.)* 2d.

This relates particularly to the preparation of the paper moulds.

820. PHOTOGRAPHIC CAMERA SHUTTERS, *T. Vickers, Scarborough.—20th February, 1882.—(Not proceeded with.)* 2d.

This relates to means or apparatus whereby the light may be quickly or instantaneously excluded or shut out from cameras in photographic operations.

824. DEVICE FOR CLENCHING METALLIC STAPLES IN PAPER, &c., *W. R. Lake, London.—20th February, 1882.—(A communication from J. W. Heysinger, Philadelphia.)* 6d.

A base of suitable material is arranged to stand upon a desk or table, and to which is hinged a vibrating arm, which, in connection with the base aforesaid, operates to insert and clinch a metallic staple through a fabric.

826. MACHINERY FOR SCOURING, MILLING, &c., WOVEN FABRICS, *A. C. Adam and D. Stewart, Glasgow.—21st February, 1882.* 6d.

This relates partly to the application of pressure to the nipping rollers of machinery for scouring, milling, fulling, washing, and wringing woven fabrics by means of hydraulic cylinders acting directly or through levers.

827. Omnibuses, *J. Abbot, Bideford.—21st February, 1882.—(Not proceeded with.)* 2*d.*

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

828. Smelting or Blast Furnaces, *W. Ferrie, Calderbank, N.B.—21st February,* 1882. 10*d.*

This invention, which relates to improvements in or connected with smelting or blast furnaces, has reference to that class of such furnaces wherein retorts are placed at the upper part thereof for the purpose of converting into coke, and collecting and utilising the gases given off from the coal being distilled in such retorts, whilst the principal end in view is the separation and collecting of the tarry and ammoniacal products.

829. Obtaining Ammonia from Furnace Gases, &c., *J. and J. Addie, Glasgow.* 21*st February,* 1882.—*(Not proceeded with.)* 2*d.*

The ammonia is produced by chemical combination of the nitrogen in the furnace gases with nascent hydrogen evolved by the decomposition of the water vapour in the said gases, or of steam or water vapour injected into the furnace, the combination being effected by causing the furnace gases and water vapour to pass through or over a vessel, chamber, or furnace containing any substance or mixture which is known to cause dissociation of the elements of water vapour.

830. Shampooing, Douche, and other Baths, *C. Bailey, Leeds.—21st February,* 1882.—*(Not proceeded with.)* 2*d.*

This consists in the application of elbow pipes or tubes to the ordinary hot and cold water taps employed in baths or lavatories, and connecting the two elbows or bends together by a metal or other tube provided with a union in the centre.

835. Asbestos Paints, *C. J. Mountford, Birmingham.—21st February,* 1882. 4*d.*

A fire-proof and water-resisting paint is composed of asbestos, ground fine and re-ground in water, aluminate of potash, or soda, and silicate of potash, or soda.

836. Moulding Boxes, *C. Bailey, Leeds.—21st February,* 1882.—*(Not proceeded with.)* 2*d.*

The box is constructed in such a manner that it is free to open at the divided part, and does so by its own elasticity, but may be closed at pleasure by turning an excentric.

840. Fountain Penholders, *H. J. Haddan, Kensington.—21st February,* 1882.—*(A communication from A. Cohn, Berlin.)—(Not proceeded with.)* 2*d.*

This relates to means for filling the ink receptacle.

841. Circular Knitting Machines, *J. W. Watts, Countesthorpe.—21st February,* 1882. 6*d.*

The inventor claims, First, improved means for guiding the ribbing needles in the ribbing cone; Secondly, a combined thread feeder and fender; Thirdly, a movable catch for keeping the needle latches open; Fourthly, a segmental catch or lever at the base of the ribbing cone; Fifthly, a spring bolt for driving the ribbing cone; Sixthly, a tension apparatus at the top of the yarn post; Seventhly, heel weights; Eighthly, a slotted collar at the top of the ribbing cone.

843. Apparatus for Detaching Ships' Boats, *J. A. Wilkinson and N. McGonnell, Folkestone.—21st February,* 1882. 6*d.*

Ordinary davits and tackle are used, but instead of hooking the blocks to ring bolts rigidly secured to the boat, the inventors provide removable ring bolts, or their equivalent, which can at a given moment be released by the coxswain of the boat or other person deputed for the purpose, thus leaving the boat quite clear of the tackle.

844. Transmitting Motive Power, *J. Dobney, Gosberton, Risegate.—21st February,* 1882.—*(Not proceeded with.)* 2*d.*

This consists in the employment of a series of levers which alternately grip the shafts or axles and rotate them.

846. Manufacture of Weldless Tubes, &c., *R. Elliott, Newcastle-on-Tyne.—21st February,* 1882.—*(Void.)* 2*d.*

This relates to apparatus in which the tubes are produced with the grain or fibre of the metal in a helical direction, to prevent the longitudinal splitting of the tubes.

847. Sash Pulley, *W. Meakin, London.—21st February,* 1882. 4*d.*

This relates to the combination of a frame casting moulded in one piece, with a provision for lubrication of the pulley axle.

848. Velocipedes, *J. Bumpage, Bristol.—21st February,* 1882. 6*d.*

This relates, First, to the construction of the wheels; Secondly, to the method of securing the spokes; Thirdly, the method of steering bicycles; Fourthly, the arrangement of backbone and fork; Fifthly, the arrangement of the brake; Sixthly, the construction of movable handles; Seventhly, the method of supportign the seat.

849. Glass Reflectors for Gas and Other Lights, *F. H. F. Engel, Hamburg.—21st February,* 1882.—*(A communication from G. Franke, Hamburg.)* 6*d.*

This consists essentially in the mode of producing single-walled glass reflectors by applying an argentation to the other side of the glass shade, and by covering the argentation by a mineral varnish.

850. Raising and Lowering Blinds, *J. Everard, Birmingham.—21st February,* 1882. 6*d.*

This relates to the employment of a lever in combination with other parts for raising blinds.

851. Files for Holding Letters, &c., *R. Setter, Birmingham, and H. Dyer, Bridgewater.—21st February,* 1882. 6*d.*

This relates to an arrangement whereby one or more of the letters or documents may be removed after filing, or other papers may be added without disarrangement.

852. Reaping and Sheaf-binding Machines, *J. Harrison, Ipswich.—21st February,* 1882. 10*d.*

This relates to automatic sheaf-binding apparatus which automatically makes the sheaves according to previous adjustment, uniformly of the size required, whatever variations there may be in the crop.

853. Safety Apparatus for Lifts, *A. M. Clark, London.—21st February,* 1882.—*(A communication from J. McCarroll, New York.)* 6*d.*

The object is to prevent the falling of the cages of lifts, and the invention consists in self-acting stop mechanism held out of action by the rope, until the latter being slackened from any cause, the mechanism is released and arrests the cage.

857. Shank Springs for Boots and Shoes, *L. A-Groth, London.—22nd February,* 1882.—*(A communication from J. Wahlen, Cologne.)—(Not proceeded with.)* 2*d.*

The invention consists in the employment of springs made from whalebone, horn, ivory, and other similar bone or horn-like substances, likewise from prepared wood.

858. Apparatus, &c., for Preventing and Extinguishing Fires, *K. and J. McLennan and R. Owen, London.—22nd February,* 1882. 8*d.*

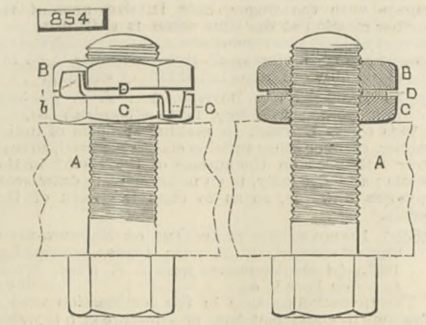
This relates partly to the combination of pipes and junction cocks with the ordinary gas apparatus, so as to admit of the water supply being substituted for the gas supply.

860. Nose-bags for Horses, *J. Archibald, Kensington.—22nd February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to an arrangement for preventing the loss of grain, &c., when the animal tosses its head.

854. Locking Nuts to Screw Bolts, *A. M. Clark, London.—21st February,* 1882.—*(A communication from S. Pattee and A. B. Smith, San Francisco.)—(Complete.)* 4*d.*

The inventor claims the bolt A having crossed



threads combined with nuts B and C that are adapted to match said threads respectively, and with the interposed plate D having ear or ears *b* and ear or ears *c.*

859. Screw Propellers, *T. Lambert, Plymouth.—22nd February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to placing the blades one behind the other on the shaft.

861. Closet Valves, &c., *H. J. Haddan, Kensington.—22nd February,* 1882.—*(A communication from W. Rüdiger, Berlin.)—(Not proceeded with.)* 2*d.*

The object is to avoid the shocks and consequent repairs of valves by causing them to close gradually on their seat.

862. Fire-bars, *T. Nash, Sheffield.—22nd February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to making the bars of perforated plates, strengthened by longitudinal and transverse ribs.

863. Apparatus for Drawing in Warp Threads, &c., *J. H. Johnson, London.—22nd February,* 1882.—*(A communication from L. P. Sherman and R. H. Ingersoll, Bideford, and G. Moore, Berwick, U.S.)* 1*s.* 6*d.*

The invention consists of an organised machine embodying certain automatic devices, by means of which the operation of drawing in warp threads is performed in a very rapid and reliable manner.

865. Treatment of Hair Felt, *J. Forsyth, Glasgow.—22nd February,* 1882. 2*d.*

This relates to the application and affixing of a coating of incombustible material to the surface of hair felt.

868. Tell-tale Apparatus, *M. Levy and F. Lowe, Leicester.—22nd February,* 1882. 6*d.*

This relates to the construction of apparatus for recording the time at which each workman or other person enters and leaves a factory, in order to dispense with the services of a time-keeper.

871. Apparatus for Showing the Speed of Ships, *T. Davison, Glasgow.—23rd February,* 1882. 8*d.*

The invention relates to apparatus arranged to obtain indications of the speed of a ship from the pressure of the water on an instrument carried by the ship; and an important feature consists in placing the instrument on which the pressure is to act in a position where the water is disturbed to the least possible extent.

873. Self-cocking or Hammerless Fire-arms, *J. Dickson, jun., and A. G. Murray, Edinburgh.—23rd February,* 1882. 10*d.*

The object is to produce a convenient fowling-piece having three barrels.

874. Manufacture of Wrought Nails, *J. Maynes, Manchester.—23rd February,* 1882. 6*d.*

This relates to the rapid production of wrought nails from metal rods by a novel process of heating, compressing the metal into form and cutting from the bar.

875. Shoring or Supporting Buildings in Course of Alteration, *J. Slater and R. Pollock, Edinburgh.—23rd February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to the mode of "shoring" up or supporting the superstructure in dwelling houses or other buildings whilst parts of the structure beneath are removed for purposes of alteration or repair, and to a new or improved mode of inserting the girders or beams to support the superstructure.

876. Spinning Machinery, *G. Perkins, G. Wimpenny, and J. H. Evans, Manchester.—23rd February,* 1882. 6*d.*

The First part relates to the method of carrying the rings, the Second part to the carrier.

878. Screw Propellers, *J. Heppell, Birtley.—23rd February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to a mode of attaching and securing the blades to the boss of the screw propeller.

882. Combined Match and Fusee Box, *G. Simons, Bow.—23rd February,* 1882. 4*d.*

This consists in dividing the sliding tray of the box, by a partition arranged diagonally in a vertical plane into two triangular spaces or receptacles, one opening on one side of the box for matches, and the other opening on the opposite side for fusees.

883. Motive Power Engine, *J. Nisbet, Bishopsbriggs.—23rd February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to improvements in the general construction of the engines, which are operated by means of steam, compressed air, or explosive gaseous mixtures.

884. Grippers for Stretching, Retaining, or Suspending Woven Fabrics, &c., *J. Hardaker, Leeds.—23rd February,* 1882. 6*d.*

The gripper consists of a frame, by preference of metal, and on it is hinged a pawl, lever, or jaw, which at its gripping part is provided with a pin or pins, or a serrated or other rough surface, for assisting in bringing the gripper into operation. It also has a relieving piece, which also serves as a gauge to determine the amount of surface or material to be gripped.

885. Treating Sulphur, Arsenical, Sulpho-antimonial, and Telluride Ores for the Extraction of Gold, Silver, &c., *W. A. Barlow, London.—23rd February,* 1882.—*(A communication from C. de Vaureal, Paris.)* 4*d.*

The object of the First part of this invention is the extraction of the gold; and of the Second part, the elimination of the arsenic and of the antimony.

887. Regulating and Controlling the Diffusion of Artificial Light, *J. R. Smith and J. J. Learoyd, Halifax.—23rd February,* 1882. 10*d.*

The invention consists of a combination of beacons and adjustable radial reflecting lamp for diffusing artificial light, such as the electric light, over a defined area.

888. Manufacture of Apparatus Connected with Water-closets, &c., *H. Sutcliffe, Halifax.—23rd February,* 1882. 8*d.*

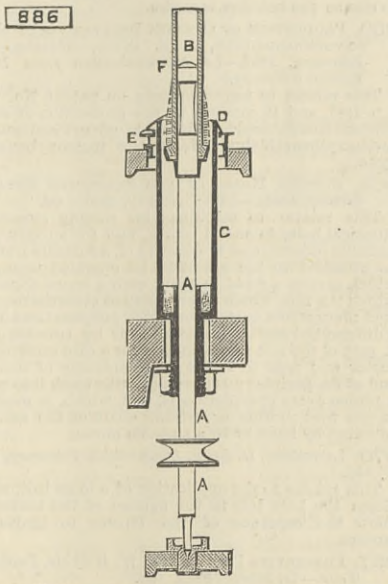
This relates to forming the apparatus consisting of syphon traps, stand pipes, overflow pipes, and the like, in two halves secured together by bolts and nuts.

890. Apparatus for Testing Pressure and Vacuum Gauges, *W. C. de Witt, Amsterdam.—23rd February,* 1882.—*(A communication from C. D. Gäbler, Hamburg.)* 6*d.*

The testing apparatus consists of a cylinder fitted with a piston, which can be moved to and fro along the cylinder by means of a screw spindle made to screw through one end of the cylinder, which is made solid. The other end of the cylinder is by a passage put into communication with two nozzles, one situated at one end of the cylinder, the other at the opposite end. A standard or control gauge is by a screw coupling attached to one nozzle, and the gauge to be tested to the other nozzle. The cylinder and nozzles are filled with liquid. By turning the screw spindle the piston can be forced against the water in the cylinder, and the pressure will then be communicated by the column of water to both gauges simultaneously.

886. Machinery for Spinning Fibre, *F. Ripley and T. H. Brigg, Bradford.—23rd February,* 1882. 6*d.*

At A is the spindle revolving and carrying the bobbin or spool B enclosed by the cup C, which is stationary outside, and concentric therewith is the ring D and traveller E; the yarn F passes through the traveller to the upper edge or top of the cup C, thence to the bobbin or spool B, and as the ring D is nearer to or further from the upper edge or top of the



cup, so will the angle of the yarn from traveller to top of cup C vary, and the drag on the yarn be changed and adjusted to the varying diameter of the cop (in contradistinction to the ordinary traverse necessary to form the cop and its cone), the traverse of the ring being solely for the purpose of regulating the drag and not for building the cop, the latter operation being effected through the traverse of the spindle.

893. Apparatus for Mixing Concrete, *A. Jamieson, Blaytyre.—24th February,* 1882. 6*d.*

This relates to the combination of a rotating cylinder, barrel, or box, with a central-bladed shaft rotating in the opposite direction, the said cylinder, barrel, or box being connected at one end to a stationary feed box, and being supported on rollers.

894. Manufacture of Tin Plate, *A. J. Maskrey, Coatbridge.—24th February,* 1882.—*(Not proceeded with.)* 2*d.*

The improvements consist essentially in subjecting the iron plates when within the annealing pots or chambers or within a close furnace, and while at a red heat, to the action of carbonic oxide, for the purpose of reducing the oxide of iron on the surface of the plates.

895. Decorative Coverings for Walls, Ceilings, &c., *C. Hibbs, Plaistow.—24th February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to the employment of slabs of glass having suitable designs or patterns thereon.

896. Frictional Wheel Gearing, *W. R. Lake, London.—24th February,* 1882.—*(A communication from J. B. Tibbits, New York.)* 6*d.*

The invention consists partly of a rim driven by a belt or other suitable means, and operating on intermediate wheels which transmit motion to a hollow spindle fixed on the shaft of a dynamo-electric or other machine, the said rim being constructed in two parts, joined by screw threads, so as to facilitate the fitting together of the several parts of the gearing, and to afford positive means for compensating for wear.

899. Cotton-opening and Lapping Machines, *W. R. Lake, London.—24th February,* 1882.—*(A communication from R. Kitson, Lowell, U.S.)* 6*d.*

This comprises the combination with the beater and cage on which the lap is formed, as ordinarily constructed of calendar rolls, one of which is provided with collars, between which the pressure surface of the other acts; also to the manufacture of a lap having a straight and square edge, and equal solidity at all points.

901. Treating Maize, &c., *A. G. Frazer, London.—24th February,* 1882. 2*d.*

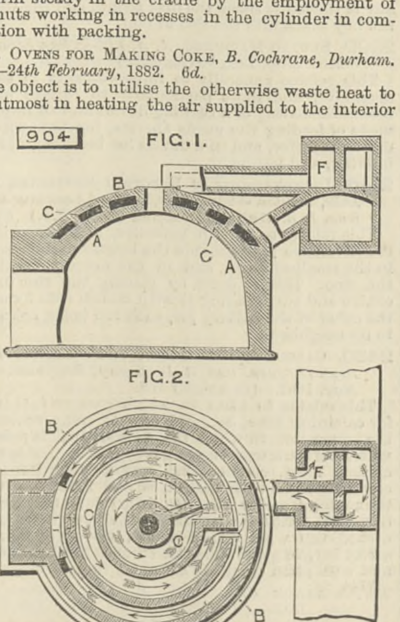
This relates to the process of treating maize, consisting in first cracking the grains and then subjecting the cracked grains to friction in a mortar, thereby detaching the germ, so that it may be removed by sifting or like means.

903. Machinery for Drilling, Boring, or Cutting Rock, &c., *G. F. Wynne, near Wrexham.—24th February,* 1882. 6*d.*

The inventor claims, First, the arrangement of the ports and passages in the gland and piston-rod of rock drills, whereby a reciprocating motion of the piston is produced; Secondly, the method of taking up the wear of the feed screw in rock drills, and of keeping the drill steady in the cradle by the employment of two nuts working in recesses in the cylinder in combination with packing.

904. Ovens for Making Coke, *B. Cochrane, Durham.—24th February,* 1882. 6*d.*

The object is to utilise the otherwise waste heat to the utmost in heating the air supplied to the interior



of the oven, and at the same time to protect the ovens from loss of heat at the upper part, and it consists in forming over the upper part A or dome a covering B, a space C being left between the two through which air is caused to circulate and enter the oven above the level of the coal being coked. The drawings represent the air passage C as of spiral form, and the air first enters a chamber F, situated above the outlet flues of the oven, and which is fitted with baffles.

907. Pendulum Motor Apparatus, *W. R. Lake, London.—24th February,* 1882.—*(A communication from J. von Zach, Budapest.)* 6*d.*

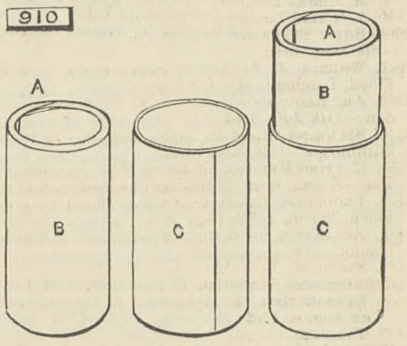
The construction of this engine or apparatus is based on the combination of a pendulum with a lever, or the transformation of a pendulum into a lever of the variety known as levers of the first-class.

908. Washing Wool, *W. R. Lake, London.—24th February,* 1882.—*(A communication from E. Mehl, Germany.)* 6*d.*

This relates to apparatus for washing wool, and comprises means for passing air through the washing water to loosen the wool and drive it to the surface; and, further, a novel construction of rotating drums for transporting the wool from one end of the tank to the other. The tank or tub is made with double walls, the inner ones being perforated, and warm air is injected into the space between the walls. Four drums are immersed in the liquid in the tank, and each has internal partitions, so as to form chambers, the outer walls of which are perforated to permit the liquid to flow in and out of the chambers, and so alternately draw the wool to and repel it from the drums.

910. Cores for Casting Steel Tubes, &c., *B. Johnson, near Leeds.—25th February,* 1882. 6*d.*

Fig. 1 is a perspective view of the inner tube or piece, Fig. 2 a perspective view of the outer sheath or case, Fig. 3 perspective view, showing the outer sheath or case partly covering the inner tube or piece. The



duplex cores, consisting of the inner tube or piece B, and the other sheath or case C are placed one within the outer in the mould, and the molten steel is poured into the mould around the duplex core. After the mould is filled the inner tube or piece is withdrawn and the metal allowed to set.

913. Rolling Mills Used in the Manufacture of Metals, *P. Kirk, Workington.—25th February,* 1882. 6*d.*

This relates to improvements on patents No. 740, A.D. 1876, and No. 637, A.D. 1880, in which sets of "three high rolls" are used in conjunction with the ordinary or extended "two-roll" arrangements to obtain two or more reductions with the same heat by lifting the ingot from the lower to the upper rolls, and it consists in means for obviating the necessity of lifting the ingot. It is preferred to employ a triple "two roll" arrangement, the ingot being reduced between the first and second set of "two rolls," and making its exit between the third set of "two rolls," through a blank left therein for its passage. The mill is then reversed and the ingot shifted along opposite the next groove in the rolls, and so on until the operation is completed.

915. Gas Stoves, *P. Geofroy-Gomez, Toulouse, France.—25th January,* 1882.—*(Not proceeded with.)* 2*d.*

A suitable box placed below the ordinary grate has tubes or burners projecting upwards, and supplied with gas and air. The back and sides of the space within the chimney are lined with refractory material, and a box is provided and forms the opening into the chimney, such box being perforated to allow the fumes to pass, and containing quicklime to decompose the carbonic acid set free by the combustion of the gas.

916. Folding Sheets of Paper, *H. M. Nicholls, Hatton-garden.—25th February,* 1882. 6*d.*

This relates to improvements on patent No. 2534, A.D. 1878, and consists in the development or extension of the folding process described for giving the first fold in such machine, and the adaptation of the machine for use either in combination with apparatus for cutting continuous paper into sheets, or as a folding machine only. A modified form of grippers is employed to draw the sheet between the rollers, and continue their action until it is clear of them, when the sheet is delivered to a second similar set of grippers, which close on the top and bottom edges in the centre of the sheet, and draw it between a second pair of rollers at right angles to the first, so as to give the sheet a second fold.

917. Reflectors, &c., *H. J. Haddan, Kensington.—25th February,* 1882.—*(A communication from W. Wheeler, Massachusetts.)* 6*d.*

One improvement consists of a reflector having a reflecting surface of such shape as would be described by the revolution about its principal axis of a curve or line of variable curvature varying throughout its revolution by a fixed law, but having always a focus common to all the variations thereof, and an ordinate common to said curve in all its variations.

919. Elastic Fabrics, *T. H. Harrison, Derby.—25th February,* 1882.—*(Not proceeded with.)* 2*d.*

This relates to the manufacture of fabrics with both elastic warp threads and elastic shoots or wefts.

921. Sulphate of Ammonia, *J. Dempster, Elland.—25th February,* 1882. 6*d.*

This relates to apparatus to manufacture sulphate of ammonia chiefly adapted for small gasworks, and it consists of a boiler or still to contain the ammoniacal liquor, and a saturator or second vessel to contain sulphuric acid. The liquor is conveyed to the still by a pump, and kept at a moderate heat for some hours, so as to expel the free ammonia, after which a quantity of soda or lime is added and the heat raised to boiling point so as to liberate the whole of the ammonia, which is conveyed to the saturator, to which a drainer is attached.

923. Filter Presses, *H. E. Newton, London.—25th February,* 1882.—*(A communication from A. L. G. Dehne, Germany.)* 4*d.*

The object is to give filter presses a greater power of resisting the action of chemical substances, and it consists in coating the plates of such presses with a protecting covering of lead, tin, zinc, copper, bronze, or other suitable metallic alloy, or of vulcanised india-rubber or vulcanite.

924. Lined Valve Cases, &c., *H. E. Newton, London.—25th February,* 1882.—*(A communication from A. L. G. Dehne, Germany.)* 6*d.*

In order to protect valve cases, cocks, bodies for pumps and other hollow "pieces" against the action of chemical substances, they are coated with a protecting covering of lead, tin, zinc, copper, or an alloy of metals, vulcanised rubber, or other suitable substance; and it consists in forming the casings to be lined as simple as possible, so that cores of cast iron may be readily inserted, and form, with the inner surface of the casing, a mould for casting the lining.

925. Earth Closets, *W. H. Lascelles, London.—25th February*, 1882. 6d.
This consists in adapting to earth closets immediately below the seat a rotary receptacle for the soil, divided into compartments and rotated by a ratchet and pawl actuated by a handle. A hopper for earth is placed outside and behind the receptacle, so that the earth falls into the compartment which is next to receive the soil. The soil is projected from each compartment in succession into a pit, the earth in falling covering the same.

927. Lubricating Steam and Gas Engines, &c., *J. J. Royle, Manchester.—25th February*, 1882. 6d.
This relates, First, to improvements on patent No. 4909, A.D. 1879, and consists in employing the steam jet to exhaust a vessel containing graphite or black-lead, and inducing a current of air to carry a portion of the same to the cylinders of the engine; and Secondly, to arranging a lubricator in connection with a glass gauge which will indicate the height of the lubricant in the reservoir, and also the speed at which the lubricant is being fed to the engine.

928. Horseshoes, &c., *T. Grason, near Wakefield.—25th February*, 1882.—*(Not proceeded with.)* 2d.
This relates to means for fastening the shoe without nails, and for allowing caulkings and roughs to be secured and removed without removing the shoe, and it consists in forming holes in the hoof to receive a plate, to which the shoe is secured by screws with countersunk heads. The caulks or roughs are inserted into holes in the shoe, and secured by bolts.

929. Hygrometer, *L. Boye, Norway.—25th February*, 1882.—*(Not proceeded with.)* 2d.
This relates to an improved construction of hygrometer for ascertaining and indicating the degrees of saturation of steam, and it consists in causing a certain volume of steam to pass into a cylinder fitted with a piston, which is then raised so as to allow the steam to expand, the temperature being maintained constant, and the diminution in pressure recorded by a suitable needle.

932. Tempering Hackle, Gill, Comb, and Card Pins or Teeth, &c., *T. Crabtree, Leeds.—25th February*, 1882. 6d.
A furnace is constructed preferably of oven shape and lined with fire-brick, and a cylinder or barrel of corrugated form or with internal projections receives the articles to be tempered and is suspended over the fire, one end being open so as to give access to the interior, but is capable of being closed by a cover. The barrel is rotated so as to agitate the pins or teeth during the operation. A pyrometer or heat tester is employed in connection with the apparatus.

934. Opening, Closing, Supporting, and Locking Window Sash Frames, &c., *J. Carpenter, Southampton. — 25th February*, 1882.—*(Not proceeded with.)* 2d.
The side frames are fitted with a plate through which a sliding bolt works, one end engaging with a rack formed on the sides of the sashes, and capable of being withdrawn by a suitable handle.

935. Dobbies for Fancy Weaving, *J. Shorrock, Darwen.—27th February*, 1882.—*(Not proceeded with.)* 2d.
This relates to looms for fancy weaving, in which the shed is caused to open by the "dobby" or "index machine," and it consists in the method of working the lattice or pattern motion for the "dobby," and at the same time reducing the power required to drive the same. Catches and springs are mounted to the arms or knives actuating the hooks, and on the lattice barrel shafts is a catch or rack wheel actuated by the catches on the arm coming in contact with them during each down stroke, and thus giving the requisite motion to the lattice barrel shafts, and thereby enabling the lattice pegs to work the wire according to the pattern required.

936. Carpet and Similar Fabrics, *J. J. Delmar, Old Kent-road, and W. Folliott, Bethnal-green-road.—27th February*, 1882. 4d.
This relates to the manufacture of the facing of carpets and similar fabrics from any kind of spun hair combined with Tussah or waste silk, or with cotton, jute, hemp, flax, fibre, grass, or other suitable materials, which can be dyed, spun, and woven to suit the work, while the groundwork or warp and shoot may be of any kind of spun yarn or wire.

945. Saddle-bars, *J. L. Reed, near Rugby.—27th February*, 1882. 4d.
This relates to improvements in patent No. 589, A.D. 1880, and consists in constructing the saddle-bar so as to secure greater safety and to fasten the saddle-bar more firmly to the saddle-tree. The hinged stop and lever for retaining the stirrup leather and disengaging it when a backward strain is put thereon are abolished, and the under part of the saddle-bar is carried further forward to enable it to be fixed to the saddle-tree.

946. Railway Signalling Apparatus, *P. P. Sykes, near Huddersfield.—27th February*, 1882.—*(Not proceeded with.)* 2d.
This relates to a bar connected with the signals, so that it can be raised and come in contact with a lever on a passing engine and connected with a gong or whistle so as to cause the same to sound.

947. Thimbles, *F. H. F. Engel, Hamburg.—27th February*, 1882.—*(A communication from J. Hirsch, Stockholm.)*—*(Not proceeded with.)* 2d.
This relates to the application of a knife or cutter to the thimble for the purpose of cutting the thread or yarn.

952. Compression Pumps for Compressing Ammoniacal Gas, *C. D. Abel, London.—27th February*, 1882.—*(A communication from A. Osenbrück, Germany.)* 8d.
The main object is to surround the whole of the working parts of such pumps with oil, so that they may be relieved as much as possible from wear and so that the stuffing-boxes and other connections may be rendered effectually gas-tight. The moving mechanism is enclosed in an air-tight chamber filled with oil, which is subjected to the minimum pressure of the pump, while at the same time a regulated quantity of oil is injected in front of the pump pistons at each stroke in order to do away with dead spaces, the supply of such oil being effected either from the maximum or the minimum pressure side of the pump, in order to rectify any alterations that may occur in the oil levels in the chambers on the two sides owing to leakage past the piston.

953. Centrifugal Apparatus for Manufacture of Starch Blocks, *C. D. Abel, London.—27th February*, 1882.—*(A communication from C. Rudolph and Co., Germany.)* 6d.
The starch milk is filled into receptacles hung to the hooked ends of radial arms carried at the top of a vertical shaft revolving in a casing, such receptacles swinging out to a horizontal position when the shaft is in motion. The tops of the boxes are open and the bottoms closed by a permeable material that will allow the water to escape but retain the starch, so that as the shaft revolves the water is expelled by centrifugal action through the bottom of the boxes, leaving the starch behind in solid blocks.

955. Reducing and Parting Certain Metals, *F. Wirth, Frankfort-on-the-Main. — 27th February*, 1882.—*(A communication from H. Roessler, Frankfort-on-the-Main.)* 6d.
This relates more particularly to a new method of reducing and separating gold, silver, copper, and lead, and consists in blowing air on or under the surface of the sulpho-metals, which are molten, in closed vessels, by which means concentrated sulphurous acid gases are formed, and are transformed into sulphuric acid, whilst the volatilised metal particles are collected in the condensing apparatus.

957. Spinal Support, *G. E. Vaughan, London.—27th February*, 1882.—*(A communication from P. J. Le Bellegulc, Paris.)* 4d.
This relates to apparatus to prevent curvature of the spine or check the progress thereof.

958. Cutting and Reeling Paper for Telegraphic Purposes, *W. W. Colley, Camberwell.—27th February*, 1882. 6d.
This relates to means for cutting a roll or web of paper into strips for use in recording and printing telegraphic instruments and simultaneously reeling the same, and it consists mainly of a pair of cylinders, one plain winding cylinder and the other fitted with circumferential knives at proper distance apart, such cylinders being used in combination with a spindle carrying the bobbins on which the strips are to be wound, mounted over and between the cylinders, and pressed down on both by weighted levers, with freedom to rise as the bobbins increase.

960. Production of Certain Derivatives of Metaoxybenzaldehyde, *J. A. Dixon, Glasgow.—28th February*, 1882.—*(A communication from Dr. C. Kœnig, Germany.)* 4d.
This relates to improvements on patent No. 2179, A.D. 1881, and it consists in the production of orthonitrometaoxybenzaldehyde and of orthonitrometamethoxylbenzaldehyde from the metaoxybenzaldehyde.

968. Cutting Holes in and Surfacing Metal, *C. Scriven, Leeds.—28th February*, 1882. 6d.
This relates to machines for cutting circular or elliptical holes in metal plates, and for surfacing up metallic objects, and it consists of a suitable frame to be attached to the object to be operated upon, and which carries a fixed spindle with a screw-thread on which is a nut, which when operated gives the required feed motion to a cutter, for which purpose the nut has a differential motion imparted to it by suitable gear. A part of the nut forms an axis to a disc carrying the cutter and free to rotate independently of the nut, and at its periphery is provided with teeth into which a pinion gears that drives it, and which is mounted on the first motion or driving shaft of the machine actuated by hand or by a suitable motor.

970. Lanterns, *G. Bray, Leeds.—28th February*, 1882. 4d.
This relates to the application of a loose ball, which closes the hole left in the bottom of the lantern to allow the entrance of the burner to ignite the lantern.

987. Preserving Life at Sea, *W. Wilkins, Tunbridge Wells.—1st March*, 1882. 6d.
The object is to afford special protection to the head against the power of the waves and foam when in a rough sea, as well as to increase the buoyancy and efficiency of ordinary life-preservers, with which it may be used or alone, and it consists of a helmet of hood capable of being inflated and serving to envelope the head. The part of the helmet opposite the mouth is fitted with a valve which closes under the action of the waves, but opens again automatically as they retire.

992. Propelling and Steering Ships, &c., *J. Cooke, Richmond, Yorkshire.—1st March*, 1882. 6d.
One arrangement consists in the use of a centrifugal pump in conjunction with apparatus for dividing the stream produced from the pump into two or more streams, which are utilised for propelling and steering.

1027. Stands or Frames for Cruets, Liquors, &c., *J. Beresford, Birmingham.—3rd March*, 1882. 6d.
The central post of the cruet stand carries at top a cap capable of being revolved and fitted with as many arms as there are bottles, and which when brought over the tops of the stoppers can be locked in position, so as to prevent the removal of the bottles from the stand.

1064. Distributing Manure over Land, &c., *H. A. Bonneville, Paris.—6th March*, 1882.—*(A communication from L. A. Couteau, France.)*—*(Complete.)* 4d.
This relates to improvements on patent No. 489, A.D. 1881, and it consists, First, of a smooth-surfaced drum and a smooth-faced roller revolving at a greater speed than the drum; Secondly, of a hopper with vertical sides, the bottom of which is formed by the drum; Thirdly, of a movable trap regulating the exit of the matter; and Fourthly, of disengaging blades or knives and cleaning scrapers.

1084. Wheels for Locomotives, &c., *R. H. Brandon, Paris.—7th March*, 1882.—*(A communication from A. Cottrau, Naples.)* 4d.
This consists in forming the wheels with two tires of varying diameter in one single piece, the object being to enable them to run on two different railroads and travel at a slow or at a fast rate.

1472. Governors for Regulating Pressure of Gas, *W. Lyon, Sheffield.—27th March*, 1882. 6d.
This relates to governors for automatically regulating the pressure and flow of gas so as to cause it to be delivered at an uniform pressure, and it consists of a valve closing with and opening against the gas supply, and suspended by a rod attached to a float placed in a water vessel over the valve, and the lower end of which communicates with a second closed vessel also containing water, on the surface of which the gas in the outlet pipe is caused to act, and by raising or lowering the float in the other vessel opens or closes the supply valve to the required extent.

1870. Locks, *W. S. Frost, Peckham.—19th April*, 1882. 6d.
This relates to a simple construction of lock, and consists of a pin or tube fitted in the box and carrying one or more loose discs. The bolt is guided in the box in any suitable manner and is formed with curves, into one of which a part of the circumference of the discs takes, so that the bolt cannot be pushed back without the key. The discs have each a slot formed therein, and the bolt has also a slot, so that when the key is turned it turns the disc round, and the ward of the key takes into the slot in bolt.

2399. Sewing Machines, *A. A. Fisher, San Francisco.—22nd May*, 1882.—*(Complete.)* 8d.
This relates generally to improvements in sewing machines, and more particularly to certain attachments consisting of a tucking device and an improved mode of feeding the goods thereto, together with the means therefor, and in a device for braiding, darning, binding, and felling.

2416. Improvements in Electric Batteries, *H. H. Lake, London —22nd May*, 1882.—*(A communication from J. B. Wallace, Ansonia, Conn., U.S.)* 6d.
This relates to carbon batteries, and the object of the invention is to provide the largest carbon surface in the smallest space, and in the nearest relation to the zinc. This is done by placing the zinc in the centre and surrounding it with carbon rods fixed into the cover of the battery jar, each rod being connected to its neighbour.

2430. Calcining Kilns, &c., *J. T. Raynes, Pen-y-Bryn Llysfaen, and B. D. Healey, Brighouse.—23rd May*, 1882.—*(Complete.)* 6d.
This relates to kilns in which gaseous fuel is used for calcining lime, &c., and also to improvements in the generators in which the gaseous fuel is produced where carbonic oxide is the gas supplied. The inventor claims, First, constructing continuous regenerative calcining kilns with deflectors and inclines dividing the material under treatment into two or four streams; Secondly, forming such kilns with two shafts and an arched top with closed doors; and, Thirdly, constructing gas generators with arches for fuel inclines, and with plain charging boxes for fuel.

2470. Alarm Clocks, *W. R. Lake, London.—24th May*, 1882.—*(A communication from Jerome and Co., New Haven, U.S.)*—*(Complete.)* 6d.
This relates to clocks in which the alarm attachment is operated by the same spring which operates the time movement, the object of the invention being to permit two or more revolutions of the main wheel of the alarm, whereby the time of sounding the alarm is prolonged, and it consists essentially in the arrangement of a finger on the main shaft which will engage with a tooth wheel and advance it one tooth at each revolution of the shaft, the toothed wheel having an extension or elongated tooth at one point which will engage with the finger, hold it, and prevent its further rotation at the time when it shall have performed at least two revolutions, and yet permit the rewinding of the spring at all times, whether it be for the alarm only or for the full extent of winding.

2479. Stoppers for Bottles, &c., *J. S. Davison, Sunderland.—25th May*, 1882.—*(Complete.)* 6d.
This consists, First, in making stoppers of india-rubber, cork, or other suitable elastic material, so that they will float on the surface of the liquid in the bottle; and Secondly, to an instrument to draw such stoppers upwards, so as to close the neck of the bottle.

2526. Improvements in Dynamo or Magneto-electric Machines, *W. R. Lake, London.—27th May*, 1882.—*(A communication from J. J. Wood, Brooklyn, New York.)* 6d.
This invention consists in the combination with a Gramme or equivalent form of armature of a movable brush holder, adapted to move the brushes on the commutator to the point of greatest effect towards the minimum position of a manipulating or adjusting device engaged with the brush holder, and with a catch and definite scale of graduation, so that the brushes can be set to any position corresponding to a certain current suited to one or more lights.

2531. Improvements in Armatures for Dynamo or Magneto-electric Machines, *W. R. Lake, London.—27th May*, 1882.—*(A communication from J. J. Wood, Brooklyn, New York.)* 6d.
This relates to an improved method of securing the armature of the Gramme machine to its hub or shaft, and consists in the introduction at intervals of thin plates between the coil sections of the armature; these plates embrace iron cores and project into or are received to the hub, thus producing a positive rotating connection between the armature and its hub, so as entirely to prevent the hub turning on the armature or slipping.

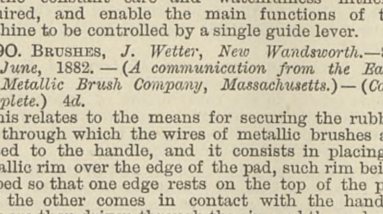
2561. Scouring, Setting, and Glassing Leather and Beaming Hides, *F. A. Lockwood, Boston, U.S.—31st May*, 1882.—*(Complete.)* 10d.
This relates to the general construction of machines for these purposes, the principal objects being, First, to drive the operative parts by direct positive mechanical devices in lieu of a belt, thereby insuring uniform and certain action of the various agencies, and reducing the power required to run the machine; and Secondly, to relieve the attendant to a great extent of the constant care and watchfulness hitherto required, and enable the main functions of the machine to be controlled by a single guide lever.

2690. Brushes, *J. Wetter, New Wandsworth.—8th June*, 1882. — *(A communication from the Eagle Metallic Brush Company, Massachusetts.)*—*(Complete.)* 4d.
This relates to the means for securing the rubber pad through which the wires of metallic brushes are passed to the handle, and it consists in placing a metallic rim over the edge of the pad, such rim being shaped so that one edge rests on the top of the pad and the other comes in contact with the handle. Pins are then driven through the rim and the pad and into the handle, thus securing the whole together.

SELECTED AMERICAN PATENTS.

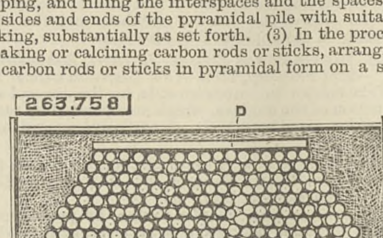
From the United States' Patent Office Official Gazette.

263,688. Spindle Step for Spinning Machines, *William A. Delmage, Lowell, Mass.—Filed July 21st*, 1881.
Brief.—The step is located at the base of an oil receiving reservoir, which is provided with a dead-air chamber located above said step and separated



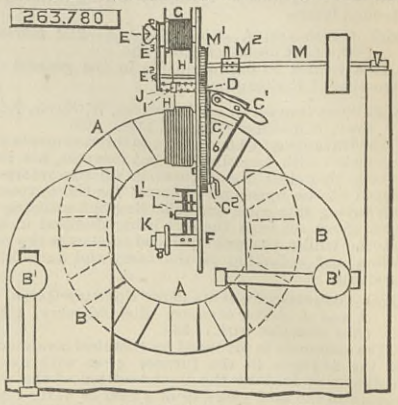
from the reservoir by a downwardly inclined diaphragm, the whole so arranged that the only communication between the reservoir and air chamber, and the latter with the external air, is the hole through which the spindle passes.

263,758. Process of Baking Carbon Rods, *Charles F. Brush, Cleveland, Ohio.—Filed May 27th*, 1881.
Claim.—(1) In the process of baking or calcining carbon rods or sticks, arranging the carbon rods or sticks in pyramidal form in a receptacle and filling the interspaces and the spaces at the sides and ends of the pyramidal pile with suitable packing material, substantially as set forth. (2) In the process of baking or calcining carbon rods or sticks in a receptacle, arranging the carbon rods or sticks in pyramidal form on a slab or plate of suitable material to withstand warping, and filling the interspaces and the spaces at the sides and ends of the pyramidal pile with suitable packing, substantially as set forth. (3) In the process of baking or calcining carbon rods or sticks, arranging the carbon rods or sticks in pyramidal form on a slab



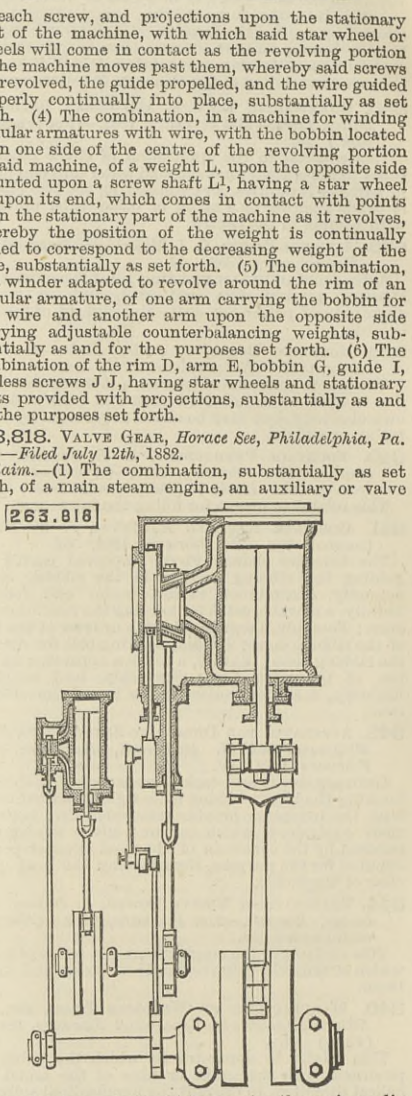
or plate of suitable material to withstand warping, filling the interspaces and the spaces at the sides and ends of the pyramidal pile with suitable packing, and subjecting the pile to a superior cumbent weight during the process of baking, substantially as and for the purpose set forth. (4) A pyramidal pile of carbons having the ends of its lower course formed of twin or connected carbons to prevent displacement, substantially as and for the purpose set forth. (5) The combination, with the pyramidal pile of carbon rods or sticks, of the supporting slab, the packing, and the inclosing box, substantially as and for the purpose set forth. (6) The combination, with the pyramidal pile of carbon rods or sticks packed in suitable material, of the supporting slab A, upper slab D, and inclosing box E, substantially as and for the purposes set forth.

263,780. Machine for Winding Armatures for Magneto-electric Machines, *Robert Haase and John P. Recker, Indianopolis, Ind.—Filed August 23rd*, 1881.
Claim.—(1) The combination in a machine for winding wire upon annular armatures, of the divisable clamp C, constructed substantially as specified, and adapted to surround and be secured upon the rim thereof, and mechanism, substantially as described, secured to and adapted to revolve upon said clamp, substantially as and for the purposes set forth. (2) The combination, in a machine for winding wire upon annular armatures, of the surrounding clamp, the toothed rim, the arms thereon, the bobbin, a travelling guide, and an endless screw mechanism, substantially as and for the purposes set forth. (3) The combination, in a machine for winding armatures with wire in which one portion revolves upon another or stationary portion, of an endless screw or screws for driving a travelling guide, a star-shaped wheel upon the end



of each screw, and projections upon the stationary part of the machine, with which said star wheel or wheels will come in contact as the revolving portion of the machine moves past them, whereby said screws are revolved, the guide propelled, and the wire guided properly continually into place, substantially as set forth. (4) The combination, in a machine for winding annular armatures with wire, with the bobbin located upon one side of the centre of the revolving portion of said machine, of a weight L, upon the opposite side mounted upon a screw shaft L^1, having a star wheel L^2 upon its end, which comes in contact with points upon the stationary part of the machine as it revolves, whereby the position of the weight is continually varied to correspond to the decreasing weight of the wire, substantially as set forth. (5) The combination, in a winder adapted to revolve around the rim of an annular armature, of one arm carrying the bobbin for the wire and another arm upon the opposite side carrying adjustable counterbalancing weights, substantially as and for the purposes set forth. (6) The combination of the rim D, arm E, bobbin G, guide I, endless screws J J, having star wheels and stationary parts provided with projections, substantially as and for the purposes set forth.

263,818. Valve Gear, *Horace See, Philadelphia, Pa.—Filed July 12th*, 1882.
Claim.—(1) The combination, substantially as set forth, of a main steam engine, an auxiliary or valve



engine driving a shaft which operates the main or distribution valve of the main engine, and an independent cut-off valve governing the admission of steam to said distribution valve and operated by the shaft of the main engine.

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The Engineer, September 29th, 1882.