THE FRENCH INTERNATIONAL EXHIBITION.

In a passing notice a few weeks ago of the awards of the juries of the French Exhibition we called attention to the fact that England was altogether absent from the list of the new order of recompenses for well managed establishments. As it was quite impossible to suppose for a moment that we were without worthy instances of the most enlightened and judicious government of old and important factories in every branch of industry—in fact, as we and every one else knew, that there were many such in England capable of favourable comparison with most of the great continental houses so justly celebrated in this respect, we were fain to assume that our own leading men had not come forward, and that no trouble had been taken to bring them forward. That few, if any, of our great employers would have undertaken of their own accord the task of expatiating on their respective philanthropy and their good deeds in general, we have no doubt; but they were not left to themselves, they were called upon by the British commission to supply such data as would enable them to compile a statement which could not be otherwise than useful as giving examples of good order, in some cases approaching to perfection, in attention to the true interest of large bodies of workpeople.

This call for statements, which might not have been voluntarily presented, was responded to by no less than thirty-seven of our leading English and Scotch firms. A volume of considerable size and of great interest was actually printed by the commission embodying these reports, some of which were little histories in themselves, extending back beyond the commencement of the century, and all of them were illustrative of hearty efforts in a good cause. That volume, however, has never been allowed to issue from the sacred precincts of South Kensington; no adjudication on the merits of the many English establishments of which it treated has taken place, and so far as receiving the reward which some, at least, of them merited, nothing more has been heard of the matter. We may be permitted to ask, in the name of English masters and English workmen, for some explanation of this apparent failure of justice, feeling confident, as we have reason to do, that it did not arise from any ungenerous opposition on the part of the foreign members of the jury of this new but by no means unimportant class of awards. Did it or did it not spring from a total absence of English representation on the jury, from which cause we would be left *hors de combat*, and if so who is to blame?

We leave this question for those to answer who have had the distribution of the funds voted by Parliament for the purpose of the Exhibition, and who, barring the presence of the lighthouse (which, by the bye, is charitably left out of all French engravings of the Champs de Mars), and the absence of any national civil engineering exhibit, have well fulfilled their trust.

The £116,000 voted by Parliament will, it is expected, not be much, if at all, exceeded, Mr. Bernal Osborne's prophecies to the contrary notwithstanding. At the 1855 Exhibition a considerable balance remained of the sum voted for the expenses of British representation, and in one way this has turned out to be rather an unfortunate precedent, for when lately the parliamentary committee recommended that a sum not exceeding £25,000 should be placed at the disposal of the English Commission for the purpose of purchasing scientific and technical apparatus of novelty and value, the treasury practically annulled the recommended vote by intimating that the commission, with the consent of Parliament, might expend on these objects any sum, not exceeding £25,000, that might remain as a balance of the grant already made after the payment of all expenses connected with the Exhibition.

Whilst deprecating anything like injudicious expenditure, it cannot but be felt that this is not a time when we can afford to dispense with any available means of accumulating and bestowing scientific information, and if the recommendation of the committee be ultimately carried out, and the sum which it proposed be wisely expended, we can see no more fitting object for a national vote.

The island of Billancourt was again on Monday and Tuesday the scene of one of those pseudo trials of agricultural machines which have been conducted with more or less irregularity all through the season. In respect to these trials the English interest and the agricultural interest in general has suffered more severely from the proverbial absence of English jurors than have any other of the hundred classes open to competition. From the number and frequency of agricultural exhibitions in England it is possible to count on tolerably efficient arrangements and a tolerably competent tribunal in our own country, and there at least exhibitors have timely advice of the days of trial, and have some general idea of the mode in which the contests will be conducted; but the arrangements for similar trials during the Exhibition have been arbitrary and uncertain, and, and the separation of a portion of the permanent exhibits by placing them in their out-of-the-way quarters at Billancourt, has been attended with great expense and inconvenience, and has proved a complete failure from the almost total absence of visitors.

A space of ground equal in extent to an average local Exhibition showyard in England is tolerably well filled with most varieties of farming implements and portable engines, and partially covered with wooden sheds and annexes, besides being flanked with several very temporary refreshment booths, and further ornamented by a most woe-begone specimen of the *châlet* class of *cafés*. The Parisians have no notion of going so far to fare so badly, and the regular sight-seeing visitor generally finds out how to get there about the time that he begins to see that he has a great many more places of real interest to visit in Paris and at the Exhibition than he can well accomplish, and wisely leaves out Billancourt. The consequence is that the average attendance there is popularly estimated at about six souls, and from the general appearance of the place we cannot but regard it as a very benighted region. Monday's trial was a postponement of a portion of what ought to have been done on the day of the threshing machine tests, which, as we noticed, only occupied a few minutes. A dynamometric test of the portable engines employed was then to have taken place, but from whatever cause, the remainder of the day passed over without it, and not a few English exhibitors were left under the impression that it no longer formed part of the programme. However, a few days afterwards they were informed that such a competition would take place on the 26th and 27th insts., and were requested to provide themselves with their own brakes and come to execution. This produced, on the part of our English exhibitors, no small feeling of irritation. The only English representative for Class 74, Mr. Scott, who was acting as supplementary juror—if we may use the expression in relation to the first appointed jurors who never attended at all—had left Paris, and, indeed, as it turned out there was a notable deficiency of jurors of any nation, besides which some of the English firms had sent their attendants home. One Eastern Counties firm took a dignified leave of the world in general, and the Imperial Commission in particular, through the medium of a well-expressed and badly-lithographed letter in which it is announced that it is a rule of the establishment not to compete, except at the Royal Agricultural Shows, where they have recently obtained the first prize; that their mechanics had gone home, and, finally, that seeing neither "reason nor advantage" in breaking their rule on the present occasion, they declined the honour of competing. Now there has been quite sufficient reason, from the irregularity and imperfection of previous trials, and the total neglect of the class by English jurymen for any competitor to have withdrawn on the present occasion, but we must be allowed to suggest that if the firm in question make it a rule not to be tested by any but one particular tribunal they ought to abstain from attending any but its exhibitions. Other exhibitors, with or without protests, declined to compete, and the result was that seven engines—three English and four French—were brought to trial on Monday, and some others were experimented with on Tuesday. Of these tests we give tabulated particulars elsewhere, from which our readers will readily draw their own inferences of the results of the competition. The dynamometers were all applied to the driving wheels of the engines, and a pleasing diversity existed as to the weights, speeds, &c. The four French brakes were all put on with the lever, from the end of which the weights were suspended. Messrs. Marshall and Ransome and Sims suspended their weights directly from pins on the friction bands, the latter firm employing a heavier weight than the maximum intended to be sustained by the engine, and counterbalancing it by a Salter's spring balance at the opposite side of the wheel, the mean tension shown as exerted by this spring during the trial being deducted from the weight carried on the scale-board of the dynamometer. This arrangement has the advantage of rendering the test more accurate, and of giving a greater range of speed in driving the engine, for within the limits of the tension registered by the spring the weight actually sustained can be varied by merely tightening or loosening the brake band. It must, however, be observed that in order to take advantage of the precision of the instrument a careful and constant observation of the tension of the spring would be required. At best, as compared with the means at the disposal of the Royal Agricultural Society, those employed at the great French Exhibition have been but makeshifts, and the attendance of the jury was confined to that of one of its members, M. Gardvoinnet, an able French professor of agriculture.

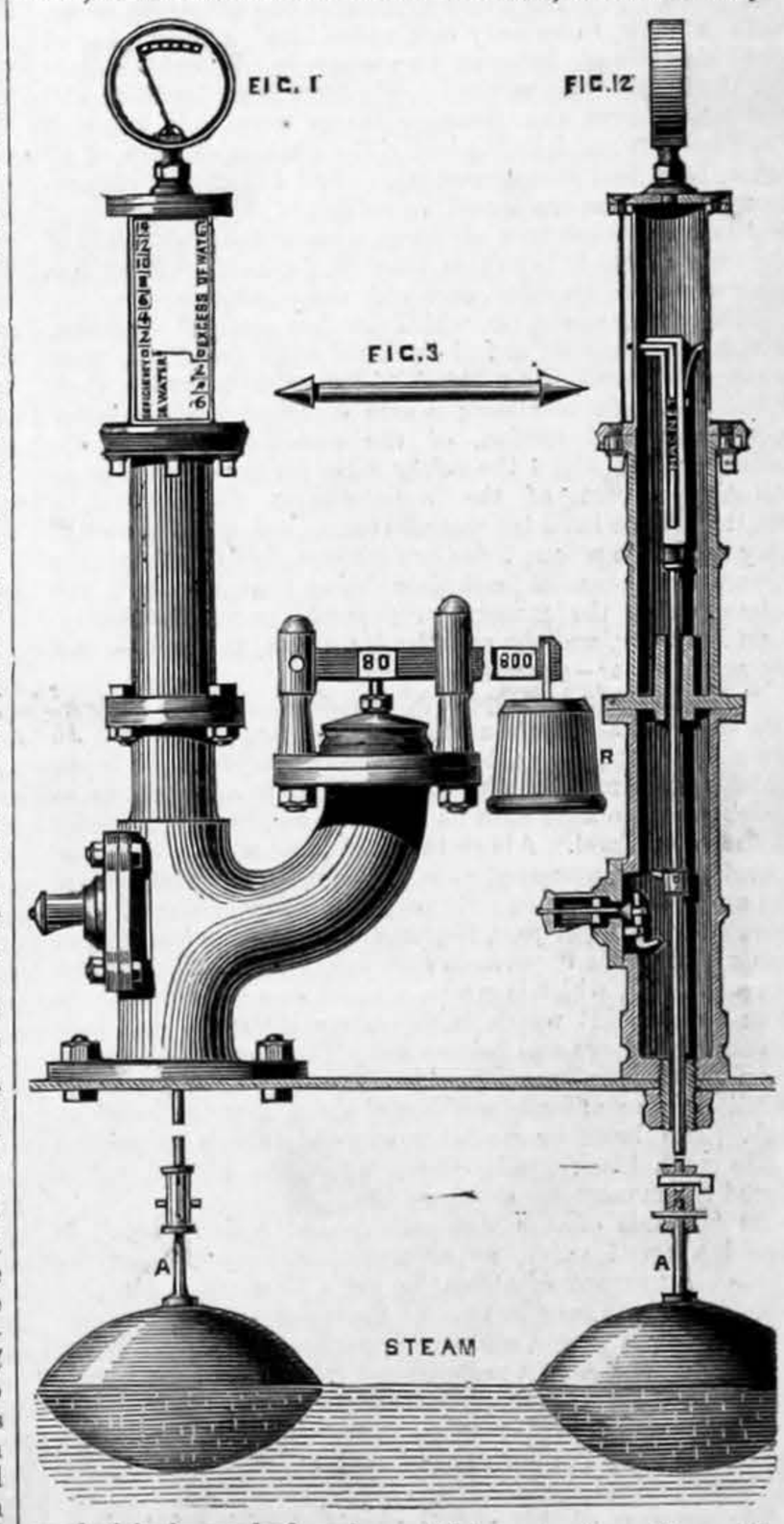
Although no such experiment had been hitherto contemplated, it is now understood that a steam plough trial will take place at St. Cloud this week. It will, however, be too late for us to publish any account of the proceedings that take place in the present number. The daily attendance at the Exhibition seems to be in direct proportion to the temperature. After the heavy thunderstorm and rainfall of Monday night both visitors and temperature considerably decreased, though in reality the weather was much more enjoyable. Some of the more temporary structures are already manifesting signs of decrepitude, and as for the green awnings, they have been for the third time, and, we presume, finally blown from their high estate. The great iron doors of the Grande Porte have fallen down like guillotines a second time, and the chairs, as all the world know, have been made a clean sweep of from the front of the cafes; so much for the little passing events of a small world, which will soon be a thing of the past. The comments of some of the English journals on technical subjects at the Exhibition often afford matter for a little lively criticism. The *Illustrated News* lately published the excellent report of Mr. Anderson, of Woolwich, on machine tools, one of the series which will appear in the South Kensington report. In order, we suppose, to embellish an article which required no commendation, it was accompanied by a page of good engravings, purporting to represent "machine tools, class 54," and further described as the various kinds of "machine tools for cutting iron." The sheet illustrated but one tool in the Exhibition, the only one shown by one of the English exhibiting firms, the other four engravings, so far as regards the Paris International Exhibition, are purely imaginary. Although not directly in connection with the Exhibition, as it has a bearing on the important cognate subject of technical education, we cannot but notice an error into which "a correspondent of great experience," of the *Pall Mall Gazette*, has recently fallen. He describes a visit to an iron merchant's yard in London, where he was told that rolled iron was sent into the country from France, Belgium, and Prussia, better done than we could do it, and of a larger size; and on another occasion, when visiting a Scotch shipbuilding yard, he is surprised to find a certain important part of a marine engine, weighing from fifteen to twenty tons, now made abroad, of solid steel, instead of being made in nine different pieces, as he had seen it some years before at the same establishment. On inquiry he is informed of the astounding fact that this "piece of machinery" of fifteen tons weight (a crank shaft, we presume) cannot be had "at home at any price," and is imported at a cost of "more than half a crown a pound." We must say that we should consider this Scotch shipbuilder a very valuable customer—one, in fact, whom it would be a privilege to serve. We have always maintained that the more enlightened continental nations have made such good use of the inferior natural advantages which they possess as to leave us little chance of competing with them on their own ground, and to enable them, as in the case of Belgium, to send some inferior qualities of bar into our southern markets. But the impression conveyed by the letter to which we allude is calculated merely to amuse mechanical engineers and mislead the general public. There are no qualities of iron produced abroad which cannot be just as well turned out in England. A 20-ton crank shaft is but a trifle to any of a dozen of our largest forges, and we doubt if half the number of establishments could be pointed out elsewhere in Europe in which so heavy a forging could be produced. The absurdity of a steel crank shaft costing 2s. 6d. a pound is self-evident. We have by no means done with urging on our countrymen the necessity for a higher class of technical education; but arguments based on mistaken statements of technical facts will do injury to the cause instead of helping it.

PARIS EXHIBITION—BOILER FITTINGS.

Boiler attachments, auxiliary to the safe and convenient use of these appliances for raising steam, exist in multitudes in the Exhibition—more especially in the departments of Great Britain, France, Germany, and Belgium—which, including the United States, are, indeed, all the great steam-using nations of the world.

Amongst these all, there is not probably a prettier or more perfect piece of boiler fitment than the safety apparatus patented and exhibited by Mons. Lethuillier-Pinel, manufacturing engineer of Paris and of Rouen, for indicating the water level in boilers, and giving audible notice of the insufficiency or surplusage of water supply in the same. Numerous as have been the contrivances for enabling the water level inside the opaque boiler to be judged of from the outside—and of which some score or two may be found in systematic works on the steam engine, or scattered in the pages of technical journals—those in actual and trusted use may be almost resolved into three classes, which are known and common everywhere, though employed in many slightly differing forms, viz., the gauge cock, the water glass, and the indexed float.

The two first, as every practical engineer knows, afford but the most uncertain indications of water level, under many conditions of use. With a priming boiler—greasy, or soapy, or impalpably muddy water—or with a boiler violently agitated, as in a locomotive oscillating upon a very rough road, or a marine boiler in a short, chopping seaway—it is not unusual to see all three gauge cocks blow off a hot froth, which is neither steam nor water, in a sense sufficiently pronounced in any one of them, to decide the actual level of the water, which has really



no decisively-marked surface within. Again, with muddy water, or that containing certain mineral salts which rapidly remove the smooth surface from the interior of the gauge glass, its indications soon cease to be very distinct, while, with the water within the boiler violently in agitation, and especially if it

should oscillate—as it often does in small marine boilers, so that bubbles of steam rise up and break with the water occupying the glass, but whose level is momentarily changing—the water glass becomes a very truthless instrument; in fact, both gauge cocks and water glasses can scarcely be said to work perfectly, except in the dignified quietude of a fine boiler-house attached to some grand factory or waterworks, or other like circumstanced and leisurely worked engine. And even here their indications address the eye alone, and they never force their notice upon the lazy or inattentive stoker. The water gauge float possesses the immense advantage that when the float itself inside the boiler is large and heavy enough, it swims at practically an invariable level, and that this level is really that of the water in the boiler, or in a constant relation to it, no matter almost how or to what extent that may be agitated. There have, hence, been very numerous attempts made to connect the float within the boiler with an index external to it, which shall give to the eye indications of the state of the water level within, and shall address the ear, by releasing the steam upon a whistle, in the event of the water falling dangerously low. The difficulty always has been how to pass the rod or wire connecting the float within, with the indicator and whistle apparatus without, so that there shall be little or no friction, nor any chance of the rod sticking fast, or being wilfully or accidentally set fast in the stuffing-box or its equivalent, which was indispensable to make the shell of the boiler steam tight at the point of intersection with the float wire.

The old Watt float wire passed through a simple hemp-packed stuffing-box—bend the wire, put the least *kink* within the range of its play, and it would no longer work freely, if at all. The very best stuffing-box for the wire we have ever seen was that contrived by the late Mr. George Forrester, of the Vauxhall Foundry, Liverpool. It consisted in a bored gun-metal tube of a few inches in length—a little more than the intended vertical play of the float—and of about six-tenths of an inch in diameter. This was provided with a flange collar outside and a screw and nut within the boiler to secure it in place. The copper float wire at the proper point of its length had two small brass collars brazed on to it, each about four-tenths of an inch in diameter and about the same apart in the line of the wire. Between these a round packing lap of tallowed hemp was made, so as to pass easily, but steam-tight, into the tube in which it worked up and down with what the French call *douce frottement*.

This arrangement worked admirably while it was kept in order—no kinking or bending of the float wire by rough usage did it any harm. But it was not perfect; if packed too tight by a rough or stupid hand it was liable to become deceptive, if too loose it was always fizzing out a film of steam, and dripping condensed water on the boiler-plating to its serious corrosion and detriment; worse than these, if packed just as it should be, dust, grit, ashes, &c., day by day accumulated in the tube and got impacted with the hemp stuffing, the friction increased and we have known the wire set so fast by this that the float could not be lifted by it. The writer himself, in one or two instances, with a view to remedy this, substituted a short plug of good elastic cork between two screw or adjustable collars for the hemp. This worked nicely for a time, but cork will not stand even low pressure steam very long before it becomes soft and falls to pieces. The vital point, then, of all water level float arrangements is to find a method of connection between the inside and the outside of the boiler without friction, and when once adjusted, without the probability of derangement. It is to this that M. Lethuillier-Pinel has addressed his ingenuity, and with remarkable success.

His arrangement, of which he has several varieties, which are exhibited at full size and with the floats upon water, will be readily understood from the following Figs. 1 and 2—the former being a side elevation, and the latter a vertical axial section, of the essential parts of the indicator. In Fig. 1 the safety valve (or one of them) constituting a part of the apparatus in Fig. 2, that is omitted. The inventor manufactures (and we may add at very moderate prices) three or four standard forms of the apparatus, the most complete being that in which the safety valve, the manometer pressure guage, the water-level indicator, and the whistles for alarm, at too little and too much water—are all combined.

A relatively larger copper hollow float, in form that of two spherical segments united base to base, and proved to ten atmospheres, so as to avoid any chance of its being burst by the included air when heated, is adjusted as to weight so as to float with its greatest horizontal diameter at the water level. Above this is secured upon the boiler a vertical pipe, arranged as in Fig. 2, the lower part, except the screw collar, passing through the boiler, being of cast iron, and the upper part, together with this collar, &c., of gun metal. The uppermost segment of all is of brass, and has a flat side, which is graduated upwards and downwards from a zero point which is the normal water level, into centimetres above and below this. This surface is covered by a movable glass plate leaving a space between the parallel glass and brass surfaces of about four-tenths of an inch. The brass or copper graduated face is enamelled white with black graduations; upon the top of all is placed the manometer steam gauge.

At one side of the vertical pipe, at a fixed level, is placed a small valve, so arranged as to permit, when opened, a current of steam to issue through a metallic whistle. There may be two of these—one higher to indicate surplus of water, and one lower for deficiency. From the top of the float a metallic rod rises up, passes freely, but without needless freedom, through the lower collar of the vertical pipe; and again, in the same way, through a collar formed in the bottom and centre of the middle piece of that pipe.

The top part of this rod is provided with a flat piece, to which is screwed or rivetted between cheeks of brass a powerful permanent bar magnet. The upper or south pole of this magnet is bent at right angles to the rest of the piece, and rounded and polished at its extremity, which, when the carrying rod is vertical and in position, rubs with very slight friction against the smooth back face of the graduated brass plate. At the rear of the magnet carrier is fixed a slight spring of hard gun metal, which bears with gentle pressure against the interior of the pipe opposite it, and thus ensures the upper pole of the magnet remaining always in contact with the back of the graduated plate.

The float, by its form, secures the constant perpendicularity of the float rod. The two collars through which it freely passes within the pipe, prevent departure from this beyond narrow limits. Within these limits alone the small spring is needed. Before the glass plate outside the graduated brass one is closed, a black varnished or blued steel index in the form shown at full size in Fig. 3, is placed horizontally and loosely at the bottom. It is instantly caught up by the upper pole of the magnet inside, as soon as this is depressed so as to come near it, and it thereafter remains always in suspension, in close contact with the graduated brass plate, and at whatever level upon this corresponds with that of the top pole of the magnet inside. The horizontality of this magnetic index or armature is secured by the form of the top pole of the magnet itself, which, being a flat bar bent as has been described, has its pole, when in contact with the back of the scale plate, also horizontal, *i.e.*, the contact is a horizontal line.

We have thus established communication between the free rod and magnet inside, and the equally free rolling index outside, by means of the unseen and frictionless, though powerful, constraining force of magnetism. The mere idea is probably not quite new—for other purposes it has been often suggested, and occasionally applied; we are not quite sure even but that we have met with the notion, proposed as a mode for connecting boiler floats and indices in some British periodical of former years, but it is but justice to the inventor to say we have never seen the idea so perfectly, and in every detail, efficiently worked out in practice. The rapidity and exactness with which the rolling index follows the motions of the float and magnet within, however sudden or *brusque*, are strikingly shown at the Exhibition, where one is at liberty to jerk the floats by hand up or down as fast and as far as we can; and yet it is found impossible to detach or to derange the position of the index in the slightest degree. The magnets are manufactured, we are informed, by the usually practised method of "touch," and they are stated not to lose their magnetism in use. From their position—vertical—and other conditions, we should not expect them to do so. When we forcibly detached one of the indices and put it down horizontally or diagonally, or even vertically, at the bottom of the scale plate, it was instantly again seized by the magnet, and, in a way that looked quite magical, regained its position, and that always perfectly horizontal.

It remains only to describe the arrangement by which the whistles are set going. As regards the lower one, which is shown on Fig. 2, this needs but a few words. The adjustable collar and tappet seen upon the float rod when it comes in contact with the little latch lever of the whistle valve, pulls the latter inward with a force equal to the momentary unsupported weight of the float; and as the absolute weight of this is considerable, and the area and friction of the steam valve are very small, there is ample force to effect this. When the float rod has descended to this point its uppermost collar rests upon that of the pipe, as will easily be seen in Fig. 2, so that the little touching piece or cam on the rod cannot descend below the latch lever of the whistle valve, and on the float again rising, this latter is released, and the whistle valve closes of itself. But the apparatus may also be so arranged that once the float has been depressed to this position through the carelessness of the stoker, the instrument will not rise to zero again until readjusted by hand, so that it then becomes a tell-tale, even though the whistle's voice be stifled. The arrangement for blowing a whistle for showing too much water is almost precisely similar, but placed and acting in a reverse direction. The inventor states that he has already supplied in commerce more than 8000 of these indicators.

THE CHALLENGE COMPETITION OF SAFES FOR THE DEPOSIT OF VALUABLES AT PARIS.

This contest, now likely to prove remarkable in more respects than one—is ended, at least for the present as it would appear, though not concluded.

Events have, in fact occurred, which have resulted in the formal withdrawal, under protest, of the two English engineers, in the resignation of the chairman of the committee, Mons. Douliot, and, we believe, also in that of the secretary.

There has ceased, therefore, to be any committee, and as no decision had been arrived at when this took place, none can be arrived at now, further than what follows we presume naturally from the turn events have taken—namely, that the challenge stakes must be withdrawn by the respective parties each paying his own expenses, and that no verdict can be given other than that which the public will undoubtedly award upon the judgment of *all the facts*, when these shall have been published. The facts of the trial by experts of the two safes, up to the conclusion for that day, of that ordeal, on the evening of the 13th instant, have been already recorded by us in a recent impression. The main facts, as well as many observations as to matters of fact bearing upon the issue, of great perspicuity and pertinence, may also be with advantage read, in collation with our account, in the excellent article which appeared in the *Times* of the 19th inst. We are unable to say as much for the account given by a contemporary engineering paper, in which the most preposterous errors both as to facts and deduction abound, and in which some claims, without any basis, are imagined in favour of Mr. Chatwood, which he himself would be the first to disown.

The following are the occurrences as they took place after the day of the 13th inst., so far as we are at present informed of them and feel ourselves at liberty on the present occasion, to divulge or refer to them:—On the morning of Wednesday, the 14th inst., we are informed, the committee again assembled at the British testing house, where, as we have already stated, Chatwood's three workmen (we wish they had all been more completely entitled to be called "experts"), tore out the entire front of Herring's inner safe or coffer (remaining over night), in four minutes, and the drawers of Chatwood's safe (fragile bits of wood) were destroyed by one of the American members of the committee (as Mr. Herring's workmen could not be obtained for this purpose), in one minute. This completed on both sides the trial by "experts," and we are now in a position to give with exactness the times in which each of the two safes was fully broken into.

The experts began to operate upon both safes at 2.45 p.m. on the 13th, and the wood block was taken out of Chatwood's safe at 7.25 p.m. Deducting from both sides forty-five minutes (allowed to the men for rest and refreshment) the time, therefore, occupied in the extraction was 3h. 55m., or 235 minutes. As regards Herring's safe, at 7.15 p.m. the thick double front plate of the inner safe or coffer was broken off, and in five minutes after the inside of the coffer was opened to the extent of a horizontal surface of two and-a-quarter inches wide by the entire length of the coffer. Although the brick of wood could not be got out through this—having been wisely placed by Mr. Herring at the lowest and furthermost part of the coffer—still this opening was amply sufficient to have enabled gold coin or jewels to have been extracted from the interior.

As far as being still proof against burglars, Herring's safe was thus, at this instant, *hors de combat*—that is to say, it had really—though not to the full extent demanded by the letter of the law as fixed for the trial—then been broken into, and thus had been so in 230 minutes from the moment of the common start, or in *five minutes less* than in the case of Chatwood's safe.

The entire times employed upon Herring's safe may be recapitulated as follows:—Time up to when the front plates of the coffer were torn off, 225 min.; time consumed after that by the men in hammering (nearly in the dark, and under great disadvantages) at the remainder of the partly-opened coffer front, on the 13th inst., 25 min.; time in which the men completely tore away the remains of the front of the coffer, and took the wood block out, on the morning of the 14th inst., 4 min.; Total time from starting to the final destruction of Herring's safe was, therefore, 254 min. Making no deductions nor allowances of any sort on either side, the relative times, therefore, were—Chatwood's safe, 235 min.; Herring's safe, 254 min.

The difference between the two is only nineteen minutes, so that the advantage in time in favour of Herring, thus taken, without any deduction or qualification due to circumstance, is only $\frac{1}{12{\cdot}3}$, or *eight per cent.* of the entire time consumed upon Chatwood's, or *less than eight per cent.* $\left(\frac{1}{13{\cdot}39}\right)$, if we take the total time consumed on Herring's safe as the unit for comparison.

Were we to institute estimative deductions which might be made from this small difference of nineteen minutes in Herring's favour, based upon impartially fair and undeniable considerations of relative circumstances, we are of opinion that even this small difference would be seriously reduced, and that good grounds could be adduced for its becoming evanescent, or even passing through zero and leaving the difference fairly viewed, as the other way.

However, we shall not now go into that which can be discussed with greater fairness to both parties after we shall have been enabled to make public all the facts up to the end of this memorable contest.

So far, however, according to the conditions fixed, and subject to all the "inseparable accidents" to which any such test by experts must be inevitably liable, the time of being broken into, to the extent exacted by those conditions, and small as was the difference, was in favour of Herring.

But the relative goodness of burglar proof safes, though—as was well expressed by M. Douliot the chairman—it is undoubtedly a function of the time occupied in breaking into them respectively, does not rest upon that matter alone.

Of that the entire committee before the trial began, expressed their concurrent belief; it therefore became the more important that these gentlemen should take into consideration in the fullest and most impartial manner, and weigh with the most scrupulous and anxious care every other circumstance, both of a constructive character as regards the safes themselves, and of a circumstantial character as affecting the trial by these experts, before arriving at a final conclusion as to "which was the best safe," and the one, therefore, by the articles of agreement, entitled to the heavy stakes deposited on challenge.

The articles of agreement left to the committee unlimited latitude in considering and deciding on those points, as will be obvious on re-perusing them. Accordingly, upon the 14th inst., after the conclusion of the operations above described, the committee, before leaving the testing-house, decided upon what further experiments, if any, they required made on either or both of the safes. They examined personally the condition of the safes, made out a written list of data as to weights, dimensions, &c., which they required to be conjointly obtained on the part of both Chatwood and Herring, and to be on the next day handed to each member of the committee, signed by or on the part of each of the parties. They compared, in certain parts, the drawings which had been handed in by the respective parties as representing the construction of their safes, and, we understand, found some serious discrepancies, and of a character likely to mislead, between Mr. Herring's drawings and his safe. Upon the part of Mr. Chatwood there were certain omissions in his drawings, but no discrepancies, nor anything calculated to mislead, and the omissions as to the structure of his outer compound shell were supplied by his illustrative tracings delivered with his working drawings.

It was proposed in writing by the chairman—who, unfortunately, does not speak or understand English—to the other members of the committee, that they should develope into the form of a written memorandum each his own

opinions and judgment upon all that had so far taken place, and that these opinions, when translated into French, should be placed in his (the chairman's) hands, for his information, —such memoranda, or reports of progress, not to be viewed as decisions, but simply as records of the facts as they appeared to each of the committee, with such deductions from these as they each deemed those facts to warrant—with a view to supply information to the chairman in a more full and precise manner than he found, owing to his want of knowledge of English, he had been able to obtain during the progress of the investigation.

This was agreed to by the committee, and upon their separation on the 14th it was understood that each of the four members should separately record his views, and that all four documents should be translated and simultaneously sent, through the secretary (Mr. Hoyle), to the chairman. Upon the 16th inst., as we are informed, the two English members learned that Messrs. Holmes and Pickering, the two American members, had departed from this arrangement—that they had thought proper to make a joint report, and that that report had been already translated and been transmitted to Mons. Douliot, the chairman. Messrs. Mallet and Fairlie, the English members, thereupon deemed it best to take a like course: they prepared a joint report of progress on that day, had it translated, and forwarded it with as little delay as possible to the chairman also.

Upon the same day (16th inst.) it was settled by the chairman with other members, American and English, of the committee, that it should meet on Monday, the 19th, at 5 p.m., for the purpose of conferring upon those reports, and upon the views which the chairman might himself entertain, and of arriving at a final decision, as to whose was the best safe, and who was, therefore, entitled to the stakes.

This meeting was accordingly held, all the committee, together with the secretary, being present. The joint reports of progress, of Messrs. Holmes and Pickering upon the one part, and of Messrs. Mallet and Fairlie upon the other were respectively read in English and were in writing before the chairman in French, and the chairman was requested now to favour the committee with his own views, in fact, to prepare a *proces verbal*, or report of progress—not as a decision, but as a mere instrument for clearer consideration—which should be translated into English and laid before the committee at its next meeting, which was fixed for the following evening (20th inst.) at 7 p.m. During the course of this meeting of the 19th inst., however, it turned out, as we are informed, that not only had Messrs. Holmes and Pickering forwarded to Mons. Douliot, the chairman, their joint report, as before stated, but that Mr. Holmes had individually addressed to Mons. Douliot a letter of considerable length and of a most extraordinary character, and departing altogether outside the limits of the proper field of discussion for any member of the committee. It also appeared that two other documents of a totally different character from any report of progress had been also sent, subsequent to the 14th inst., by Messrs. Holmes and Pickering or by Mr. Holmes, to Mons. Douliot, and that these documents had been translated, and forwarded by the secretary to the chairman, and were at last produced, at the requirement of Messrs. Mallet and Fairlie, in the original English. These three documents, other than and in addition to the joint report, appeared to the English members of the committee of a character so objectionable and so unexpected that they announced at once their doubts as to how far they were warranted in acting further on the committee. They proposed a resolution, in which the chairman, Mons. Douliot, expressed his concurrence, and which was carried and recorded the judgment of the entire committee except the two American members, that those documents ought not to have been forwarded. Some warm discussion is said to have followed, and may be supposed, if it be a fact that the meeting lasted until 1.30 a.m. on the morning of the 20th, when it was adjourned to the evening of that day at 7 p.m. In the interval Messrs. Mallet and Fairlie, as we are informed, upon a mature and dispassionate review of all the facts including the last evening's proceedings, came to the conclusion that even-handed justice was no longer possible, and in any case that various circumstances, of a character calculated unduly to bias the issue, which they had had occasion previously to remonstrate against, as well as these last events, rendered their own withdrawal imperative to them, having regard to their own professional and personal reputation.

Messrs. Mallet and Fairlie, therefore, attended the committee of the 20th inst., at 7 p.m., and having seen that the minutes of the previous meeting were duly entered and signed by the chairman, initialled the originals of the several objectionable documents, and got a resolution passed that all documents now in the hands of the secretary should be accessible to both Mr. Herring and Mr. Chatwood. Messrs. Mallet and Fairlie then, before the chairman's report of progress (and of the nature of which they are still entirely ignorant) was read, announced their intention to retire, and they read, in the form of a memorandum handed to the secretary, their formal resignation and the immediate grounds of it. They at the same time deemed it right to express to Mons. Douliot individually their undiminished respect for him personally and as chairman. Upon this Mons. Douliot at once wrote out and handed in his own resignation as chairman, and the secretary verbally offered his.

Neither the terms of these resignations, nor of those documents, are before us, nor, we believe, have yet been made public. No doubt they must in due time, along with all and every circumstance of this trial, come before the public. The characters of those concerned demand this and nothing less than this, and we shall probably be ere long ourselves in a position, not only to give the facts but to comment upon them, and, what is to the mechanician more important, to criticise the safes themselves, which have thus become so prominent.

Meanwhile the committee no longer exists since 7:30 p.m., or thereabouts, on the 20th August instant, and having been dissolved without a decision, and no power under the articles of agreement of re-appointment existing, the whole matter, so far as the challenge is concerned, is at an end, and, as we presume, the stakes must be returned to their respective depositors. We are far from thinking, however, that this challenge trial has been fruitless or unproductive in a technical sense, of any end. On the contrary, we believe there are abundant evidences upon which to found a solid and sound judgment as to which of the two safes, viz., as constructed by Herring or by Chatwood, is the better—or the best, in an absolute sense—and so far as we are concerned we shall discuss this fully and impartially as soon as we shall have had all the information we require placed at our command.

In the account of the ordeal of the 13th ult., in our last impression, we made one omission which we wish now to supply. We should have stated that "time" was kept during the trial (as corroborative of the time taken by the respective members of the committee by their own watches) by Mr. John Walker, of 68, Cornhill, and Regent-street, London, goldsmith and jeweller, who supplied a marine chronometer, from his place in the Exhibition, for the use of the committee. Mr. Walker's name will be in the recollection of our readers as the gentleman whose safe in Cornhill was broken open in February, 1865, and about five thousand pounds worth of property carried away; a robbery which has largely though indirectly contributed both to the improvement of safes, and to the increase of trade of the safe makers.

PARIS EXHIBITION—THE VENTILATION OF THE MAIN BUILDING.

It is stated on pretty good authority in Paris, and which, at least, has the sanction of type in the official catalogue, that the forced ventilation of the interior zones of the Exhibition building employs a total steam power of about 100-horse power, by which some 700,000 cubic metres of fresh air are assumed to be delivered in *some unit* of time, but whether that unit be one hour or two hours, appears from official or demi-official documents, somewhat obscure. It is stated in the catalogue that the interior atmosphere will be completely renewed every two hours—but here, again, there is a good deal of obscurity—as we are unable to decide of *how much* of the entire internal area of the building, the entire atmosphere will thus be renewed. The renewal of the whole cubic contents of the building, including the great zone, it cannot possibly mean. It cannot even mean the whole of the remaining roofed-in portions of the building; whatever it does mean the ventilation of the central zones of the structure has now, when tested by an extreme case, proved itself wholly insufficient.

On last week, *i.e.*, the week between Wednesday the 14th and 21st August present, there occurred at Paris, three days at least of exceptionally great heat and powerful sunshine. Upon two of the days these were so great as to be almost overpowering to those exposed to the sun, and so oppressive even in the shade, that Americans accustomed to the fierce dry heat of the summer at New York, and to the heat and vapour of New Orleans, complained of it. This state of weather which, even in this exceptional year, attracted the notice of all both at Paris and London, ended, as we all know, by a thunder storm, which appears to have extended over the entire South of England and North of France with great power, and with diminished energy over a far wider area. Upon those days of extreme heat the three inner zones of the Exhibition building, viz., those of the objects—belonging to the person—to the house and furniture—and to the liberal arts, &c., were found to have an atmosphere in a condition highly oppressive and disabling. Registers which have been kept at the building are stated to prove that up to a short time ago the average difference in temperature between the air outside and that inside those portions of the building did not exceed 5 deg. Cent., or about 9 deg. Fah. It is quite possible that during those oppressive days this difference may not have been greater. But when the air to be forced in was taken up by the fans or blast cylinders at about 85 deg. Fah., and in some cases, probably, nearly 90 deg. Fah., and further heated by friction and compression, and by direct sun or other heat absorbed by some of the metallic surfaces of the ventilating apparatus, it will be easily imagined that 85 deg. + 9 deg. would give a very unbearable temperature in the inner recesses of the immense enclosed area of the building, assuming the stated difference to have been the actual one. Perhaps we ought in the preceding statement to make some little allowance for the cooling produced in the current of air forced in, by its passage through the subterraneous ducts leading from the apparatus at the several points, most of them outside the great zone, but not all so. This cooling for various reasons, however, must be very small indeed, if anything at all now, for in fact the currents of air rapidly tend to bring the walls of these ducts to their own temperature, and these surfaces are no doubt now at about the same temperature as the air outside, for the mean of each week or other short period. The main cause, however, of the sickly sense of oppression felt during those almost tropical days in the inner recesses of the building, was not the mere want of fresh air, nor yet the mere high temperature of the air itself, but the pathological effect upon the nervous system of the rays of invisible heat, constantly showered down from the roofs, whether of metal or of glass, with which the building is covered. Why such rays of *non-luminous heat* should prove so much more nerve-depressing than an equal degree of warmth radiated upon the human body from a source of *luminous heat*, such as a blazing fire or the sun, we shall not pretend even to discuss; it is a question for the physiologist mainly. The fact, however, we do not think admits of dispute, and it is one suggestive of several not unimportant deductions as to the construction and the ventilation, and even the illumination, of public buildings.

The exterior belt of restaurants around the main building, as is well known, is roofed with corrugated sheet iron. There is a floor and storey above several of these restaurants, the ceiling of which in several instances consists only of this bare surface of iron, fully exposed to the sun's rays externally for the greater part of the day.

Some of the rooms thus circumstanced (notably one above Kirkland's restaurant) are perfectly open in front, so that there is no want of ventilation in the sense of mere freedom and change of air, and there is complete shade from the sun. In these rooms, however, the sense of oppression and languor produced by sitting for a moderate time, especially with the head uncovered, is very remarkable. A singular instance of the same sort of action was stated to us by the workman in the British testing house who has attended there constantly to the trials made of the various forms of cooking apparatus for ships or for domestic or public uses. He mentioned that he had found the obscure heat radiated from the surfaces of a large circular closed in, sort of hot hearth of considerable size still in the building, far more exhausting to himself than the fiercest heat radiated during the same time from the open roasting or other fires also experimented upon. With this man it was a mere fact; he had no theory, nor any prepossessions.

A still more curious example of the same train of circumstances exists in another part of Paris. The two theatres at opposite sides of the Place du Châtelet—the Lyrique and the Du Châtelet—were, one of them fully, the other partially, heated and ventilated in accordance with the designs of General Morin. In point of ventilation, even in the hottest weather, both are excellent, and one of them absolutely perfect; there is no very perceptible difference in purity between the air within and without the building, even towards the conclusion of the performance.

Both theatres are lighted by means of gas jets placed above a translucent and in part coloured ceiling of glass, rendered untransparent by the surface being wrought into very beautiful diaper patterns—a sort of gigantic muffling, in fact.

Notwithstanding the goodness of the ventilation and the agreeable character of the light, it is a common remark at Paris that everybody feels sleepy at those theatres after the two first hours or so of the performance. The general fact is not doubtful—we have personally, and more than once experienced it—though no doubt the more nervous the temperament or feeble the health the more fully it will become evident, and thus more to others than to ourselves.

But what is the cause? We believe it is to be found in the rays of invisible or obscure heat, which are continually showered down from the great surface of the glass ceiling, heated as it must be by the numerous gaslights close above it. These observations, though so far having no pretensions to the rigid exactitude which science demands before she accepts aught as a truth proven, may yet be taken as sufficient hints that bare metallic surfaces as coverings for roofs are very objectionable in any climate, cold or hot. Colonial churches of iron, now so common, must thus superadd to the somniferous power of the "discourse" that due to the invisible rays shed down upon the congregation from the iron roof, bare within, and bare to the sun's rays without.

The lesson seems to be that in every building thus externally constructed, which is to be temporarily or permanently occupied by human beings—whether Exhibition buildings or churches—some surface of a light material should be interposed interiorly to the sun-heated iron, to cut off, as far as practicable, those obscure rays of heat. Common canvas, or other analogous material, will do so to a considerable extent; a thin interior surface of boarding would be still better, especially if within that, and studded off from it by a couple of inches, there was also a surface of canvass stretched.

Returning to the ventilation of the Exhibition building, we think it must be pronounced scarcely sufficient. We hope that the reports of the French executive, when at length they shall appear, will comprise full statements of all the data and registered phenomena, such as shall permit of a final judgment as to the *exact* nature of the means employed and of their adequacy to the end in view. Meanwhile we may venture to suggest that during the continuance of the hot and oppressive weather of this and the next month at Paris, if all the ventilating engines were kept at work *all night* long the effect would be a considerable reduction in the day temperature of the inner recesses of the building, as well as a good deal more freshness in the air during the day. The volume of air forced into the building, however, is not adequate to the vast space—to the crowded masses of heated and excited people that at times move about in it, and to the unquestionably considerable amount of odorous matter that must be evolved from the countless objects, more or less volatile, that occupy the building; even metals, such as brass and copper, as is well known, are not devoid of odour. Whenever there is a little breeze, in whatsoever direction, the ventilation is greatly improved. The construction of the building itself, with its shallow, tundish-like upper exterior form, and with its radial passages penetrating in all directions from centre to circumference, does more in such case for the ventilation in an hour than the whole 100-horse power does in the day.

A great central brick tower is placed in the middle garden, where the circular building now stands, which is occupied by the standards of weight and measure of all nations, of adequate height, probably not less than 250ft., and supplied with a powerful furnace to produce draught placed in a vault beneath the garden, and connected by tunnels with the gratings in the floors of the various parts of the building needing ventilation, would, in our judgment, have proved far more effective than the system of forced in ventilation actually adopted. This would have required the separation of the zones thus ventilated from those not requiring any artificial ventilation by means of double doors or curtains across the radial passages.

It would also have demanded a good deal of forethought as to the best positions and the most suitable constructions for the apertures of ingress for the fresh air. Even if these had been simply distributed over the roofs, so that the fresh air came in through these—although the air thus introduced would be at times heated by the sun, we believe the result would have proved good—provided the volume of indraught and outdraught were abundant. At present the volume of fresh air sent in is certainly insufficient. The current incoming can scarcely be perceived when standing within a yard or two of the wooden gratings of the fourth or inner zone, and the gratings themselves are badly constructed—one of the few bits of shabbiness about the building.

METROPOLITAN MEAT AND POULTRY MARKET.

DESIGNED BY MR. HORACE JONES, CITY ARCHITECT.

PARTIAL LONGITUDINAL SECTION THROUGH ROADWAY SHEWING ENTRANCE TO CENTRAL AVENUE

SCALE OF FEET

A. CURVED WROUGHT IRON GIRDERS 12X7X⅜
B. TIE BEAMS 10X7
C. LOWER PRINCIPAL RAFTERS 12X7 INTERMEDIATE 12X4
D. UPPER PRINCIPAL RAFTERS 11X7 TO 10X7 COMMON RAFT 4X2
E. STRAINING BEAM 10X7
F. STRUTS 6X6
G. PITCHING PLATE 5X4½
H. CURB PLATE 14X10 WITH WROUGHT IRON FLITCH AT ENTRANCE TO CENTRAL AVENUE
K. POLE PLATE 5X5
L. PURLINS 10X6 TRUSSED WITH WROUGHT IRON RODS
M. RIDGE PIECE 10X2

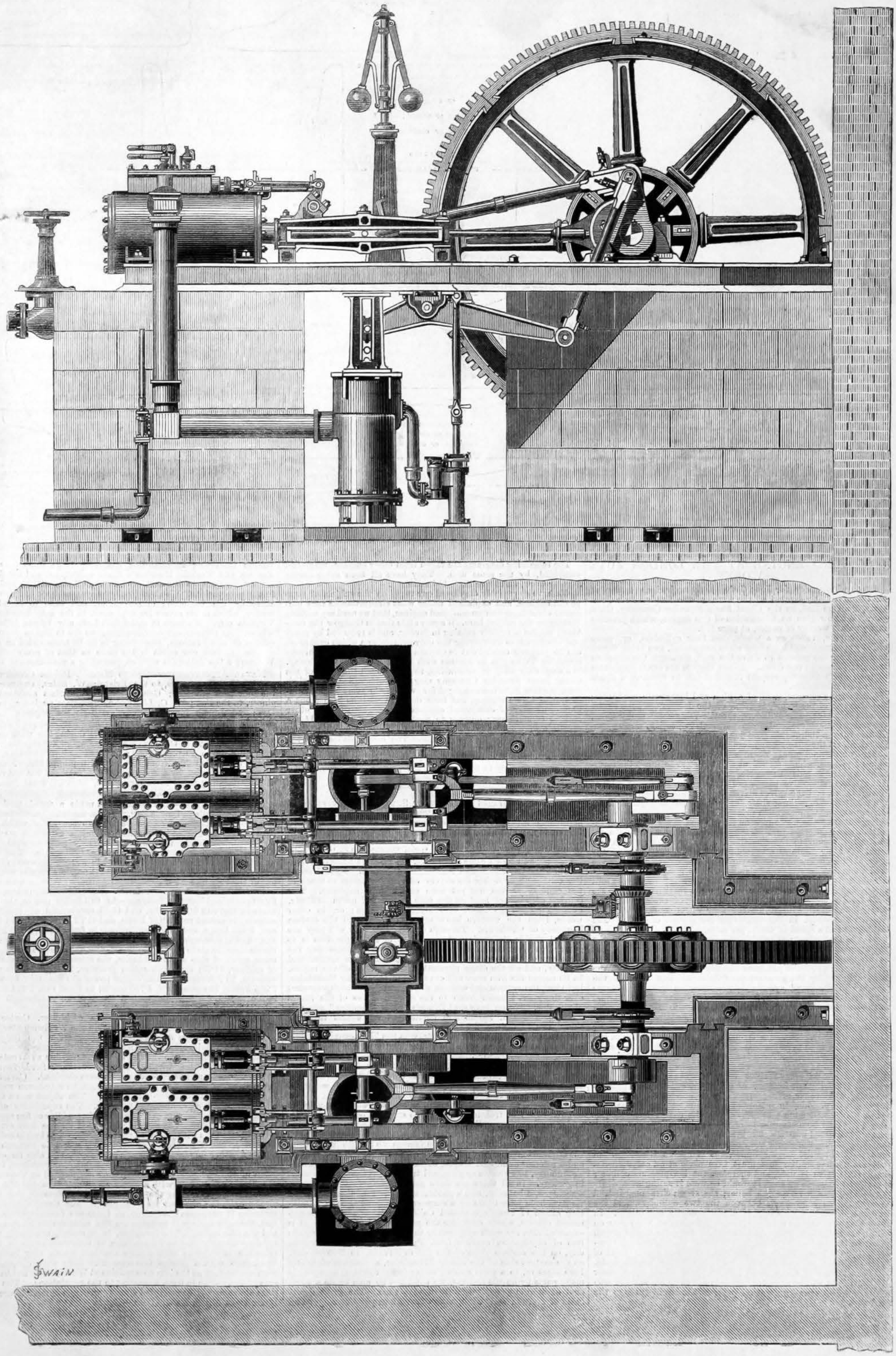
HALF ELEVATION OF END OF ROADWAY THROUGH CENTRE OF MARKET

HALF SECTION OF ROADWAY

J. SWAIN.

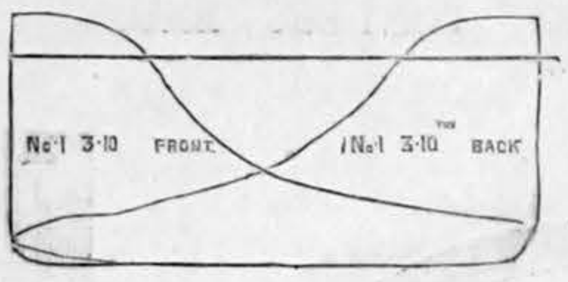
HORIZONTAL COMBINED ENGINE AT THE LONDON JUTE WORKS, PONDERS END.

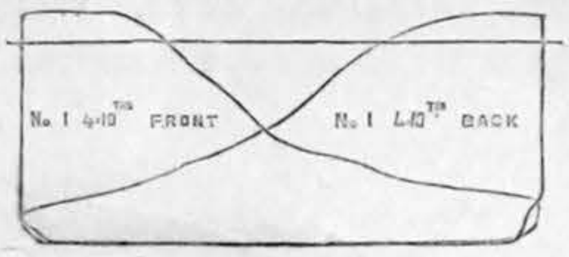
THE CANAL BASIN FOUNDRY COMPANY, GLASGOW, ENGINEERS.

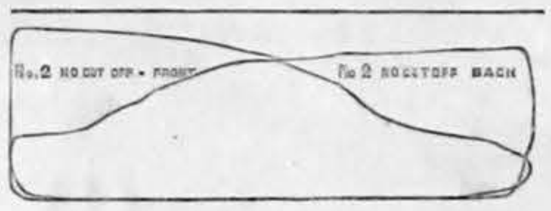


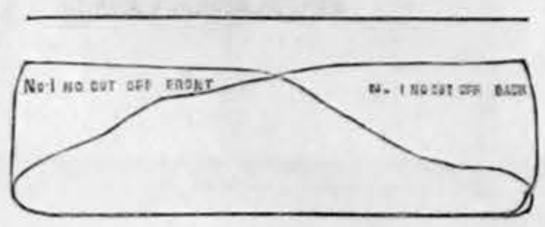
SWAIN

DIAGRAMS FROM ENGINES CONSTRUCTED BY THE CANAL BASIN FOUNDRY COMPANY, GLASGOW.





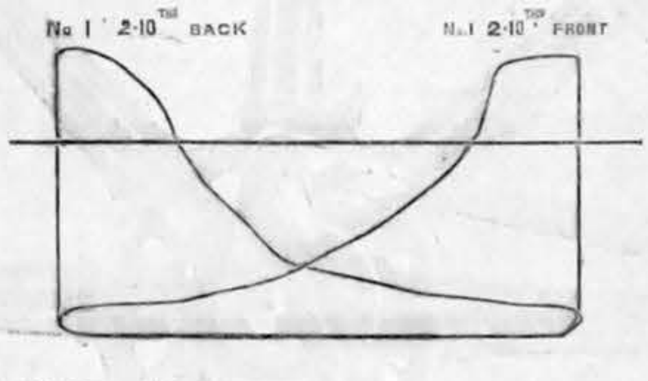


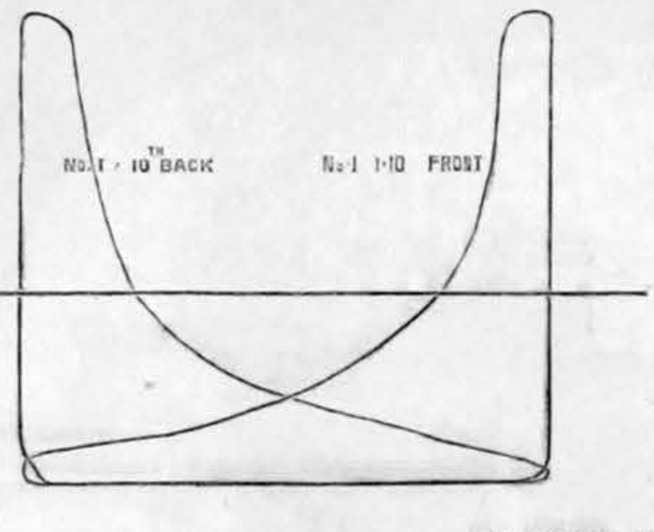


DIAGRAMS FROM A HORIZONTAL SINGLE CYLINDER CUT OFF ENGINE.

DIA.R OF CYLINDER 24
LENGTH OF STROKE 4FT
NUMBER OF STROKES 40

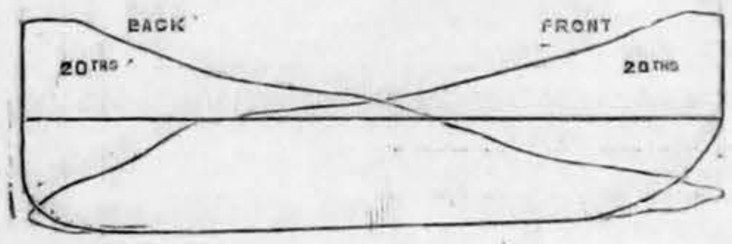
EXTRACTED FROM DIAGRAM BOOK



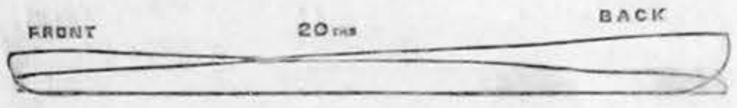


HIGH PRESSURE CYLINDER 19 DIA
LOW PRESSURE 30 DIA
LENGTH OF STROKE 4FT
NUMBER OF STROKES 45

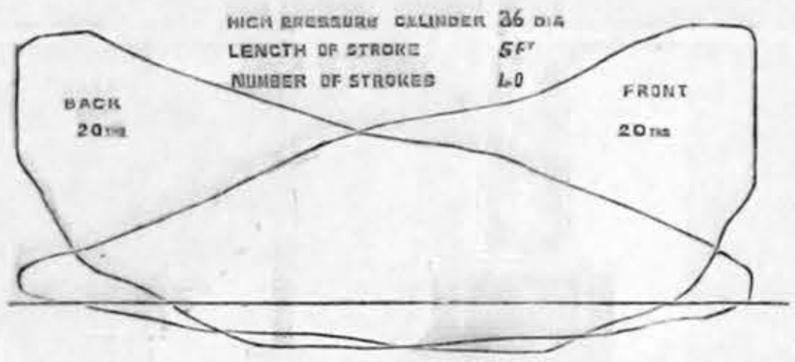
EXTRACTED FROM DIAGRAM BOOK



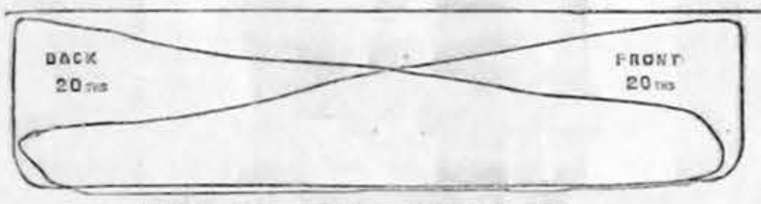
TAKEN WITH A RICHARDS INDICATOR



HIGH PRESSURE CYLINDER 36 DIA
LENGTH OF STROKE 5FT
NUMBER OF STROKES 40



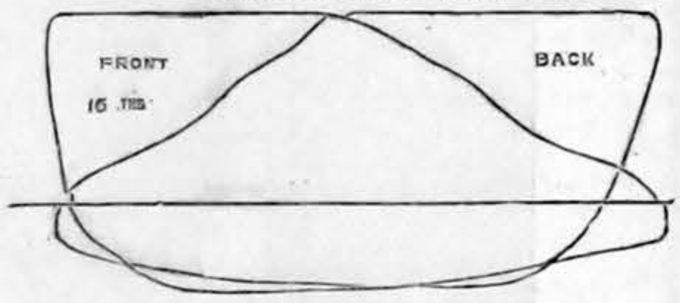
LOW PRESSURE CYLINDER 36 DIA
LENGTH OF STROKE 5FT
NUMBER OF STROKES 40



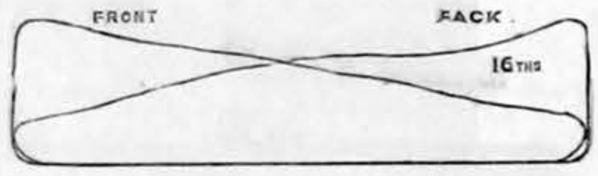
LONDON ILTE WORKS PONDERS END

HIGH PRESSURE CYLINDER 17 DIA
LOW PRESSURE 26 DIA
LENGTH OF STROKE 4FT
NUMBER OF STROKES 44

EXTRACTED FROM DIAGRAM BOOK



TAKEN WITH A M° NAUGHT INDICATOR



COMPOUND ENGINE AT THE LONDON JUTE WORKS.

In our impression for June 7 we briefly noticed an engine at that time recently erected at the works of the London Jute Company, Ponders End, by the Canal Basin Foundry Company, Glasgow. We now give an illustration of this engine, which presents many points worthy of notice, at page 173.

The engine, taken as a whole, has four cylinders, or, more strictly speaking, will have four when completed, two being found sufficient for the present to drive the mill, although the complete bed-plate has been put down. As the engines are exact duplicates of each other in every respect it will suffice to speak of a single pair of cylinders here.

Each engine consists, then, of a high and low-pressure cylinder; the diameter of the former is 24in., of the latter 36in., the stroke of both being 5ft. The cylinders, throttle-valve chest, and jackets, are cast in one piece, and, from personal inspection, we can pronounce them a thoroughly good job. The cylinder covers are also jacketted, all the spaces being supplied with steam direct from the boiler by a distinct pipe. There is but one connecting rod for each pair of pistons, widely forked at the tail so as to grasp the crosshead as near the rods as possible, in order to avoid the chance of side strain. The valve chests are arranged on the upper sides of the cylinders, and the valves driven by a single eccentric through the medium of a rocking shaft, as will be seen at a glance from our engraving. Condensation principally takes place in a horizontal enlargement of the waste pipe on its way to the air pump, the injection water entering just at the elbow and flowing with the uncondensed vapour to the condenser, which is not immersed in a tank. The air pump is actuated by a rocking shaft beneath the floor of the engine room; an arm from this shaft also drives the feed pump. The remaining details will be easily gathered from our engraving. We may state that the fly-wheel drives the mill through the medium of a spur wheel on a shaft lying about the same level as the crank shaft outside the wall of the engine room, through an aperture in which the spur wheel comes. We have omitted the wheel in our engraving from want of space. The engine runs at a speed of 400ft. per minute.

At the first glance it might be assumed that, owing to the arrangement of the cylinders, an injurious twisting strain would be brought on the crossheads, but this is not the case. Steam from the small cylinder exhausts directly into the valve-box of the large cylinder by the shortest possible route; and although the pressure in the small cylinder is much higher than in the large cylinder, it must be borne in mind, first, that a back pressure equal to the positive pressure on the large piston has to be deducted from the strain on the small piston end of the crosshead, while the much larger area of the low-pressure piston tends still further to bring about an equality. If steam is cut off at about one-third of the stroke of the high-pressure piston the strain is about the same at each end of the crosshead. It is quite certain that no evidence of twisting strain is perceptible while the engine is in motion, and engines similar in every respect have been running for five years without requiring one farthing of outlay for repair. It is difficult to see by what other arrangement of compound engine as much power can be provided in a limited space and at a moderate cost, and a glance will suffice to prove that the design is eminently simple and free from complexity of valve gear, &c.

It may be urged possibly that there is a certain loss of efficiency caused by taking the steam from one end of the small cylinder to the other end of the large cylinder, but it must not be forgotten that a somewhat similar loss must take place in all cases when a simple slide valve is used, and therefore the low-pressure cylinder is really little worse off than it would be were it acting as a single cylinder fed straight from the boiler; the steam chest may indeed be regarded as a reservoir between the two cylinders, and the influence of such a reservoir is not necessarily prejudicial. In order that our readers may judge for themselves of what goes on within the cylinders, we append a series of diagrams kindly placed at our service by Mr. Turnbull, of the Canal Basin Foundry Company, from whose designs the engines have been built. Four of these diagrams have been taken from the engine we illustrate. The consumption of coal is about 2·85 lb. per indicated horse power per hour. As will be seen, the engine is not fully loaded, the low-pressure engine drawing air at all parts of the stroke through the pet-cocks.

The remaining diagrams are taken from other engines, single and combined, by the same firm. They have all been made during regular work, and leave little to be desired.

We have so recently expressed our views on the subject of compound engines, and explained under what circumstances they possessed advantages over uncombined engines, that we need say nothing further on the subject here. We may state that in Glasgow the combined engine is rapidly gaining in favour, and is regarded by many manufacturers as embodying the only principle on which expansion can be properly carried out in engines intended to drive machinery requiring to be put in motion with a perfectly regular velocity. We shall only add, in conclusion, that although the name of the Canal Basin Foundry Company may not be familiar to English ears, the firm have been engaged for over twenty years in the manufacture of steam engines, and have during that time turned out a greater number of compound engines than perhaps all the other makers of stationary engines in Scotland put together. If the principle were objectionable it is to be assumed that they would have discovered the fact long since. The circumstance that the manufacture of compound engines is seldom or never given up in favour of single-cylinder engines by long-established houses is very excellent testimony to the value of the principle in a commercial sense.

The United States Government Survey.—A correspondent has forwarded us the following extract from a letter written by a gentleman who occupies the position of one of the geologists on the survey, and which, coming from so good an authority, will doubtless be of interest to our readers. The letter bears the date of 5th June, 1867, and is headed "San Francisco":—"And now let me tell you how I came to be here. The United States Government have lately authorised a geological survey to be made across the continent, or rather the survey of a section across so much of the country as has not yet been scientifically explored. This consists of a belt of land on the 40th parallel of north latitude, extending from the 105th to the 120th meridian; or, in other words, from the western boundary of Nebraska to the eastern boundary of California. Through or near this belt will pass the Central Pacific Railroad, and the object of the expedition is to gather in advance as much information as possible respecting the structure of the country, the mineral resources, the agricultural capacity, and all the other physical characteristics of the region. In its course the iron road will cut through the Rocky Mountains, including the eastern and western slopes, and will stretch westward over the great interior basin to the eastern slopes of the Sierra Mountains. If you have read Dixon's "New America" you will have some idea of the eastern portion, as our course takes us through Salt Lake and the Mormon country. The survey is under the command of Mr. Clarence King, who has been connected during the last few years with the State Geological Survey of California, under Professor J. D. Whitney. The experience that he has acquired as a mountain explorer admirably fits him for the leadership of this expedition. He has travelled extensively over the great mountain ranges of the West, has ascended and measured some of the loftiest peaks (he it was who first scaled and named Mount Lyell and Mount Tyndall), and is thoroughly inured to the hardships of frontier life. There are nine of us, assistants, under his direction. His friend and associate of the Californian survey, Mr. James T. Gardner, who has lately been engaged with King in surveying and mapping the famous Yo Semite Valley, and the adjacent mountain region, is the first assistant in topography, and Professor James D. Hague, of the Massachusetts Institute of Technology, likewise an experienced traveller, is the first assistant in geology. In all there are three geologists, three topographers, a zoologist, a botanist, and a photographer. In addition to these we have been joined here by a surgeon, six campmen, and a military escort of twenty mounted Californians, under non-commissioned officers, which complete the *personnel* of our party. It is expected that the work will occupy three years. As, however, the line of exploration extends from Pyramid Lake, near Virginia city, on the eastern slope of the Sierra Nevada, to Denver city, on the eastern side of the Rocky Mountains, a distance of nearly 1000 miles of, to a great extent, undeveloped country, occupied in many parts by hostile Indians, we shall not be able to do a great deal of *minute* geological work in that time. The great desert basin of Nevada and Utah, and the various parallel ridges and valleys traversing it, including the lofty ridge known as the Eastern and Western Humboldt River mountains, and the Wahsatch mountains, to the east of Great Salt Lake, will be included in our observations. We start in a few days, and hope to reach Fort Riley by the beginning of November, and then to spend the winter, which is too severe for field work, in the neighbourhood of Virginia city. We hope to make Salt Lake city by the following winter. As regards our commissariat, we are to live in tents and subsist on army rations, everything is to be transported in army wagons; in fact, our outfit is the same as that of army officers. We carry a few delicacies with us, including a good chest of tea."

Naval Appointments.—George Metcalf, Robert Crosthwaite, and W. Kelly, engineers, to the Bristol; W. Sides, engineer, to the Indus, for Skipjack; George Fabian, first-class assistant engineer, to the Fox; W. G. Littlejohn, first-class engineer, to the Dee; and Joseph Monk, second-class assistant engineer, to the Bristol.

South Kensington Museum.—Visitors during the week ending August 24th, 1867. On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., 9520; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1419. National Portrait Exhibition, by payment, 3970. Total 14,909. Average of corresponding week in former years, 14,072. Total from the opening of the museum, 6,919,062.

The Waterwitch.—The Waterwitch made a speed trial over the measured mile in Stokes Bay, near Portsmouth, on Wednesday as a supplementary and corrective trial to the series which had been already conducted there, the particulars of which we have published. The draught of water of the ship was—forward, 10ft. 8in.; aft. 11ft. 2in. Her mean draught was 10ft. 11in. The wind was at a force of from 2 to 3 from west to west-south-west; the sea was, therefore, undisturbed, and the best possible results were got out of the ship under her conditions of trial. Six runs were made with full-boiler power, and four with half-boiler power, the figures obtained being as follows:—At full-boiler power the ship made in first run 9·113 knots, and 41·16 revolutions of engines a minute; in second run, 9·137 knots, and 41·72 revolutions; in third run, 9·524 knots, and 41·90 revolutions; in fourth run, 8·738 knots, and 41·36 revolutions; in fifth run, 9·954 knots, and 42·76 revolutions; in sixth run, 8·108 knots, and 41·62 revolutions. The mean speed of ship was 9·219 knots, the mean of the revolutions of engines, 41·75; the mean steam pressure, 29lb.; and the mean vacuum, 25·7 inches. At half-boiler power she made in first run 7·516 knots; in second run, 4·755 knots; in third run, 7·214 knots; in fourth run, 4·950 knots, with a mean of 29 revolutions in a minute.

A New Rifle Musket, the invention of Messrs. Carter and Edwards, has undergone an official trial in the Woolwich Marsh, in competition with the Snider Enfield rifle, with the following results:—The Snider rifle was fired by Lieut. Lecky, assistant-instructor of musketry to the Royal Marine division at Woolwich; the time two minutes, when sixteen rounds were fired, fourteen hits were made, and thirty-four points were obtained. Carter and Edwards' rifle was fired by Sergeant Bott, twenty-seven rounds, twenty-four hits, and fifty-four points. The object was a third-class target with a Wimbledon bull's-eye. The superiority of the Carter and Edwards' rifle over the Snider in rapidity of fire appears to be fully established, as the rifle, which is on the bolt system, cocks itself in the withdrawal of the cartridge. The lock is entirely concealed, and the weapon is fired with a needle through the bolt. Another advantage, equally important, and also an entire novelty in small arms is—that a line or party of skirmishers, in the event of their being taken prisoners, or surrounded by the enemy at a disadvantage, can, with a turn of a screw, take out the bolt and cast it away, leaving the arm as totally useless as the Armstrong field-gun without its vent-piece. For simplicity of construction it surpasses the Snider, as there are fewer springs. In fact, the only springs it contains are the main-spring of the lock and the rear spring. The inventors, it is stated, are fitting up a spacious manufactory in Birmingham to construct arms on their principle, in order to fulfil a large contract which they have entered into with a foreign Government. They were disqualified from contending at the late competition at Woolwich by not having sent in their arms in time, according to the regulations. The new rifles above named are adapted equally with the Snider to use the Boxer ammunition, Enfield bore.—*Times.*

RAILWAY MATTERS.

The Great Northern has adopted the plan of stopping further extension.

The London, Chatham, and Dover Company are now taking £17,000 a week.

The chairman of the South Devon line opposes any further extension of that railway.

A railway brake which can be applied to the whole train has been tried at Philadelphia.

The Midland subsidy for the use of the King's-cross station, &c., will cease in the year 1870.

The subject of through communication from Caithness to the south is again occupying public attention.

The net receipts from the Midland Company for the use of the line from Hitchin to King's-cross are now about £64,000 a year.

The Newquay and Cornwall Junction line is completed to within two miles of the Burngullow station on the Cornwall Railway.

The South Devon line it is expected will benefit largely by the decision of the Government to land the West Indian Mails at Plymouth.

An accident happened on the Midland Railway, near Masborough, on Friday, through the engine running over a bullock that had strayed on the line.

Mr. Thomas Arter, of Ludlow and Kington, Herefordshire, has been fined £20 for sending lucifer matches from Ludlow to Brecon by rail, contrary to the bye-laws.

There are three distinct belts of *mauvaises odeurs*, in passing from London Bridge Station, those of (1) defunct horses, (2) of tanyards, (3) of sewage-watered gardens.

Twelve years ago the Brighton Railway Company had a capital of eight millions; now the capital is twelve millions, but the income has remained about stationary through all.

The Spilsby and Firsby line is approaching completion. The rails are laid along the whole line, and there is reason to believe that it will be ready for traffic by the time agreed upon.

The special train in which the Emperor Napoleon went with his suite from Paris to Salzburg is described as exceeding in comfort and elegance anything of the kind that has hitherto been known.

The engineer of the Cockermouth, Keswick, and Penwick Company reports that the permanent way and other works have been well maintained during the past half-year, and are in good order throughout.

The half-yearly meeting of the Dublin and Drogheda Railway Company was held on the 22nd inst., when the report showed a prosperous condition of the property, and a dividend at the rate of 4¾ per cent. was declared.

On Monday the first engine passed over the Mont Cenis Summit Railway. The trip was most successful, and it is expected the railway will be opened for public traffic shortly, thus connecting the French and Italian systems.

A Louisiana paper asserts that on the Opelousas Railroad, since the overflow, the engineer on the train has frequently to blow the whistle to clear the track of alligators, as the track is the only thing above water for them to rest on for many miles beyond Tigerville. The train has run over several alligators since the water went down.

The report of the Blythe and Tyne directors states that during the progress of the bill to carry out certain extensions through Parliament a conference took place between the wayleave proprietors and the directors, when an arrangement was come to for continuing the payment of wayleaves on a basis satisfactory to both parties.

The Waterford and Limerick Company have ceased to work the Waterford and Kilkenny line since the 1st of June last; the Kilkenny Junction Extension is now open to Maryborough in connection therewith, and this system now extends over about fifty miles. The Kilkenny Company now use the company's new station at Waterford.

The Newry and Armagh directors are unable to report any improvement in the relations with the Ulster Company. The management of the company's business at Armagh continues to afford just cause for dissatisfaction, and goods for Newry coming from the Ulster line are still stopped and rebooked at the junctions of Armagh and Portadown.

A feeling of disappointment has been occasioned among Belgian firms by the results of the adjudication for rails required for the Dutch State railways; it had been hoped that contracts for these two lots of 5000 tons would have been secured for Belgian establishments, and with this hope considerable reductions have been made in prices.

A youth named David Williamson, aged fourteen, was committed to the Chester assizes by the county magistrates at Stockport on Monday, on a charge of placing ten chairs on the rails near the Mersey Bridge, Cheadle Bulkeley, on the Stockport and Timperley Railway, with intent to upset the express train from Godley to Liverpool, consisting of an engine, tender, and eight passenger carriages.

On the Cornwall Railway fish traffic for the last six months shows an increase of 1200 tons, and there is £1000 extra in the parcels account. The brocoli and vegetable traffic shows a deficiency of 1672 tons, owing to the extremely severe season. China clay is still an increasing traffic. In the goods there is an increase of about 1000 tons, in the working expenses there is a decrease of £4581. As to the line account, the engineer cannot hold out any hope of lessening the expenses.

The South Eastern directors, in common with the directors of the Brighton Company, are taking the necessary steps to obtain as early as practicable in the ensuing session Parliamentary sanction to the powers conferred by the agreement between the two companies. In the meantime it is proposed to anticipate, so far as may legally and prudently be done, such working arrangements as will tend not only to terminate all unnecessary competition between the companies, but secure as soon as possible those facilities in London and at various other points so long and urgently demanded by the public.

The works of the Thull Ghât and Bhore Ghât inclines on the Great Indian Peninsular Railway were of enormous difficulty, and now those of the Bhore Ghât have been rendered practically useless by the failure of a viaduct, the reconstruction of which will involve great delay and expense. The works of the Bhore Ghât were no less than seven years and a quarter in hand, and at one period (March, 1861) more than 42,000 men were employed upon them. The work which has now given way, and has rendered it impossible for the present to conduct traffic with full vigour upon the incline, is the Mhow-kee-Mullee Viaduct, comprising eight 50ft. arches, 143ft. from the ground. It is the greatest work upon the incline.

Two new lines of railway were opened last week in Wales. The first was the Manchester and Milford, which runs from Aberystwith to Carmarthen, and which, by completing a link in the western line of railways running through the principality, opened up a new route between South Lancashire and South Wales. The entire length of the line is 41½ miles. The second line was the coast section of the Cambrian railways, which had been for a long time delayed in consequence of financial difficulties. Hitherto passengers from the Midland district travelling to Towyn, Barmouth, and other towns on the coast section, had been obliged to change at Twyslas and cross the Dovey by steamer. The opening of the new line will do away with this inconvenience, and afford an unbroken communication between Aberystwith and Carnarvon.

NOTES AND MEMORANDA.

Diamonds to the value of 3,250,000 dols. are annually sent abroad from the port of Bahia, Brazil.

Pennsylvania furnishes seventy-three and three quarters per cent. of all the coal produced in the United States.

California now exports 10,000 tons of copper annually, an amount five times as large as the whole production of the United States ten years ago.

The inhabitants of Quito manufactured magnificent mirrors from obsidian, and those of the Azores and Ascension islands, and Guiana, used splinters of obsidian as points for their lances, razors, &c.

Harnecher proposes the use of chloride of mercury for the removal of silver stains from cloth, as a substitute for cyanide of potassium. It destroys the dark spots without injuring the colour of the cloth.

Fremy exhibited to the Academy on 22nd April, two ingots of iridium obtained from the Freiberg Blendes, which were about a decimeter high and a few centimeters in diameter, and weighed 500 grammes. They were valued at 20,000f.

The expansion of the rails of a railroad 500 miles long amounts in a hot summer's day to nearly a quarter of a mile from the point of the extreme contraction in winter. Of course this expansion is all taken up by the joints.

The *Medical Journal* notices with favour the introduction of a new tonic wherein England's favourite beverage is made to do service in a medicinal way. The innovation consists in introducing one grain of quinine in an imperial pint of ale, the additional bitter element being considered a decided improvement.

Professor Whitney reports fifteen localities in California where diamonds have been found in the course of washings for gold, but in his view it would not pay to wash the gravel beds of those places solely for the precious stones, for diamond washings are not profitable in any country except with slave or convict labour.

Baron Humboldt says that Cortez mentioned, in his letter to the Emperor Charles V., having seen razors of obsidian at Tenochittan; and the above naturalist likewise discovered, on the Sierra de las Nabajaz, in New Spain, the old shaft that was used for raising the rough obsidian, with relics of the tools and half-finished utensils.

A German chemist has been conducting some delicate experiments with cobalt and nickel to determine their respective atomic weights. The mean of five experiments with cobalt gave the number 29·496. The mean of four with nickel, the number 29·527. The atomic weights may therefore be taken as identical, *i.e.*, 29·5.

It is with much satisfaction that we see it announced that Professor Augustus Kekulé of Ghent has been offered the directorship of the magnificent laboratory now nearly completed at Bonn. No chemist of his years has done as much, either theoretically or practically, for the establishment of the present views in organic chemistry.

A curious fact in relation to the metal lead has been observed by M. H. Neberland, a German founder. When a small quantity of lead is mixed with iron in a state of fusion, the lead rises to the surface and floats in the form of little spheres. These spheres do not appear to be solid, but simply little vesicles. The cause of this does not seem to have been satisfactorily explained.

In her mercantile tonnage Great Britain leads the world, with 7,000,000 tons. Germany far exceeds France on this score, being third on the list. In the year 1860 the United States had overtaken England, and stood as the first commercial power in the world. The four years of war sadly reduced her merchant fleet, and now she ranks second, with 5,000,000 registered tonnage.

M. Kletzinski takes equal weights of sulphate of zinc, sulphate of magnesia, and sal ammoniac, mixed together in a mortar. The addition of three times the weight of ammonia alum produces a pasty mass, which is to be carefully dried. To make like fabrics indestructible by fire he uses one part of the above mixture with two parts of starch. This compound is much cheaper than tungstate of soda.

In the process of fermentation air bubbles are formed in wines. For a long time scientific men believed these bubbles to be cells of a vegetable nature, but their true character being discovered, the owner of a French vineyard, by exposing his liquid for two hours, to the action of a vacuum, has succeeded in removing them. The same result is secured by a treatment with heat, but this latter system is superior in many respects, and above all, is much more economical.

Nearly all photographic varnishes reduce the intensity of the negative. Mr. F.A. Wenderoth, of Philadelphia, states that if a thin solution of gum arabic is applied to the negative after fixing and before drying, the varnish will not affect the intensity. This is a very simple and useful remedy. Mr. Wenderoth also states that he has long practised the covering of photographic paper prints upon both sides with collodion varnish, and finds it a complete preservative of the picture. This method has been claimed by Mr. Blanchard.

It has been asserted that the dollar mark $ is a contraction for U.S. It has, however, generally been supposed to stand for the figure 8, and to mean eight reals, which was the Spanish dollar from which the American dollar originated. The two parallel lines were drawn across the "8" to distinguish it from the ordinary numeral. There is another origin sometimes given to this design which refers to the old pillar dollar. There were on that coin two pillars or columns connected by a scroll, and the $ bears a rude resemblance to this device.

In the Andes-Rocky-mountain chain, extending entirely through both continents, there are no less than fifty active volcanoes, the most interesting being located in South America. Those in the neighbourhood of Quito are remarkable for vomiting forth enormous quantities of water and muddy substances, which fertilise the land to the extent of eight or ten leagues around them. The subterraneous noise of Cotopaxi extends to the distance of upwards of 500 miles. The reason why melted lava is not thrown out is supposed to be the vast depth at which it lies. It frequently throws out filth from the crater, which is 2500 or 2600 fathoms above the level of the sea.

As an instance of early advertising we find that of the *Civicus Mercurius*, or *London Intelligencer*. In the number dated August 11th, 1643, the fourth part of Prynne's work on the Sovereign Power of Parliaments is advertised. In the number dated October 23rd, 1643, is an advertisement of Pyrnne's work, entitled "The Doom of Cowardice and Treachery." This old newspaper, *Mercurius Civicus*, is not only remarkable as containing the earliest instances of newspaper advertisements, but as being the earliest illustrated newspaper, each number containing a woodcut portrait of the heroes of the day, when the Civil Wars were going on throughout the kingdom, in the troublous times of King Charles I.

The source and exact length of the Ottawa river, the second largest river in the dominion of Canada, has recently been determined by a party of explorers sent out by Government in last March. The party went up the Du Moine to Gros Lake, which they explored, and by Governmental instruction re-christened Victoria Lake. Thence up the "Grand Prince of Waters," until it overlapped the head waters of the St. Maurice. Pushing on further in a little south-easterly direction they found themselves fifty miles distant from the head waters of the Saguenay. Making friends with the Indians, the party proceeded in safety to its destination, discovering the length of the Ottawa to be 1000 miles. The land on these upper reaches is of the best quality, but the climate is cold. The explorers reached civilisation after spending four months and a half in the wilderness.

MISCELLANEA.

The English watchmakers are alarmed at the progress of watchmaking in America.

By the Act just passed master and servant now stand on a perfect equality before the law.

It is calculated that Pennsylvania contains coal enough to supply 20,000,000 tons annually for the rest 650 years.

The recovery of the Zuyder Zee is seriously looked forward to, and this would throw all former undertakings of the kind into the shade.

The position of Belgian metallurgy is not considered to have improved; old orders are being worked up without being replaced by new ones.

A matter of some interest to the Belgian iron trade is the intended construction of 129 miles of "vicinal," or cheap local railways in Brabant.

It is stated that a Franco-American Company is in course of formation which contemplates the laying of a submarine cable from Ushant to Boston.

A Mechanican of Boston, U.S., has constructed a thermo-electric machine, comprising cylinders filled with coal, which produces a continuous electric light.

Mr. Robert Ball, assistant-astronomer at Lord Rosse's, Parsonstown, has been appointed Professor of Applied Mathematics in the new College of Science, Dublin.

The French metallurgical groups complain of depression, as they are suffering not only from external competition but are also contending a good deal against each other.

Haarlem-meer took thirteen years to drain, and the work was completed in 1852, and cost nearly a million sterling; but the outlay has been recouped by a sale of 42,000 acres.

A great trade has lately sprung up in Skibbereen in Carrageen moss, and consequently the greatest activity prevails along the coast among the parties who save this article.

The organised association of trades at Sheffield repudiate the resolution of the saw grinders, and decline any intercourse with them till they change their union principles and practice.

Mr. Thurlow compares the Netherlands to a copyhold property, with Neptune as lord of the manor, whose fines amount to a million sterling per annum for repairs and superintendence.

The great Creusot works are more and more monopolising orders in the south and east of France—a state of affairs which, of course, renders the position of secondary establishments a difficult one.

The Telegraph Construction and Maintenance Company have sent out the wire which is about to be laid from Placentia, in Newfoundland, to the island of St. Pierre; the length of this wire is 320 miles.

On Thursday last 2434 tons of copper ore were sold at Truro for £14,903 12s. The standard advanced £2 10s. The advance has tended somewhat to relieve the gloomy feeling prevalent in the county.

Some quantity of Belgian iron has been forwarded of late to Switzerland; MM. de Dorlodot, of Acoz, have been sending some iron to Bâle, notwithstanding the heavy transport expenses which have to be sustained.

In consequence of the depression which prevails in the trade of Belfast the flax spinners have resolved to adopt a system of short time (forty hours weekly) after the month of September, instead of fifty-six hours, as heretofore.

The great ironworks at Blaenau in the South Wales district are stopped, and 9000 persons are said to be thus thrown out of employ. Many are leaving the place, and the relieving officer is inundated with applications for relief.

One of the granite columns which are hereafter to ornament the east and west ends of every pier of Blackfriars Bridge has already been delivered at the works, and two more are expected shortly. They are splendid specimens of granite work.

The grand prize of £1200 has been awarded by the Emperor of Russia (over twenty other competitors) to Sir Charles A. Hastley, C.E., and engineer-in-chief to the European Commission of the Danube, for his plans for improvements of the harbour of Odessa.

A transport service organised from Port Said by the Suez Canal Company appears to have acquired a certain importance. The delivery of the necessary plant (tugs, sloops, &c.) is completed, and the receipts acquired during the first six months of this year amounted to £21,055.

"M. de Greyse," the *Erfurth Gazette* states, "has invented a new rifle which throws grenades or explosive bullets, and which is shortly to be tried at Spandau. It is a breech-loader, on the system of the needle gun, and sends the missiles to a great distance and with extraordinary effect."

A circular has been issued by the Hon. Robert Grimston, the chairman of the Electric and International Telegraph Company, in reference to the idea which has occasionally been discussed for a transfer of the electric telegraphs in the United Kingdom to the Government, so that the whole system may be placed under the management of the Post-office. Such a transfer Mr. Gibson thinks undesirable and impracticable.

Mr. B. Samuelson, M.P., who is engaged in the iron and engineering business, and has resided some years on the Continent, is about to visit France, Belgium, Germany, and Switzerland, with a view to obtaining accurate information as to their industrial position, and especially to their recent manufacturing progress, and the state of labour and instruction among them.

The Liverpool Crown Preserved Coal Company have declared a dividend at the rate of 5 per cent. per annum, although the dearness and scarcity of coal and pitch have increased their cost of production, and lessened the extent of their manufacture. The company are now putting down improved machinery, which they believe will enable them successfully to combat the difficulties alluded to.

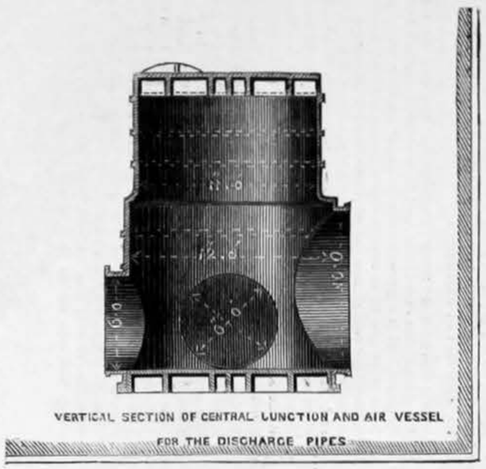
The magnificent new Millwall Docks have now so nearly approached completion that it is expected they will be ready for the admission of water by the end of the present week, and shortly after for the reception of vessels. The total area of the land purchased by the Millwall Dock Company is 204 acres; 52 acres will be the area of the water in the docks, so that 152 will be available for wharves and warehouses.

The Government received tenders on Thursday for steamers for the Abyssinian expedition, and have ordered sixteen for survey in England. It is supposed a much larger number will be required. Some were offered at twenty-four shillings per ton per month. The demand for coal on account of these steamers going out has caused a considerable rise in the rates of freight, particularly for the Cape and Bombay; ninety-five shillings per ton is freely offered for steamers to carry coal to the Cape, and for cargoes afloat for Bombay seventy and eighty shillings per ton is demanded by holders.

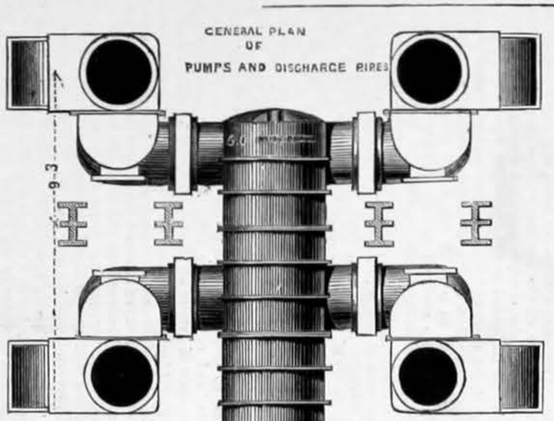
The fourth pier on the Middlesex side of the new Blackfriars Bridge is giving great trouble. The caissons for this pier have all been placed and weighted, and ring after ring added as they reached the surface of the water, yet still they continue to go down, although they are already far below their contract level. For more than six months has the progress of the works been delayed by this obstinate pier, and nearly £12,000 additional expense has been incurred. This sinking goes on in such an uncertain and erratic manner as clearly shows the rotten and unsafe nature of the soil through which they are passing. Thus, for days they remain immovable, or only sink an inch or so, while very recently they went down thirteen inches in a single night.

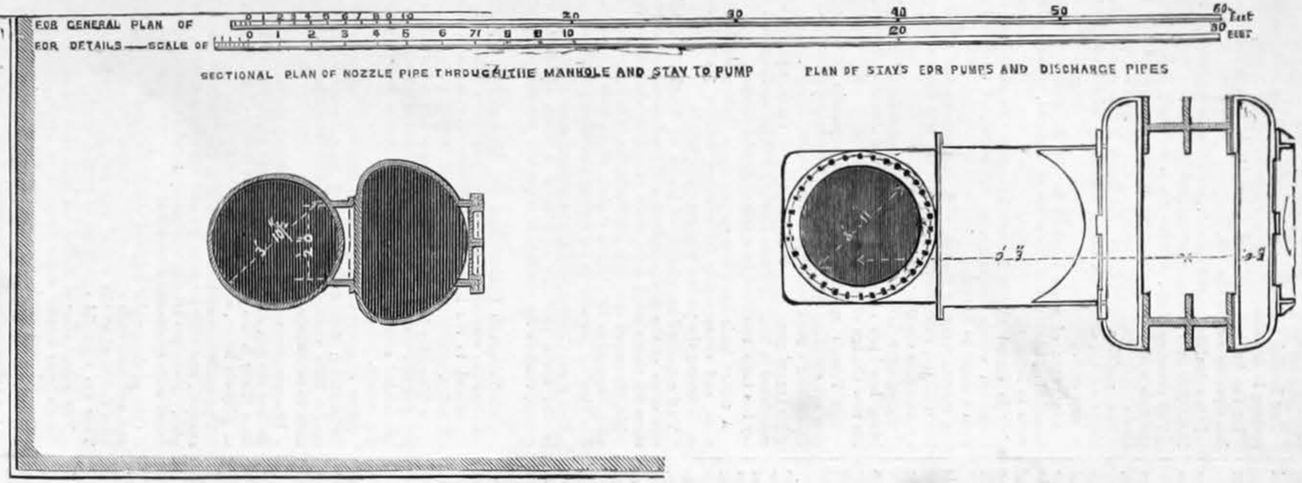
ABBEY MILLS PUMPING STATION, METROPOLITAN MAIN DRAINAGE.

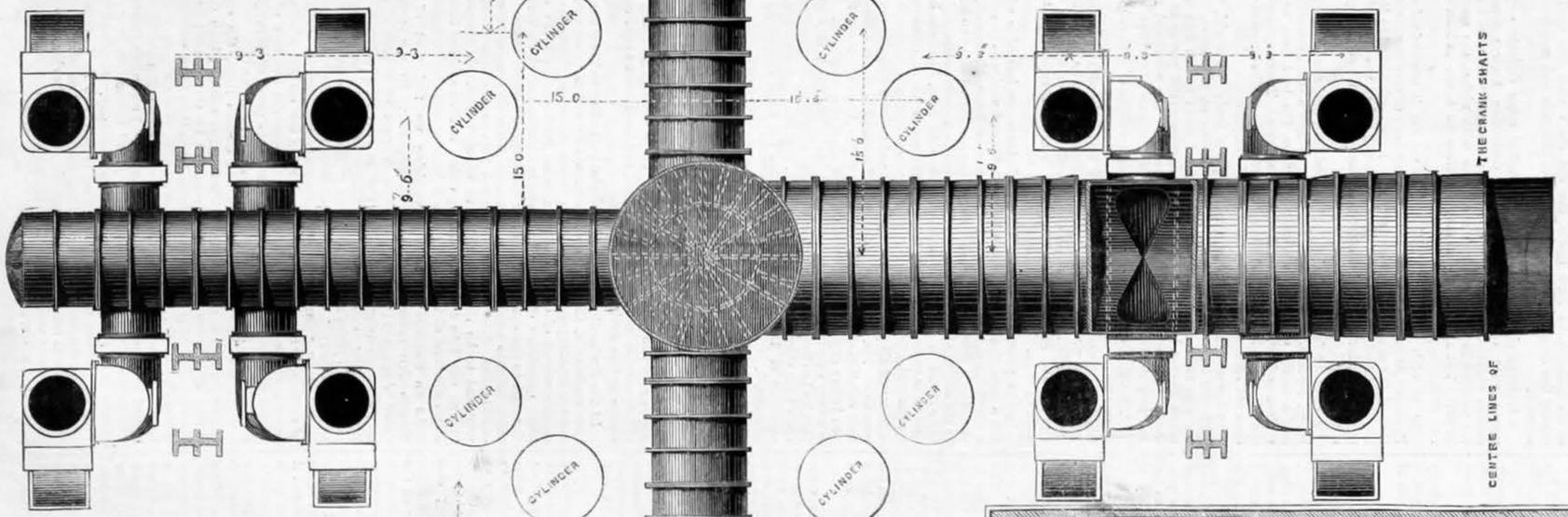
GROUND PLAN OF MAINS AND DETAILS OF PUMPS, &c.

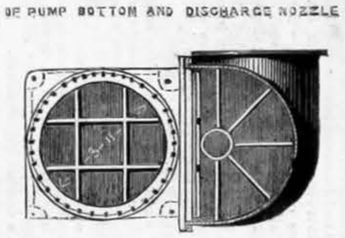


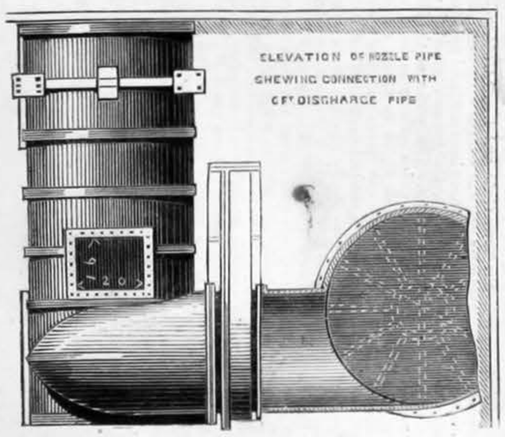
VERTICAL SECTION OF CENTRAL JUNCTION AND AIR VESSEL FOR THE DISCHARGE PIPES

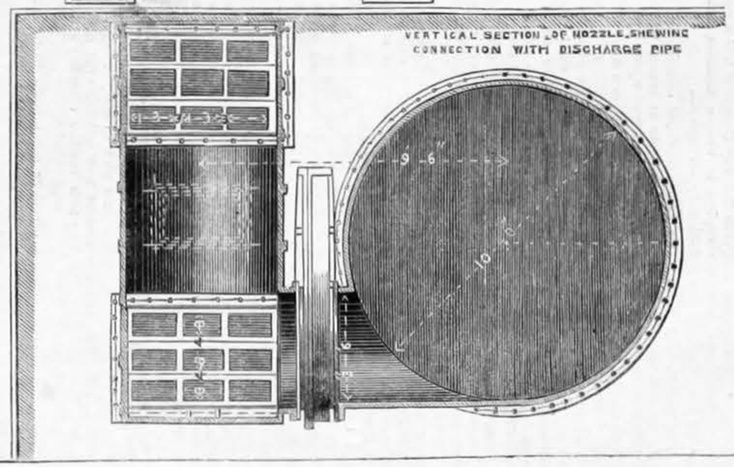


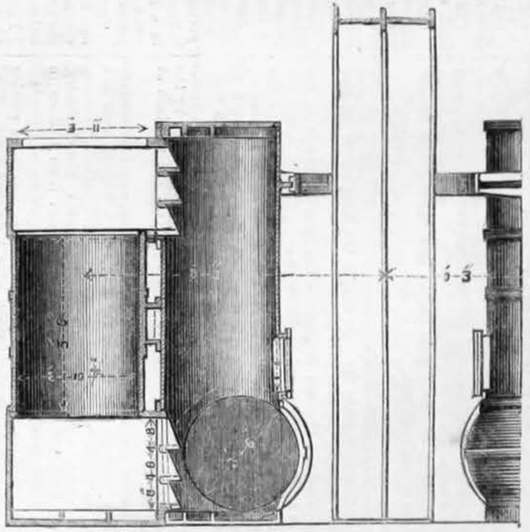






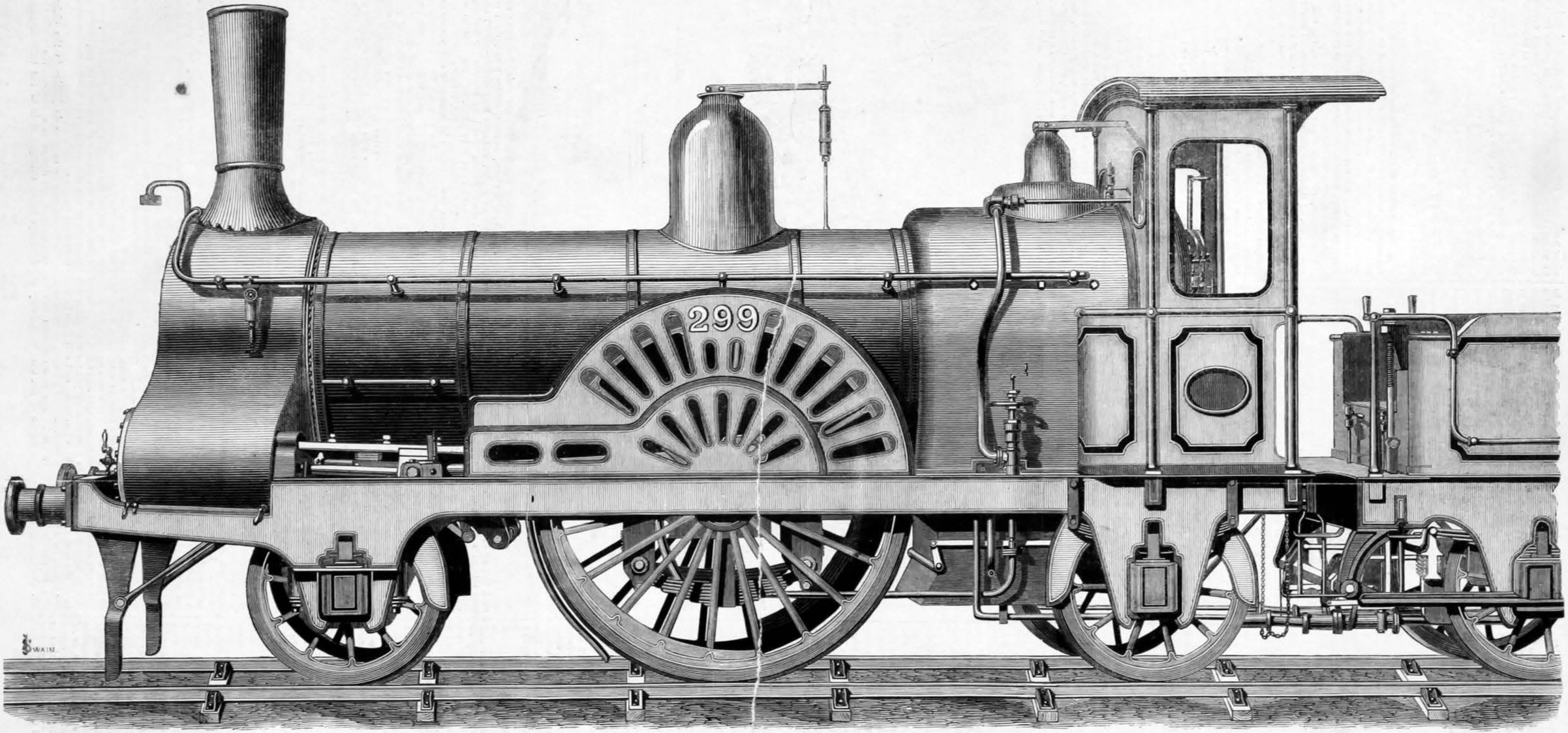






PARIS EXHIBITION—LOCOMOTIVE ENGINE FOR THE GREAT EASTERN RAILWAY COMPANY.

CONSTRUCTED BY MESSRS. SCHNEIDER, CREUSOT.



AMONGST the locomotives exhibited at the International Exhibition, the express engine constructed at Le Creusot by Messrs. Schneider and Co., for the Great Eastern Railway Company of England, has deservedly a high place in the estimation of professional visitors, and has not a little tended to enhance the fame of the great factory from which it was turned out. We have already alluded to it in the description of the Creusot Works to be found in our number of the 1st February of this year, when we illustrated two other types of locomotives, now exhibited by this company, one for collieries made as required of any small gauge, from 2ft. 6in. to 3ft. 6in., and the other a pilot or small goods engine of the ordinary gauge, as used in the works of Messrs. Schneider.

We now illustrate above a locomotive which if it were only on account of the peculiar interest attaching to it as a specimen of the first contract taken by France for England, is well worthy of notice, but it does not depend on this fact alone for meriting registration in our pages, for it is as thoroughly well turned out a job as any railway company need wish to possess, and the other engines of the contract have, as far as we can learn, given satisfaction.

Whilst again alluding to the subject of this contract, which attracted much attention at the time it was undertaken, we are bound to observe that it has not been followed by any other direct contracts for locomotives made abroad to run on English lines. One other has been let for an Indian line divided between Swiss and German houses, and is in great part, if not altogether completed, but the practice does not seem likely at present to be followed up, and we can safely say, with common reason on the part of our workpeople, it is quite impossible that any part of our home trade in locomotives can be taken from us with profit to the foreigners, which is as much as to say that it cannot be taken from us at all, for however enthusiastic to outstrip us in the race, neither the Gaul nor the German is fool enough to work for nothing. The Creusot contract is about half completed, the delay, however, is in no way attributable to any supineness on the part of Le Creusot, who, whether they make or lose by this experimental contract are well able and thoroughly willing to complete it as fast as other circumstances over which they have no control shall permit them; in fact cutting their coat according to their cloth. There are some of our railway companies who are not quite in a position to buy any more locomotives, or any other luxuries just at present.

The home trade in locomotives or in anything else is, however, but a small part of an Englishman's ambition, and if we are only to be able to retain it we shall have very small profits to divide and very little to be proud of. To retain the large share of foreign trade which the national energy and talent deserve, there must be greater national unanimity, and, as we have urged a thousand times, a higher scale of national culture. As a handicraftsman, an English fitter or moulder, smith or boilermaker, has still the lead over his continental fellow-tradesmen, but he has not such a lead as will enable him to compete with the foreigner if his trade unions will not allow him to work his best, or force him to waste a quarter of each year in strikes for wages that the trade cannot pay, and only permit him to work shorter hours than the foreigners when he is earning. As men of business our engineers are more enterprising than most foreign houses, and will take contracts, in spite of strikes, with a lower margin for profit, and a far lower scale for direction expenses than is usual abroad, but they are too often either thoroughly commercial business men, who have not the time, they say, for the scientific consideration of the many questions which daily practice involves, or else they are what are called "thoroughly practical" men, who, with as fine intellects as any in the world, but more or less despising the trained use of the powers they ought to cultivate either in themselves or their workpeople, are content to arrive with immense labour and expense at correct results—if they do reach them—which a more educated thinker would have reached by a much shorter road.

It may be impossible to beat us in our own special machines on our own special grounds, but if we become pig-headed, fight with one another, and expect only to do half the work other people do, and earn as much—if we don't learn how to think the bottom of every subject thoroughly out ourselves, and teach our children how to think it out better than even we can do, we cannot hope to keep our place, or to have the wealth, the consideration, and the power we enjoy.

Numbers of English firms do exercise the highest faculties of the mind on all they undertake to construct. But the conventional term "numbers" expresses but a small fraction of the nation; they are exceptions, who, by their success, more fully prove the rule of the great necessity we are urging. Numbers of good English workmen hate and despise the tryanny which is exercised over their weaker brethren by men who simply live on them, but their numbers are also insignificant as compared with the general body. A national movement alone in support of national advancement will enable us to keep our place in the keen competition which we have taught others to emulate.

Our strong feeling on these subjects must alone be our excuse for

diverging into generalities whilst describing a good engine, well designed in England, and well executed in France. Our engraving will sufficiently exhibit its general characteristics to those of our readers who have not seen this class of locomotive working on the Great Eastern line. The plans and specifications were drawn by Mr. Sinclair, late locomotive superintendent of that railway. The tires, motion bars, piston rods, valve spindles, crank pins, &c., are of Krupp's steel, the axle boxes and keeps are of best gun metal. The tires, which are 2⅛in. thick, are put on the wheels on Beattie's patent system; the fire-bars are pendulous, on Lee and Stevens' patent; the axle blocks are of Naylor and Vickers' cast steel. The engine and tender are mounted on auxiliary india-rubber springs. The engine exhibited is for express work, the mixed engines included in the contract are almost identical with it, except that the leading and trailing wheels are coupled, and are of 6ft. ½in. diameter. The following are amongst the principal dimensions of these engines, viz.:—Weight of engine, empty, 27 tons 10 cwt.; weight of engine on service, 30 tons 10 cwt.; weight of engine, empty, on leading wheels, 9 tons; weight of engine, empty, on driving wheels, 9 tons 10 cwt.; weight of engine, empty, on trailing wheels, 9 tons. Diameter of driving wheels, 7ft. 1½in.; diameter of leading and trailing wheels, 3ft. 7½in.; diameter of boiler (outside), 4ft.; diameter of cylinders, 16in.; diameter of boiler tubes (exterior), 1⅝in.; length of boiler, 16ft. 9in.; length of boiler between tube plates, 12ft. 1½in.; surface, 320ft.; total heating surface, 344ft.; length of fire-box, 4ft. 9in.; stroke of pistons, 2ft.; total wheel base, 15ft.; distance from centre to centre of cylinders, 6ft.; thickness of boiler plates, $\frac{7}{16}$in.; weight of tender, empty, 11 tons. The copper pipes used are $\frac{3}{16}$in. thick; the boiler is butt-jointed and single-rivetted.

ABBEY MILLS PUMPING STATION — METROPOLITAN MAIN DRAINAGE, NORTHERN OUTFALL.

No. I.

We feel much pleasure in laying before our readers a description of the great pumping station of the metropolitan main drainage works at Abbey Mills now in course of erection, prepared from drawings and particulars courteously placed at our disposal by Mr. Bazalgette. These works are so important that it is impossible to place all the engravings necessary to make their nature and construction clear before our readers in a single number of The Engineer. We propose, however, to supply here some detailed particulars of the engines and pumps, although we are unable to publish all the drawings required to illustrate this description at the same time. This will not, we think, be productive of any inconvenience, as the description once mastered the drawings will explain themselves afterwards. If any points are left in doubt it will be easy to turn back to this number. In future impressions we also propose to illustrate and describe the buildings within which the machinery will be erected.

We need hardly state that all the drainage of the metropolis under the new system partly in operation requires to be lifted by pumping in order that it may find its way into the river. The engines at Crossness and Deptford—and, indeed, the details of the entire scheme—have already been fully described in our columns.* The pumping station now under consideration constitutes the last important work to be carried out in connection with the undertaking, and the dimensions of the machinery, not less than the work it will have to perform, entitles it to the fullest consideration from engineers—if for no other reason, as a precedent for future undertakings, and as a guide to the most approved means of carrying out great pumping operations in connection with drainage schemes.

As will be seen from the accompanying map the station will be situated in a piece of ground, the property of the Metropolitan Board of Works, close to Abbey Mills, near Abbey Creek, in the parish of Westham, in Essex. From this point, after being raised about 36ft. by the pumps, the sewage will be conveyed by three parallel lines of sewers to Barking Creek. At a little distance beyond the station the three lines of sewers are passed over the Channelsea river and Abbey Creek; then over Marsh-lane and the North Woolwich Railway, and so finally to Barking Creek, where it will be received in a reservoir 9½ acres in area and 16½ft. deep, in which the sewage will be stored about eleven hours each tide.

The machinery will differ in many respects from that at Crossness, especially in the construction of the pumps, which will be of the double-acting piston class, while those at Crossness are of the plunger type. It will consist of eight pumping engines, twelve boilers, and sixteen sewage pumps. One of the engines we illustrate at page 180. It will be seen from the ground plan of the pumping floor at page 176 that the engine-house will be in the form of a cross, two engines being located in each arm side by side, the cylinders being all disposed centrally, with the large air vessel on the mains within the group. In this engraving are given also sectional details of the sewage pumps, &c., so clear as to require little description.

The engines will be of the kind known as double-acting condensing beam engines, made according to the most improved construction and design, and will be perfectly balanced when in and out of action, and finished dead bright in all parts usually so finished by the best makers of first-class waterworks engines. The cylinders will each be 54in. diameter and 9ft. stroke, with steam cases, valves, steam chests, pipes, &c., effectually covered with double-felt clothing, with intermediate and outer canvas coverings, each painted in two coats of white lead and oil, mahogany jackets, covers and false covers, raised bottoms, turned column nozzles, polished hand gear, and wrought column standards, shafts, rods, levers, and handles, and double-beat brass valves of the Cornish type, brass throttle valves, brass upper blow valves, three-pin glands (brass bushed), brass grease cocks, cast steel piston rods, metallic spring pistons of the most improved construction with brass pins, expansion joints, bright valve bonnets, case-hardened nuts, waste cocks and waste pipes to carry the condensed water from the cylinders and easily accessible from the engine-house floor, and all other appendages complete. The nozzles will be placed on the back of the cylinders, opposite to and symmetrical with each other. The steam will enter the nozzles from the branch steam pipes, which will each be of 10in. diameter, and have brass-faced slide valves to operate both as stop valves and as regulating valves, worked by means of a bright vertical shaft and a pair of spur wheels to be put in motion by hand from the engine-house floor. There will be two double-beat steam valves of clear areas each equal to at least 80 circular inches through every part, and two double-beat exhaust valves of clear areas, each equal to at least 120 circular inches through every part. All the passages within the nozzle to the condenser along which the steam will flow will have clear areas of not less than 180 circular inches through every part, and all abrupt angles will be rounded off in the castings.

The beams will each be 70in. deep in the centre, having top and bottom flanges each 88in. sectional area, and the web will be 2½in. in thickness. The plummer blocks will be supported by a cast iron moulded entablature and arches and four cast iron moulded columns placed on and bolted to a cast iron girder, and will be 37ft. 6½in. long between the extreme centres. All the gudgeons will be of wrought iron, case-hardened in the working parts, or of Bessemer cast steel, and will be inserted into holes truly bored through the bosses in the beams for that purpose, so placed as to divide the vibrations upon the principal centre lines, according to the following leading dimensions, namely—Distance from centre of beam to the centre line of cylinders, 18ft. 6in.; ditto, to centre line of inner end sewage pumps, 9ft. 3in.; ditto, to centre line of cranks, 18ft. 6in.; ditto, to centre line of outer end sewage pumps, 9ft. 3in.

The air pumps and condensers will be of 27in. and 30in. diameter, placed in suitable cast iron cisterns fixed in front of the cylinders and fitted with hot wells, lower blow valves, and sluice valves, and with waste pipes, and will have brass foot valves, brass bucket gratings, brass delivery valves, and brass facings to each, and also improved hemp-packed buckets, together with proper brass injection cocks and cast iron injection pillars, with levers, rods, handles, and indexes complete. The waste pipes from hot and cold water cisterns will be turned down into the reservoir under the engine-room floor. The cold water pumps will each be 20in. diameter and 27in. stroke, and be fitted with common buckets and clacks. These pumps will each draw from a vacuum vessel 2ft. in diameter and 7ft. 6in. high, to which an 18in. suction pipe to reservoir under engine-room floor, with hanging valves and windbore piece, is to be attached, as shown in our engraving. The feed pumps will each have a cast iron plunger of 7in. diameter and 27in. stroke, with glands, stuffing-boxes, and brass valves, and 6in. delivery pipes, each pump to be united to an air vessel 2ft. diameter and 5ft. 6in. high, to which will be attached a 6in. feed pipe, enlarging to 8in. after its junction with the corresponding pipe from a second air vessel. Three of these 8in. pipes will deliver into a pipe 12in. in diameter, carried round the well in the centre of the engine-house, from which the feed-water will be conveyed through a 16in. pipe to a 12in. pipe, branching right and left to the two sets or ranges of boilers, and returned to and along the front of the boilers; that portion, however, in front of the boilers is to be gradually reduced to 6in. diameter at the extreme end of each range of boilers. From the last-mentioned pipe will descend at and in front of every alternate boiler a 4½in. pipe with a 3in. branch right and left to each boiler. These pipes will all be furnished with valves at the several junctions to enable communication to be made with or shut off from any one of the feed pumps to either set of boilers, and will be fitted with all proper escape, regulating, and drain valves and cocks complete. The connecting rods and cranks will be of cast iron, the crank shafts of wrought iron, and the crank pins of steel. A cast iron trough or race will be provided for each crank.

The fly-wheels will each be of 27ft. in diameter, with rims 18in. deep and 11in. wide, so as to enable the engines to pass their centres with facility when working at a slow speed. The rims will be neatly hollowed in the angles, and both rims and arms neatly panelled on the face, and each provided with a cast iron trough or race. For moving the engines when on the dead centres there will be a toothed wheel bolted on the face of the fly-wheel next the wall, taking into a crab with shifting handle shaft and lever, so that all parts of the crab gearing shall be at rest when not required.

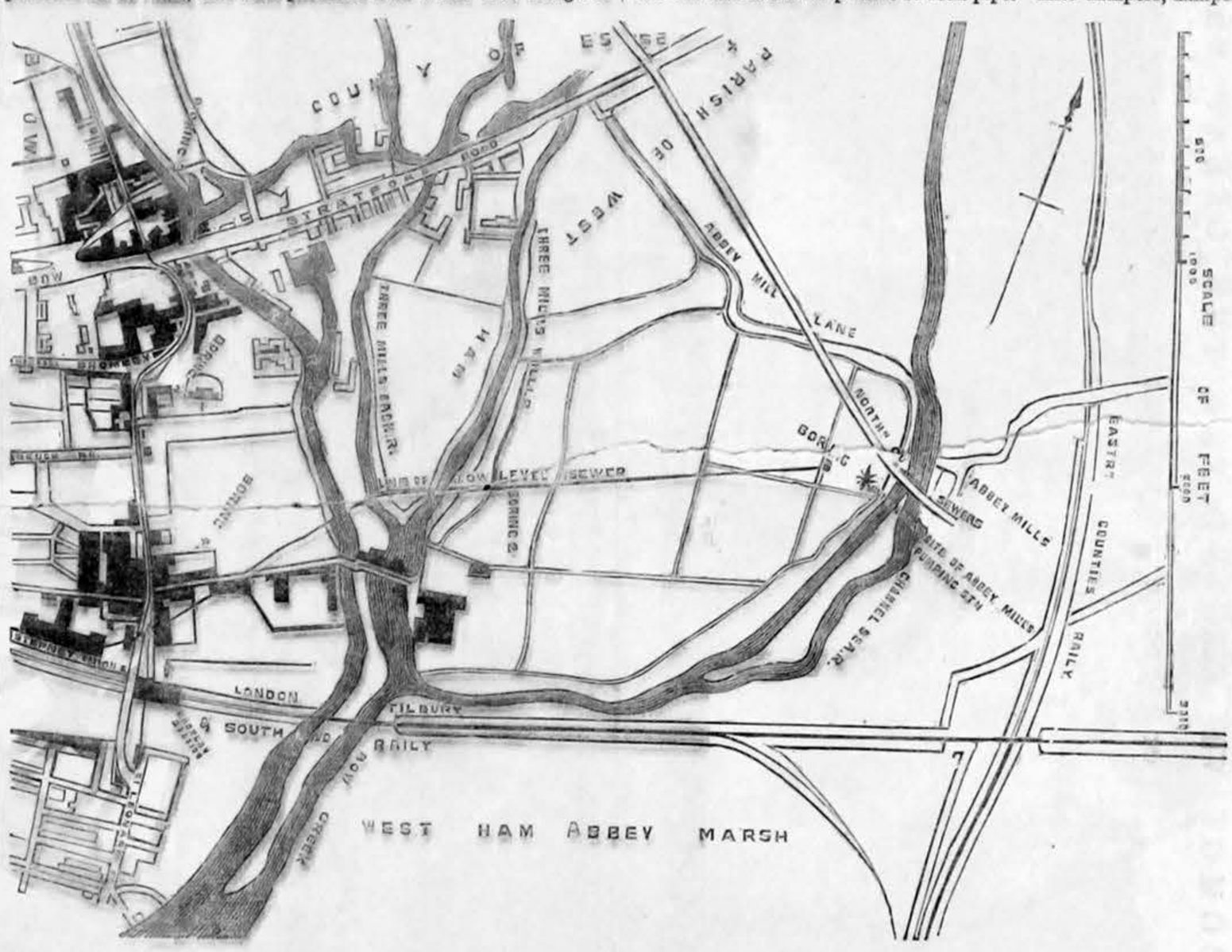
The valve gear will consist of shafts, silent gearing, cams of not less than 5in. radius, carefully shaped and properly adjusted, plummer blocks, adjustable valve rods, and levers, and other usual appendages; and the steam cams will be so arranged as to enable the steam to be cut off at any variable length of stroke, and to these cams the action of the governor will be applied. An alternative arrangement will also be made for cutting off the steam at any length of stroke, independent of the action of the governor, with index-hand, pillar, levers, &c., to show to what extent the steam is cut off. Also to the governor will be attached suitable means for regulating the amount of injection water. The governors will be Pitcher's patent, driven from the fly-wheel shafts by wood and iron bevel wheels, placed underneath the floor of the engines. The governors will be so adjusted as to admit of the speed of the engines being limited to eleven revolutions per minute.

The sewage pumps, sixteen in number, will each comprise a barrel 3ft. 10½in. in diameter, and an upper and lower valve box with two sets of valve seats in each box, one for suction and the other for delivery; also a suction pipe communicating with upper and lower suction valves, and a delivery pipe communicating in like manner with the upper and lower delivery valves, and at its lower end by means of a branch pipe with the main discharge culvert. In this branch pipe will be fitted a brass-faced slide valve worked by a screw and spindle from the engine-room floor. A double-faced valve of similar make will also be fitted between the suction pipe and the upper suction valves, and a 6in. opening left in the top of the upper valve box, fitted with a loaded valve, and furnished with all necessary means for readily lifting and closing the same from the engine-room floor. Each valve seat will be divided into nine openings, each 1ft. 3in. by 8in. in the clear, each opening being closed by leather valves with wrought valve-irons on back and face. The valves shall be suspended from lugs on back valve-irons, on rods turning in eyes cast on the valve seats. The valve seats will be very accurately cast and faced. The valves will be interchangeable. The leather employed for the valves will be of the best description of hide ¼in. thick, and will have laid in the tanpit for a period of two years. No belly pieces, or other soft, thin, or porous parts, will be used. The pump pistons will be 3ft. 10½in. in diameter, with a stroke of 4ft. 6in., with hemp or other packing of the most improved description, and will be fitted to wrought iron piston rods, cottered to pump rods, and passing through suitable stuffing-boxes in the pump covers. Each of these pumps will be bolted down to stones as shown, and stayed at the sides to the cast iron standards which carry the girder under centre pillars by means of girders bolted thereto and to the descending pipe from the sewage pump delivery valves. A cast iron circular trough or culvert will be placed in the centre of each cross arm of the engine-house parallel to the main beams for the reception of the sewage from the pumps, as will be seen from the plan. Three of these culverts will be 6ft. in diameter, and one 10ft. in diameter, for a length of 33ft., and 10ft. 6in. diameter for the remaining length of 12ft. A cast iron air vessel, 13ft. internal diameter at the lower end, and 11½ft. at the upper end, extending to the under side of the girders of engine-room floor, will be fixed at the intersection of the four arms of the culverts. The whole of the culverts and air vessel to be constructed so as to sustain with safety a pressure of 20 lb. per inch super. Air pumps with cocks, valves, pipes, rods, and shafts will be fixed for charging the several air vessels, and all requisite discharging valves, cocks, and pipes fitted to pumps, delivery troughs, &c., with proper appliances for opening and closing the same.

The boilers, of which there will be twelve, will be Cornish boilers, 8ft. in diameter and 40ft. in length. Their position and construction we shall illustrate in an early impression. There will be two flue tubes, each 3ft. 3in. in diameter, extending from the front of the boiler for a length of 12½ft., and united into one furnace tube, 4ft. in diameter, in front of the boiler by a breeches piece. The shell of the boiler will be $\frac{7}{16}$in. in thickness, of best Staffordshire plates, lap rivetted, connected to the ends, which will be $\frac{9}{16}$in. thick, by gusset stays and angle irons. The two 3ft. 3in. tubes to be $\frac{7}{16}$in., the breeches piece ½in., and the 4ft. furnace tube $\frac{7}{16}$in. in thickness, all of guaranteed Lowmoor iron, and to have butt joints, with T-iron covers. The breeches piece will be stayed by two vertical tubes, one 10in. and the other 6in. in diameter. The ends of plates forming longitudinal seams in shells of boilers will be doubly rivetted, and all holes throughout will be drilled and rimered out. Each boiler will be fitted with one manhole, with wrought iron frame rivetted to boiler, and with faced cover, and will be tested in the maker's yard under the engineer's inspection for two days, at a pressure of 100 lb. per square inch. Each boiler will be furnished with the following fittings:—One nozzle with 12in. screw steam stop valve, brass-faced, two 6in. safety valves, with levers and weights graduated to a pressure of 40 lb. per square inch, one lock-up safety valve, one self-acting steam whistle, one atmospheric valve, one Chandler's 12in. water gauge, three gauge cocks, and one Bourdon's pressure gauge, and one 3in. check and stop valve to feed pipe. Also dampers, damper frames, balance weights, balance rods, fastening screws, chains and pulleys, fire-bars, bearers, bridge plate, dead plate, draught doors, ash-pit plates, wrought iron double-plated folding furnace door and door frames, cast iron bearers for boilers, mud door, blow-off or mud taps, with 100ft. of 12in. pipe to each range of boilers, and all other apparatus, matters, and things whatsoever shown upon the drawings or necessary and proper for the perfect working and safety of the boilers. Two mercurial syphon steam gauges will be provided and fixed where directed, to show 40 lb. pressure, with brass mountings, graduated scale, pipes and cocks, complete. The nozzles with 12in. steam valve of each three adjacent boilers will be connected together by a 9in. steam pipe, and from the centre of the three valves a branch pipe 14in. in diameter will connect the steam pipe with a steam chamber of $\frac{5}{16}$in. boiler plate, and 4ft. in diameter. This chamber will extend over each range of boilers at the back of and parallel to the 9in. steam pipes, but will be divided at its mid length by a short length of 14in. cast iron pipe, fitted with brass-faced slide valve. All the cast iron pipes will be fitted with expansion joints. From the end of the steam chamber next the engine-house the steam pipe will be continued of cast iron, 20in. in diameter, and turned down under and across the engine-room floor to meet the pipe from the opposite range of boilers, and from a point midway across the engine-house the pipe will be returned at right angles and 28in. in diameter to the well at the intersection of the four arms of the engine-house, round which it will be conveyed 20in. in diameter, with connections and branches therefrom to the several steam cylinders of 14in. and 10in. respectively. All the pipes will be well and effectually clothed, and to be fitted with valves, as shown in the drawings. To give access to the steam and feed pipes a gangway will be formed round the central well of the engine-house of open iron plates, carried upon cantilevers and girders, and furnished with iron hand-rail.

The materials, workmanship, and finish of the said engines and other works will respectively be the best of their kind, and no part of the engines will be of less strength than is equivalent to at least ten times the maximum pressure (estimated at 35 tons) of the steam on the piston, the engines being intended to work expansively with a pressure on the boilers of about 30 lb. per square inch above the pressure of the atmosphere, and to elevate the sewage water to a maximum height of 36ft.

It would not be easy to do justice to the elaborately ornate character of the design as a whole. We shall shortly publish drawings to an enlarged scale of the entablatures and columns



* See The Engineer for Jan. 5th and 12th, 1866.

carrying the plummer blocks of the beams, from which something may be learned of the beauty of the machinery. The design of the engine and boiler, the chimney stalk, and, in fact, of every portion of the whole structure, does infinite credit to Mr. Bazalgette and his staff; while we are at a loss to detect a single feature calculated to unnecessarily increase the outlay. Until we have placed our readers in full possession of the details of this dainty palace of machinery—if we may use the words—it would not be well to speak further of its merits. It is to be regretted that in the locality in which it will be erected it will not have half the attention it deserves. North London will feel its influence in the promotion of cleanliness and health far more than as an example of high art in engineering.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE WATERWITCH, VIPER, AND VIXEN.

Sir,—In your last publication, giving an account of the recent trials of these vessels at Stokes Bay, in your introductory observations you have expressed several unfavourable views and opinions regarding the hydraulic or jet propeller, to which I hope you will allow me a few words in reply.

"At this moment," you say, "very little has been decided as to the actual value of the scheme." Allow me to say to this that a great deal has already been done and decided. The Waterwitch gun vessel has been fitted with this propeller and tried against her sister ships with twin screws, Viper and Vixen, of the same power and displacement, and as nearly alike as the two systems will admit of, and the result was that at the trials at the Maplin the Waterwitch made, by the Admiralty reports, 9·9 knots, while the Vixen made only 9·0, and the Viper 9·1, showing thus a large percentage in favour of the hydraulic. At Stokes Bay the trials, as reported, show that the hydraulic beat the Vixen again by about a quarter of a knot, while the Viper had the advantage to about a corresponding extent. As the Viper, however, at the Maplin—and no doubt doing her utmost—made only 9·1 knots, it remains yet to be proved how she could possibly perform the feat at Stokes Bay of doing the work of 150 extra horses with 50-horse power less, with same boiler and same engines. Assuming, however, for argument's sake, the entire accuracy of the results as given of those trials, they still prove that the hydraulic holds its own against the best double screws; and this shows that very much, instead of "very little," as you say, has already been decided as to the actual value of the hydraulic system. One single success is just as good as a hundred. If the hydraulic does well in the Waterwitch, so will it do in any other vessel, or any number of vessels.

You further state "it is perfectly certain that the best arrangements for applying it (the hydraulic system) in practice have yet to be designed," and "that the great loss of power manifested by both the Nautilus and Waterwitch," is easily accounted for by the defective arrangement of the machinery—especially the turbine."

It may be safe, as a general remark, to guess that "the best arrangements have yet to be designed;" but where is there any evidence of great loss of power manifested in either Nautilus or Waterwitch? or of "the defective arrangements of the machinery—especially the turbine?" The practical fact already known is that the hydraulic has beaten the screw with the Ruthven arrangements; and that, too, in the first large vessel ever built; while the screw has had the benefit of nearly thirty years of previous perfecting. Having accomplished this, there cannot—it is but reasonable to think—be anything very "defective in the arrangements—especially the turbine;" nor is there much left to be gained. Certainly, that ought not to be styled a bad or defective arrangement which already beats the old established propellers.

Neither has there been any loss of power proved in practice with either Nautilus or Waterwitch. What the latter has done has just been stated; but the Nautilus, with her sister up-river vessels, has shown equal superiority. The Nautilus, as reported by all the press, at the trial in March, 1866, beat, at a fair race, the Volunteer (Citizen Company's vessel), though the latter had greater horse power, less displacement, and much finer sailing lines.

Perhaps the "loss of power" to which you refer is not the loss as shown in the practical experiments—but the loss which mathematicians have proved. Here I shall not attempt to dispute with them. They have clearly demonstrated, as your pages recently showed, that four-fifths of the whole power was wasted by the hydraulic, and there is nothing to set against this authority but the practical fact that if the hydraulic, which beats the screw and paddle, waste four-fifths of its power, these other propellers must waste even still more.

W. B.

London, 26th August, 1867.

NEWSPAPER "RATTENING."

Sir,—I wish to call your attention, and that of your readers, to a mode of procuring advertisements adopted by the proprietors of a scientific journal published in London, which, in my opinion, very much resembles a practice lately in vogue at Sheffield.

The facts which I have to lay before you are these:—I am a member of a firm of mechanical engineers, and we advertise in most well-established scientific papers for the purpose of assisting the sale of the machinery manufactured by us. After repeated solicitations I was induced to give an advertisement for a short period to the journal in question. On the expiry of the term agreed upon I was, of course, asked to renew the advertisement, but I thought proper to decline its continuance, as we had not obtained any return for our money in the shape of orders. Immediately there appeared in this journal one of the most untruthful and scurrilous articles ever penned, evidently specially written and designed to damage the reputation of machines manufactured by my firm. A copy of an American paper, in which the article was inserted, was a few weeks afterwards posted in London to us anonymously, but I could see at a glance the source from which it came.

Now, Sir, my idea of the manner in which a newspaper ought to be conducted has always been that if it aspires to become anything like a truthful organ of a profession it ought to have its editorial department distinct from the publishing and advertisement departments, so that the opinions and judgment of its editor should be completely unbiassed by the contents of its advertising columns. Here, however, we find the closest connection.

When an editor acts in the capacity of advertisement canvasser, it need not be a matter of surprise that the public should get articles presented to them deviating from the truth, and others strongly influenced by a "page advertisement." It may be, in one sense, quite legitimate that advertisers who pay for it should be hoisted into the position of the most successful and celebrated engineers by the aid of the editorial lever; but when the editor, in giving a "lift" to his "full page" friends, makes a fulcrum of those who will not advertise, I consider, Sir, that such a proceeding is as fair an attempt at tyranny and terrorism as ever was practised by a Sheffield trades' union.

In my case I may add that I do not know the editor—the responsible author of the criticism to which I have referred—the only communication I ever personally received from him being a letter wherein I was ingeniously flattered by being asked to lend the weight of my name as subscriber for the first appearance of his journal, which was, however, not given.

I believe I am only one of many who have been similarly treated by the journal to which I refer, and it would be well if others would come forward—as one firm has already done—to more fully expose a disgraceful system of obtaining advertisements.

A. B.

DRAUGHTSMEN'S BENEVOLENT SOCIETY.

Sir,—I quite coincide with the opinion of your correspondent, "An Assistant." The time has indeed arrived for "something decided to be done," and the sooner the better. Engineers' draughtsmen and assistants are—more especially at the present time, when engineering business is, to say the least of it, dull—in a far worse position than the mechanic, who has his trades' union, and usually a friendly society as well, to fall back upon when he is sick or out of work. This is not the case with the class of men who are employed as draughtsmen and assistants in engineering firms, yet these very men must necessarily have a superior education, their scientific knowledge alone must be far greater than is required of an ordinary mechanic, and besides, an assistant must be capable of directing, and even performing, the work which he lays out and sends to the shop to be executed; he must also dress respectably, and I am confident that the great majority of draughtsmen will agree with me that it is scarcely possible to do so, and at the same time to live even in a moderate state of comfort on a salary rarely exceeding that of a competent fitter or turner, and which is, in a vast number of cases, considerably less than the average wages of those mechanics. Again, a draughtsman—as we all know too well—has more difficulty in obtaining a re-engagement than any reasonably good workman, however good his recommendations as to character and ability may be. I might say more in favour of this much-needed association which will benefit a large class of intelligent and hard-worked men, but I have already taken up too much of your valuable space; I only hope that others more competent than myself will at once move in the matter, and that at last "something decided will be done."

London, August 27th, 1867. A Draughtsman.

THE EFFICIENCY OF HEAT ENGINES.

Sir,—In The Engineer of July 12th I endeavoured to illustrate the superiority of air as a fluid for the transmission of the power of heat, by a very simple example of the application of heat to air and water according to the first law of dynamics. I also referred to what appeared to me a popular error in the application of the second law of thermodynamics, and invited scientific men to show wherein my statements were not correct, and to explain the apparent conflict between the first and second law. No one has, to my knowledge, done so. In The Engineer of June 28th Professor Rankine states that the external work done in evaporating water under the mean atmospheric pressure is less than 7½ per cent. of the whole work, the remainder, or 92½ per cent., being internal work, and that the internal work done in expanding air by heat is practically inappreciable. In the same article he also states that the second law of thermodynamics informs us that in order that the whole heat expended in a heat engine may be converted into external work, it is necessary that the temperature of the condenser or refrigerator should be the absolute zero, a temperature unattainable by human means. I demonstrated by a fair example, in The Engineer of July 12th, that it was not necessary in an air engine. In The Engineer of July 19th, Professor Rankine makes an explanation, which I understand to be substantially this: if in the air engine it is not necessary to make use of 461 deg. Fah. below zero to utilise the full value of the heat expended, 92½ per cent. (which is the difference in the external work done by heat in expanding air and steam) must be lost in compressing the air.

In The Engineer of July 26th I showed by quotations from a "Manual of the Steam Engine" that theoretically there was nothing lost by compressing air—that it would give out the same power by expansion which was consumed by compression. In The Engineer of August 2nd I am informed that, practically, in an air engine the heat produced by the compression of the air is wholly and unavoidably lost, and as I understand it, implying that consequently the whole power expended in compressing the air is lost. Is it so? Will a cubic foot of air when compressed into half a cubic foot and allowed to stand under pressure until the heat produced by compression is radiated, remain in the space of half a cubic foot without force? Certainly not. It will expand with nearly the force expended in compressing it, and by supplying about 143 deg. Fah. of heat during expansion, the work performed would be the same. Now is the 143 deg. of heat, which appears to be all that is lost by compressing the air, 92½ per cent. of all the heat imparted to the air in a properly constructed air engine? To double a volume of air by heating it, requires 490 deg. Fah. 143 deg. is about 30 per cent. of 490 deg., leaving 70 per cent. for air against 7½ per cent. for steam.

Perhaps it may be more satisfactory to the public to have some practical demonstration in proof of the theory that air is a more economical fluid for the transmission of the power of heat than water. My air engine now on exhibition in the park is, fortunately, so constructed as to give a perfect demonstration of the truth of this theory. It will be perceived by reference to the drawings, published in The Engineer of June 7th, that the engine is provided with a tubular boiler or regenerator, for the purpose of transferring the heat from the exhaust air to the air on its way from the air pump to the furnace, when it is used as an air heater. When used as a steam generator the air passages are closed, the boiler filled with water, the steam pipe connected with the furnace, and the heat of the exhaust is imparted to the water. All other conditions remain the same; the same amount of heat must pass to the regenerator in the exhaust air whether it is filled with water or air, and, consequently, if there is any difference in the efficiency of the fluid it will be manifest in the work done.

We discovered long ago that, in practice, air was more efficient in the regenerator than water, and we have recently made several trials to determine as nearly as possible what the difference is. In making the trials 132 lb. of coal were weighed out for each trial, and 66 lb. of it were put in to make the fire and get up heat to start with. In about 45 minutes after lighting the fire the engine was started, and the pressure maintained at 10 lb. by supplying coal in small quantities about once in ten minutes while it lasted. Uniformity of speed was kept up by a friction brake on the fly-wheel; the power indicated was 13·3-horse power. With the air regenerator the engine ran on the 66 lb. of coal supplied to the fire after starting six hours; with water in the regenerator it ran 4h. 40min. on the same amount of coal; without the regenerator it ran 3h. 40min. on the same amount of coal. Deducting the time run without the regenerator from the time run with air in the regenerator we find the engine ran 2h. 20min. on the heat imparted to the air in the regenerator. Deducting the time run without the regenerator from the time run with water in the regenerator we find the engine ran one hour on the heat imparted to the water in the regenerator, showing that in actual practice the same amount of heat will do more than double the quantity of work by expanding air than it will by expanding water and steam. If the second law of thermodynamics teaches that there is no difference in the efficiency of the fluids it certainly does not harmonise with facts established by experiment.

If any scientific men would like to witness the experiments we should be most happy to give them the opportunity.

Paris Exposition, August 27th, 1867. P. Shaw.

JACKETTED CYLINDERS.

Sir,—If Messrs. Aveling's object in sending you the sections of their patent cylinder and our traction engine cylinder, published in your last, had been to induce a fair comparison of the two, they would have given a description of ours as well as of their own, and it would have been manifest that one is totally different from the other in principle, and bears no more resemblance in detail than necessarily exists between one jacketted cylinder and another placed in similar position.

We are at a loss to know upon what grounds they intend to put in force the threat which they make your paper the vehicle of conveying to us. Because they put their so called "dome" on the fore part of the engine, does it infringe their patent to put the working cylinder in the fore part of a traction engine? Or, would the infringement be confined to putting a steam dome, or in ordinary language a steam jacketted cylinder, on the fore part of the engine?

If Messrs. Aveling have, as they appear to suppose, legal remedy against us, and intend to put it in force, why do they not do so instead of in this way forcing themselves upon your columns, and thus necessarily dragging us after them.

Ipswich, Aug. 28th, 1867. E. R. and F. Turner.

OPENING OF THE MONT CENIS RAILWAY.

The two Alpine railways, the one through and the other over Mont Cenis, are both bold engineering projects, but the last-named exhibits, if it may be said without offence, the smartest jockey-craft. The first started project for connecting France and Italy by railway was by the route which includes a tunnel of about seven and a half miles long through Mont Cenis, with nearly thirty-five miles of very difficult approach to the tunnel, twelve miles from St. Michel to Modane on the French, and twenty-two and a half miles from Susa to Bardeneche on the Italian side. The works for this important communication are of almost, if not quite, unprecedented magnitude and costliness, and were from the commencement expected to occupy the labours of a considerable series of years. They were commenced, backed by the imperial and royal resources of France and Italy, in 1857. Of the forty-two miles of this mountain railway, only about five miles of tunnel has been in part made up to this time, and this portion, being driven from the openings on each side of the mountain, is of course the easiest of execution. On the most favourable estimate the next decade will be far advanced before the tunnel line can be opened. A company of Englishmen stepped in after these works were commenced and persuaded the imperial and royal promoters that they could give them the advantages of railway communication for a number of years before the route could be ready. This they proposed to accomplish by going over instead of through the mountain, and almost all that they needed, in the way of concession, was the use, to a certain extent, of the Government roads through the pass, facilities which they duly obtained, and now their line, only about six and a-half miles longer than the "direct" tunnel line, is practically finished, and was inspected on Monday last by Captain Tyler, R.E. Official intervention is called for, inasmuch as the Mont Cenis Railway will form part of the route by which the Eastern mails will in future be sent, at a saving of about forty hours. The experimental trip, which was most successful, was over the entire length of the line from St. Michel to Susa, forty-eight miles. The serious injury caused by the inundations of last autumn to the Government road, upon which the line is for the greater part laid, is now completely repaired, and the works throughout give the best promise of stability. Between St. Michel on the French, and Susa on the Italian side, the village of Lanslebourg is perched about halfway. St. Michel is 2493ft. above the sea, Lanslebourg is 2099ft. higher, and the summit, about six miles from Lanslebourg, and between it and Susa, is 6332ft. above the sea. On this section 2240ft. is ascended by an average gradient of 1 in 14. From the summit to Susa, fourteen miles, the average gradient is 1 in 17, but three miles being comparatively level, the prevailing gradient on this length is really 1 in 12. The Fell system of traction, adopted upon the line, was tried on this occasion upon what may be pronounced an adequate scale, and gave conclusive evidence of its safety and efficiency. The existing traffic across the Mont Cenis is very great, and may be expected to be largely increased on and after the opening of the line on the 1st October next. The average passengers both ways daily by road is about 220, with about 120 tons of goods daily. The number of horses engaged in the conveyance of passengers and goods across Mont Cenis is about 1200, which, allowing ten miles a day to each horse, gives a daily average of about 12,000 miles travelled. In the event of the system of traction proving indisputably safe—as there is the best reason to believe it will—there can be little doubt that this overground line will prove the preferred permanent route, as there are few travellers who will not prefer a slight detour, an hour or two's detention, and a pretty stiff gradient, to a seven and-a-half mile tunnel.

Captain Tyler was accompanied in his trip by Mr. Brunlees, engineer-in-chief of the line; the Duke de Vallambrosa, Mr. Alex. Brogden, and Mr. Fell, directors; Mr. Bell, resident engineer; Mr. Blake, who has carried out the works for the railway and the reparation of the road for Mr. Brassey; Mr. Alexander, who has superintended the construction of the engines; Mr. Barnes, locomotive superintendent; Captain Bernout, R.E., and others. The most lively interest was manifested in the trip and inspection at St. Michel, Lanslebourg, Susa, and along the whole route.

With the formal opening of this line in October railway communication will be complete between Calais and the south of Italy.

METROPOLITAN MEAT AND POULTRY MARKET.

No. II.

On p. 172 will be found further details of this beautiful structure, consisting of half elevation and half section of central roadway, and part of a longitudinal section through the same.

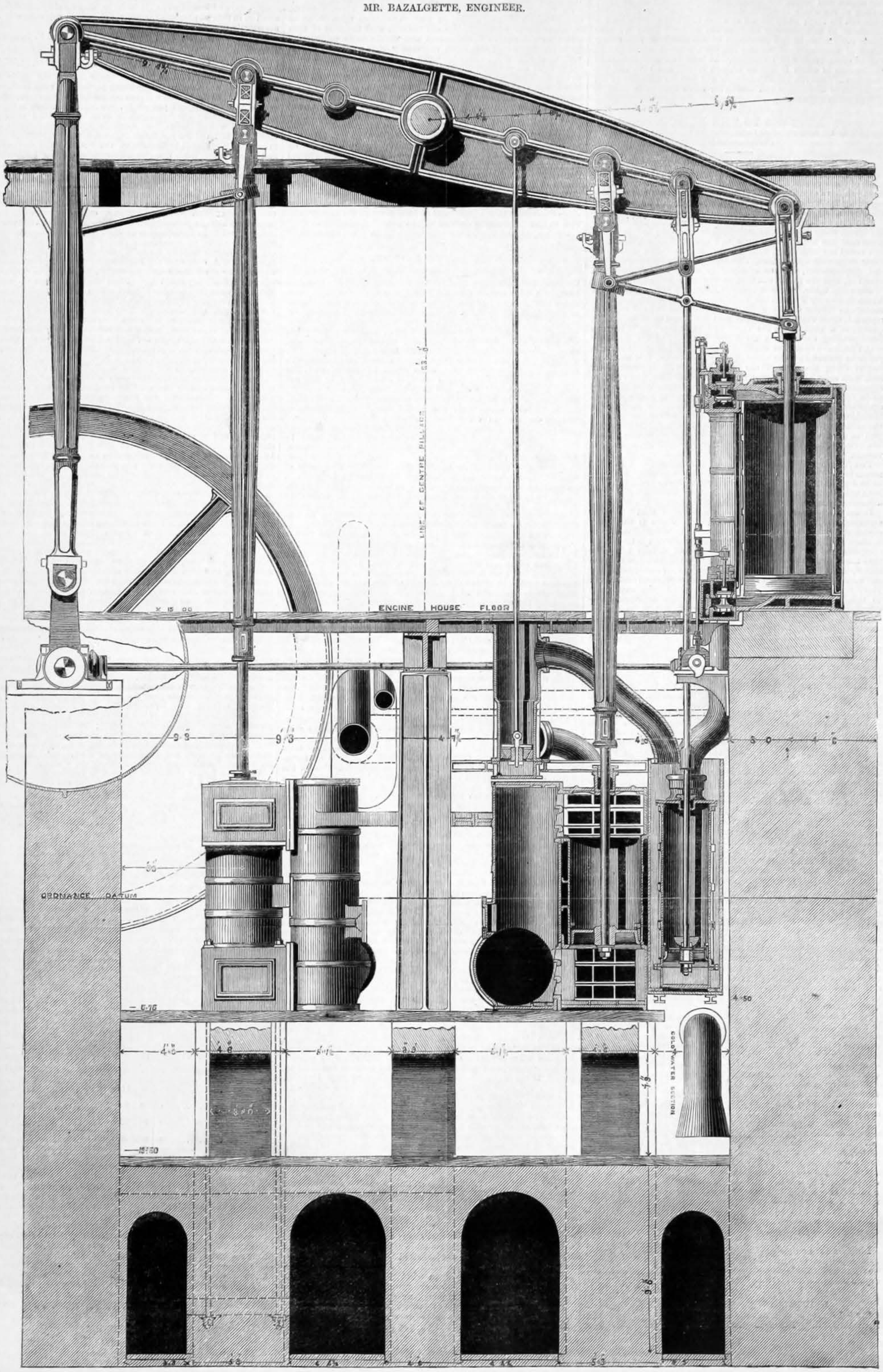
Agricultural Engine Trial at Billancourt on the 26th Inst.—The following table gives the results obtained at the first day's trials of portables at Billancourt, to which we have alluded in our notice of the French Exhibition for this week. We have not yet received particulars of the second day's trial. It was, however, not of much importance, there having been only three engines—one English (Allen's engine, by Tuxford and Sons), and two French—tested. We shall feel much interested in hearing the result of the trial of the former engine, which is, in reality, a portable on Woolf's principle.

	Horse power, nominal.	Mean pressure of steam.	Mean number of revolutions.	Fuel consumed in kilos.	Length of time run.	Fuel per H.P. in kilos.	Approximate in pounds.	Mean dynamometrical H.P.
Ransome and Sims ..	10	74	156½	103½	3 h. 12½ m.	1·62	3·6	19·84
Marshall and Sons ..	8	65	147	83	3 „ 30 „	2·28	4·7	10·4
Gerrard	6	100	144	62½	3 „ 22 „	2·94	6·6	6·34
Ferdinand Del	6	100	140	62½	3 „ 19 „	2·709	6·5	6·93
Protte, of Vendnore ..	4	86	123	42	2 „ 51½ „	3·760	8·2	4·15
Ganterau	5	82½	107	52	2 „ 10 „	„	„	„

The breech apparatus employed by Messrs. Ransome and Sims, in the trial of their 10-horse power portable expansion engine, consisted of a strap with hard wood blocks applied to the fly-wheel of the engine, the ends of the strap being united by a right and left-hand screw for obtaining the necessary grip. On one side of the wheel a scale for carrying the load was suspended by a leather strap forming a vertical tangent to the fly-wheel and maintaining the load at a constant distance from the centre; on the opposite side of the fly-wheel a similar vertical strap carried a spring-balance, the bottom of which was attached to a fixed point near the ground. The application of the spring-balance on the side opposite to the load forms the principal feature of this arrangement, the spring-balance being the index, showing at once any variation which takes place in the friction of the break-strap on the fly-wheel, and also furnishing a means of adjusting the load to the required speed, for on tightening up the strap the spring balance will indicate less, which is equivalent to adding more to the load, and the engine will run slower.

PUMPING ENGINE, ABBEY MILLS, METROPOLITAN MAIN DRAINAGE.

MR. BAZALGETTE, ENGINEER.



NOTICE.

*** *The office of* The Engineer *at the Paris Exhibition is situated close to the promenade round the building, and opposite to the English boiler-house. Our correspondents in Paris will be happy to be of use to any of our English or continental subscribers visiting the Exhibition.*

Messrs. Kirklands have undertaken the agency of this journal at the Exhibition, and it will always be found on sale at their English newspaper office, Gallery VII.

TO CORRESPONDENTS.

*** *We beg to call the attention of our Advertisers to the notice below, and to state that the large circulation of* The Engineer *compels us to go to press at an early hour on the morning of publication. Advertisements, to ensure insertion, must be delivered at the Engineer Office before seven o'clock on the Thursday evening of each week.*

*** *Letters intended for publication must be accompanied by the names and addresses of the writers, not necessarily for insertion, but as an evidence of good faith.*

*** *We cannot undertake to return drawings or manuscripts, and must therefore request our correspondents to keep copies.*

Ferro. Junior.—*You have sent neither your name nor address.*

A Young Reader.—*About twenty revolutions of the crank shaft per minute, not more with safety.*

A. Craig.—*Your letter partakes too much of the character of an advertisement to be suitable for insertion.*

T.—*If you have cast steel ingots for sale advertise them. They are in demand, to a greater or less extent, in most large forges.*

S. P. (Somerset).—*We have forwarded your note to the parties you mention. Doubtless they will communicate with you. But have you not seen their advertisement in our front page?*

F. D.—*The patent to which you refer is somewhat irregular in the way in which it is specified. We think you would find it more satisfactory to examine the case yourself at the Patent-office, Southampton-buildings, Chancery-lane.*

G. G.—*Your method of finding the relation which exists between the diameter and the circumference of a circle has no pretensions to minute accuracy. It is far simpler to multiply the diameter by 3·14, while the result is quite as accurate.*

T. A.—*You cannot examine a provisional specification. The complete specification may be examined shortly after it is filed, and before it is published in the shape of a blue-book, by paying a small fee at the Great Seal Patent-office, Southampton-buildings, Chancery-lane.*

Bee.—*We are not aware that any attempt has ever been made to test the resistance of the Waterwitch by towing her and registering the strain on a dynamometer. There are no reliable available data to show what is the maximum efficiency of the injector as a means of raising water.*

W. B.—*Humber's "Treatise on Bridges," last edition; "Examples of Bridges and Viaducts," by Haskoll. "Clarke's Treatise on the Britannia and Conway Bridges," though not new, you will find sound and useful. There is a dictionary of technical terms, published by Weale, which may suit your purpose.*

J. H. (Westminster).—*Twelve rounds were fired from each of the following breech-loaders at the recent competitive trials at Woolwich in the time affixed to each name:—Henry, 49 sec.; Joslyn, 47 sec.; Barton, 57 sec.; Bacon, 54 sec.; Peabody, 53 sec.; Remington, 50 sec.; Sharpe, 51 sec.; Soper, 39 sec.; Fosbery, 50 sec.*

R. C. G. (Cleckheaton).—*Brass wire may be annealed by placing the coils in an oven or furnace in which it is protected from the direct action of flame, raising them to a dull red heat, and cooling them in water. We are not aware that any special apparatus is used in the process; if there is, probably some of our correspondents will favour you with particulars through our pages.*

Regular Reader.—1. *Machinery between 6½ per cent. and 10 per cent. per annum, according to the quality of the materials, workmanship, and the amount of work done. Belting is not an inconsiderable item in a large factory, and on this the depreciation will be about 45 per cent. per annum. The depreciation on engines is about 9 per cent., and on boilers about 13 per cent., including wear and tear.*

G. Mellor.—*The formula to which you refer is not satisfactory. The following you will find accurate:*—$V = 48 \sqrt{\frac{d\,h}{L + 50\,d}}$; *where* V *is the velocity in feet per second.* h *the head in feet, and* d *the diameter of the pipe in feet. Let* Q *be the quantity discharged in cubic feet per second, then* $37{\cdot}7\ d^2 \sqrt{\frac{d\,h}{L\ 50\,d}} = Q$.

These formulæ will not hold good for very short pipes of large diameter.

SHALE OIL IN FRANCE.

(To the Editor of The Engineer.)

Sir,—Can you or any of your correspondents kindly give me, through the medium of your paper, the names of parties having interest in the recent discoveries of shale which are reported to have been made in France?

9, Victoria Chambers. Henry Davey.

ENGINEERING SOCIETIES IN MANCHESTER.

(To the Editor of The Engineer.)

Sir,—Would you or any of your correspondents be kind enough to inform me if there exists in Manchester a society for the discussion of topics connected with engineering which will admit an apprentice?

Premium Apprentice.

Advertisements cannot be inserted unless delivered before seven o'clock on Thursday evening in each week. The charge for four lines and under is three shillings; each line afterwards, eightpence. The line averages eight words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

The Engineer *can be had, by order, from any newsagent in town or country, and at the various railway stations; or it can, if preferred, be supplied direct from the office on the following terms paid in advance):—*

Half-yearly (including double number) 15*s.* 9*d.*
Yearly (including two double numbers) £1 11*s.* 6*d.*

If credit be taken, an extra charge of two shillings and sixpence per annum will be made The Engineer *is registered for transmission abroad.*

Letters relating to the advertisements and publishing department of this paper are to be addressed to the publisher, Mr. George Leopold Riche; *all other letters and communications to be addressed to the Editor of* The Engineer, *163, Strand, London, W.C.*

MARRIAGE.

On the 15th July, at Kussowlie, Punjaub, Edward Tanner, Esq., C.E., to Mary, second daughter of John S. Lister, Esq., J.P., of Saleby Grange, Lincolnshire.

DEATH.

On the 17th July, at Dinapore, Shahabad, from dysentery, W. Purcell, Esq., C.E., E.I.R., Calcutta, eldest son of the late F. Purcell, Esq., Dublin, aged 46.

THE ENGINEER.

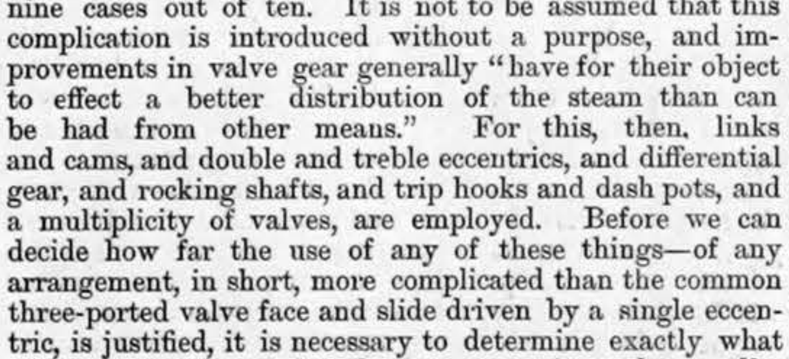
FRIDAY, AUGUST 30, 1867.

WORKING STEAM EXPANSIVELY.

All engineers agree that to work steam economically it must be worked expansively, but engineers disagree as to the best method of constructing engines in which steam is expanded. The value of the principle is recognised, but wide differences of opinion may be met with as to the way in which the principle should be applied in practice. Although this diversity of opinion has acted as a stimulus to invention, it is more than probable that the progress of the steam engine towards the perfection of economy has been retarded by its existence. Men have sought to attain the same end by different means; very grave mistakes have been made; much money expended to no purpose, and a fair proportion of talent wasted in consequence. This is bad enough, but the waste of time, money, and talent does not represent the worst. Engines theoretically right in principle but practically faulty in construction, have been forced upon the market, purchased, and worked to the disgust of purchasers. The general public of manufacturers, shipowners, and other employers of steam power seldom dive very deeply below the surface of things, or take much pains to draw distinctions between theoretical and practical shortcomings. In other words, all shortcomings represent practical commercial losses, and thus if a mistake is made in the method adopted in carrying out any principle — say that of expansion—the fault is attributed quite as much to the influence of the principle as to the lack of skill, knowledge, or perception of mechanical fitness in the engineer. Thus, if a manufacturer of cotton thread buys an engine which he is assured is constructed on such a principle that it will save him much money in coal, and this engine is constantly out of repair, he will be almost certain to attribute the fact to the principle, not to the maker, provided only the workmanship appears good. If the workmanship is bad that is a different affair; but even then he will not be unwilling to think that the expense of applying the principle must be so great that he cannot expect to obtain first-class workmanship and the principle together for the price of first-class workmanship only. In this way an idea grew up many years ago, and is still sufficiently prevalent, that an engine to work expansively must be complex and therefore liable to get out of order. There is just such a basis of truth lying below this theory that it is difficult to combat it, and there can be no doubt that as a result engines in which the principle of expansion is fairly carried out do not receive that general recognition of their value as representing a good principle, which they deserve. We shall not attempt to prove that complication does not necessarily mean a liability to disarrangement; those who have had to deal with complex machines know better than to be led into error by any reasoning on the subject. In our eyes complication is a monstrosity in engineering. We wish it, of course, to be understood that we use the word with reasonable limitations. A machine is not necessarily complicated because it has a great number of parts, provided no fewer can be used to obtain a required end; but complexity commences the moment a single unnecessary part or motion is introduced. We shall, therefore, not dispute with those who assert that complicated steam machinery is more liable to get out of order than simple steam machinery, but we believe it may be shown that the fullest benefit which the principle can confer may be derived from expansion in engines of exceedingly simple construction; that no multiplication of parts or motions is necessary or desirable in such engines as compared with those in which steam is not greatly expanded, and that, in short, the whole question is one far more of proportion and arrangement of the members of a design than of anything else. Complexity in steam machinery generally represents the embodiment of the crotchets of an inventor, seldom or never the necessities of practice.

Inventors have done their best and their worst with pistons, cylinders, connecting rods, and guides; but those members of the entire machine have such straightforward duties to perform, and are so simple in their nature, that we seldom or never meet with any complexity in their construction or arrangement. When we turn to the means adopted for distributing steam we find that we have, so to speak, entered a new mechanical region. The patents which have been taken out for "improvements in the valves of steam engines, and the means to be employed in driving the same," may be counted by hundreds, and these most probably represent but a small proportion of all the inventions in valve gear which have been made. It may be stated, without fear of contradiction, that in complex steam engines the complexity is almost certain to exist in the valves and valve gear and nowhere else, in nine cases out of ten. It is not to be assumed that this complication is introduced without a purpose, and improvements in valve gear generally "have for their object to effect a better distribution of the steam than can be had from other means." For this, then, links and cams, and double and treble eccentrics, and differential gear, and rocking shafts, and trip hooks and dash pots, and a multiplicity of valves, are employed. Before we can decide how far the use of any of these things—of any arrangement, in short, more complicated than the common three-ported valve face and slide driven by a single eccentric, is justified, it is necessary to determine exactly what the best principle of distributing steam is; and, secondly, how far complex valve gear is calculated to give better results than gear of the simplest form. There is little trouble in doing this, although many inventors contrive to mystify themselves strangely in dealing with the subject.

If the valves giving admission to and exit from a cylinder could be opened suddenly at the proper time, and if, further, the steam admitted worked without expansion, and entered and escaped from the cylinder without sensible frictional retardation, then would an indicator diagram taken under such circumstances be a perfect rectangle, shown by *c, f, d, g;* and if its altitude represented the boiler pressure and vacuum combined, while its length represented the stroke of the engine, then would the diagram represent the greatest possible amount of power which could be got out of the engine during any one stroke under the given limitations of boiler pressure and vacuum. We have now lying before us a diagram taken from a



steam fire engine, the valve of which has very little lap or lead, which is nearly a perfect rectangle; but such diagrams are never taken from engines in which economy of fuel is studied—a matter of no importance whatever in steam fire engines. In all such cases the diagram shows a portion only of the complete rectangle, and it may be divided into two parts; one of these represents the power exerted while steam continued to enter the cylinder, the other the power exerted after the admission port was closed by the steam expanding. Now as a perfect rectangle would represent the greatest amount of power which can be obtained through any single stroke, so will a perfect rectangle represent the maximum development of power through any portion of a stroke to which that rectangle corresponds. In the case of the practical steam engine this rectangle can only be contained between a line *a, b* drawn across the diagram from the point where admission cease and the terminal line of the diagram, *c, d* representing the maximum pressure in the cylinder. Under any circumstances that portion of the cylinder corresponding to the rectangle must receive the same volume of steam from the boiler, that is to say, it must be filled; and it is therefore important that during this, the first portion of the stroke the engine should develope the greatest possible power; but this condition can only be ensured when the action of the valves is such that the first part of the diagram, as we have said, is approximately a rectangle. If the valve opens too slowly the line of maximum pressure will be shown by *e, d* in the cut, and the space between it and *c, d* represents a loss of fuel, because while the piston moved through the space corresponding to *e, c,* it was not submitted to a pressure equal to that attained subsequently; but before this maximum pressure could be attained at all, the space *e, c, d,* had to be filled up to the maximum pressure by steam doing no work on the piston; the loss, in a word, exactly resembles in character that due to clearance. If, on the other hand, the valve opened too soon a space would be cut off the rectangle at the lower corner (as shown by the dotted line), which would represent a loss of power, but not a waste of fuel, as the steam compressed would be available for the return stroke. Still it is not expedient, from many reasons well understood, that compression should be carried to excess, and therefore the more nearly a perfect rectangle the full pressure part of the diagram is, the better, within certain limits.

So much for the influence exerted on the shape of the diagram by the opening of the admission and the closing of the exhaust port. We have now to consider the influence of the mode in which the admission closes. If the valve acts quickly, expansion will commence at the point *a;* and if the cylinder be kept hot, the curve of expansion will be nearly that due to the operation of Mariotte's law. If the port is not closed quickly, steam will continue to find its way into the cylinder, and the curve will be too high. It is true that the steam so entering will act to impel the engine and increase the total power of the machine; but this steam acts to a disadvantage, a great portion of its pressure being lost through wire drawing. Its effect, indeed, will be as though it acted almost altogether without expansion. We find a precise parallel in the case of an engine working steam which is wire-drawn, and therefore is worked at a loss.* It is unnecessary to point out how essential it is to economy that the exhaust port should be opened as quickly as possible to its full area.

The deductions from the foregoing statement of facts lie in a nutshell. The valves of a steam engine should open and close the ports as quickly as possible at the proper time, and any arrangement which will effect this sudden opening and closing will give first-class results as far as economy is concerned; whether the action is the best possible may be at all times determined by taking a diagram. Now it so happens that diagrams taken from engines with the common slide valve with a good lap and lead, and a long stroke, may be, and frequently are, quite equal to any which are taken from engines with the most complex gear; nor can we ascertain that any economical results have ever been obtained from complicated engines as a consequence of the action of their valves, which cannot also be paralleled with ease in the case of engines of the simplest construction. The fact—and that it is a fact admits of the fullest proof—demonstrates that the use of complicated valve gear is a mistake. It adds to the first cost of the machine, and to the expenses of its maintenance; while the assertion that by such means, and such means only, economy of fuel can be realised, tends to retard the adoption of the principle of expansion to the fullest extent which is desirable. It appears upon the whole, the distribution of steam can be effected by two D valves, one at each end of the cylinder each controlling an exhaust and admission port, about as well as in any other way. The valves may be of the gridiron or marine engine type, worked by a single eccentric, and provided with an amount of lap corresponding to the required point of cut off. The valves when large may be balanced by a simple ring at the back. If it is deemed desirable to introduce a still sharper action of the valve than can thus be had, a second eccentric may be employed working cut-off valves on the backs of the main valves, and these cut-off valves can easily be made to act the part of equilibrium rings. The ordinary link motion, or a modification of it, with but a single eccentric, may be used when it is desirable that the cut-off should be variable. An engine constructed on such a principle will cost less money, be less liable to get out of order, require less care in its management, and give more satisfaction, even as regards economy of fuel, than complicated machines, delicate in their operation, and extracting, or pretending to extract, a fraction more power from each pound of coal burned than their apparently commonplace rivals. Cam gear and puppet valves constitute in some respects a better arrangement than any modification of the slide valve, but unfortunately one not very well suited for engines running much over twenty revolutions per minute. The maximum degree of complication admissible in stationary engines is represented by the use of a second slide worked on the back of the main valve by a distinct eccentric, and even this is only required in the case of engines expanding largely in a single cylinder. When compound cylinders are used a very early cut-off is not required, and the ordinary slide

* "The object of cutting off is to obtain the greatest mean pressure with the lowest terminal pressure; and it is clear that the sharper the cut-off the more completely this object is attained."—*Porter on the Indicator*, p. 59.

valve will upon the whole give, over a series of years, more satisfactory results than any other arrangement.

IRON ROOFS.

Had the same necessity arisen for the employment of iron in the roofs of railway stations and of other large buildings as existed in the case of bridges, there is no question but that the application of iron would have received a far greater development in that particular branch of construction than it has done. Taking the span in the clear as the standard there is no precedent for a timber bridge possessing the proportions of that over the Menai Straits; but there is a precedent for timber roofs, exceeding in dimensions any similar structure erected of iron, based upon the same datum. We are, therefore, justified in asserting that many railway bridges have been constructed of iron from the sheer impossibility of building them of timber; but we cannot advance the same argument in favour of iron roofs. The important considerations of durability, incombustibility, lightness, and elegance of outline have mainly tended to their adoption; and what in the one case was an impossibility in the other was a matter of judgment, engineering good taste, and ultimate economy. Anticipating a little, we may say that the roof of the largest span will be that over the Midland Railway Station at St. Pancras. This, however, has been equalled within five feet, many years ago, by the laminated timber system of De Lorme, in the splendid example at Moscow. In tracing what might be termed the history of iron roofs, we shall find a strong analogy between them and their contemporaries, iron bridges. Similarly to the latter, the first examples of the former were constructed of cast iron, and, although a few casualties occurred, yet, in consequence of the comparatively insignificant duty imposed upon them, they are not very liable to be effected by causes which exercise a most dangerous influence upon their more heavily-loaded neighbours. The difference between a roof and a bridge, so far as external forces are concerned, is that the former has no rolling or moving load to contend against. A variable load it certainly has—the pressure of the wind, the weight of a fall of snow, or of a heavy rain or hailstorm, for instance—but these cannot be regarded as movable or rolling loads; they are allowed for upon statical principles. While it will be admitted that the effects of a heavy rolling load—particularly if it be, as it frequently is, enormously disproportionate to the dead weight of the structure—is calculated to actually imperil the security of a cast iron bridge, it cannot be argued that a roof of the same material is liable to be effected to the same extent by the forces acting upon it. The absolute safety of the structure is concerned in the one instance but not in the other.

The next step in the construction of iron roofs affords another point of similitude between them and bridges of the same material in the injudicious combination of cast and wrought iron. There never was a more mischievous and sophistical interpretation of the laws of pure theory than that exemplified in the application alluded to. It was argued that because cast iron was stronger when submitted to a compressive or crushing strain than wrought, therefore those parts of a design under a strain of compression should be of cast iron; and, for a similar reason, those submitted to a strain of the opposite character should be of wrought iron. *Primâ facie*, nothing appears more evident, more simple, or more conclusive; but practice wofully disappointed these theoretical anticipations. One little fact was lost sight of in the calculation, and that was how would the two descriptions of iron work together? With different rates of expansion and contraction for the same alterations of temperature, with different degrees of elongation under strain, how were the various parts to be so adjusted that when they were called upon to fulfil their common duty each should contribute its own share of resistance, neither more nor less, at the right time and in the right place? This was the rock upon which all these combinations, and compound girders split; and yet, strange to say, it was not until several serious and disastrous failures had taken place, involving loss of life, that many engineers could be persuaded of the error, and led to believe that the rigid dictates of theory must always undergo more or less modifications in actual practice. That some are not even now convinced of the mistake is apparent from the fact that nothing is more common than to witness roofs designed with cast iron struts and wrought iron ties. From what has been already stated respecting the different duties imposed upon bridges and roofs, it is manifest that this error may be committed in the latter structures—if upon a small scale—without necessarily entailing their destruction. As roofs upon the plate girder system are of very rare occurrence we may omit any consideration of them, and pass on to notice the usual open truss wrought iron roof. It will be found, as may be naturally expected, that the earliest examples of this character now in existence are distinguished by presence of those errors which attended the original attempts at open web bridge-work. Indeed, the first specimens of the lattice system, so far as the peculiar principle of openwork is concerned, may be considered as most successful instances of the application of "rule of thumb" to modern engineering. To all other intents and purposes they are standing examples of how little was known at the time of their erection respecting the true nature of strains upon ironwork. To confound those parts of a structure which were under a strain of compression with those which were undergoing one of tension was a common fault. Mr. Fairbairn, in his third series of "Useful Information for Engineers," mentions a prominent instance where this blunder was committed, and, in fact, there is not a drawing of the earlier designs of open trusses from which it would be possible to gather information respecting the different strains acting upon the component parts. It might be asked that if struts and ties can be employed in this heterogeneous and indiscriminate manner, how is it that the structure is able to perform its duty unless it is a question of no moment what parts are in compression and what in tension? The answer is, that owing to the large margin of strength allowed, particularly in the earlier examples of ironwork, the ties and struts were enabled to interchange duties; moreover, when the design is upon a small scale, and the ties very short, there is comparatively but a very slight tendency to deflection upon their part when they are compelled to act as struts. At the present time, when engineers economise material as closely as possible, a mistake of a similar nature in a bridge or roof of large dimensions would be obvious at once. Were it not so the proper conclusion to be drawn would be that there was an enormous surplus of material in the design, and, consequently, an unpardonable waste of money. In every frame or truss, whether of timber or iron, no one part ever performs the duty properly belonging to another without a sacrifice being incurred somewhere. Each bar has its own work, so to speak, cut out for it, and, in the due execution of the individual resistance of the bars lies the real economy of the construction. Before leaving the trussed roof, or that description involving the employment of the ordinary rafters or principals, the introduction of the inclined tie rod should be noticed, for, although not peculiar to iron roofs, it is rarely seen in those of timber. By its means additional headway is obtained, but the increased accommodation, like all luxuries, must be paid for, in this instance by an increase in the strains upon all parts except the struts. The normal direction of the tie rod of a roof is that of the horizontal thrust which it is intended to resist, and directly this is departed from the principle of the roof becomes to some extent infringed upon, and additional strength is required to compensate for its violation.

With the erection of new and larger railway stations than had previously been even contemplated, came the erection of roofs upon a scale of commensurate magnitude. The form given to these gigantic structures is that of a curved truss, of which the curve may be of a regular or irregular character. Sometimes the principals are simply bow and string girders, similar to those at the London Bridge station of the Brighton line. For large spans this principle of construction undoubtedly possesses strong features of recommendation, and is to be preferred to the bastard system of trussing adopted in the roof of the Charing Cross Railway, although, at the same time it does not afford the same headway with the same height of side wall as the latter roof, in consequence of the necessity of the tie rod being horizontal. Theoretically the difference between the principle of the bow and string girder and that composing the roof at Charing Cross station, which is a curved truss, is that in the former the sections of the bow and string, or upper and lower flange, are equal and constant throughout the span, and there is no strain upon the diagonals, since they are not subjected to a rolling load. By making the horizontal tie rod of a bow and string girder of a polygonal form with various angles of inclination, and doing away with the uprights, we at once destroy its principle and make a curved truss of it, and in this instance the strains are no longer equal and constant in the upper and lower flanges, but vary from the centre to the ends, and the diagonals undergo strains of different amount, varying in the reverse direction. When the walls are of a height similar to those of the Charing Cross and Cannon-street stations, the amount of additional headway dependent upon the mere raising of the tie rod is of no importance, and therefore for this cause alone there is no particular reason for giving the preference to the curved truss girder. Any one who has been under the roof over the platform and station of the London and North-Western Railway cannot help observing its extreme lowness, and what is, after all, of more real consequence, the great want of light. The multiplicity of pillars supporting the roof is also a serious inconvenience. All these objections—and they are undoubtedly valid ones—are removed in the new system, but it is also very questionable whether the other extreme has not been indulged in. The great height of the roofs of the stations we have mentioned has been objected to as unnecessary and needlessly expensive. It must not, however, be forgotten that the same roof could not well be placed lower down; that is, the height of the side walls could not be lowered to any great extent without destroying what must always be adhered to in every design, namely, proportion. The width of the roof determines in a great measure the height at which the springing must take place, and to which the crown should attain. A large room must evidently be higher than a small one, or it will always appear low. If the dome of St. Peter's rested upon the ground it might easily be taken for an overgrown coke furnace or a big oven. The real question to decide upon in designing a roof for any large building is whether there are to be intermediate pillars or not. Is the roof to be in one span from wall to wall, or is the span to be divided into sub-multiples? Having once decided upon the former plan the height must be regulated in proportion. There is, however, a wide difference between the erection of a multiplicity of small columns, as in the London and North-Western station, and in the judicious introduction of a few for the purpose of curtailing what would otherwise be a roof of gigantic proportions; and it might be observed that there is no possible utility in constructing a roof of dimensions similar to those of the future St. Pancras station. When the conditions of a sufficiency of light, air, and space, in their fullest sense, are fulfilled, the rest becomes not a work of utility, but of supererogation. It is scarcely necessary to comment upon the costly nature of these monster roofs, since, like that of bridges, it increases in a ratio far more rapid than that of the span. The idea of vastness and size that is appreciable in the interior is well matched by their external appearance. Viewed from the river Charing Cross and Cannon-street Stations completely eclipse the churches in the Strand; and were a stranger at a distance to mistake their rounded contours for the dome of St. Paul's the error would not be an unpardonable one.

MICHAEL FARADAY.

After a long and active life, devoted to the pursuit of the great truths of Nature with such earnestness, simplicity, and success as could not fail to gain for him the love of all who knew him, and every honour that the world of Science and Letters could bestow, Michael Faraday quietly ended his days in the circle of his family on Sunday last at Hampton. The history of his life has so often, and so rightly, been held up as an example of what self-help can make a man, that it must be familiar to everyone, and the briefest recapitulation of its leading points will, therefore, answer the present purpose. Faraday was born in the month of September, 1791, at Newington, in the county of Surrey. His father, who was a native of Yorkshire, appears to have been possessed of but limited means and was unable to provide his son with any instruction beyond the veriest rudiments of knowledge that are to be acquired in a day-school. As soon as young Faraday was in his teens he was bound apprentice to a bookbinder of Blandford-street, choosing this vocation to be among books. "But," to quote his own words, "I was very fond of experiment and very averse to trade." So he bought what volumes and apparatus his earnings allowed, and taught himself. The intelligence of this apprentice of Riebau's attracted the attention of a gentleman named Dance, who took him to the Royal Institution to hear the last four lectures that Davy delivered in 1812. Faraday knew how to take occasion by the hand; of these four lectures he prepared a full set of illustrated notes and sent them to the lecturer, together with an expression of his wishes to pursue the study of science. He was kindly received, and the advice which Davy gave him at this time gives us a good insight into Faraday's character, and cannot be better told than in his own words:—"Whilst he thus gratified my desires as to scientific employment, he still advised me not to give up the prospects I had before me, telling me that Science was a harsh mistress, and, in a pecuniary point of view, but poorly rewarding those who devoted themselves to her service. He smiled at my notion of the superior moral feelings of philosophic men, and said he would leave me to the experience of a few years to set me right on that matter." The interview ended in Faraday being appointed assistant in the laboratory of the Institution, and here it was he resided for the greater portion of his life. Thus at last he was enabled to engage in his favourite study; the gates of Science were opened to him and he was free to enter in,

"And wander away and away
Into regions yet untrod,
And read what was still unread
Of the manuscripts of God."

During the following year he made the grand tour in the capacity of secretary to his friend Sir Humphry, and on his return commenced those investigations of nature that extended over half a century. His first paper, on a native caustic lime, was published in 1816, and was soon followed by a number of others recording, among the more important results, the formation of chloride of carbon, certain phenomena of electro-magnetism, and the liquefaction of bodies generally existing as gases. The year 1827 first saw him at the lecture table of the Institution. The production of suitable glass for optical purposes was his next triumph, and he now commenced his experimental investigations on electricity, the results of which, during the space of some ten years, form one of the grandest achievements of exact scientific research on record. The recognition of his labours was not long wanting. In 1832 Oxford conferred on him an honorary degree, and in the succeeding year Dr. Faraday was, by the wish of the founder, called to the chair of the Fullerian Professorship of Chemistry, established at the Royal Institution at this period. Honours, titles, medals, now poured in upon him from every side and country, the British Government granted him a pension, and preferments of various kinds were offered to him.

Still we find him engaged with untiring zeal in reading nature; in 1847 he made known the interesting discovery of the magnetic character of oxygen, more recently his investigation of the phenomenon of regelation, and more recently still that on the relation of metals to light. During his later years he withdrew himself from the excitement of scientific life to the residence which the Queen provided for him at Hampton Court. He had to content himself with an occasional lecture at Albemarle-street, and the usual Christmas course that he was wont to deliver to an auditory of young people. At last this, too, had to be given up, and at nearly his last lecture—one on platinum, in 1861—it was sad to mark the failing powers and hear him express his wish to retire, "as I think everyone ought to do before his faculties become impaired; but I must confess that the affection I have for this place, and for those who frequent this place, is such that I hardly know when the proper time has arrived." He spoke again after this—in his lecture on gas furnaces—and then his work was done.

And thus one of the brightest stars that ever adorned Science rose, culminated, and—has set. Beautiful as such a life as this must be acknowledged to be, it was in his case enhanced by a gentleness of spirit, uprightness of character, and earnestness of purpose that drew all to him, and will cause the remembrance of this grand old Christian gentleman to be carried very tenderly in the hearts of all who had the good fortune to possess his friendship. When we consider this career in its entirety we recognise the truth of the saying—ascribed to Davy's friend, Gilbert, the President of the Royal Society—"That the greatest discovery Davy ever made was the discovery of Michael Faraday."

EDITORS AND ADVERTISERS.

Messrs. Powis, James, and Co. and "A. B." have called attention to an abuse of the press, which is, we believe, as rare as it is reprehensible. No better definition of this phenomenon of journalism than that adopted by our correspondent "A. B.," as the title of his letter, which we publish this week, can be devised. The words "newspaper rattening" pithily express the scope and intent of the practice to which he alludes, and the parallel implied between this practice and the policy of Sheffield trade unionists is not far-fetched. We have examined the articles to which both our correspondents refer, and we have been at some pains to investigate the accuracy of their statements before admitting their letters to a place in our columns, and it is only fair to both to say that the contents of their letters are fully justified in every particular. A journal conducted on the principle of rattening those who will not advertise in its pages can only hope to subsist on the weakness of those whom the proprietors or editors endeavour to terrify into compliance

with their wishes. It unfortunately happens that a large class of manufacturers entertain an unwholesome fear of leading articles depreciating the goods which they produce; and as a result this black mail system, if managed with some caution by unscrupulous men, may succeed for a time. In the long run, however, it is certain to be exposed and denounced by some individual stronger-minded than his fellows, who refuses to submit to unwarrantable exactions. We leave our readers to determine what the result of such an exposure may be. We have happily no precedent to go on in forming an opinion as far as the respectable portion of the London press is concerned; but there are, we believe, instances of newspaper rattening to be met with in the history of American journalism, and to a very limited extent indeed in English provincial districts. It is not difficult, however, to arrive at tolerably accurate conclusions on this subject; or to perceive that any journal adopting the practice must ultimately lose caste and influence. A journal which rattens a man because he withdraws an advertisement, or because he will not give one, must be weak. Any newspaper which enjoys a large and influential circulation can obtain all the advertisements for which it has room without trouble, by the most perfectly legitimate means. Advertisements appearing in its pages are found to pay, and therefore they are inserted; as a consequence the difficulty is not to obtain them, but to find room for them. It may safely be asserted, therefore, that a paper which can only fill its advertisement pages by illegitimate means is powerless for either good or evil; and this fact we commend especially to the attention of those who pay in order that their reputation, or that of their goods, may not be assailed. Once its impotence is recognised, the power of the offending journal is gone, and its abuse or its praise equally become matters of no moment whatever. The opinion of an editor who measures the merits of men or machines by the contents of advertising columns with which he should have nothing to do, of whose existence he should be scarcely aware, cannot possess the smallest value, and his praise or his blame will equally fail to influence public opinion. No newspaper or periodical can hope for a large measure of permanent success in this country unless it is conducted with strict impartiality and honesty of purpose. These things are dear to the hearts of Englishmen, who are quick to perceive when they are wanting. A little experience will suffice to convince the most unpractised advertiser that he has nothing either to fear or to hope from the influence of any journalist sufficiently venal to praise for pay, or sufficiently audacious to drive advertisements into his pages by an organised system of terrorism.

LITERATURE.

The Central-fire Cartridge before the Law Courts, the Government, and the Public; showing who Introduced the System into England, who has Improved it, who has Benefitted by it, and who ought to be Rewarded for it. By George H. Daw.

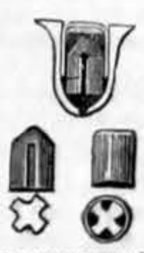
Under the above somewhat lengthy title Mr. Daw has printed, "for private circulation," a pamphlet in which he fully describes the salient points of his and other systems of central fire cartridge, with the view to prove that his cartridge of 1861 is the basis upon which the Government service cartridge and that manufactured by Messrs. Eley Brothers, have been framed, and that the modifications which it has thereby undergone are simply, in their real nature, evasions. The subject is certainly a very important one, for not only does the author assert that his system of cartridge has been flagrantly copied, but that the copies are much less effective than the original, at a largely increased cost.

Sixty rounds, he says, of the latest Woolwich cartridge weigh 6 lb. 8 oz., while the same number of his own, having the same weight of powder and ball as those of the service pattern, weigh only 5 lb. 11 oz., being a saving of 13 oz. per sixty rounds which the soldier has to carry. Mr. Daw also points out that his metal cartridge does not necessitate so long a chamber in the rifle as the Boxer, for length of chamber, and consequently of cartridge, is of course detrimental to loading and extraction, as well as more awkward in transport.

The early history of this battle of the cartridges seems to be pretty much as follows:—About 1853 a Frenchman named Bellford obtained a patent for a breech-loading cartridge, which was taken up by Mr. Lancaster, and apparently was not a success. About two years later a modification of this cartridge was patented by Pottet, also a Frenchman, and this Pottet cartridge has since played a very prominent part in the question. This cartridge, as

will be seen from the accompanying engraving, was discharged by a percussion cap introduced into a recess formed at the rear end of the cartridge, so that the percussion powder in the cap came into contact with a thin flat anvil placed in a metal chamber, and secured in its place by the cap itself. This little anvil, it will be seen, is the apple of discord among the contending inventors. Mr. Lancaster also adopted this patent, but did not further patent it in England; and it too, like its predecessor, does not seem to have given satisfaction. The anvil was too long and narrow, and was apt to become displaced, and so miss fire. Besides, the space between the anvil and the sides of the chamber was too great; the gas from the exploding cartridge frequently recoiled upon the cap and drove it back against the striker, and so impeded its action. It was stated in evidence at the trial Daw *v.* Eley, in November, 1865, that Mr. Lancaster came to Messrs. Eley some time in 1857, and suggested some improvements in the Pottet cartridge, which he desired might be carried out, the most important of which was a change in the shape of the anvil. Mr. Lancaster said he tried several schemes. He tried a square anvil, and afterwards contrived one that was triangular in shape with plane sides, so as to be less liable to displacement in the cap. No exact date could be assigned at which these alterations were made, nor was a single specimen of the new anvil produced at the trial. It could not have been a success at all events, as cartridges made on this plan were never offered for sale, and none seem to have been made later than 1858. Sir W. Page Wood accordingly ruled that there was not sufficient evidence here to invalidate a subsequent patent.

We now come to Schneider's patent. In September, 1861, Mr. Daw applied for a patent in this country, under Mr. Schneider's name, for an invention in some respects similar to that of Pottet, in which a cylindrical grooved-sided anvil pointed at one extremity was substituted for the awkward flat-shaped anvil of the old pattern. To quote the patent specification, "The anvil used in these cartridges is, by preference, of a cylindrical form; it has longitudinal grooves in it, by which the fire of the percussion powder may readily pass from the cap to and through the opening at the fore end of the chamber or recess in which the anvil and percussion cap are received," then come words which are very important: "It is not essential that the anvil should be cylindrical or that it should have four longitudinal cuts or grooves formed in it, as it may be formed with a greater or less number of grooves, and be formed of other transverse section, so long as it is made to fill as nearly as may be the cap, and has cuts or grooves formed in it." Soon after the introduction of this cartridge Mr. Lancaster commenced legal proceedings against Mr. Daw on the ground that his (Schneider's), cartridge was an infringement of Bellford's patent, of which he was the proprietor. He lost his case, however, for it was ascertained that Bellford's French specification had been deposited in the Bodleian Library only a few days before it was patented in this country. In 1862 Messrs. Eley Brothers entered into negotiations with Mr. Daw for the purchase of his patent, for during the proceedings in Lancaster *v.* Daw, Messrs. Eley informed Mr. Daw that they had made cartridges similar to his for Mr. Lancaster, but that if he would oppose Lancaster's claim they would be happy to make arrangements for working the Schneider patent. Mr. Daw declined to sell, and states that for two years he supplied Messrs. Eley with his cartridges. In 1864 Messrs. Eley again took up the Pottet cartridge, and this time they also availed themselves of the triangular anvil, but by scooping out the sides they gained more space for the passage of the gas without sacrificing the rigidity of the anvil. In February, 1865, they issued a circular, announcing that they were supplying breech-loading cartridges on the Lancaster and other systems, and after some correspondence in which they claimed that they had manufactured cartridges on a similar system long prior to the date of Schneider's patent, Mr. Daw applied for an injunction to restrain the alleged infringement. The accompanying engravings represent the anvil of Schneider's patent and that manufactured by Messrs. Eley to which Mr. Daw took exception.



M. Schneider's cartridge.

Messrs. Eley Bros. cartridge.

As we previously stated, the Vice-Chancellor ruled that Mr. Lancaster's experiments could not be taken as evidence against the validity of the patent; there now only remained the question whether Mr. Daw's own patent was so specified as to indicate with clearness what he claimed and what he did not claim. "If he has claimed too much by his patent, the patent cannot stand; and regard being had to Pottet's invention, I am to look into the plaintiff's patent to see whether that which he has claimed will include Pottet's invention. I think, besides that one, there is hardly any question in the cause, because it is scarcely disputed that the article is useful; it is scarcely disputed that, except Pottet's patent and this in 1857*, the "thing is new, and the whole matter comes to the question whether, or not, the plaintiff's claim is too large."†

The result of the trial was that Mr. Daw gained his point, and Messrs. Eley were restrained by injunction from making the cartridges in question.

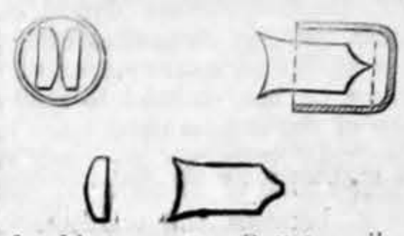
In 1864 the present principle for converting the service Enfield rifles was coming prominently into notice, and consequently there was every probability that a good central-fire cartridge would speedily be required. Mr. Snider had been concerned with M. Schneider and Mr. Daw in the transfer of the patent, and consequently was perfectly acquainted with it and the machinery used for the construction of the cartridge; and it is not altogether unreasonable to suppose that such knowledge may have assisted him in the designing of suitable ammunition for his breech-loader. Mr. Snider also at that time was in constant communication with the Woolwich authorities: his ammunition, defective as it was, was being tried by the Ordnance Select Committee, and though the results were far from satisfactory, the committee, in a report dated February 8th, 1865, stated that "As far as the trials with Mr. Snider's system have proceeded, the sub-committee think the results obtained with this ammunition encouraging, and as a cartridge carrying its own ignition is a great desideratum for military service, the committee would take the opportunity of suggesting that the superintendent of the royal laboratories, separately, or in conjunction with the chemist of the War Department, be requested to investigate the subject with a view to the ultimate production and manufacture of a primed cartridge, loading safely and adapted for all the exigencies of the service." Colonel Boxer and Mr. Snider then had a common object in view—a design for a good cartridge.

In January, 1866, Colonel Boxer had so far matured his plans as to be in a position to patent a design for a cartridge to be used with the Snider rifle. The specification chiefly refers to the metallic coil of which the body of this case is composed. Now this system of manufacturing cartridges by means of a metallic coil was patented in 1860, by Mr. Rigby, in company with Mr. Needham, who included a gun of his own in the specification; the patentees, however, do not seem to have considered the system of much value, for we find that the patent was allowed to lapse. It is, however, but fair to Colonel Boxer to state that the existence of this patent was unknown to him at the time when he designed his cartridge, though it is stated he was aware of the fact when he called the cartridge by his name. The arrangement of the cap or anvil, he does not particularise in his specification, apparently, as the *Saturday Review* remarked, the cotton wool in Colonel Boxer's cartridge is the only part of it which had not been previously patented.

* Lancaster's.

† Extract from the judgment of Vice-Chancellor Sir W. P. Wood in November, 1865.

Later on in the year Mr. Daw took umbrage at what he considered an infringement—if it be possible to use that term in connection with the Government—of his patent. He accordingly wrote to the Secretary of State for War in October in the same year, calling his attention to the similiarity of the two cartridges, and the method of manufacturing them, at the same time declaring that the manufacture of the Boxer cartridges by machinery at Woolwich clashed directly with his patent, and asked for some recognition in a pecuniary sense. In reply, Mr. Daw was requested to furnish the authorities at the War Office with copies of Colonel Boxer's and his specifications, having previously marked those parts which he considered to be similar; this he did and was subsequently informed that the Government saw "no grounds for interfering in the matter." Meanwhile Messrs. Eley were issuing to the market cartridges in which they were using two thinner anvils, which amounted to nearly a square, and certainly secured the advantage of two of Mr. Daw's principles, viz., a "firm bearing" and as "nearly as might be filling the cap." Ascertaining all this Mr. Daw instituted fresh proceedings in September, and applied for a further injunction. The accompanying illustrations show the anvils employed in Messrs. Eley's new cartridge. Messrs. Eley were restrained from using a solid square anvil by the previous injunction; but they urged that it was preferable to use *two Pottet anvils*, which, as Pottet's patent had expired, they were at perfect liberty to do. In this trial Colonel Boxer gave evidence from which the following extracts are taken:—



I am well acquainted with the central-fire cartridge patented by François Eugene Schneider, and which usually passes by the name of the "Daw cartridge." The anvil of this cartridge is made of a piece of cylindrical wire, with four longitudinal grooves and pointed at one end, which end is placed against the percussion powder in the cap. This anvil is a modification of the form of "anvil" long previously known as the "Pottet Anvil," and in the cartridge known as the Pottet cartridge this anvil is simply cut out of a sheet of brass and pointed at one end, which rests on the percussion powder of the cap. I consider a cartridge with the "anvil" simply cut from a sheet of brass (Eleys' and Boxer's), and similar in its general features to the Pottet anvil, upon the whole the best anvil for general purposes, as it fulfils every requirement as regards certainty of ignition and freedom from escape of gas round the cap, and it is the cheapest and most easily manufactured, and if made of the proper length to fit the internal chamber, is firm and incapable of being moved or otherwise being displaced.

I am also acquainted with the system adopted by Messrs. Eley Brothers, three of the above-named defendants, by using a double anvil, each of the Pottet form. In addition to all the advantages enumerated above by the use of the single Pottet anvil, there are several other advantages attending the adoption of this improvement among them. One is that there is much less likelihood of a miss-fire, where there is any carelessness in the manufacture of the gun-striker or cartridge it can be very easily examined and any faults of the workpeople detected, and is not open to the probability of the anvil being put in the cap the reversed way. As compared with the cylindrical, longitudinally-grooved anvil (Daw's), I consider that it is a great improvement, and far preferable to that system. The cylindrical, longitudinally-grooved anvil (Daw's) fitting, as it does, the cap, and which I consider one of its principal defects, is more liable to block the chamber, thus causing a miss-fire and escape of gas round the cap. It (Daw's) is also liable to the grave defect of being able to be placed in the cap the reverse way by the carelessness of the workmen, and the result must be a miss-fire. The extra weight on the sharp point will cause accidental explosion, and which, to my knowledge, has occurred even with a single anvil (Boxer's) when the cartridges have been subjected to rough usage, and the cylindrical anvil (Daw's) would be much more liable from its comparative great extra weight. And, lastly, the Schneider (Daw's) are much more costly to manufacture than the Pottet anvils—*i.e.*, Boxer's and Eleys'—I should think about three or four times the expense.

We do not agree with Colonel Boxer in his statement that the Daw anvil is a modification of the Pottet. The former is round with longitudinal groove, the latter is thin and flat, and without grooves; the former is combined to leave but little space for the passage of the flame from the cap, while the avowed object of the latter is to give as much room as possible. Mr. Daw states that the manufacture of his anvils from the cylindrical wire is a much easier matter than the manufacture of the flat Pottet anvils, which have to be stamped out from sheet metal by dies. We understand, and it is only reasonable to suppose that it would be so, that these dies soon wear, and that the resulting anvils consequently are too large to enter the cap without filing.

We think the objections put forward by Colonel Boxer, with regard to the respective prices of the anvils, are somewhat hypercritical, and we are not inclined to attach much importance to his statement that the extra weight of the Daw anvil over that of Messrs. Eley is dangerous as inducing explosion. Nor should we imagine that there is much to choose between the risk of inserting Daw's anvil the reverse way, and the trouble incident upon having to insert *two* anvils instead of one, as in the case of Messrs. Eleys' patent.

Mr. Daw considers—not without reason, we think—that Colonel Boxer, as patentee of a similar cartridge to his own, and therefore a rival, should not have been called upon to give evidence in a case in which, to some extent, he was an interested party; but we do think that it would have shown better taste on Mr. Daw's part if he had refrained from alluding in the way he has done to the report made by the Colonel to the Home-office with regard to Messrs. Eley's premises in Gray's-inn-road.

Our space forbids us giving more of the evidence adduced on the trial; suffice it to say this time Messrs. Eley came off victorious. The remainder of Mr. Daw's pamphlet is occupied with diagrams and letterpress illustrating the points of similarity, and making other comparisons between the various systems of cartridges in dispute.

We believe it is admitted that the Daw cartridge is equal, if not superior, to the Government ammunition; it is also lighter, and Mr. Daw assures his readers it is also cheaper. We are also given to understand that Mr. Daw has offered to pay the expenses of a Government trial, and it does seem to us, then, unfortunate that such a remedy should not be adopted. If the cartridge is *not* equal to the Boxer the

trials will prove it—if it be superior it is evident we should adopt it till we can get a better.

A Handbook of Practical Telegraphy. By R. S. Culley. Second Edition. London: Longman.

[Concluding Notice.]

"To meet the growing desire for information," says Mr. Culley in his preface, "the leading principles of submarine telegraphy have been introduced" in the present edition of the work. Indeed, the section on "Underground and Submarine Telegraphs" will be to the student one of the most interesting portions of the work, opening out, as it does, a broad and comparatively new field of investigation hitherto explored only by the few. Mr. Culley himself is here perhaps not so thoroughly master of his subject as in the preceding sections on overland telegraphy, and might advantageously have consulted, in addition to his other sources of information, the "Notes on the Electrical Construction of Submarine Cables," published in our issue of December 22nd, 1865, and those in other numbers of this journal. The author's principal authority in this section, viz., the Government Report on Submarine Cables, is, in fact, getting somewhat out of date, and, though Mr. Culley has by no means exclusively confined himself to this source, he has omitted to notice several more novel principles of the utmost importance in the theory of submarine telegraph construction—such as the determination of the highest ratio of efficiency to *cost* in specifying the relation $\frac{D}{d}$ between the diameter of a core and that of its conducting wire, and the mode of calculating equivalent thicknesses in the case of dielectrics differing in the property of specific inductive resistance.

The method of testing the electro-conductive quality of samples of copper wire is so simple and so useful, both to manufacturers and telegraphists, that it may be well here to quote it. In the appendix to the work Mr. Culley, amongst a number of useful tables, gives one specifying the resistance, in ohmads, of wires one foot long, and weighing one grain, at various temperatures :—

"If a quantity of soft copper wire is purchased on the condition that its conductivity shall be, say 80 (pure copper being 100), and it is required to test it; cut off 100ft. and weigh it carefully, after ascertaining that the gauge is correct. Let the sample weigh 10,000 grains, or 100 grains per foot. Ascertain the temperature of the room, and refer to Table 10 for the specific resistance at that temperature of one foot of pure soft copper weighing one grain.

Let the temperature be 59 deg. Fah.

One *foot grain* of pure soft wire at 59 deg. has a specific resistance of	0·2186
Add 20 per cent., being the resistance of the sample in excess of the standard	0·0437
Then the resistance of one *foot grain* of the required quality is	0·2623
And the resistance of 100ft. weighing ten grains per foot...	$\frac{0·2623 \times 100}{10}$

= 2·623 Ohms."

Mr. Culley refers as follows to the two insulating materials which have been practically utilised in the construction of submarine lines :—

"Percha is practically indestructible when under water, and insulates well enough for all purposes at ordinary temperatures; but as it becomes soft, and also loses in great measure its insulating power, at about 100 deg., it is unsuitable for hot climates. Hooper's material will bear boiling without injury, and does not decrease in resistance with increase of temperature as rapidly as percha."

We think that electricians will ultimately modify the now prevalent opinion that an insulating material of comparatively low conductive resistance may be "good enough" for all purposes, or, in other words, that any increment in the property of specific conductive resistance is, beyond a certain point, of no practical moment. This opinion is based upon a proposition which, within certain limits, is apparently verified by practice, and which has been very generally accepted as a law, viz., that an increase in the electromotive force of the battery employed in signalling (which may be rendered safely practicable by an augmentation of the conductive resistance of the dielectric) does not affect the degree of rapidity attainable in the transmission of the signals.* This is by no means strictly correct, as would be seen by working through either of the Atlantic cables with one cell of Daniell instead of twenty, albeit the electromotive force of the one cell is ample for the purpose of obtaining a clearly indicated signal. What is termed "the height of the electric wave," the difference of the tensions at different points of the conductor, has in point of fact considerable influence upon the degree of rapidity attainable in signalling. The current at the distant end of the cable gradually grows in intensity until it is sufficient to produce the signal; and, in the ordinary method of working, a given intensity of current will necessarily be obtained in a less period of time with high battery power than with a low power. To render this perfectly clear, let us suppose that the given intensity of current be the maximum obtainable with a certain electromotive force; we should have to charge the cable fully to the corresponding tensions before a signal could be obtained. Let the electromotive force of the battery be now doubled; we shall obtain the given intensity of current long before the cable is charged to the tension corresponding to this doubled electromotive force. But, as the telegraph electrician is well aware, it takes no longer time to charge a cable with high battery power, to the maximum corresponding tension, than with low battery power, to the maximum tension corresponding in this case. Thus, under the simplest conditions of working, the electromotive tension of the source has a very appreciable influence upon the practicable speed of signalling;† and in the more modern and complicated methods of working the influence of the "height of wave" is at least as considerable. The degree of electromotive tension which it is practicable or expedient to employ in working a submarine line being limited only by the conductive resistance of the dielectric, it follows that the latter can never "insulate well enough" where greater speed of transmission is of moment.

Entering upon the important question of the inductive or electrostatic capacity of cables, Mr. Culley contents himself with quoting Professor Sir W. Thomson's formula for the capacity of a given length of cable, without attempting to show how the logarithmic expression for the resistance, conductive or inductive, of hollow cylinders of dialectric—upon which this formula is based—may be derived from the expression $\left(\frac{l}{s}\right)$ for prismatic resistances, in which l is the length of the conductor or thickness of the dielectric, and s the sectional surface. The omission of any theoretical explanation of the formula in question is to be regretted, for, as our correspondence columns have recently evidenced, a very grave misconception exists in relation to it—certain electricians not being aware that it is an accurate "expression of physical truth," and regarding it merely as an "artificial contrivance." Moreover, an explanation of the formula would have shown that though, in the expression $\frac{I}{2 \text{ Nap. log. } d}\frac{D}{}$ for the electrostatic capacity of a cable, * Professor Thomson—for reasons dependent upon the coherence of a particular system—adopts that logarithmic series of which the base is 2,71828, the simpler and more convenient formula $\frac{I}{\log. \frac{D}{d}}$, in which log. indicates the common logarithm with the radix 10, will answer with equal accuracy the purposes of the practical electrician. This will be obvious when it is considered that the formula is not required to give a concrete value for the charging capacity of a cable, but simply to determine the ratio between the capacities of any two cables, and that the ratio of the Nap. log. of 3 to the Nap. log. 9, for instance, is the same as the ratio between the common log. of 3 and of 9.

A little further on we notice what is probably a printer's error, which has escaped the author's observation. It is stated that "If a thickness of coating, t, give an inductive capacity of 3, a thickness $t + t\frac{D}{d}$ will reduce the capacity to 2." This is not the case; the capacity would be reduced to 1·5. By substituting 4 for 3, in the first value for capacity, the example given by Mr. Culley, and ascribed by him to Mr. Varley, may be made to read correctly. The rule here referred to follows as a consequence from the logarithmic expression for inductive capacity, or for its reciprocal inductive *resistance*, in the case of hollow cylinders of dielectric, such as the coating of a submarine wire. Where the diameter d of the wire is constant, and taken as unity, the inductive resistance, other things being equal, is proportionate simply to the log. of D, the diameter of the insulated core. Or, R = log. D.

Let D = 2, then $t = 0·5$, and R = log. 2 = 0·301. (1)

To halve the electrostatic capacity, or, in other words, to double the value of R, a thickness of coating is required equal to $t + t \times D = 0·5 + 0·5 \times 2 = 1·5$.

Then $t' = 1·5$, $D' = 1·5 \times 2 + 1 = 4$,

and

$$R' = \log. D' = \log. 4 = 0·602 \qquad (2)$$

Again to halve the inductive capacity, the thickness must become $= t' + t' \times D' = 1·5 + 1·5 \times 4 = 7·5$.

Then $D'' = 7·5 \times 2 + 1 = 16$,

and

$$R'' = \log. D'' = \log. 16 = 1·204. \qquad (3)$$

The values for R, with a given length of cable, express in this case the relative speed attainable in signalling. The rule that, to double the inductive resistance of a cable, by augmenting the thickness, t, of its insulating covering, an additional thickness must be added equal to t multiplied by the ratio $\frac{D}{d}$, has not very frequently been given, and has almost invariably been expressed or exemplified incorrectly, much to the disadvantage and perplexity of the student in practical electricity.

At page 226 we notice a passage which would almost lead us to suppose that Mr. Culley had misapprehended the law of induction, as applicable to submarine cables; and which at all events is likely to lead to a complete misapprehension of this law on the part of the ordinary reader of the work. Mr. Culley says:—"In cables of similar length and of similar materials, but of different dimensions, charge is inversely proportional to the log. $\frac{D}{d}$, *and directly proportional to the surfaces under induction;* if a number of cables be connected together at their charging ends, with their distant ends insulated, the charge is equal to what would have been obtained had they been joined in one continuous length."

The statement relative to the effect produced when several cables are simultaneously charged under the conditions specified is perfectly correct; but the "surfaces under induction" may vary in the case of single cables, of similar length and materials, and in which the value of log. $\frac{D}{d}$ is in each case the same. Now what Mr. Culley, probably by inadvertence, here asserts is, that the charge in such cables would be directly proportionate to the surfaces under induction. In other words, a cable in which D might = 1in., and d = 0·354in., would take from a given battery a greater quantity of charge than would an equal length of the Malta-Alexandria cable, in which D = 0·457in., and d = 0·162in., the ratio $\frac{D}{d}$ being in both cases the same. Nothing can be more erroneous: a "cable" one yard in diameter, with a conductor 5·832in. diameter, would have precisely the same charging capacity as a similar length of the Malta-Alexandria cable! The formula log. $\frac{D}{d}$, for induction in cables of similar materials and length, is absolute; no other condition than that which is here expressed influences the amount of inductive charge at a given tension. It is of considerable importance that the telegraphic learner should clearly realise this fact; the more so that, from the manner in which the above expression is generally enunciated—apparently as an empirical formula—there is generally in his mind a lingering impression that the quantity of charge is essentially dependent upon the extent of the surfaces in the Leyden condenser constituted by the cable, instead of upon the mean ratio of the surfaces (s), of an indefinite number of layers of dielectric of varying surface, to their aggregate thickness (l) which ratio is concisely expressed by log. $\frac{D}{d}$.

Mr. Culley states that "no unit of capacity has yet been determined, but a standard is constructed for each special case. It is generally a condenser made of sheets of tinfoil separated by mica, rubber, or paper soaked in paraffin, adjusted by trial to take the same charge as a mile of the cable, and each mile of coil is tested as soon as covered to ascertain if its capacity agree with the condenser." The author is mistaken in asserting that a standard unit of capacity has not yet been determined. The unit in question was definitively chosen by the Committee on Electrical Standards appointed by the British Association; though we are not aware that condensers or Leyden jars of the unit capacity have as yet been issued and sold, as was proposed by the Committee, and as was carried into effect in the case of the B. A. unit of electrical resistance. Mr. Culley's statement shows evidently, however, that the standard unit of capacity has not yet come into practical use amongst telegraphists generally.

The present section, on submarine cables, contains a considerable amount of information, condensed into twenty-five pages; and the subject, almost a novel one in our technical literature, is well handled, and divested of all unnecessary complication. Without bringing forward many novel or striking views or original facts, Mr. Culley has summarised for the benefit of the student of telegraphy nearly all the important data which have been obtained in connection with this branch of applied science. And henceforth our telegraphic *employés* will have no excuse for being in any way behind their continental brethren in the knowledge of facts relating to the marvellous instrument of civilisation which so faithfully performs the bidding of the intelligent operator who has studied its organisation, and can find his own remedy when a "screw is loose." The notes and tables at the conclusion of the work constitute a valuable addition, and, being to all appearance most carefully compiled, will, we have no doubt, be productive of many tacit but sincere compliments to the author in the shape of well-thumbed copies of his book. We must not omit to notice, in the appendix and notes, a valuable little article by Mr. W. H. Preece, on the method "To calculate the proper proportions of the core of a cable to provide for the transmission of a certain given number of words per minute." Mr. Preece has arrived at the conclusion that, with copper and gutta-percha as at present produced by the manufacturers, the best practical value that can be given to $\frac{D}{d}$, for a given value of D, is $\frac{10}{\sqrt{10}}$, or 3·16.

In conclusion, we may state that the work, which extents to nearly 300 pages, is neatly printed on good paper, and illustrated with a number of diagrams and woodcuts, which, though in most cases greatly inferior to those which both illustrate and adorn some of the foreign treatises on the same subject, answer perfectly the main purpose for which they are intended—that of facilitating the comprehension of the various arrangements and conditions which are adverted to.

The Mining and Metallurgy of Gold and Silver. By J. Arthur Phillips, Mining Engineer. London: E. and F. N. Spon. 1867.

The author of this handsome volume has brought a great amount of valuable experience to bear on its production, and has supplied a welcome addition to the literature of the subject. The first part of the work treats of gold in all its aspects, its modes of occurrence in nature, the chief goldfields of the world, with description of the methods employed for the extraction of the metal, and statistics of the annual yield. The most recent modifications of the metallurgical processes for the extraction of gold are likewise considered. After a chapter on the assay of auriferous ores and gold bullion, the author proceeds to the second part of his subject—the occurrence and preparation of ideas, which are treated in a manner corresponding to that adopted in the case of gold. The argentiferous ores and the chief silver mines of the Old and New World are described, and the various processes employed in the metallurgy of silver, including its separation from lead and other metals, are fully discussed. The subject of silver assaying concludes the volume, which, it should be mentioned, is illustrated with a number of excellent woodcuts, for the most part from photographs. We shall shortly give a detailed review of this useful treatise.

Interesting Experiments with Coal Gas on Safety Lamps.—On Monday last a large nnmber of those interested in mining affairs in the South Yorkshire district were present to witness a number of experiments with miners' safety lamps. It will be remembered that a few weeks ago a number of experiments were made at the gasworks at Barnsley. It was suggested that the lamps should be tried with the natural gas at the Oaks Colliery. The apparatus was fixed into the flue of the engine chimney, whilst the gas was conducted from the escape pipe to a small receiving tank, and from thence into the apparatus. The lamps experimented upon were Stephenson's, Davy, Clany, the Mozart, and what was designated the "Cockney"—a lamp which had been sent down from London by a gentleman. The result of the experiments went to show that all the safety lamps will stand longer in natural coal gas than with refined gas which is burnt in towns. The Davy, Clany, and Mozart all exploded, but the Stephenson stood the test well. The "Cockney," which was a very crude attempt at a safety lamp, incurably went out. The experiments show the safety lamp more complete than it was considered with refined gas.

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* It seems to be generally admitted by experimentalists that the rapidity of succession of the signals is not affected by varying the number of elements of the battery.—"Report of the Submarine Telegraph Committee," p. xxiii.

† It might be supposed that, *cæteris paribus*, the speed of signalling attainable would be directly proportionate to the battery tension. This, however, is not the case, owing to the conditions which prevail in what the French term the *état variable*, which precedes the normal distribution of tensions.

* *Id est:*—The specific inductive capacity of the material employed, divided by twice the Napierian logarithm of the ratio of the diameter of the insulated core to that of the conducting wire.

THE BRITISH ASSOCIATION.

Next Wednesday the members of the British Association will hold their annual gathering, which this year is to take place in Dundee. This town is very rich in historical associations, for Edward I. burnt a large number of women and children in an old monastery there, Wallace was educated in Dundee, Bruce once made the town his residence, and he was declared king of Scotland therein, James V., Mary Queen of Scots, and James VI. visited it. Dundee was pillaged and burnt by Montrose, it was the temporary residence of Charles II., it was stormed by Gen. Monk, whose soldiers massacred the inhabitants right and left for several days, Graham of Claverhouse besieged it and was beaten off by the defenders, it was entered by the Pretender in 1716, and occupied by his followers in 1745. Thus archæologists and politicians will have a rich field before them in the town of Dundee and its vicinity.

As regards the modern aspect of the town, it ranks next to Glasgow in commercial importance, and carries on an extensive business in linen and linen yarns, importing large quantities of flax, hemp, and jute. It is situated upon an arm of the sea, the Firth of Tay, about four miles from the German Ocean, and it is backed by hilly and picturesque scenery. The harbour usually contains a good show of shipping, and the town rather more smoke than a stranger would like, which smoke is belched forth by several tall chimneys. Dundee has about 100,000 inhabitants, who are all in a lively state of preparation for the advent of the British Association. It likewise has a Provost to rule over it, at least, we suppose it has, although we have not yet seen him. In the days of old, at all events, it certainly had a Provost, for memory dimly furnishes a picture of a Dundee Provost, who died and was buried, and left £400 in his will for the composer of a good epitaph to be inscribed over his remains. The four executors, so the legend states, resolved to compose the epitaph themselves, since it would be a pity to let the £400 go into the hands of strangers, but as they were not of a literary turn of mind, it was unanimously resolved that it should consist of four lines only, and that one line should be written by each. The task of the first executor was comparatively easy, for he took up his pen and wrote, "Here lies John Anderson, Provost of Dundee." The second spent half a day in deep thought, as he had to make a rhyme, but at last he wrote, "Here lies him, here lies he." It did not occur to the third to change the rhyme, so his was a terrible task; he took physic, lay awake in deep thought all night, and finally wrote, "Hallelujah! hallelujee!" The fourth in a fit of inspiration went back to the first rudiments of education, and added the line, "A, B, C, D, E, F, G." This monument to the lamented Provost is said to be still visible in Dundee, so archæologists are earnestly requested to search for the same, and we wish they may find it, as its examination connot but excite the warmest interest in the breasts of the members of the British Association.

One of the most interesting features of the forthcoming week in Dundee is one not entered in the official programme of the British Association, namely, an experimental lecture to working men on "Matter and Force," by Dr. John Tyndall. The creation of a taste for the study of physical science, ignorance of which is such a prominent feature of the system of education in this country, will perhaps be more forcibly promoted in Dundee by this popular movement of the prince of scientific lecturers than by any other proceedings of the Association. But Dr. Tyndall, Mr. Balfour Stewart, and all the other philosophers who are deeply versed in the phenomena of heat and molecular physics, have already a terrible and unexpected rival in the field. The "Fire King" himself is now in Dundee. Dr. Tyndall will let dark rays of intense heat into his eye and lick red-hot pokers; but the great Rel Mueab, the Fire King, despises such petty performances, according to the following paragraph from the *Dundee Advertiser* of Tuesday last:—

The Fire King at the Alhambra Music Hall.—One of the most remarkable performers that ever appeared in Dundee is at present astonishing the large audiences that nightly assemble at this favourite music-hall. The gentleman to whom we refer is Rel Mueab, the Fire King, a native of Russian Poland, who goes through a variety of the most marvellous feats we ever witnessed. He is a handsomely-made young man, and possesses apparently great muscular strength. He brings to the stage with him a sort of forge, which he employs in heating the iron used by him in doing his performances. He first makes a strip of iron, about the eighth of an inch thick, red hot, and then bites off pieces of it with his teeth. This is a wonderful enough feat, yet it is not nearly so surprising as those which follow. He next pours a bottle of olive oil into a cauldron and heats it over the fire—indeed, he makes the oil boil. After it has been boiled he drinks two glasses of it, and does not seem in any way inconvenienced. He next makes red hot the end of what may be considered a miniature spade, and rubs it over his legs, arms, and face. A large flat piece of iron is subjected to the heating operation, and is then laid on the stage. Rel Mueab steps over it once or twice, and afterwards dances on it. There was no deception practised on the audience in any of the performances. The metal from which the pieces were bitten off, when put into a pail of water, showed unmistakably that it had been well heated, while the small bits bitten off and handed round among the audience, were still very hot, and bore the evident marks of the performer's teeth. The oil was also in a condition peculiarly suitable for scalding purposes, and the hissing sound produced by red-hot metal coming into contact with any fleshy substance was clearly heard when Rel Mueab danced with his bare feet on the iron. Altogether the performance created a great sensation among the audience.

When the popular lecture of Dr. Tyndall comes off it would be as well for the Provost of Dundee to provide a plentiful supply of white-hot pokers, which could first be licked by Dr. Tyndall and then eaten by the Fire King. If Professor Sir William Thomson should then mount the platform with a *Wirbel-Bewegung* motion, and explain that he does not believe in solid matter, and Professor W. Allen Miller should take a photograph of the scene with the invisible light of the extra-violet end of the spectrum, the inhabitants of Dundee will own that they never witnessed such a lecture before, and are not likely to do so again.

Dundee is twenty or thirty miles from some of the finest scenery in the Scottish Highlands, within easy communication by rail. The programme of the forthcoming proceedings of the British Association has already appeared in our pages.

METALS, MACHINERY, AND MANUFACTURES, PAST AND PRESENT.

Not a few of the English visitors to the Paris International Exhibition—practical and scientific men—have come home disconcerted and cast down by the evidence it has seemed to present indicative of England as a manufacturing country being a loser in the world's competitive race. In textile and fictile manufactures France and Belgium have long been ahead of us in the higher qualities of production, and even in the lower classes of cotton, silk, and woollen goods, more largely consumed by the great bulk of the peoples of various parts of the world, they have been drawing up to us rapidly. Almost universally until now, however, it has been tacitly accepted as an indisputable fact that in the production of machine tools and machinery this country has kept ahead of all competitors. Now, however, it is feared that this master key is to be wrested from us, and that continental manufacturers are about to become independent of us for the supply of the machinery which we have hitherto exported to them, and by means of which their manufacturing industry in various departments has been so largely developed. In the machinery we have sent them the golden eggs, but have kept the goose which has laid them. Now, it seems supposed, they have got a goose of their own, and will not only not need to draw from our basket, but will go into the same markets to compete with us for the sale of the eggs. The fillip supplied by the evidences of mechanical and engineering progress made upon the continent of Europe is not unneeded, and the sharp warning we receive not to rest content with laurels that may be withering will prove salutary if due heed be given to it. Inventive genius is challenged to sleepless and sustained activity and the exercise of its best powers; and, above all, employers and employed are admonished with trumpet tongue to set their house in order, and to settle on a permanent and mutually satisfactory basis the moot points in the relations between capital and labour which lie at the root of our continued prosperity as a nation. Whether or not masters and men will adopt the motto and cordially act upon it, the conditions and results expressed certainly attach to their mutual relations—"United we stand, divided we fall." To parley or hesitate is to be undone; better keep now than seek anon—England's division and extremity will be the foreigner's opportunity.

What the returns of the national exports and imports for the current year may show it is of course impossible at present to predict. When the time may come—we hope it may never come—when "Ichabod" is to be written upon our factories and workshops, we know not, but up to the end of 1866, at any rate, that time had not come, and unless a galloping decline has commenced in the year 1867 the history of the past should encourage us to take heart of grace for the future, and to believe that as a nation of manufacturers and shopkeepers we shall not be defunct for yet awhile.

By an almost unbroken series of annual augmentations the value of the imports and exports of the United Kingdom have increased from £268,210,145, or £9 14s. per head of the podulation of the United Kingdom in 1854, to £534,011,453, or £18 per head, in 1866; the exports in the latter year amounting to £238,806,900. The value of the steam engines exported in 1852 was £338,222, in 1866 it was £1,750,492, being a decrease as compared with 1865, but an increase upon 1864 and all preceding years. The value of machinery of other sorts exported in 1852 was £913,138; in 1866 it was £2,998,692, a decrease upon 1864 and 1865 (confessedly significant exceptions), but an increase upon any year preceding 1863. The iron, pig, and puddled exports amounted in 1866 to £1,544,647; of bar angle, bolt, and rod, to £2,314,438; of railroad iron to £4,166,419; of hoops, sheets, and boiler plates to £1,779,177; of wrought iron of other kinds to £2,678,535; of unwrought steel to £1,129,761. The total value of iron and steel exported in 1866 amounted to £14,829,369, as against £6,684,276 for 1852, and higher than any amount since that year. In the exports of copper and other metals the increase has been inconsiderable, excepting in copper, bars, rods, sheets, and rails, the value of which in 1866 was £1,119,390, or nearly double what it was in 1852. The value of the coal, cinders, and culm exported in 1852 was £1,372,114; in 1866 it had risen to £5,084,009.

Turning to some of the other principal articles of export essentially affected by improvements in machinery, it appears that the cotton piece goods exported in 1852 amounted to 1,524,256,914 yards; in 1866 the quantity exported was 2,575,967,256 yards, or nearly fifty times the circumference of the globe! Manchester as well as Mulhouse evidently continues to prosper. The only year from 1852 to 1866 in which a greater quantity was exported was 1860, when it reached 2,776,218,427 yards. The linen piece goods exported in 1852 amounted to 133,192,627 yards; in 1866 they reached to 254,943,531 yards. Between the one year and the other the quantities exported were increased, respectively, of woollen cloths from 26,406,828 to 34,520,340 yards, of flannels and blankets from 9,046,677 to 14,419,298 yards, of worsted stuffs from 127,798,552 to 224,342,174 yards, and of carpets and druggets from 2,280,373 to 7,613,609 yards. Although Lyons may be thriving, and Coventry and Macclesfield may be languishing, we are still manufacturing silk goods for home consumption and for exportation, the value of the silk manufactures in 1852 and in 1866 respectively having been £1,156,305 and £1,317,529. Worcester and Staffordshire are not likely to extinguish Sevres and Dresden, but they, nevertheless, get quit of a goodly quantity of their produce in the world's markets, and exported goods last year to a higher value—£1,652,609—than they ever did before; the value of the exports and earthenware in 1852 was £1,151,897. Broadhead and Co. have not had time to bring Sheffield cutlery into disrepute, and goods manufactured with false trade marks have not yet superseded the genuine article, the value of the hardwares and cutlery exported last year—£4,377,922—being the highest ever known. In 1852 it was £2,691,697. The exquisite glass manufactures known as Bohemian will doubtless continue to command their preference and their price; our manufactures of flint, plate, and other kinds of glass are nevertheless on the increase. The value of these manufactures exported in 1852 amounted to £378,827; by a progressive increase it had reached to £801,169 in 1866.

The estimated value at the place of production of the following minerals in 1854 and 1865 were respectively:- Of coal, £16,165,350 and £24,537,646; pig iron, £7,674,595 and £11,774,220; total of coal, iron, and other metals, £29,155,701 and £40,310,933.

Some other figures of a reassuring nature may be quoted to show the improved condition of the people. In 1852 the amount received by the trustees of savings banks amounted to £7,281,177, and in 1866 the amounts received from depositors amounted to £11,795,639, including the Post-office savings banks. The capital of the savings banks in 1852 was computed at £31,754,261, and in 1866 at £44,428,194. In 1854 the number of children present at the inspections of the primary schools in Great Britain was 410,904, whereas in 1866 it was 1,116,374. In Scotland (exclusive of Roman Catholic schools) the numbers rose from 62,310 in 1854 to 171,230 in 1866; and in Ireland, from 473,214 to 1,287,604. The persons committed for trial in 1852 and in 1866 were respectively in England and Wales, 27,510 and 18,849, in Scotland 4027 and 3003, and in Ireland 17,678 and 4326. The reader is cautioned against mistake—the smaller numbers are for the later year, 1866. The gross estimated rental of property assessed to the poor rate in 1856 was £86,077,676, in 1866 it was £110,079,308.

It is beyond our province to comment on politics except in so far as they may seem likely to affect the material welfare and prosperity of the country. We do not care to speculate as to the probable proportions of so-called Liberals or Conservatives likely to be returned under the new Act, which will add such an enormous number to the politically enfranchised. It can scarcely be doubted that the important question of public instruction will be quickly and greatly promoted. Mr. Lowe puts the matter harshly when he tells the House of Commons that it is absolutely necessary that its new masters should "learn their letters." Working men will note the sardonic expression, and probably profit by it although they can scarcely be expected to be grateful for it. Unless the working classes are to belie their professions and their antecedents, popular education will be one of the first practical questions upon which they will concentrate their newly acquired power. In one of the many educational agitations, of which Manchester has been the centre in past years, occasion was taken to canvass the working classes in almost all parts of England. Duly advertised public meetings were held in numerous populous towns and districts throughout the country, and a vote was taken on a resolution for the establishment of a complete system of free schools, to be supported by local rates and managed by local authorities, the instruction in such schools to be secular or unsectarian, and the religious instruction to be left to parents, ministers, Sunday-school teachers, or such deputies as the parents might appoint. Opposition was invited at these meetings, and was freely offered by voluntary educationists on the one hand, and by the advocates of religious day-school education on the other. There was, notwithstanding, an immense preponderance of opinion in favour of the proposition, and it may reasonably be believed that the opinions so strongly held fifteen years ago have become intensified in the interval- that the seed sown then will soon fructify in the army of working-class voters making education a hustings question, and in their cutting the Gordian knot of educational difficulty. With primary schools where they are needed, freely accessible to all classes, well conducted by trained and efficient teachers, and under the control of responsible local or other managers, the latent intellect of the country would be developed in a high degree, and to the advancement of the highest interests of the nation. Religious teachers would have more hopeful material to operate upon—even elementary instruction would lead to mental culture, induce a higher moral tone, which would revolt from crude, cowardly, unjust, and illogical expedients for the promotion of class interests. As regards skilled workmen in various branches universal elementary schools would beget technical schools—would establish and promote free scientific and popular libraries, and would, in fine, add so much dignity, power, and worth to the common people, as would make Old England, in deed and truth, the "glory of the world and the envy of surrounding nations."

DRAUGHTSMEN'S BENEVOLENT ASSOCIATION.

The following is a copy of a circular which has been forwarded to the draughtsmen of the leading engineering firms in the kingdom:—

"Sir,—You are, perhaps, aware that considerable correspondence has lately taken place in the columns of The Engineer with reference to the formation of an "Assistant Engineers', Surveyors', and Draughtsmen's Benevolent Society."

The time seems now to have arrived when something of a more decided character than newspaper correspondence or editorial encouragement is required in order to set the matter fairly afloat, and it has been suggested that a meeting of the persons interested in the movement, and particularly of delegates from as many as possible of the large engineering offices, should be convened on an early day; such meeting to be presided over by some well-known and universally respected member of the profession. The subject could then be freely discussed, and, if desired, a committee be appointed for carrying out the wishes of the meeting, and for promoting the general success of the movement.

I, therefore, beg to inform you that as soon as the necessary steps have been taken, and the time and place of such meeting have been determined on, the invitations will be issued.

In the meantime may I also venture to commend to your earnest consideration the various advantages aimed at in this movement.

A plan is proposed for providing a fund for sickness, old age, and superannuation, also a provision for the widows and orphans of deceased members, and a scheme by which the children of assistant engineers, surveyors, and draughtsmen would be enabled to obtain a good sound education at a very reasonable rate.

Of the many details involved in these matters, you will easily understand, it is at present premature to speak. What is first wanted is to arouse general attention to the question. We may then safely reckon on securing a good and influential meeting of those who are interested, and if this be followed by a hearty co-operation of all concerned, I feel convinced that the objects can and will be speedily obtained.

Before, however, we can with any propriety ask any of our leading engineers for their counsel and support we ought to have some idea as to how far the desire for such a society is shared in by assistant engineers, surveyors, and draughtsmen generally, not only in London, but throughout the kingdom.

May I, therefore, further request you will lay this letter before your associates, and that you will kindly oblige me with a line as early as possible, stating what are the views you entertain on the question, and whether I may hope for the pleasure of your attendance and co-operation at the meeting proposed.

I remain, yours truly,
Signed) R. M. Bancroft.

P.S.—By the kind permission of the proprietors all letters may, for the present, be addressed to the honorary secretary, *pro tem.* of the proposed Assistant Engineers', Surveyors', and Draughtsmen's Benevolent Society, office of The Engineer, 163, Strand, London, W.C."

The Society of Engineers.—The council of the Society have obtained permission for a visit of the society to the works of Messrs. J. Penn and Son, at Greenwich, on Friday, the 13th of September. Members and associates who purpose joining the party are requested to communicate with the secretary, on or before the 10th proximo. Members and associates to meet at the London Bridge station at a quarter past twelve o'clock, on the 13th of September, to proceed to Greenwich by train leaving at 12.31 p.m.

A Self-lubricating Packing.—Mr. T. Silver, the American engineer, whose name has been so long connected with his well-known form of marine governor, is now engaged in introducing into this country a remarkably original kind of packing for piston rods. It works entirely without oil, being apparently self-lubricating, though we should say that its lubricating action is possibly aided by the presnce of condensed steam. The packing, put into the stuffing-box in the ordinary way, simply consists of a plaited cotton gasket made up with a composition principally consisting of soapstone.

A Novel Race.—On Monday morning, the 26th instant, in accordance with previous arrangement, two road 'steam carriages, one made by Mr. Isaac W. Boulton, of Ashton-under-Lyne, having only one 4¼in. cylinder 9in. stroke, the other, made by Messrs. Daniel Adamson and Co., of Newton Moor, having two cylinders 6in. diameter, 10in. stroke, started from Ashton-under-Lyne at 4.30 a.m. for the show ground at Old Trafford, a distance of over eight miles. The larger engine, made by Messrs. Adamson and Co., is a very well-constructed engine, and had a good quarter of a mile start of the smaller machine. The little one, with five passengers upon it, passed the other in the first mile, and kept a good lead of it all the way, arriving at Old Trafford under the hour, having to go steady through Manchester. The engine made by Mr. Boulton ran the first four miles in sixteen minutes. The running of both engines is considered very good. On arrival at Old Trafford they tested their turning qualities, and both engines turned complete circles of 27ft. diameter, both to right and left, frequently.

The Staveley Coal and Iron Company (Limited).—The fourth annual report of the directors has just been issued, and states that, notwithstanding the very exceptional year, the inherent value of the company's property has maintained its relative position. The net profit for the year, including £960 16s. 1d. from the last account, is £65,719 7s. 2d., out of which interim dividends of £6 10s. old share and £1 1s. 8d. per new share were paid in February and June last, which have been absorbed £42,358 6s. 8d. The directors recommend a further dividend of £3 10s. on the old and 11s. 8d. on the new; to be paid on the 3rd of September next, which will absorb £22,808 6s. 8d., leaving a balance £552 to be carried forward to the next account. The directors feel especial gratification of the great labour and perseverance of Mr. Markham, the managing director, who had promoted the establishment of the movement amongst the workmen employed by the company in opposition to the trades' union. The directors state that they have agreed to contribute to the Staveley Works Accident Fund the sum of £2000 by four yearly instalments, and after that period a further sum equal to 25 per cent. to the amount subscribed by the workmen, and the directors rely upon the shareholders confirming by their authority this gift and contribution.

TECHNICAL EDUCATION IN AUSTRIA.

The Imperial Royal Polytechnic Institution at Vienna, the rules of which we give below, was established in 1816 for the object of promoting instruction in the practical sciences. At first it formed a kind of preparatory school for artisans, but has since been gradually extended and improved into what may be termed a scientific university. Properly speaking this more dignified title is only due to it since October, 1865, when by imperial decree it was created a "Hochschule," power being given to it to grant diplomas, and the entire course of education being made strictly compulsory, whilst a higher scale of knowledge was demanded from students applying for admission. The fees paid by most of the students (the total number of whom averages 600 annually) amounting to only about £5 per annum, or say £9, including laboratory and drawing fees, &c. This Institution is to a considerable extent supported by the state, the management being conducted by a committee of professors, who annually elect from amongst themselves a president—the so-called "Rector" and nominal head of the institution. The salaries of the professors amount to respectively 1800, 2900, 3400, and 3900 florins per annum. There are altogether twenty-six professors, three salaried "Docenten" (minor professors), ten unsalaried "Docenten," eight teachers of languages, stenography, sketching, and modelling, three "Adjunkten" (special assistants), and twenty-three assistants. An annual sum of 13,000 florins is given by the state for development and expenses of the twenty different laboratories and collections, of which 2000 florins go to the laboratory for chemical technology, 1250 florins to the laboratory for analytical and general chemistry, 1500 florins to the engine building collection, and 1500 florins to the mechanical technology collection. A special fact worth mentioning is that students passing all their examinations with "vorzug" (excellence) are exempt from military service. Besides, students liable to military service may, on passing a satisfactory examination on technical subjects before a military commission, enter as cadets instead of being compelled to serve as private soldiers. An exceedingly useful and altogether excellent system is embodied in the so-called scientific excursions made at certain intervals by the professors and students of botany, zoology, geology, mechanical technology (including metallurgy), chemical technology, agriculture, surveying, and mechanical and civil engineering. In these excursions various manufactories and works are visited, botanical and geological expeditions of great length made; in fact every means adopted for giving the students a practical as well as theoretical knowledge whenever possible. It only remains to be said that most of the students enter at about eighteen or nineteen years of age, having generally previously passed through an education of six annual courses in the Realschulen (Government schools where solely technical subjects, entirely excluding the ancient languages, are taught), preceded by four annual courses in the Hauptschulen (preparatory Government schools for children).

REGULATIONS OF THE IMPERIAL ROYAL POLYTECHNIC INSTITUTION IN VIENNA.*

I.—General Regulations.

Sec. 1. The Vienna Polytechnic Institution is intended to afford a thorough theoretical, and also, as far as possible, practical education for the professions which are represented in it by special preparatory divisions.

Sec. 2. The following divisions exist in the Institution:—A, the *general division*, in which those subjects are taught which form the scientific basis of the subsequent special studies; B, the division for *civil engineering*; C, for *building*; D, for *mechanical engineering*; E, for *technical chemistry*.

Sec. 6. The instruction in the separate subjects is given partly in annual terms lasting from 1st of October to the end of July, and partly in biennial terms, the first ending in February, and the other beginning 1st of March.

II.—Regarding the Students.

Sec. 7. The students are divided into *ordinary*, that is those who are matriculated either for the general division or one of the special divisions, and who attend the entire course of education according to the proper regulations; and into *extraordinary*, that is those who only attend certain lectures.

Sec. 8. The ordinary students are designated as such in the certificates; they have all the rights connected with attending the Institution, and have to fulfil all the appertaining duties. The extraordinary students have in general the rights of the ordinary, but are not admitted to the "rigorosum" examinations (strengen Prüfungen, sec. 28); neither have they any right to scholarships. In the public certificates they are expressly designated as extraordinary students. Disregarding any special exceptions their duties are the same as those of the ordinary students. All students are subject to the disciplinary regulations. The ordinary students are subject, as regards discipline, to the heads of the divisions, the extraordinary to the rector.

Sec. 9. Only those can enter as ordinary students into the first session of the general division who have either—1, absolved the upper Realschule, or upper gymnasium, with proper certificates; or, 2, passed with good results the "maturitäts" examination at a Realschule authorised thereto by the Government, not having been educated at a middle school. Gymnasium scholars must also prove sufficient readiness in geometrical and general drawing.

Sec. 10. As long as "maturitäts" examinations are not regularly introduced in the Realschulen, those who are unable to show the proper certificates have to be subjected to an entrance examination at the Polytechnic Institution. Those mentioned in sec. 9, heading 2, must be at least seventeen years of age. The following are the subjects of the entrance examination:—*a*, arithmetic, algebra, geometry, plane and spherical trigonometry, analytical plane geometry; *b*, geography and history; *c*, physics; *d*, natural history; *e*, geometrical and general drawing; *f*, readiness in German style, to be proved by an essay on a given subject. The subjects from *a* to *e*, to the extent taught in the upper Realschulen, are accurately detailed in the special programme published by the Institution. A fee of five florins has to be paid for the entrance examination, which is received by the examiners.

Sec. 11. Students just entering, who wish to be admitted as ordinary students to higher divisions, have—1, to fulfil the general entrance regulations (sec. 9), and, 2, to prove the necessary proficiency either by legal certificates, or by subjecting themselves to a gratuitous examination.

Sec. 12. The following conditions have to be fulfilled by those wishing to enter as extraordinary students:—1, an age exceeding seventeen years; 2, proofs of the preliminary knowledge necessary for successfully attending the desired lectures. These proofs must be afforded either by legal certificates or by an entrance examination. For each subject of examination in this case an examination fee of two florins must be paid.

Sec. 13. The entrance of ordinary students takes place at the beginning of the school year. They have to announce themselves personally, on or before the 7th of October, to the head of the division which they intend entering, and have to deliver to the same their *nationale* (written statement of name, age, birthplace, name and position of parents, &c.), together with any other necessary explanations. The head of the division examines the written statements as to whether they fulfil the necessary conditions, and makes, if necessary, the arrangements respecting the entrance examinations. He then delivers to the applicant an attestation of his matriculation, in which the division and session into which he has been admitted, as well as the selected subjects, are detailed. In doubtful cases the determination respecting the admission of the applicant is left to the decision of all the professors of the division.

Sec. 14. The announcement of extraordinary students has to be made in the same way to the professors of those subjects which the students wish to attend. For those lectures which are only delivered in the summer term the registration can only take place in the beginning of the second term.

Sec. 15. As soon as the conditions mentioned in secs. 9 to 14 have been fulfilled, and as soon as the fees stated in secs. 19 to 21 have been paid, the matriculation of newly admitted students, as well as the registration of already matriculated students, can take place.

Sec. 16. The ordinary students have as a rule to adhere to the plan of study determined for the general and special divisions. Exceptionally they may be allowed to form another plan, in which case they must obtain the permission of the professors of the divisions in question. But this permission can only be given when in the plan selected, firstly, regard has been taken of the proper sequence of studies depending upon and supporting each other; and, secondly, when the total sum of all the weekly hours for the selected subjects amount to at least eighteen, each two practice or drawing hours being reckoned as one.

Sec. 17. Besides the subjects contained in his plan of study, the ordinary student may also attend lectures concerning other subjects for which he has sufficient preparatory knowledge. The statement of this has to take place either at the announcement (sec. 13), or at the latest on the 15th of October or 15th of March (sec. 6), and personally to the rector.

Sec. 18. The students are also allowed, within certain limits, to attend the drawing schools and laboratories at other hours besides those fixed in the plan of study.

Sec. 19. Each student has, on first admittance to the Institution, to pay a fee of five florins. After an absence of one year or more the same amount has to be again paid.

Sec. 20. Each ordinary student, to whatever division he may belong, and without regarding the number of the lectures he may select, has to pay a fee of fifty florins for the whole year. This fee may be either paid entire on admittance, or in two parts, of which the first is due on admittance, the second at the latest on the 7th March.

Sec. 21. The fees to be paid by the extraordinary students are so calculated that for each hour per week during each biennial term, one florin fifty kreutzers has to be paid, each two practice or drawing hours being reckoned as one.

Sec. 22. The extraordinary lectures of the professors, the lectures of the assistants, and of the teachers not paid by the Government, have to be paid for according to the fees determined upon by the same.

Sec. 23. By proving poverty, and at the same time proficiency, students may be either entirely freed from paying the fees (secs. 20 and 21), or only subject to half the charges.

Sec. 24. From the *viva voce* and written examinations held during the year and at the end of the same, as well as from the other tasks delivered by the student, the result of his studies in the separate subjects is determined. The determination as to whether a student is altogether proficient enough to advance into a higher course is left to the divisional committee of professors. If a student has failed in the examination of any one subject, he will have to prove his proficiency in the subject at the beginning of the next session, up to at the latest the 7th October, paying for this examination a tax of five florins. If he omits to do this, or again fails, then his further advancement in his studies can only be allowed if the subject in question is not one the knowledge of which is indispensable for the proper study of the chief subjects in the next course. And in this case only those subjects must be attended for which a previous knowledge of the one failed in is not necessary. But for the advancement from the general division into a special division, at least a "sufficiently good" result must have been obtained in all the subjects given in the plan of study for the general division. Students who have been compelled to repeat a course, are allowed to attend single subjects of the next following course of their division, provided they are able to prove sufficient preparatory knowledge for each subject. The repetition of a subject attended with insufficient result, as well as the repetition of a course, is only allowed once.

Sec. 25. Each ordinary student obtains at the close of the year a certificate, in which the attendance of, and result in each of the subjects of his division, as well as his general conduct, are specified. Similar certificates, but only for each single subject, are given to the ordinary student upon his attending not compulsory subjects. These latter certificates are the same as those which are given to the extraordinary students. The result is designated in the certificates—"excellent," or "good," or "efficient," or "insufficient." The conduct is designated either—"entirely according to," or "according to," or "less according to the academical laws." The ordinary students can also obtain certificates of attendance for subjects not compulsory.

Sec. 26. The resigning the attendance of single lectures has to be intimated to the respective professors; the leaving the Institution to the rector.

Sec. 27. Under the name of guests, males may be admitted to the lectures on separate subjects, by permission of the respective professors, who, from their station and other qualifications, entitle the expectation that the objects of the teaching will not be prejudiced thereby.

III.—Regarding the Strict (Rigorosum) Examinations for obtaining a Diploma.

Sec. 28. The strict examinations are intended to prove the efficiency of the candidate for his profession. They have to show that the candidate has a complete knowledge of all the subjects of examination, both theoretically and practically, and particularly of the amount taught in the special professional division. A diploma is given on completing the strict examination.

Sec. 30. The candidate for the strict examination has to prove at least sufficient proficiency in all the subjects contained in the plan of study of the division in question, and also in national economy, in the laws of trade and exchange, and in book-keeping.

Sec. 31. A fee has to be paid for the strict examination: it amounts to 150 florins for each of the divisions for civil engineering, building, or mechanical engineering; and to 80 florins for the technical chemistry division. The fee in question has to be paid beforehand, and no gratuitous examination will be granted.

Secs. 32 and 33 contain further unimportant particulars concerning the strict examinations.

Sec. 34. Should the result be insufficiently good, the strict examination can be repeated. This repetition can only take place once, and only after the expiration of the time fixed by the examining committee. The fee due for the examination has in this case to be again paid.

Sec. 35. The subjects for the strict examination to the extent taught in the respective divisions are the following:—

B. *Civil Engineering Division.*—1. Mathematics, geometrical drawing, technical physics, theoretical mechanics, machinery; 2, practical geometry and higher geodesy, building mechanics, building construction, road and hydraulic engineering.

C. *Building Division.*—1, Mathematics, geometrical drawing, technical physics, mechanics, machinery, geology; 2, practical geometry, building mechanics, building construction, history of building, road and hydraulic engineering.

D. *Mechanical Engineering Division.*—1, Mathematics, geometrical drawing, technical physics, mechanics, practical geometry; 2, general building construction, laws of machinery, building of machinery, and mechanical technology.

E. *Technical Chemistry Division.*—Mineralogy, botany and zoology, general and technical physics, machinery, chemistry, chemical technology, and knowledge of goods.

Sec. 36. The strict examination may be passed for more than one division, provided the rules of secs. 30 and 31 be adhered to. In this case the examination committee may grant a dispensation from examination in those subjects of the next division in which the candidate has been examined in the former division.

PLAN OF STUDY FOR THE YEAR 1866–67.

A.—*For the General Division.*

Both the annual sessions of this division have to be passed by students wishing to enter the civil engineering, building, or mechanical engineering divisions. Students intending to enter the chemical division need only pass the first session of the general division; such students need not attend the geometrical drawing, taking instead the lectures on mineralogy and the laboratory practice.—*First Session.*—Mathematics (algebraic analysis, analytical geometry, elements of differential and integral calculus), 10 hours weekly; geometrical drawing, 7 hours; constructional drawing, 8 hours, inorganic chemistry, 3 hours; zoology, 6 hours (in the winter term); botany, 6 hours (in the summer term); technical and free drawing, 4 hours. *Second Session.*—Mathematics (differential and integral calculus), 5 hours; physics, 4 hours; technical mechanics, 5 hours; practical geometry, 4 hours; situational drawing (*Situations Zeichnen*), 6 hours; mineralogy, 5 hours; constructional exercises in geometrical drawing, 4 hours; technical and free drawing, 4 hours.

B.—*Civil Engineering Division.*

First Annual Session.—Technical physics, 3 hours; knowledge of machinery, 3 hours; constructive practice, 5 hours; building (course 1), 5 hours; constructional drawing, 10 hours; geology (course 1 in winter), 2 hours; geology (course 2 in summer), 8 hours; geological practice (in summer), 2 hours; ornamental drawing, 6 hours. *Second Annual Session.*—Analytical mechanics, 2 hours; building mechanics, 2 hours; spherical astronomy (in winter), 4½ hours; higher geodesy (in summer), 4½ hours; hydraulic and bridge engineering, 5 hours; constructional exercises and plans, 10 hours; tracing (*Terrain Lehre*), in summer, 2 hours. *Third Annual Session.*—Road and railway engineering, 5 hours; constructional exercises and plans, 15 hours; artistic perspective (in winter), 2 hours; perspective and landscape drawing, 4½ hours.

C.—*Building Division.*

First Annual Session.—Building (course 1), 5 hours; building construction exercises, 10 hours; knowledge of machinery, 3 hours; constructional exercises, 5 hours; geology (in winter), 2 hours; mechanical technology (in winter), 5 hours; ornamental drawing and modelling, 6 hours. *Second Annual Session.*—Art of building, 3 hours; practice in architectural drawing and planning; encyclopædia of road and hydraulic engineering (in summer), 4 hours; building mechanics, 2 hours; technical physics (in winter), 2 hours; perspective and landscape drawing, 6 hours; ornamental drawing and modelling, 4 hours. *Third Annual Session.*—The particulars concerning this session will only be published for 1867–68.

D.—*Mechanical Engineering Division.*

First Session.—Analytical mechanics, 2 hours; laws of machinery (*Maschinen Lehre*), course 1, 3 hours; building of machinery (*Maschinen Bau*), course 1, 3 hours; constructional exercises, 10 hours; mechanical technology, 5 hours; technical physics, 3 hours; knowledge of building, 2 hours; building drawing, 6 hours. *Second Session.*—Laws of machinery (course 2), 2 hours; building of machinery (course 2), 10 hours; constructional exercises and plans, 15 hours; chemical technology (sugar manufacturing and brewing), 7½ hours.

E.—*Chemical Technical Division.*

First Session.—Organic chemistry, 3 hours; analytical chemistry, 2 hours; laboratory practice, 10 hours; general physics, 4 hours; technical mechanics, 5 hours; mineralogy (in winter), 5 hours. *Second Session.*—Chemical technology (sugar manufacturing, brewing, dyeing, tanning, soap manufacturing, distilling, wines, &c.), 7½ hours; laboratory practice, 20 hours; technical physics, 3 hours; knowledge of machinery, 3 hours; knowledge of goods, 2 hours. *Third Session.*—Laboratory practice, 20 hours; knowledge of building (in winter), 4 hours; mechanical technology (metallurgy, working of metals, working of wood, spinning, paper manufacturing, &c.), 5 hours; geology (course 1 in winter), 2 hours; geology (course 2 in summer), 5 hours.

Lectures not appertaining to any Division in particular.

Modern history, history of Austria, zoological palæontology, history of German literature, the German classics, essays and declamation, esthetics, agriculture (courses 1 and 2), national economy (courses 1 and 2), laws of trade and barter, statistics, political laws of Austria, book-keeping, business style, modelling.

Extraordinary Lectures.

Integration of lineal differential equations, geometry of position and graphical calculations, political arithmetic and assurance, graphical statics, mathematical crystallography, crystallographic physics, anatomy of plants, botanical physiology, chemistry of the alcohols, psychology and logic, ornamental drawing, accidental surgery.

Languages and Accomplishments.

French, English, Italian, Persian, Turkish, Vulgo-Arabic—Stenography.

* According to imperial decree of 17th October, 1865.

The Sultan's First Railway Journey in Turkey.—There is no doubt that the Sultan's first railway journey in his own dominions was a great success. The line from Rustchuk to Varna is about 120 miles in length, and runs through some of the finest hill and wood scenery of Bulgaria. His Highness, after a stay of two days at Rustchuk, left that city on the morning of the 6th ult. in a train consisting of nine carriages, painted white and emblazoned with the star and crescent in white and gold. The engine was elaborately ornamented, and was in the charge of an English driver, named Frank White. The journey occupied seven hours, as the Sultan received deputations *en route* at Rasgard, the Schumla road, and Pravadi. The embarkation at Varna was made before sunset, a stay of only three hours being made at that port. The Imperial suite of 700 persons, with their baggage, horses, &c., were conveyed to Varna in nine special trains, and no hitch of any kind occurred during the journey. The Sultan has signified his intention of conferring the Order of the Osmanli on Mr. J. Trevor Barkley, who was in immediate charge of the Imperial train, and who has been most actively engaged for many years in forwarding railway enterprise in Eastern Europe.—*Times.*

The London Traffic Act.—As this new law, which comes into operation on the 1st November next, makes special regulations as to the passage of materials and implements of engineers and builders through London, we extract that part of the enactment. It will be observed that special limits are alluded to, and many explain that the general limits mean that part of the metropolis enclosed in a circle of which the centre is Charing Cross, and the radii are four miles in a straight line from Charing Cross. The special limits are such streets or portions of streets advertised in the *London Gazette*, with the consent of the Secretary of State, as may be declared to be special under the provisions of the Act. With these provisoes the new Traffic Act limits that no person shall, within the said limits of this Act, and between the hours of ten in the morning and seven in the evening, except with the permission of the commissioner of police,—1, Drive or conduct along any street any cart, carriage, or other vehicle laden with timber, metal, or any other article which exceeds in length 35ft., or which protrudes more than 8ft. 6in. behind the vehicle or more than 1ft. from the sides of the vehicle; 2, Carry in any way along any street any ladder, scaffold pole, or other article which exceeds 35ft. in length or 8ft. 6in in breadth; 3, Drive or conduct along any street any cart, wagon, or other vehicle used for conveying goods or merchandise, and drawn by more than four horses. Any person acting in contravention of this section shall for each offence be liable to a penalty not exceeding forty shillings. No penalty shall be imposed on or costs awarded against any person for acting in contravention of this section if such person prove to the satisfaction of the magistrate having power to impose the penalty that the Act alleged to be in contravention of this section was done on the occasion of a fire or other sudden emergency with a view to prevent accident, or to save life or property. Any byelaw, rule, order, or regulation made or to be made within the city of London and the liberties thereof that is inconsistent with this section shall be void.

UNIVERSAL EXHIBITION OF 1867.

GROUP V, CLASS 44.—CHEMICAL AND PHARMACEUTICAL PRODUCTS.

(*Condensed from "Les Mondes" and other French Periodicals.*)

(*Continued from page* 145).

MM. John Casthelaz et Cie, of Paris.—Their space is remarkably rich in products obtained by greatly improved processes which do great honour to French chemistry. They daily decompose two tons of nitrate of soda by sulphuric acid to make nitric acid, either monohydrated, of 48 deg. to 50 deg., or pentahydrated, of 35 deg. to 40 deg. Almost the whole of these acids is employed at the place of production. The monohydrated acid serves for the formation of the nitro-products of benzine and toluene, the 35 deg. acid for transforming arsenious into arsenic acid, phenic acid into trinitrophenic or picric acid, bichloride of naphthaline into phthalic acid, &c. They transform daily a ton of benzine into nitrobenzine and aniline, and manufacture picric acid on a very great scale in two forms, crystallised and fused—the weight of some of the specimens exhibited being as much as one and two kilogrammes. They have designed an apparatus for buyers, called a picrometer, which gives them the means of easily verifying for themselves the purity of the acid sold to them. Starting from the fact shown by MM. Paul and Ernest Depouilly, that the basic phthalate of lime when sulphurated at 300 deg. changes into benzoate of lime, they employ naphthaline for the production of benzoic acid. Phthalic acid results from the oxidation of the naphthalic bichloride; phthalate of ammonia when distilled gives the phthalimide of Laurent; the phthalimide distilled with powdered quicklime gives benzonitrile; the benzonitrile boiled with caustic soda produces benzoate of soda, whence hydrochloric acid precipitates benzoic acid. When treated with nitric acid bichloride of naphthaline produces an oil, the binitrochloro-formene or binitro-chloroform of Berthelot, which possesses such a penetrating smell and such an energetic action on the eyes and respiratory organs. Here, too, we see picrates of baryta, of iron, lead, and mercury; chloroxynaphthalates of baryta, iron, zinc, nickel, and copper with aniline violets, soluble garnet, isopurpurate of potassium, a fulminating substance, which has to be kept in water, and a product of the reaction of cyanide of potassium on picric acid, which dyes wool of as rich and fine tints as those of orchil and with an economy of 25 per cent.

MM. Coblenz Frerès, of Paris.—Their pure and crystallised aboratory products leave nothing to be desired: as their phenylure, azobenzide, nitroline, binitrobenzine, binitrotoluene, toluyldiamine, and paraniline. They are remarkably skilful in transforming the direct coal tar products into colouring matters, their enormous block of nitrotoluene, so admirably crystallised and of a pale yellow colour, is almost perfectly free from nitrobenzine. They have discovered an extremely economical process for the conversion of nitrobenzine into aniline and of nitrotoluene into toluidine. They take cast iron turnings coarsely powdered, and covering them with a sheet of copper, they plunge all into a solution of sulphate of copper. The galvanised iron turnings put in contact with about an equal quantity of the same material not galvanised is surrounded with a sufficient quantity of water, and nitrobenzine or nitrotoluene is added, a galvanic current is established within the liquid, the water is decomposed, its oxygen goes to the iron, the hydrogen transforms the nitrous body into the state of aniline or toluidine, which is afterwards rendered pure by rectification. By treating the residues with sulphuric acid the copper is recovered in the state of sulphate and is ready to be employed in a fresh operation.

M. Huillard, sen., Paris, exhibits the crystallised salts which form his special manufacture, one class derived from orchil, as orceine, orcine, erythrine, erythric acid, &c., the others are mineral, the protoxide, sesquioxide, and five carbonates of cobalt with the arseniate, phosphate, silicate, borate, sulphate, nitrate, and chloride of cobalt. His aim is, first, to make, commercially, various preparations of orchil, as liquid orchil orcellane, extract of orchil or imperial red, which contains in the smallest bulk the greatest possible quantity of chemically pure colouring matter. Second, to produce cobalt blues on a great scale which shall rival the German blues in beauty and cheapness. The price of these blues is so moderate that we may expect to see them used for printing stuffs and papers, and they are so good that the Bank of France has used them for 500f. and 100f. bills. They have been used for 20 centime postage stamps, although they have th inconvenience of appearing green by artificial light.

M. Eusèbe, of Paris, has created two highly interesting specialities, aniline green and the red obtained from carthamic acid. He has ceded the monopoly of the first to M. J. J. Muhr, of Basle, and keeps the other a secret. These colours are unrivalled—the first in brightness and the second in freshness—and can be given any degree of depth or paleness, as is shown by the splendid exhibition of specimens of silk dyed with them. It is known that the green is produced by the action of hyposulphite of soda on the blue arising from the treatment of rosaniline salts with ethylic aldehyde, but no one can guess at the mode of producing artificial carthamic acid.

M. Jean Rod, of Basle.—We have already noticed his 500 gramme specimen of crystallised and almost colourless rosaniline. He competes successfully with the most renowned manufacturers of Paris and London, and produces daily 175 kilogrammes of hydrochloride of rosaniline with proportionate quantities of aniline violets, blues, and greens. He produces at will from the same substances, and of equal purity, hydrochloride of rosaniline, dyeing red, monophenylated ditto, dyeing violet red, diphenylated ditto, dyeing violet blue, and triphenylated dyeing blue. This shows what a master he is of his art.

In another series of violets, blues, and greens, exhibited under the name of Parma or Alexandra, ethyl replaces the phenyl, as in M. Hoffmann's processes. Like M. Menier, M. Rod exhibits a trophy of 500 grammes of cyanine or quinoleine blue, incomparably the most beautiful of blues, but also, unfortunately, the most ephemeral. M. Rod is also eminent in the manufacture of pure crystallised dyes extracted from dye woods; his hœmatine, hœmatoxyline, pure and commercial bresilines and berberines are triumphs of crystallisation in their way, and yet are cheap.

M. Paisant, of Pont Labbé.—His establishment was founded in 1840, for the manufacture of starch and its conversion into alcohol syrups and dextrine, but its very existence was soon after threatened by the terrible invasion of the potato disease, and only retained subsequently its original purpose, so far as the starch and glucose manufacture went. The rest was transformed into an establishment for extracting the chemical products from kelp. The consumption of this raw material is at present 1,800,000 kilogrammes, and it supplies to farmers 16,000 hectolitres of lixiviated ashes. M. Paisant has greatly ameliorated the condition of his workpeople by buildings of a sanitary and cheap character, and by the creation of a common provident fund against slack time and sickness, in which the women participate already, and in which it is expected the children will soon join.

M. E. Deiss, of Paris and Marseilles, must surely be placed in the very foremost rank of practical chemists for his creation of the famous manufacture of sulphide of carbon and its application to the extraction of all kinds of fatty substances. In 1847 sulphide of carbon was worth 60f. the kilogramme, and was a mere laboratory product. In 1867 M. Deiss produces it at 35f. the 100 kilogrammes. In 1848 a little sulphide of carbon was used in the manufacture of india-rubber. At present millions of kilogrammes of oleaginous matter which were previously lost are recovered from the residues of various trades by means of it, and this application of it is undoubtedly one of the most brilliant discoveries of modern times. However powerful the presses may be they always leave a sensible quantity of oil in the residues of oil seeds. Sulphide of carbon removes the last trace of this.

Paris, Brussells, Lyons, and Marseilles have vast establishments specially devoted to the recovery of waste fatty matters. Even in 1862 the trade of M. Weiss had attracted much attention; it has since then attained to perfectly colossal proportions.

At Chartreux, in Marseilles, Bouvelard Achard, a gigantic extractor treats forty-three cubic metres of pulp and waste of olives every thirty-six hours, employing 45,000 kilogrammes of sulphide of carbon; the liquid successively penetrates the oil-containing mass, takes up the oil and deposits it in the distilling apparatus, undergoes a complete regeneration almost without loss, and returns through the worms to take up more oil, &c. &c. This once dangerous agent now works without any inconvenience, and almost without smell. The quantity of oil recovered at each operation by the two extractors at Marseilles is from 3000 to 3500 kilogrammes.

At Lyons there were annually thrown into the Rhone, which carried it to the sea, 5,000,000 kilogrammes of soap, which had served for washing silk. Hundreds of attempts had been made to utilise this soapy water. The only theoretically successful process was the treatment by acids, which made a useful product of the matters coming from the silk termed 'grit' (*grès*). But now sulphide of carbon, as if by magic, separates instantaneously, and without putrefaction, the 'grit' from the fatty matters in which it is entangled, which it gives up again on distillation without trouble, and which are then ready to form more soap in a new establishment at Mulatière. The Lyons dyers already accept the regenerated soaps, and very soon not an atom will be lost of the enormous mass of soap which would otherwise be thrown into the Mediterranean. The process for the extraction of the fatty acid contained in the soap waters of the silk washings is as follows:—1000 kilogrammes of the soap waters are turned into a sheet iron apparatus hermetically closed, but carrying a swan neck communicating with a refrigerator. An equal weight of sulphide of carbon is introduced, and it is heated by a steam worm to boiling, and when the fatty acids are dissolved it is allowed to cool. Two strata are formed, the upper the *grès* one, mixed with a little greasy sulphide, and the lower one limpid, and holding the fatty acids in solution; the limpid part is drawn off into a distilling apparatus and distilled, as in the extraction of other fatty matter.

Experience shows that the residues of oil seeds form better manure when the whole of the oil which they still contain has been removed. The explanation of this fact is easy. The oil is a neutral body formed of hydrogen and carbon, and its presence is an obstacle to the assimilation by the soil and plants of the nitrogenous materials contained in the pressed seeds; it was thus in any case a great improvement to treat these residues with sulphide of carbon, and this was the foundation from which M. Deiss has built up a new and great trade. He also expects to treat the cakes coming from the stearine presses, on the largest scale, and with great advantage.

M. Collas, of Paris, noted for his manufacture, by machinery, on a great scale of drugged pastilles. He was the first in 1848 to discover benzine in coal oil, and the first to employ it for cleaning fabrics. He then discovered nitrobenzine, and for six years he was the only maker of it on a commercial scale; he offered it to the trade under the names of essence of mirbane or essence of bitter almonds, and in creating nitrobenzine he certainly became one of the earliest authors of the magnificent aniline colours. The Society of Mulhouse said of him at its meeting of 22nd March:—"M. Collas has made benzine and nitrobenzine and introduced them into the trade. He employed the first to cleanse stuffs and the second for perfumery. He did not discover any colouring matter—but once put in possession of a product which was previously unobtainable, M. Homan repeated the experiments of M. Runge on kyanol (aniline), Perkin reproduced a reaction which had been before pointed out by Berzelius, and a great trade sprang up." The Mulhouse Society thus recognises the value of the labours of M. Collas, and considers that they have greatly contributed, though indirectly, to the origin of the aniline colours.

M. Collas believes, after much study, that phosphate of lime powerfully provokes or aids the decomposition of animal matter. Digestion being a sort of decomposition, M. Collas proposes to aid it by various preparations of phosphate of lime. M. Collas also prepares, for medical purposes, chemically pure iron, enclosed in capsules of ten grains each to protect it from oxydation. It is precipitated by a Bunsen's pile from a chloride solution, and is said to be a very efficacious form for administering iron.

M. Rousseau, of Paris, exhibits, firstly, specimens of pure products and reagents; secondly, series of oxides and salts intended for the colouration of silicates, rendered very cheap without deterioration of quality; thirdly, masses of sodium, which he was the first to make on an industrial scale, and at such a price as to make it applicable for the production of aluminium (in this M. Henri St. Claire Deville co-operated); fourthly, magnesium prepared in a similar way, and also the metals lately discovered, as cœsium, rubidium, thallium, indium, &c.; fifthly, pyrogallic acid, which he has manufactured since M. Regnault showed of what service it would be in photography, and of which he sells 1500 to 1800 kilogrammes a year; sixthly, and lastly, the benzoic acid employed in the preparation of aniline dyes, which he extracted without anyone suspecting, it in enormous quantities—many thousand kilogrammes annually—from the urine of cows, collected with infinite trouble from the dairies round Paris. Before this all the benzoic acid used in France came from Germany.

M. Rousseau's great aim has been to assist scientific research by continuing to lower the prices of apparatus and reagents. He exhibits in Class 51 a stove, which is an improvement on that of Gay-Lussac, and costs 25f. instead of 75f.; a mineralogical case complete for 45f.; a new densimeter very easy to use; and plates and cylinders of charcoal and porous vessels impregnated with charcoal, for the readier and cheaper production of electricity by Bunsen's piles. There is also in Class 90 a collection, priced at 200f., intended for elementary instruction in chemistry, accompanied by a small explanatory volume. M. Rousseau intends to extend this idea to other branches of physical science.

M. Rousseau was the first to propose and patent the employment of pyrites for the manufacture of sulphuric acid, and the agglomerated coal or "patent fuel" of Paris. In 1849 he organised the method of extracting sugar by the double agency of lime and carbonic acid, which has been almost universally followed in Europe for the last twenty-four years, under the name of the Rousseau, or *saturation*, process. He has lately made some further and greater improvements in this process by the discovery of a new sucrate of lime, solid and insoluble in the cold. Reduced to this form the sugar contained in the juices or syrups of the mills can be preserved indefinitely, or sent without loss to the refining works. He has also discovered a decolourising black, obtainable at the low rate of 8f. the 100 kilogrammes.

M. Robinet, of Paris, exhibits 100 specimens of water, his object being to solicit other specimens from all parts of the world for analysis, with a view to the publication of a "Hydrographical Dictionary." M. Robinet undertakes to supply bottles and to pay the carriage from the remotest ends of the earth.

M. Joly, of Rochille, and of 13, *Rue d'Autin, Paris*, produces a very novel article in "marine silk" made from the eggs of the saddle ray (*la raie bâtis*), a fish of the sœbaciæ family. The outer envelope of the egg is formed of a very close tissue, giving a good and beautiful fibre when combed out. The egg also contains a considerable quantity of albumen. M. Joly also shows a cream of cod liver oil more agreeable than the purest oil; also oil from the livers of other fishes for leather dressing; and a valuable manure, termed French guano, made from refuse and inedible fish.

M. Ch. Genevoix, 58, *Rue Bonaparte*, exhibits some nice preparations of iron, powders for effervescing drinks, and other drugs. As these are prepared on a very large scale they are good and cheap.

M. Emile Genevoix, 14, *Rue des Beau Arts*, has introduced successfully into medicine a new oil, that of Indian chestnuts. The chestnuts are fermented, boiled in ten times their weight of water, and converted into glucose by treatment with two per cent. of sulphuric acid. The oil floats to the top, and after filtration is ready for use. It is very limpid and readily absorbed by the skin, and thus becomes valuable in gouty and rheumatic affections.

M. Genevoix also introduces some new compounds of valeric acid—the valeriate of ammonia was already known as a valuable drug. He also proposes as a substitute for poultices, which are always unpleasant, an impermeable tissue covering one or two folds of an absorbent, one which is to be moistened with the drug it is desired to exhibit.

M. Bobœuf, of Rue Buffault, Paris, is well known as the inventor of sodic phenol. He exhibits some grand specimens of phenic and picric acid. Through his labours the price of phenic acid has fallen from 100f. to 5f., and that of picric acid from 60f. to 14f. His sodic phenol is likely to become a very highly prized perfume.

M. Scipio Dumoulin, among many other useful things, is the author of a mode of preparing phenic acid by the reaction of nitric acid on the quasi resin of the carnauba palm. A part of the carbon of the resin combines with the acid to form carbo-azotic, or picric acid, and the resin is transformed into wax similar to beeswax. The acid obtained is very pure, and not greasy like that obtained from tar; it is highly fulminating, and explodes on the least shock.

THE French army will require five and-a-half millions of breech-loaders.

TYPE MACHINES.—Mr. Mackie, of the *Warrington Guardian*, who has long been engaged perfecting type-composing and distributing machines, announces that he can set a column of news (*Times* size) fifty times over at the same operation, each column requiring less than an hour to set and distribute. He offers the use of these columns at a third of what they can be set at in the usual way, paying carriage both ways. They are to be set by means of his combined composer and distributor—a machine soon to be at work—driven by steam, and feeding itself. This machine is so contrived that it lays down the first letters of, say, fifty columns of type by one movement, then the second letters of the same fifty, and so on. Each movement of the machine in reality composes fifty types, which, when in lines, are put in their respective places. The plan is adapted for setting duplicates or triplicates, saving stereotyping. We shall watch the carrying out of the plan with much interest.

DR. PERCY AND SEELY'S PIGS.—It appears that Dr. Percy is aggrieved by the remarks of Colonel Boxer, which were printed by order of the House of Commons. The doctor states that he had no communication with Mr. Seely on the subject until the present year; but in the autumn of last year Sir John Hay requested him to examine this iron ballast, and being informed that the ballast was made in 1815, or fifteen years before the introduction of the hot blast, that fact gave a strong presumption of good quality. Dr. Percy advised the Admiralty to make experiments (which advice they followed), but he was not satisfied with the way in which they were carried out by Colonel Boxer; and states in his present letter to the Admiralty:—"Now, my lord, it is clear that no answer is given in that report to the question proposed for experimental solution, and I deliberately repeat what I stated in my letter of 8th May, 1867, previously referred to, namely, 'that the trial at the Arsenal was wholly inconclusive, nay, even useless.' I now pass on to the consideration of Colonel Boxer's letter. The first sentence is, 'the opinion expressed by Dr. Percy in the enclosed report as to the suitableness of the dockyard ballast iron for Palliser chilled shot cannot be considered of much value, as that gentleman has neither had any experience in the manufacture of these projectiles, nor made himself acquainted with the system pursued in their production in this department.' That statement is erroneous. Before my interview with Sir John Hay, I had carefully examined the pig iron used at the arsenal for the Palliser projectiles; I had seen those projectiles cast in the arsenal; and, under the guidance of Major Palliser himself I had carefully inspected the extensive and highly instructive series of specimens at the arsenal illustrative of the fracture of such projectiles made with different kinds of pig iron, and prepared under different conditions. I observed that the fracture of the metal at the arsenal, which was alleged to be most suitable for the Palliser projectiles, exactly resembled that of some of the ballast iron, and hence I inferred that the latter might be used for those projectiles. It is, moreover, a variety of fracture which I have specially studied, and with which I have long been familiar, and it is one which any person of experience in chill-casting would have immediately suggested as indicative of pig iron suitable for that purpose. The only other sentence requiring comment from me is the following:—'Dr. Percy predicts, that "hereafter much cheaper pig iron than is now purchased in the arsenal for the Palliser shot will be found equally good for the purpose." This is a very safe prediction, as the labours of those connected with the manufacturing establishments of the War Department have hitherto always resulted in continual improvements, both with regard to economy and efficiency. I beg to express my hope that Colonel Boxer may speedily have the satisfaction of fulfilling his prediction. If he do not, I venture further to predict that the credit of that fulfilment will be reserved for other persons. It should be remembered that the manufacture of Palliser projectiles is not confined to the arsenal, and other persons besides Colonel Boxer have "practical experience" in the art. The panegyric which Colonel Boxer has in the preceding sentence bestowed upon his own labours is, I have no doubt, well deserved; but it would probably have come with better grace from a less interested source. In conclusion, I have to request that this letter may be submitted to the War Department, and that in simple justice to myself it may be added to the published correspondence."

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants and Dates of Provisional Protection for Six Months.

1113. ROBERT ALEXANDER, Islington, Liverpool, "Improvements in compositions to be applied as coatings to preserve the surfaces of metals, wood, stone, and all such like materials."—13*th April*, 1867.

2003. JOHN MACFARLANE GRAY, Liverpool, "Improvements in marine steam engines."—9*th July*, 1867.

2090. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "Improvements in brushes."—A communication from Henry Rosenthal, New York, U.S.—16*th July*, 1867.

2132. THEOPHILE AUGUSTE BREITHAUPH, Passage des Petites Ecuries, Paris, "Certain processes of manufacturing extract and essence of hop to be substituted for the plant itself in the making of beer."—22*nd July*, 1867.

2177. WILLIAM EDWARD GEDGE, Wellington-street, Strand, London, "An improved machine for cutting slate in quarries previous to laying them open, and for cutting in coalpits, mines, and stone quarries."—A communication from Joseph Debry, Faubourg St. Martin, Paris.—27*th July*, 1867.

2188. WILLIAM LAWRENCE LOWE, Blackburn, and AARON SMALLEY, Preston, Lancashire, "An improved method of lighting house and other fires."—29*th July*, 1867.

2200. JOSEPH JONES, Little Bolton, Lancashire, "An improved chemical mixture or compound for extinguishing fires and destroying explosive fire-damp in coal mines."

2207. SAMUEL MANLEY MARTIN, Pinner, and SAMUEL ALFRED VARLEY, Roman-road, Holloway, Middlesex, "Improvements in signalling upon railway trains, parts of which apparatus are applicable to electric telegraphs generally."—30*th July* 1867.

2233. FREDERICK LUDWIG HAHN DANCHELL, Horwich, Lancashire, "Improvements in machinery and apparatus for preparing shaping, and drying peat and other vegetable and mineral substances."

2234. JOHN EDWARDS, Victoria Chambers, Westminster, "Improvements in machinery or apparatus for actuating and locking railway points and signals."

2236. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in hydraulic lifts, and in the mode of operating the same."—A communication from Adolphe Le Bœuf, Paris.

2237. EDWIN THOMAS MARLER, Basinghall-street, London, "Improvements in the method of and apparatus for clarifying sugar, which improvements are also applicable to other similar purposes."—A communication from Benjamin Lawrence and Phineas Lawrence, John-street, New York, U.S.

2239. EDMUND ADOLPHUS KIRBY, Gordon-square, London, "An improved system of dispensing medicines and preparing drugs therefor, together with an improved portable miniature dispensary and instrument case applicable to such system."

2241. THOMAS ALLAN, Adelphi-terrace, Westminster, "Improvements in submarine telegraph cables, and in the mode of joining the same."—2*nd August*, 1867.

2243. JOHN SMITH, Cheetham, Manchester, "Improvements in machinery or apparatus for bowking, bleaching, and cleansing textile fabrics and fibrous materials."

2245. CHARLES DENTON ABEL, Southampton-buildings, Chancery-lane, London, "Improvements in combined gas and air engines."—A communication from Eugene Langen and Auguste Nicol Otto, Cologne, Prussia.

2249. ARNOLD BUDENBERG, Manchester, "Improvements in apparatus for indicating and registering the pressure of steam in steam generators and the pressure in hydraulic presses and other vessels or chambers, which improvements are also applicable to indicating and registering pressure and vacuum in steam engines, the vacuum to condensing apparatus, also to indicating and registering the combined pressure of the steam or other power employed to give motion to an engine, and the speed of such engine or other machinery, also to indicating and registering barometrical variations."—A communication from Bernhard August Schäffer and Christian Friedrich Budenberg, Buckau, Magdeburg, Prussia.

2251. WILLIAM RUSSELL, Brooklyn, New York, U.S., "Improvements in harrows."—A communication from Halsey Haley Monroe, Rockland, Maine, U.S.

2253. GEORGE WHITE DINSDALE, Upper Norwood, Surrey, "Improvements in the construction and manufacture of traps for water-closets, drains, and other purposes."

2255. WILLIAM WILSON, Newcastle-upon-Tyne, "Improvements in felting machines."—A communication from James Seeley Taylor, Danbury, Connecticut, U.S.—3*rd August*, 1867.

2257. LEON VICTOR HUE and CHARLES ROZIERE, Rue de Malte, Paris, "Improvements in the means of moulding subjects or designs in glass or crystal for ornamenting them inwardly, and improved tools or apparatus in connection therewith."

2259. WILLIAM JOHN PUGHSLEY, Llantarnam, Monmouthshire, "Improvements in obtaining sulphuric acid from the refuse 'pickle' or liquor used in wire and galvanising works."

2261. CONSTANTINE DE NEGRI, Belsize-road, St. John's Wood, London, "Improved machinery for reducing wood to shreds to be used in the manufacture of paper pulp."

2263. GEORGE SCHNEIDER, Rue St. Anne, Paris, "Improvements in breech-loading fire-arms."

2265. WILLIAM PRANGLEY, Salisbury, Wiltshire, "Improvements in apparatus employed in athletic exercises."—5*th August*, 1867.

2267. THOMAS WHITTAKER and MARTIN ROURKE, Manchester, "Certain improvements in the preparation of waterproof paper."

2269. ALEXANDER MELVILLE CLARK, Chancery-lane, London, "Improvements in reeds for weaving."—A communication from Laurent Perret, Boulevart St. Martin, Paris.

2271. EDWARD JOSEPH WILLIAM PARNACOTT, Leeds, Yorkshire, "An improved construction of trenail."

2273. FREDERICK RYLAND, Westbromwich, Staffordshire, "Improvements in pulleys for suspending window frames and for other like purposes."—6*th August*, 1867.

2275. EMIL CORNELY, Paris, "Improvements in sewing machines."

2277. ALEXANDER JOHN PATERSON, Edinburgh, "Improvements in cartridges and fire-arms."

2279. RICHARD HENRY MICHELL, Cockspur-street, Charing Cross, Westminster, "Improvements in dredging machinery and apparatus or appliances for the stowage and discharge of substances dredged up, the said apparatus or appliances being applicable to lighters, barges, or vessels used for other purposes."

2281. THOMAS STOKES CRESSEY and JOHN WEBB, Burton-on-Trent, "Improvements in apparatus for shrinking cloth."

2283. JOSEPH PICKLES BINNS, Leeds, Yorkshire, "Improvements in machinery for the manufacture of paper bags."—7*th August*, 1867.

2285. ALEXANDER MELVILLE CLARK, Chancery-lane, London, "An improved metallic alloy, and in the applications of the same."—A communication from George Achille Schmitte and Hiliare André Levallois, Boulevart St. Martin, Paris.

2287. HENRY WILLIAM WITHERS, New Cross, Kent, "Improvements in the construction of boats."

2288. FRANCIS WIRTH, Frankfort-on-the-Maine, Germany, "An improved machine for stamping letters."—A communication from Johann Carl Wilhelm Maas and Carl Fischer, Hamburgh, Germany.

2289. JOHANN ERNST FRIEDRICH LUDEKE, New Cross-road, New Cross, "Improvements in apparatus for obtaining motive power and for raising and forcing water and fluids."

2290. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "Improvements in printing presses."—A communication from Edwin Allen, Norwich, Connecticut, U.S.—8*th August*, 1867.

2291. THOMAS JAMES BAKER, Farndon, near Newark, Nottinghamshire, "Improvements in the manufacture of wheat and other grain into flour, and in the machinery connected therewith."

2293. FREDERICK JULIUS SEYMOUR, Southampton-buildings, Chancery-lane, London, "An improved case or box for holding twine or cord."

2295. WILLIAM JOHN MILLER, Birmingham, "Improvements in table knives and forks."—Partly a communication from Frederick Jeremiah Miller, Brooklyn, New York, U.S.

2296. RICHARD HEATHFIELD, Birmingham, "Improvements in machinery for the manufacture of cut nails."—A communication from John Henry Geary, Fairhaven, Massachusetts, U.S.

2297. CAROLINE HOHGREFE, Frankfort-street, Brunswick, Germany, "Improvements in apparatus to be applied to chimney tops."—9*th August*, 1867.

2298. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "Improvements in stringed instruments having sound-boards."—A communication from Joseph Henri Marchisio, Turin, Italy.

2300. JOHN DAVENPORT and JOHN KILSON, Bradford, Yorkshire, "Improvements in or applicable to slide valves for admitting the flow or passage of steam, water, or other fluids and gases when pressed."

2302. GEORGE HODGSON, Thornton-road, Bradford, Yorkshire, "Improvements in looms for weaving, and in means or apparatus for the manufacture of parts of such looms."

2304. GEORGE WARSOP, Mount-street, Nottingham, "Improvements in apparatus for cleaning windows."

2306. RICHARD EDMONDSON, Blackburn, Lancashire, "Improvements in the construction and manufacture, and in tools for the manufacture, of pickers used in looms for weaving."—10*th August*, 1867.

2308. CHARLES DENTON ABEL, Southampton-buildings, Chancery-lane, London, "An improved method or process for removing sulphur, phosphorus, and other impurities from iron, steel, and other metals."—A communication from Joen Francis Bennett, Pittsburgh, Pennsylvania, U.S.

2310. EREMBERT COURTIN, George-lane, Eastcheap, London, "Improvements in the construction of machines for splitting or for splitting and cutting sarsaparilla and other woody or vegetable fibrous substances."—A communication from M. Gruvel, jun., Rue Folié, Mericourt, Paris.

2312. JOHANN HEINRICH EVERS, Minories, London, "Improved apparatus for generating steam."

2316. JOSEPH JAMES RAWLINGS, Melbourn, and HENRY WILKERSON, Eversden, Cambridgeshire, "Improvements in machinery or apparatus for washing coprolites."—12*th August*, 1867.

Inventions Protected for Six Months by the Deposit of Complete Specifications.

2345. JONATHAN PEACOCK, Southampton-buildings, Chancery-lane, London, "An improved machine for cleaning barrels or casks."

2352. HENRY BODART and ALFRED SIGODART, Gosselies, Belgium, "Improvements in apparatus for propelling vessels."—15*th August*, 1867.

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

2137. JOHN STENHOUSE, Rodney-street, Pentonville, Middlesex, "Rendering certain substances less pervious to air and liquids and also less liable to decay."—31*st August*, 1864.

2235. ALEXANDER CARNEGIE KIRK, Bathgate, Linlithgow, N.B., "Ice."—13*th September*, 1864.

2269. CHARLES ATTWOOD, Tow Law Ironworks, Durham, "Blast furnaces."—16*th September*, 1864.

2277. RICHARD CHRIMES, Rotherham, Yorkshire, "Hydrants."—17*th September*, 1864.

2113. GEORGE HASELTINE, Southampton-buildings, Chancery-lane, London, "Mechanism employed in the manufacture of boots and shoes."—27*th August*, 1864.

2246. GEORGE HASELTINE, Southampton-buildings, Chancery-lane, London, "Boots and shoes."—15*th September*, 1864.

2665. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Sextants, &c."—27*th October*, 1864.

2089. EDWARD TAYLOR BELLHOUSE and WILLIAM JOHN DORNING, Manchester, "Stopcocks, taps, or valves to be employed in connection with hydraulic pumps and presses."—24*th August*, 1864.

2095. RICHARD BEARD, jun., Clapham, and WALTER DOWNING, Lachmere, Battersea, Surrey, "Artificial leather, and dyeing ordinary leather cloth."—24*th August*, 1864.

2088. ARTHUR AUCKLAND LEOPOLD PEDRO COCHRANE, Portsmouth, Hampshire, "Heating and evaporating liquids and fluids."—24*th August*, 1864.

2126. JOHN LONES, Westbromwich, Staffordshire, "Coating iron with steel."—30*th August*, 1864.

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

2039. STEPHEN GREENWOOD, Butterfield-place, Cropper-lane, Bradford, Yorkshire, "Looms."—24*th August*, 1860.

2190. GEORGE WELLMAN, Lowell, U.S., "Carding engines."—11*th September*, 1860.

2271. GRIFFITH OWEN, Boston Lodge, Merionethshire, "Sawing machines."—18*th September*, 1860.

2033. JEAN HECTOR CHAMBON LACROISADE, Boulevart St. Martin, Paris, "Apparatus for heating tailors' irons, &c., with irons adapted to be used therewith."—23*rd August*, 1860.

2055. ROBERT JOBSON, Dudley, Worcestershire, and ROBERT JAMES RANSOME, Ipswich, "Apparatus used in producing moulds for casting."—25*th August*, 1860.

2063. GEORGE TOMLINSON BOUSFIELD, Loughborough-park, Brixton, Surrey, "Building water craft."—27*th August*, 1860.

Notices of Intention to Proceed with Patents.

571. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in steam and gas engines."—A communication from Charles E. Emery, Brooklyn, New York, U.S.—28*th February*, 1867.

1101. EBENEZER STEVENS, Pentonville-road, Middlesex, "Improvements in steels and forks, and in sharpeners for knives, scissors, and edged tools."

1113. ROBERT ALEXANDER, Islington, Liverpool, "Improvements in compositions to be applied as coatings to preserve the surfaces of metals, wood, stone, and all such materials."

1114. SAMUEL HARRISON, West-street, Warwickshire, "Improvements in watches."

1117. JOHN WEBSTER COCHRAN, Southampton-buildings, Chancery-lane, London, "Improvements in cartridges for breech-loading fire arms."—13*th April*, 1867.

1125. EDMUND BROOK NUNN and JOSEPH PHILLIPS NUNN, Royston, Cambridgeshire, "Improvements in apparatus for separating substances according to their nature or quality, particularly applicable to corn and seeds."

1126. JOHN LEWTHWAITE, High street, Southwark, "Improvements in knife-cleaning machines."

1127. THOMAS WOOD GRAY, Margaret-street, Limehouse, "Improvements in Sir William Snow Harris's lightning conductors for ships, vessels, buildings, and other structures."

1130. ROBERT BOBY, Bury St. Edmunds, Suffolk, "Improvements in ploughs and other agricultural implements, parts of which improvements are also applicable to wheeled carriages."—16*th April*, 1867.

1131. SAMUEL SHORE, Rochdale, Lancashire, "Improvements in apparatus for spinning and doubling fibrous materials."

1132. JAMES SMITH BROOKS, Cambridge Villas, Hackney, Middlesex, "Improvements in the means of colouring tobacco pipes and other articles of meerschaum and massa."

1134. ROBERT BOBY, Bury St. Edmunds, Suffolk, "Improvements in screens or dressing machines for screening or sifting corn, seeds, or other substances."—17*th April*, 1867.

1139. JOHN SCOTT, Oxford-street, London, "Improvements in fire-escapes."

1140. WILLIAM HOLDING and JAMES HOLDING, Wheelton, Lancashire, "Improvements in looms for weaving."

1142. WILLIAM BEGG, Preston, Lancashire, "Improvements in apparatus for admitting and regulating the supply of air to furnaces."

1143. EDWARD LINDNER, New York, U.S., "Improvements in breech-loading fire arms, and likewise the cartridges and balls to be used therewith."

1146. WILLIAM WILKINSON, Jarrow, Durham, "Improved apparatus for catching fish."—18*th April*, 1867.

1147. WILDIAM KIRRAGE, Bridge-road, Victoria Park, London, "An improvement in the manufacture of bricks and other materials without the use of artificial heat for hydraulic and other purposes."

1154. LEVI DAVIS, Edgbaston, Warwickshire, "Improvements in hat guards."

1157. EDWARD HOWELL and THOMAS HARDY, Poole, Dorsetshire, "Improvements in the construction of horse rakes."

1158. RICHARD HASTINGS FRITH Lower Gardiner-street, Dublin, "Improvements in distributing and measuring gas, steam, water, and other fluids, and in the apparatus or means employed therein."

1163. JOHN WEBSTER COCHRAN, Southampton-buildings, Chancery-lane, London, "Improvements in breech-loading fire-arms."—20*th April*, 1867.

1167. JOSEPH NEEDHAM, Piccadilly, London, "Improvements in breech-loading fire-arms."—22*nd April*, 1867.

1177. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "An improved feeder or hopper for centrifugal sugar machines."—A communication from Helem Merrill, New York, U.S.

1178. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "An improved mode of and apparatus for removing the contents from centrifugal sugar machines."—A communication from Helem Merrill, New York, U.S.

1179. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "An improved mode of and apparatus for sprinkling or diffusing liquids for refining sugar and other purposes."—A communication from Helem Merrill New York, U.S.—23*rd April*, 1867.

1183. JOHN HAWORTH, Mode Wheel House, near Manchester, "Improvements in portable apparatus for issuing tickets progressively numbered to passengers in public conveyances and to visitors at public meetings."—24*th April*, 1867.

1198. CLINTON EDGCUMBE BROOMAN, Fleet-street, London, "A new or improved process of destroying vegetable matters in wools, noils, woollen waste, and rags."—A communication from Constant Schaller, Bischwiller, France.

1204. HUGH SMITH, Much Hadham, Herts, "Improvements in preparing turnips and mangel-wurzel for food of animals."—25*th April*, 1867.

1217. GEORGE POLLARD, Hayfield, Derbyshire, "Improvements in apparatus for reducing and regulating the quantity and pressure of steam, fluids, and gases."—26*th April*, 1867.

1239. MARC ANTOINE FRANCOIS MENNONS, Southampton-buildings, Chancery-lane, London, "An improved alarm apparatus for indicating and registering the rise of water in the holds of ships or vessels."—A communication from Charles Benjamin Norton, Champ Elysées, Paris.—29*th April*, 1867.

1254. ALEXANDER MELVILLE CLARK, Chancery-lane, London, "Improvements in the manufacture of sugar."—A communication from Louis Joseph Frédéric Margueritte, Boulevart St. Martin, Paris.—30*th April*, 1867.

1274. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "Improvements in ribbon looms."—A communication from Anthony Barrallon, St. Etienne, France.

1284. THOMAS WOOD, Manchester, "Improvements in safety valves and arrangements for preventing damage to or the explosion of steam boilers."—A communication from Murdock Macpherson, Baltic Ironworks, St. Petersburg, Russia.—2*nd May*, 1867.

1548. GEORGE HOWARD, Berners-street, Oxford-street, London, "Improvements in the construction of parquet flooring."—24*th May*, 1867.

1676. JEAN PETRZYWALSKI, John-street, Adelphi, London, "An improved camera obscura."—7*th June*, 1867.

1709. RICHARD HORNSBY, JOHN BONNALL, and HENRY SHIELD, Lincoln, "Improvements in thrashing machines and other machines for dressing and separating grain, and in rotary screens to be used therein, and for other purposes."—11*th June*, 1867.

1865. ALEXANDER CÆSAR FREDERICK FRANKLIN, Princes-square, Bayswater, "Improvements in steam engines."—26*th June*, 1867.

1881. JOSEPH ROCK COOPER, Birmingham, "Improvements in breech-loading fire-arms."—27*th June*, 1867.

2134. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "An improved apparatus for cleaning boiler and other tubes."—A communication from John Baptiste Christoffel, Samuel Booth, and Samuel Booth, jun., New York, U.S.

2136. HERMANN VON SCHLAGINTWEIT-SAKUNLUNSKI, Weymouth-street, Portland-place, London, "Improvements in transferring devices in lace and other fabrics and facsimiles of textures on to printing surfaces, and in the application of the devices and textures obtained from such surfaces."—22*nd July*, 1867.

2153. RICHARD BROWN RODEN, Usk, Monmouthshire, "Improvements in breech-loading fire-arms."—24*th July*, 1867.

2163. WILLIAM WOOD, Monkhill, near Pontefract, Yorkshire, "Improvements in producing and treating fibres from rags, and in apparatus for the same."—25*th July*, 1867.

2191. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "Improvements in machinery for hulling rice and other grains."—A communication from Simon Gardner Cheever, Boston, Massachusetts, U.S.

2194. DAVID HODGE, Hatton-garden, London, and ROBERT CHRISTOPHER WITTY, Laurel-street, Dalston, Middlesex, "Improvements in apparatus to be used in making gas from petroleum and other liquids."—29*th July*, 1867.

2214. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, "An improved machine for manufacturing weavers' harness."—A communication from Joseph Sprague Winsor and William Walton Fletcher, Providence, Rhode Island, U.S.—31*st July*, 1867.

2227. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "Improvements in breech-loading fire-arms."—A communication from Theodore Yates, Milwaukee, Wisconsin, U.S.—1*st August*, 1867.

2238. JAMES DEWAR, Kirkcaldy, Fifeshire, N.B., "Improvements in preserving substances for food."—2*nd August*, 1867.

2247. CHARLES TOUAILLON, jun., Paris, "A new and improved means of utilising all the parts of all sorts of feathers."—A communication from Jean Louis Frédéric Bardin, Boulevart Sebastopol, Paris.—3*rd August*, 1867.

2253. GEORGE WHITE DINSDALE, Upper Norwood, Surrey, "Improvements in the construction and manufacture of traps for water-closets, drains, and other purposes."—3*rd August*, 1867.

2259. WILLIAM JOHN PUGHSLEY, Llantarnam, Monmouthshire, "Improvements in obtaining sulphuric acid from the refuse 'pickle' or liquor used in wire and galvanising works."—5*th August*, 1867.

2267. THOMAS WHITTAKER and MARTIN ROURKE, Manchester, "Certain improvements in the preparation of waterproof paper."—6*th August*, 1867.

2279. RICHARD HENRY MICHELL, Cockspur-street, Charing Cross, Westminster, "Improvements in dredging machinery and apparatus or appliances for the stowage and discharge of substances dredged up, the said apparatus or appliances being applicable to lighters, barges, or vessels used for other purposes."

2282. ERASMUS THOMAS HORSLEY, Pye Bridge, Alfreton, Derbyshire, "Improvements in treating cast iron."—7*th August*, 1867.

2324. BENJAMIN FRANKLIN STURTEVANT, West Roxbury, Norfolk, Massachusetts, U.S., "Having reference to blowers for furnaces, &c."—13*th August*, 1867.

2345. JONATHAN PEACOCK, Southampton-buildings, Chancery-lane, London, "An improved machine for cleansing barrels or casks."—15*th August*, 1867.

All persons having an interest in opposing any one of such applications should leave particulars in writing of their objections to such application at the office of the Commisioners of Patents, within fourteen days of its date.

List of Specifications Published during the week ending 24th August, 1867.

3429, 6d.; 101, 4d.; 102, 8d.; 103, 10d.; 104, 4d.; 105, 6d.; 106, 6d.; 107, 8d.; 109, 6d.; 110, 4d.; 111, 4d.; 112, 4d.; 113, 1s. 4d.; 114, 4d.; 115, 8d.; 117, 4d.; 118, 4d.; 119, 1s. 4d.; 120, 4d.; 121, 4d.; 123, 10d.; 125, 1s.; 126, 10d.; 127, 1s. 4d.; 129, 1s.; 130, 4d.; 132, 4d.; 135, 8d.; 136, 4d.; 137, 6d.; 138, 8d.; 139, 4d.; 140, 4d.; 141, 4d.; 142, 8d.; 143, 10d.; 144, 4d.; 145, 10d.; 146, 4d.; 147, 10d.; 148, 4d.; 149, 10d.; 150, 10d.; 151, 4d.; 152, 4d.; 153, 4d.; 154, 6d.; 156, 10d.; 158, 8d.; 160, 10d.; 161, 8d.; 199, 8d.; 485, 8d.

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

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

162. W. EXALL, *Reading*, "*Boiler apparatus of portable steam engines.*"—*Dated* 22*nd January*, 1867.

This invention relates to the application of dampers to the different rows of tubes, so combined and arranged as to produce a differential action, whereby the whole of the tubes shall be closed, more or less, at same time, and at all times in such proportion that the heat in the whole of the tubes shall be equal or nearly so, whether much or little duty is required of the engine; or it may even be while standing, and the heating effect reduced to a minimum.—*Not proceeded with.*

166. W. E. NEWTON, *Chancery-lane, London*, "*Injectors for steam boilers.*"—*A communication.*—*Dated* 22*nd January*, 1867.

This invention consists, in the First place, in placing the injector within the water tank, and below the surface of the water. By this means the outer jacket or casing of the instrument, and also some of the cocks, taps, unions, and other fittings, are dispensed with, so that, by simplifying the construction of the instrument, it may be rendered less expensive to manufacture. The injector consists of one single casing, through which a double conical passage or hole is made for the passage of the water, which obtains access to the interior through transverse holes made near the inner or butt end of the instrument, which at this end is provided with a flange, whereby it may be secured to the side of the water tank by bolts or otherwise. The steam nozzle is inserted through an opening at the butt end of the injector, and is secured in place on its seat by a screw clamp which is inserted from the outside, and also serves to secure the steam supply pipe in its place. The exit end of the steam nozzle is made conical or funnel-shaped, so that in fact, the passage through the nozzle is made in the form of two frustrums of cones, with their small ends opposite to each other. The passage through the water injector is also formed in much the same manner, but, in addition, there are transverse openings made through the injector at or near the smallest part. Through these transverse openings in the water passage any excess of water under pressure will escape back into the tank, but in order to prevent any undue escape, these openings are covered with a piece of india-rubber tubing, which is split up a certain distance longitudinally so as to form a valve for each of the openings. The india-rubber tubing is held in position by a metallic ring which embraces it.—*Not proceeded with.*

Class 2.—TRANSPORT.

Including Railways and Plant, Road-Making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

154. J. EDWARDS, *Ealing*, "*Horse-shoe cushion.*"—*Dated* 21*st January*, 1867.

In performing this invention the patentee proposes to form the cushion of india-rubber, gutta-percha, felt, cork, or any combination thereof, or of any other suitable soft material or compound, but he prefers to use india-rubber strengthened by a woven or other textile fabric on one or both surfaces. The upper surface of the cushion is made to correspond with the outline of the shoe, the upper surface fitting the surface of the hoof, and being chamfered or bevelled to fit the interior of the hoof; the underside of the cushion is made with a flange on the interior outline, and outside this flange the inner side of the shoe fits, and thus keeps the cushion in a firm and immovable position. The shoe is nailed or secured to the hoof in the usual manner, the cushion intervening; the nails passing through the cushion serve further to secure the cushion from displacement, and the webbing or fabric prevents the bulging of the cushion, which might otherwise be caused by the weight of the horse, and the pressure resulting from travelling on hard roads, especially during hot weather.

157. T. M. GLADSTONE, *Strand, London*, "*Ships' anchors.*"—*Dated* 22*nd January*, 1867.

This invention has for its object an improvement in ships' anchors, and consists in making each arm in one separate piece, and each of these separate from the shank, although two of the said arms may be welded together at the two stop points of the cross plates instead of being screw-bolted or rivetted together. The arms act in like manner to the anchors known as Hawkins' anchor, patent No. 4589, dated 11th September, 1821; but instead of the anchor shanks grasping the united arms, and the arms revolving in the shank, each arm of this anchor is welded to a face plate at right angles to it at the crown end, and of a triangular form, as most suitable, and of a proportionate thickness. At each apex of the plate are punched or drilled holes; two arms are then bolted together at two of these holes opposite to each other, and between them are collars, so as to fix them at any given distance, according to the thickness of the shank, and those two bolts form the fulcrum supports and prevent the arms from passing beyond the proper angle for holding with relation to the shank. The said collars between the two bolts are so adjusted

as to allow the shank of the anchor to traverse freely between the two plates, and when introduced, the plate apex at the third hole and the head of the shank form the crown of the anchor. At the corresponding end of the anchor shank a hole is formed of like diameter with those in the two plates, and when a pin or bolt is passed through it forms the pivot on which the shank rotates so far as the two collared bolts on either hand will allow, these being adjusted so as to bring the angle of the arms and the shank into about forty-five degrees divergence from each other.—*Not proceeded with.*

165. H. BRIDGEWATER, *Watford, Hertford*, "*Turntable.*"—*Dated* 22*nd January*, 1867.

This invention consists in providing for an equal sustaining power on the main and transverse tracks, and in making the rails which form the tracks for carriages to pass over material parts of the framing of the turntable.

179. L. THORNTON, *Shalford, near Guilford, and* E. THORNTON, *Croydon*, "*Railway sleepers and chairs.*"—*Dated* 24*th January*, 1867.

In carrying out this invention the inventors construct the sleepers of iron or other similar hard metal, or other hard material, and such sleepers (which should be of the transverse kind) he forms with notches or cuts near each of the ends in order to allow the chairs to be properly fitted on to the sleepers without making it a matter of necessity to use bolts or other fasteners. Each chair is constructed so as to fit into the said notches or cuts, for which purpose it has at its under part grooves or ears, or grooved pieces, the grooves clipping the sleeper and holding the chair and sleeper firmly fixed together.—*Not proceeded with.*

195. W. BURLEY, *Birmingham*, "*Securing lamps for railway and other carriages.*"—*Dated* 25*th January*, 1867.

This invention relates to carriage lamps, and consists of a new form of lamp iron and fastener for securing the lamp to the carriage. The lamp iron which is fixed to the carriage is made solid throughout, the free end terminating in a screw. At the side of the lamp is formed to receive the end of the lamp iron above-mentioned, the screwed portion of which enters a nut fitted to the top of the socket, so that it can rotate freely without moving longitudinally. A few turns of this nut will secure the lamp in the required position or release it therefrom.—*Not proceeded with.*

197. J. C. HADDAN, *Bessboro'-gardens, Pimlico*, "*Anchors.*"—*Dated* 25*th January*, 1867.

This invention consists in causing anchors to readily take a hold of the ground when falling at random. The inventor constructs them with the arms and flukes (while being disposed with reference to the shank as heretofore in respect of being bent or curved upwards or forwards towards the end of the shank to which the cable is to be attached) not disposed as heretofore in respect of being in end view, or as seen looking in the line or direction of the shank, with the arms or flukes in a generally straight line, but instead thereof, being disposed with the arms and flukes in a generally curved line formed more or less like the letter S, with the middle or meeting on two curves of the S situate across the shank. The invention also includes the inclination of the palms so that the effect may be, when the shank is pulled, to raise one or other of the palms (with its arm) whichever may be presented downwards to enter the ground, and form for itself and work itself into the ground in an inclined or screw-like path. The inventor dispenses with the stock or cross-bar.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1. W. *and* J. W. WOOD, *Monkhill, near Pontefract, Yorkshire*, "*Manufacture of fibrous yarns or threads and in apparatus for the same.*"—*Dated* 1*st January*, 1867.

This invention consists in making cored fibrous yarns or threads from mixtures of different lengths, kinds, or colours, of fibres or threads, in such manner that any desired kind or colour of fibres or thread is placed on the outside of the yarn, and the other forms the inside or core.—*Not proceeded with*

37. C. PRESTON, G. DANIA, W. HOUGHTON, *and* R. BOTTOMLEY, *Rochdale*, "*Improvements in or applicable to mule and like machines for roving, slubbing, spinning, twisting, and doubling cotton, &c.*"—*Dated* 5*th January*, 1867.

The First part of this invention relates to an arrangement of mechanism for giving the movements to the "cam shaft" of mules and like machines, and consists in the use of a ratchet wheel which is made constantly to rotate on the axis of the cam shaft, and in arranging a "pawl" or "click" to be carried by or jointed upon a part from or in connection with the cam shaft, the pawl being pressed towards the teeth of the ratchet by a spring, so that, when one of the stops is withdrawn a pin or projection from the pawl or click will be released, and the pawl will be forced into the teeth of the ratchet, which will thus carry the pawl and cam shaft round with it, until one of the stops comes in contact with the projection from the pawl, which will then be lifted from the teeth of the ratchet, and the movement of the cam shaft will be arrested at the same time. This releasing and lifting of the pawl or click takes place once for each movement of the cam shaft. The Second part of the invention relates to an arrangement and combination of mechanism for stopping and starting the rollers, or opening and closing the jaws or slides by or through which the material to be spun is delivered. The Third part of the invention relates to an arrangement and combination of mechanism for giving increased speed to the mule after the stretch has commenced.—*Not proceeded with.*

53. W. WOOD, *Monkhill, York*, "*Manufacture of Jacquard tapestry.*"—*Dated* 8*th January*, 1867.

In the manufacture of terry and cut pile carpets the piled surface is ordinarily composed of worsted threads, which are spun from wool and afterwards dyed the required colours. The object of this part of the present invention is to lessen the cost of the pile surface so as to make pile carpets more generally used, and this the inventor does by making the pile yarns from stuff, worsted, and woollen cuttings, and rags, or other fibrous semi-waste matters. These cuttings, rags, or waste being mostly dyed, he sorts out therefrom the different colours, putting all of one colour together, preferring when such cuttings, rags, or waste contain any cotton or linen to decompose the vegetable matters by acids, and then tear or grind them up into coloured wool, and spin into threads or yarn, redyeing or tinting when required, and generally mixing the coloured wool produced from these articles in varying proportions with new wool or other new fibres in the composition of the yarns. From these yarns he forms the raised or pile surface of Brussels, tapestry, and plain and printed terry, and cut pile carpets in the usual mode, the pile surface being either wholly formed therefrom or in combination with ordinary yarns.—*Not proceeded with*

62. J. M. HETHERINGTON, *Manchester*, "*Machinery for preparing cotton and other fibrous material for spinning.*"—*Dated* 9*th January*, 1867.

The First of these improvements is in the carding engine, and refers to that arrangement in which self-stripping flats are employed, turning upon hinges for the purpose of enabling them to be stripped. Hitherto these hinges or centres of motion have been movable for the purpose of adjusting the position of the flats. According to this invention the patentee fixes the said hinges or centres of motion permanently to the framework, and he renders the flats adjustable by mounting them on slides which can be regulated in position by screws. Another improvement in the carding engine relates to stripping the back flats more frequently than those in the front. To effect this he places a greater number of triggers for causing the flats to be turned at the back part of the machine than at the front, in conjunction with a segment ratchet which moves forward a certain distance and then returns. Another part of the invention relates to slubbing, roving, or other such machines, and consists, firstly, in a method of counterbalancing the top rail. For this purpose he applies a longitudinal weighted lever turning upon an adjustable centre. This lever is connected to another in which is a projecting part extending to the rail to be balanced. The adjustable centre above mentioned enables the apparatus to be adapted between two spindles. Also in such machines he adapts a covering to the lifting shaft, which covering also extends to the bottom shafts; also he covers the said casing at bottom to prevent the flyings from reaching the floor.

12. J. C. ELLISON, *Shelfdye Works, near Halifax*, "*Apparatus for folding fabrics, and also for holding and inserting cardboards, metallic plates, or other substances between the folds of fabrics to be pressed.*"—*Dated* 2*nd January*, 1867.

This invention consists in the employment of a musical box or receptacle divided into two compartments, each of suitable size and form to hold a necessary quantity of the cardboards, metallic plates, or other substances to be inserted betwixt the folds of a fabric required to be pressed. A slit or slot is made at the decision, or betwixt the compartments, for the fabrics to pass through. Each compartment is open at both top and bottom, and the sides nearest to the slit do not extend so low, or are not of the same depth as the other sides; thus, when the box rests on the flat surface of a table, an opening or aperture is formed to each, which are adjustable to the exact thickness of one of the cardboards, metallic plates, or other substance employed for insertion. Or these openings may be formed at the top of the box for the cards or plates to be issued from the top instead of the bottom of the box. The box or receptacle may either be mounted on wheels to run on rails or may be formed to slide in grooves upon or over a suitable table or frame. A platform the size of the cardboards or plates is employed for the fabric to be folded upon, which fits easily within an opening in the table or frame, and is capable of being moved up or down for adjusting the upper surface (as the fabric is folded thereon) to the level of the table top or the bottom of the box, which motion may be effected either by means of ratchet wheels and catches, rack and pinion, levers and cams, eccentrics and straps, or other suitable mechanical equivalents actuated by or from the motion of the box, or in connection therewith; or other suitable means may be employed for giving motion thereto. Reciprocatory motion may be given to the box by crank and rod from a rotary shaft, to which power is applied; or other means of producing reciprocating motion may be employed. The fabric to be folded is first passed between a pair of feeding rollers, then through the slit, and the end thereof is attached to the platform, when the motion of the box in one direction spreads it over the said platform, and at the same time distributes or issues one of the cardboards or metallic plates from one of the compartments of the box, and on the return movement of the box a fold of the fabric is made, and another card or plate is issued from the other compartment, which is afterwards inserted between the folds, and so on with each to-and-fro movement of the said box.—*Not proceeded with.*

86. W. E. GEDGE, *Wellington-street, Strand, London*, "*Machine and preparation for dressing and finishing cloth.*"—*A communication.*—*Dated* 12*th January*, 1867.

The frame of this machine may be of cast iron, of wood, or any suitable material. The machine is composed of seven fluted cylinders, turning two and two in inverse direction, and plunging into a reservoir containing the dressing preparation, of which use is made; they are sufficiently near to each other to draw along the stuff to be finished by a press roller movement, and to fix the flock by means of the preparation intended for this purpose. These cylinders are furnished at one of their ends with pinions gearing with a toothed wheel, which partly dips in the preparation. Three other cylinders, made of wood, and arranged outside the reservoir, guide the cloth at its entrance upon and as it leaves the fluted cylinders. The dressing bath is heated by means of steam brought into the bath by a pipe from a generator placed near it. A reservoir placed at an upper level communicates by a pipe with that above mentioned, and feeds it with the dressing preparation, thus constantly maintaining the same level. The apparatus is set on a table slightly inclined towards one of its angles; this table is arranged so as to receive the pieces of cloth as they issue from the bath, and directs their droppings or drainings into a reservoir placed near it for this purpose and at a lower level. Motion is communicated to the machine from a motor of any description, working within or without the workshop, according to the space at disposal. Baths for feeding the machine:—First, the inventor has a reservoir to contain about forty-four gallons (200 litres); Secondly, for twenty-two gallons (100 litres) of water he takes 22 lb. (ten kilos.) of colza, 22 lb. of linseed, and 17½ oz. (500 grammes) of alkali, or thereabouts; he boils the whole during an hour, and then places it in the 44-gallon reservoir. He then fills the boiler with water, and dissolves in it 22 lb. of glue, 11 lb. (five kilos.) of fine soap, 4 lb. 6 oz. (two kilos.) of starch, 17½ oz. (500 grammes) of borax, and 17½ oz. of sal-ammoniac, or thereabouts; he pours the whole into the 44-gallon reservoir, and keeps it in motion by means of a scraper. Then he passes the whole through a filter, and places it in the reservoir of the machine, which should be capable of holding about 220 gallons (1000 litres). By this process cloths will be obtained strong, glossy, supple to the touch, and without dust.—*Not proceeded with.*

93. W. E. NEWTON, *Chancery-lane, London*, "*Looms for knitting.*"—*A communication.*—*Dated* 14*th January*, 1867.

This invention consists, First, in the use of revolving and vibrating a Jacquard pattern cylinder, in combination with sliding needles on a straight frame, for the purpose of knitting irregular tubular work, such as stockings, drawers, shirts, gloves, and other like articles; Secondly, in combining and operating, in connection with two rows of needles, two Jacquard pattern cylinders that are at times both thrown forward together, at other times thrown forward alternately, first one and then the other, and at times cease to revolve, according as the style, character, or shape of the article that is being knitted may require; Thirdly, in interposing wires between the Jacquard pattern cylinders and the needles by which the needles are operated, and which admits of making the cylinders small, and operating them readily without interfering with the other working portions of the machine; Fourthly, in the use of nibs or projections on the wires that are interposed between the Jacquard and the needle, and which drive the needles, and remote from the ends of such wires, so that needles in the line of such nibbed wires may be moved forward far enough by the bars in the Jacquards to catch and hold the loops but not to knit, the making of holes in the knitted work being thus prevented; Fifthly, in the combined use of a pattern wheel having a toe and heel segment thereon, and the Jacquards for operating the pawls or dogs, whereby the Jacquard cylinders are turned on their axis; Sixthly, in a thread or yarn tension regulator in combination with a knitting loom or machine, which regulator can be adjusted at any time whilst the machine is in motion; Seventhly, in combining in a knitting loom or machine two rows of needles and two crossheads (each crosshead carrying a yarn or thread), and an intermediate needle or needles in the central part of the rows of needles for the purpose of knitting up the legs of a pair of drawers, then uniting them to or running them into the body portion of the drawers, and finishing the body, and then commencing and knitting up two legs and then a body for another pair of drawers, and so on continuously.

113. J. CRAVEN, *Thornton, near Bradford*, "*Apparatus for fringing shawls, &c.*"—*Dated* 16*th January*, 1867.

This invention consists in the application to ordinary sewing machines of certain mechanical parts for the purpose of rendering them capable of producing fringe on shawls, mantles, or other similar articles simultaneously with the process of hemming such fabrics by the same machine. An arm capable of oscillatory motion carrying a needle is employed for introducing the yarn or thread to form the fringe, which needle is inserted through the edge of the hem, or the folded edge of the fabric, when formed by an ordinary folding instrument, the said needle thus passing the yarn between the fold of the fabric. The ordinary hemming needle with its thread is then inserted laterally through the folds of the fabric, and between the fringing needle and its yarn, at right angles thereto, and on the withdrawal of the said fringe needle the fringe yarn forms a loop around the stitch or thread introduced by the hemming needle. The fringe needle is then withdrawn and carried by the oscillatory arm outward or away from the hem of the fabric a suitable distance, according to the length the fringe is required to be made, when the fringe yarn is caught by a hook, which, on the return movement of the said oscillatory arm and needle, holds the yarn in a loop at the out end of the intended fringe, and after another insertion of the said fringing needle has been made into the hem of the fabric, a knife or other cutting instrument is caused to enter into or betwixt the said yarn which forms the loop and severs it. A foot or projection is formed on the ordinary fabric holder, which passes between the folds or the hem of the fabric, holding the hem slightly open for the fringing needle to enter freely in betwixt the folds thereof. The fringe is thus secured between the folds of the hem, the stitching thereof passing laterally through the hem and the loops formed of the fringe yarn. Motion is communicated from the main shaft of the sewing machine by gear wheels to an additional shaft, on which are tappets or cams adjusted or set to act at proper times for giving motion to the oscillatory arm or fringing needle, also to the holding hook and to the cutting instrument. A carrier or stud wheel is introduced between these gear wheels to admit of change wheels being used, whereby any number of stitches by the hemming needle may be introduced for one stitch of the fringing needle, so as to have the fringe yarns any distance apart from each other, or to produce either thick or thin fringes as may be required.

116. W. HOWARTH *and* M. PEARSON, *Bradford, and* J. PEARSON, *Thornton, Yorkshire*, "*Jacquard engines.*"—*Dated* 17*th January*, 1867.

This invention consists essentially in making two of the usual Jacquards uprights or hooks of one piece of bent wire.

127. E. J. SMITH, *Halifax*, "*Apparatus for the manufacture of 'lingoes' used in looms for weaving, &c.*"—*Dated* 18*th January*, 1867.

This invention relates, chiefly, to means of manufacturing articles technically known as "lingoes," which are small weights usually made of or from round wire cut to suitable lengths, flattened at one end, and having a hole or eye in the part so flattened. The improved machinery or apparatus consists of two levers mounted on an axis after the manner of a pair of pincers or nippers, attached to which are two steel dies or nipping jaws, so arranged that when the said levers or pincers are closed upon a piece of wire placed between them, the wire is flattened thereby, as required. A punch is also fixed in one of the said dies exactly opposite to a hole in the other, so that when the said nippers are closed upon the flattened part of a wire placed between them, a hole or eye will be punched or formed therein. This punch is passed through the die from behind, where it is supported by a set screw or cottar, and prevented from being drawn forward by an enlargement at the back, or by being made taper in form. These pincers are closed by tappets or cams revolving between the arms thereof, and opened by a spring, and may be moved up and down by cams, so as to bring the flattening dies and the punch alternately opposite the wire lying between them; or the wire itself may be moved alternately into the proper positions to be flattened and punched. The wire is drawn intermittently through an ordinary dressing plate or straightening apparatus by ordinary drawing tongs, and passing the dies or nippers and punch above described is flattened and punched or perforated thereby, it is then cut off to the required lengths by cutters fixed in the drawing tongs. But in order that any required length of wire may be cut off exactly at the flattened part, or at any given distance therefrom, the mean distance between the pincers and the cutting tongs must be variable.

129. C. E. BROOMAN, *Fleet-street, London*, "*Manufacture of lace.*"—*A communication.*—*Dated* 18*th January*, 1867.

The object of this invention is the mechanical manufacture of true purl lace, or purl border (*picots de dentelle*). The characteristic feature of the invention consists in curling or turning back the threads upon themselves by means of one or several lacing threads brought into the first by a simple or multiple transverse or longitudinal passage These threads, which are submitted to determine degrees of tension, co-operate by their enlargement and their tension in the formation of the curls, and they constitute a sort of network or skeleton, forming a temporary support, which is afterwards separated simply by drawing the finished work to allow the purls to appear perfectly disengaged. The work may be effected automatically by the aid of ordinary lace machines, and either carriage threads or warp threads may be employed for the formation of the purls and of the lacing.

141. J. J. *and* E. HARRISON, *Manchester*, "*Looms for weaving.*"—*Dated* 19*th January*, 1867.

This invention relates, first, to that portion of the loom termed the "warp beam," and consists in a novel arrangement and application of a break to the same, whereby any degree of tension can be given to the warp, and at the same time effecting upon the same an even and regular tension during the operation of weaving. Secondly, the invention relates to a novel arrangement and adaptation of mechanism to the weft fork for actuating the same, in place of the tappet and lever now employed. Thirdly, the invention relates to a novel arrangement of rollers to be employed for taking up the woven cloth. Lastly, the inventors employ adjustable fronts to the boxes of looms termed shuttle.—*Not proceeded with.*

153. W. M'ANDREW. *King William-street, London*, "*Machinery for ginning cotton.*"—*A communication.*—*Dated* 31*st January*, 1867.

For the purposes of this invention the roller is, as heretofore, covered with leather, and has a spiral groove around it. Against the ginning roller a doctor, or straight knife, is pressed by springs, as is usual with this class of cotton gins. The surface of the roller moves upwards towards the doctor. To these parts is applied a beater bar, which has numerous beaters fixed to it, the edges of the lower ends of which are moved quickly to and fro along the lower edges of the doctor, and in close proximity therewith, so as to move the seeds from the cotton; these beaters are by preference of polished steel. The extent of motion of the beater bar is arranged to be capable of adjustment in order to suit its action to different lengths or staple of cotton fibre. The beaters are fixed on the beater bar parallel to each other, and at right angles to the doctor; they are also set at a short distance apart—generally between one and two inches apart.—*Not proceeded with.*

156. W. J. *and* H. HARRISON, *and* B. CROASDALE, *Blackburn*, "*Looms.*"—*Dated* 22*nd January*, 1867.

This invention is applicable to the looms in which a loose reed is employed, and it consists in dispensing with the usual stop rod, which in looms of the ordinary construction is supported in bearings fixed to the lay bottoms, and to which the back rib of the loose reed is connected. In performing this invention the patentees hinge the said back rib to the lay bottom, and to the back rib are fixed the levers or feelers, technically called "duck bills." These duck bills are usually fixed to the stop rod, and they pass under stop pieces as usual when the reed is near the fell of the cloth to hold the reed when the weft is beaten up. The above-described improvement may be used either with or without a stop finger jointed to the lay bottom, which stop finger is acted upon by one of the duck bills above referred to, and when the shuttle is caught in the shed, comes against a projection on the spring lever and releases it from its retaining notch, thereby throwing the driving strap from the fast to the loose pulley and stopping the loom.

170. S. AND G. COOK, *Bury, Lancashire*, "*Weft forks used in looms.*"—*Dated* 23*rd Jauary*, 1867.

According to this invention the inventors stamp or punch the prongs and frame of each fork out of sheet metal, and form the bearing or barrel of a separate piece of tube or drilled metal, and then braze or solder the bearing to the frame, there being a semicircular recess shaped to receive it.—*Not proceeded with.*

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour, Mills, &c.

57. R. WINDER, *Abingdon-street, Westminster*, "*Machinery for pocketing hops for puddling dams, for punning back of long retaining walls, river or sea embankment facings, &c.*"—*Dated* 9*th January*, 1867.

This invention consists in a means of pressing hops into pockets by means of feet or treaders working inside the pocket, the said feet or treaders being worked so as (as nearly as possible) to represent the treading of men's feet, the said feet being worked by two cranks on a shaft. The feet are connected to the crank shaft by long rods, and the crank shaft is turned by hand in a similar manner to a double-throw pump. The frame that supports the crank shaft is itself supported by a central bar fixed to the ceiling above; the outer part of this frame is supported upon friction rollers running on a race or flat ring of iron. This frame is made to revolve either by a pawl working along a ratchet wheel laid on the floor of the vast house, the pawl being worked by an eccentric keyed upon the crank shaft or the frame is made to revolve by cog wheel gearing connected from the crank shaft to the ratchet by shafting. In this case curved segments of teeth are fixed to the outside of the ratchet so as to form a large horizontal fixed cog wheel, in which a small pinion works that is keyed to a vertical shaft, which has at the other end a mitre wheel fixed, which wheel works in another mitre wheel fixed upon the crank shaft. The use of this frame revolving is that the feet or treaders work round and round inside the pocket so as to tread the hops evenly and perfectly all alike. The pocket does not revolve, and to regulate the pressure upon the hops the pocket is suspended by four chains or ropes to weights. These weights are added or taken away according to the pressure required. The chains or ropes just mentioned pass over pulleys fixed on to the under side of the flooring.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

79. H. BUSS, M.D., *High-street, Shoreditch, London*, "*Improvements in constructing quays, jetties, piers, sea walls and breakwaters, in the formation of reservoirs, docks, basins, coast harbours, harbours of refuge, lighthouses, and sea batteries, applicable also for the reclamation of land and for the building of bridges.*"—*Dated* 11*th January*, 1867.

This invention comprises, among other features, the construction in a suitable dock of a framework of iron, efficiently supported by internal framing, and covered externally on every side but the top with sheets of iron so rivetted to the said framework as to form a watertight vessel. The precise shape of such vessel will vary according to the structure it is designed to erect. When a jetty, pier, breakwater, or sea battery is to be constructed the transverse section of such watertight vessel will be of a pyramidal form, truncated at the apex, of the full height and width of the intended structure, and in length varying according to need from 100ft. to 1000ft. The ends thereof will be square, oblique, circular, or of any other suitable form. The framing of the bottom will vary according to the nature of the bed on which it is to rest. The entire iron jacket internally and externally will be coated with an incorrodable marine paint. Each pyramidal vessel, when completed, will be floated from the dock into open water, and be so weighted with blocks of stone, rubble, or concrete as to sink it to a convenient depth. Next it will be towed to its destination, and have as much water admitted as will compel it to sink down to its suitably prepared bed; and after it has settled down in position sufficient blocks of stone rubble or concrete will be introduced to prevent, by their own weight, the vessel being filled up at high water. The contained water will be withdrawn, and provision being made in the internal framing each pyramidal segment will, when deemed necessary, be invariably fixed to its sea or river bed by piles, iron bolts, screws, or otherwise, being driven through the bottom into its bed, and also into the end of the next segment. Finally concrete will be poured in as quickly as possible until each pyramidal vessel is filled therewith. In some cases it will be more expedient when the pyramidal vessel has arrived at its destination to sink it at once by filling it up with concrete, instead of overweighting by the introduction of water as above.

81. J. HOADLY, *Dover*, "*Apparatus for preventing wind, draughts, and water from passing under doors, casements, &c.*"—*Dated* 12*th January*, 1867.

This invention consists in the following apparatus:—In the under edge of the door or casement the inventor forms a groove in which is a metal rod of the length required. It is caused to project a little from the hinder edge of the door, so that when the door frame pushes the rod forwards in the groove, he prefers that the rod should project and press against a screw in the door frame or jamb, so that by withdrawing the screw or screwing it in farther compensation may be made for a sinking of the door, or in summer time when the apparatus may not be required, by means of a bent lever attached to the aforesaid metal rod, motion is given to a lath or board in such a way that when the rod is pushed forward when the door is shut the board or lath is pressed down upon the floor or carpet and prevents wind, dust, or water from coming underneath. In the same manner when the door is opened and the end of the rod released from pressure, it is pushed out by a spring on the underside of the lever, which causes the lath to rise so as to pass over the inequalities of the floor or other obstacle. It is preferable to insert two or more levers so as to raise the lath or board at different points, but if the door be narrow one only need be used.—*Not proceeded with.*

123. D. BARKER, *Northfleet*, "*Apparatus for mixing, pressing, or moulding coal and other substances for the formation of artificial fuel, and dividing the same into blocks.*"—*Dated* 17*th January*, 1867.

The body of this machine is a rectangular receptacle placed upon a bed plate, a vertical shaft mounted in suitable bearings being placed in the centre thereof. The upper portion of the shaft is furnished with blades or knives affixed thereto at convenient distances from each other, and to the lower end thereof is attached eccentrically a circular disc so as revolve therewith, as hereinafter mentioned. The disc is placed in the interior of a rectangular box of cast iron or other suitable material, such box fitting the interior of the lower portion of the before mentioned receptacle, but free to move therein. Upon the bed plate, at each end of the main body of the machine, and extending beyond the same, is placed a series of tubes of rectangular section, such tubes being constructed of cast iron or of any other suitable material. The upper portions of such tubes which are within the body of the machine are open for the admission of the substances under treatment, as hereinafter mentioned. Above the tubes, and within the main body of the machine, are hollow iron rollers, the faces of which have slots formed therein, through which slots project iron points or teeth, the same being mounted loosely on eccentric spindles in the interior of the rollers, in such manner that they shall project the required distances from the faces of the rollers during the revolution thereof. The rollers forming each pair revolve in contrary directions, so as to draw down between them, by means of their motion and of the points or teeth, the substances under treatment. The substances to be submitted to the operation of the machine having been, if necessary, prepared in a pug mill, or in any other suitable manner, are conveyed by means of endless bands, or in any other convenient mode, and introduced at each end of the machine on either side of the central shaft. Upon the central shaft being caused to revolve (the revolution of which, together with that of the before-mentioned rollers, is effected by means of wheels and gearing actuated by any suitable motive power, as well understood), the materials introduced into the machine are subjected to the action of the knives or blades, and also of the points or teeth carried by the rollers, and being thereby mixed and incorporated pass into the before-mentioned horizontal tubes. By the action of the eccentrical disc the rectangular box in which the same is contained is alternately moved backwards and forwards so as to force the materials through the tubes towards their respective extremities, the entrance of such materials into the tubes being alternately permitted and prevented by the motion of the box. In order to guide the materials into the respective tubes, and also to clear the sides thereof, metal plates coinciding with the interior of the tubes are attached to each end of the box, and move therewith in each to-and-fro motion. The effect of forcing the materials into the tubes, as before mentioned, is to compress such materials by means of the

friction which takes place against the internal surfaces of the tubes, the length and capacity of which proportions the dezree of compression. At any desired distance from the respective ends of the tubes are arranged knives or other analogous cutting or dividing contrivances working through the tubes, the same being caused alternately to rise and fall at any desired intervals by means of jointed levers, the motion of which is regulated by the operation of pins attached eccentrically to ratchet wheels placed respectively at each end of the machine, the pawls or detents of which are operated by rods attached to the moving box and respectively advancing and retiring therewith, slots being provided in the sides of the machine for the working of the studs to which the rods are attached. Attached to a bracket carried by the moving box, or otherwise connected therewith, are connecting rods by which trucks or slides, for the purpose of receiving the blocks as they issue from the tubes, are alternately advanced or withdrawn. Additional rods are also attached to or connected with the moving box for the purpose of operating metallic plates, so as to pass over the open portions of the tubes within the machine, thus forming close tubes and preventing the materials from pressing upwards towards the rollers as pressure is exerted by the moving box during its advance. As the blocks issue from the tubes they may be received by revolving moulds divided into compartments and mounted upon axes, and caused respectively to revolve through the required distances by rods connected with the moving box. Upon the box issuing from the tubes and being received by the moulds, the latter are caused partially to revolve by the operation of the connecting rods, whereby the blocks are brought into such a position that they can receive additional pressure or impressment from any suitable apparatus which it may be considered desirable to use in conjunction with this invention; or instead of using revolving moulds, the blocks may be subjected to additional pressure or impressment upon issuing from the moulds in the manner usually practised in similar operations. The like process takes place alternately at either end of the machine with the motion of the box.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannon, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

24. G. Haseltine, *Southampton buildings, Chancery-lane, London, "Cartridges."—A communication.—Dated 4th January*, 1867.

This invention relates to metallic cartridges for breech-loading fire-arms, and consists chiefly in the employment of a metal cup inside the rear end of the case or shell, the said cup (which carries the fulminate) being held in its place by an indentation or corrugation formed around or partially around the perimeter of the said case. This metal cup adds greatly to the strength of the rim, which is the weakest part in metallic cartridge cases of ordinary construction.—*Not proceeded with.*

26. F. R. Aikman, *City Rifle Volunteer Corps, "Rifles for the purpose of instructing soldiers to fire with precision over long ranges, &c."—Dated 4th January*, 1867.

In performing this invention the inventor bores out the barrel of an ordinary rifle in such wise that the thickness of the metal of the breech remains no more than the thickness of the metal at the muzzle, and he inserts a smaller barrel therein, and rests its breech against the breech of the gun barrel, curved out to the arc of a circle of which the nipple of the small barrel in its true position is the centre, and he causes a tenon on the breech of the smaller barrel to project and work in a groove in the breech of the gun barrel, in a true vertical movement, to give stability. He then cuts away a sufficient portion of the breech and barrel of the rifle, removing the nipple to allow the hammer of the lock to strike fairly upon the nipple of the inner barrel. He then removes the under part of the outer barrel so far back from the muzzle to the breech as to permit such movement as may be desired to the smaller barrel radiating on its breech supported by the breech of the gun with the nipple of the smaller barrel as an imaginary pivot. He raises or lowers it at pleasure in the aforesaid movement by means of a screw, or any other well known mechanical method, and affixes an index to estimate the motion.—*Not proceeded with.*

28. P. Dagnall, *Aldershot Corp, Royal Engineers, "Breech-loading fire-arms." Dated 4th January*, 1867.

This invention relates, chiefly, to a central fire breech-loading fire-arm, and consists, First, in an improved arrangement for securing the barrel or barrels in place after the insertion of a charge in fire-arms in which the breech and butt are moved to one side to open and close the rear end of the barrel or barrels; Secondly, in an improved lock; and, Thirdly, in an improved arrangement of extractor, all as hereafter described. The breech is connected to the barrel by means of a strong bolt passed through the lower part of the breech into a lump or shoe on the underside of the barrel. The portion of the bolt which enters the lump is threaded, while the remainder is plain, and the head of the bolt lodges in the breech in front of the sear. When the barrel is in place, it is held at the upper part by the point of a spring pin in the upper part of the breech entering an aperture in the rear face of the barrel, and a dovetail clip on the fore part of the top of the breach takes into an undercut on the upper side of the barrel. The spring pin before mentioned is bevelled or chamfered on one side, so that it is pushed back by the rear face of the barrel until the pin reaches its aperture, when the parts are being returned into position. The lock is arranged as follows:—The striking pin is carried on the end of a bar formed on the underside near its front end with rack teeth, into which a pinion gears; this pinion is mounted on a pin which extends through the side of the lock, where it is filled with a thumb piece or handle. Behind the rack teeth the bar is formed on its underside with a notch, and again behind the notch with a hook. The trigger plates takes into a slot in a vertical sear, which has fitted beneath it a spring tending to press it upwards. The upper end of the sear is formed to take into the notch in the bar, as well as into the hook. When it takes into the hook the lock is at half-cock, and the trigger produces no effect upon the sear, but when it takes into the notch, the lock is at full cock and the trigger when acted upon draws down the sear and releases the bar, so that the bar with the striking pin is driven forward by a spring at the back. The half and full cock are produced by turning the thumb piece before mentioned so as to cause the pinion to move the rack. The improved arrangement of extractor consists of a pin fitted in the side of the stock, and formed with a curved plate at its rear, which constitutes a portion of the rear face of the barrel. The pin carries near its front end a screw or projection which passes through a longitudinal slot in the stock. A spring keeps the extractor pressed forward; when it is required to extract a cartridge case the extractor is forced back by means of the screw or projection so as to push out the case and the spring then returns the extractor to its normal position.—*Not proceeded with.*

33. D. Dowling, *Radley's Hotel, and* C. Greves, *Shepherdess-walk, City-road, London, "Breech-loading fire-arms."—Dated 5th January*, 1867.

This invention consists in the prolongation of the barrels of breech-loading fire arms at the breech end, and the formation of such prolongation (which is open at the inner end) with slots or openings at the top and bottom, and in one side of the shape, and for the purposes mentioned in the specification. The details of this invention are too voluminous to be given space to here.

49. J. Stantan, *Wolverhampton, "Self-acting safety gun-locks."—Dated 8th January*, 1867.

This invention has for its object the throwing back the cock or hammer of any gun or pistol lock by a mechanical arrangement and self-action into the position of half-cock, thereby saving one movement in using sporting or military guns, rifles, needle guns, and pistols with one or more barrels. It is particularly adapted to the needle rifle, as the needle is always free as soon as the rifle is fired. To accomplish this the inventor fixes a strong spring supported by two solid studs on the outside of the lock. The spring lies in contact with the neck or front part of the hammer or cock, thereby producing a repelling action to the cock, so that when the hammer strikes or falls downwards to its lowest point the pressure from the spring forces the hammer back to half-cock as desired. The end of the spring may be made either without or with a roller, but is preferable with a roller, which shall press against the neck of the cock and produce a perfect motion.—*Not proceeded with.*

52. E. C. Prentice, *Stowmarket, Suffolk, "Waterproofing or encasing cartridges, &c."—Dated 8th January*, 1867.

For this purpose the patentee takes a sheet or piece of india-rubber (or it may be of a composition having a similar elastic and waterproof qualities), and by the pressure of air he distends the material into a bubble-like form, and whilst it is so distended he places within the bubble through the pipe used in distending it the cartridge or article to be enclosed and waterproofed. He then takes off the pressure of air and allows the strained material to close in around the article; then by means of a ligature, or by other means, the bubble or capsule is closed at the back, and is cut off from the remainder of the sheet or piece from which it has been produced.

56. W. J. Murphy, *Cork, "Improvements in guns or cannon, and in projectiles to be used therewith."—Dated 9th January*, 1867.

This invention relates to the method of causing the projectile to rotate on its horizontal axis on leaving the gun, and is intended to be used as a substitute for the ordinary rifling. Instead of the method usually adopted for imparting to the projectile a rotary motion when leaving the gun by means of rifling or grooving the inside of the gun, and using studded or ribbed shot, it is proposed that the bore of the gun be fitted with spirally projecting ribs or slides, two, three, or more in number, as may be necessary, these slides or ribs to be planed perfectly true, and taking the same twist or pitch as is generally given to the rifling of guns. The projectile is to be slotted or grooved at the sides to the same pitch, so as to fit perfectly the slides or ribs, thus presenting two smooth surfaces which can be always kept lubricated.

59. J. H. Burton, *Cheapside, London, "Breech-loading fire-arms."—Dated 9th January*, 1867.

The patentee claims, First, the forming the face or head of the breech bolt separate from the main portion of that bolt, and capable of ready attachment thereto, or removal therefrom, substantially as explained. Secondly, the so arranging and combining parts of the breech bolt that an abutment for the helical hammer spring may be applied to the hammer through the front end of such breech bolt. Also he claims the application of a nut or collar to the hammer or an abutment for one end of the helical hammer spring. Thirdly, the forming the hammer with a pin or projection having full-cock and half-cock notches thereon, thus combining in one piece both hammer and what is equivalent to the tumbler in ordinary gun locks, which pin or projection is also capable of sliding in a slot in the breech bolt, and in a groove in the stationary part of the fire-arm, and of being held by the end of the breech bolt in manner and for the purposes substantially as described. Fourthly, the actuating of the cartridge extractor by a projection at or near its rear end in conjunction with the compound longitudinal and transverse groove in the breech bolt, and the movable face or head of the breech bolt, as described. Fifthly, the method of stopping or limiting the extent of the backward movement of the breech bolt by the combination of parts, substantially as shown and described. Sixthly, the mode of applying and actuating the sear, as described.

67. W. B. Robins, *Penton-place, Kennington-road, London, "Improvements in fire-arms and ordnance, and in the cartridges or projectiles to be used therewith."—Dated 10th January*, 1867.

One of the objects of this invention is so to construct the arm or piece that when two, three, or more projectiles are used, they may be made to strike in succession at some distance apart on a horizontal line; that is, supposing the first bullet or shot strikes the object aimed at, the second shall strike, say a foot or more to the right or left, as may be desired, and the third and fourth each a foot or more further to the right or left. This is effected by mounting the arm or piece with its longitudinal axis eccentrically, or a little on one side of the vertical axis of the carriage or stock, so that, on the explosion of the charge taking place, the barrel will be swiveiled slightly round the vertical axis to such an extent as to give the requisite degree of deflection to the muzzle to cause the shots to strike at equal distances apart along a horizontal line By this means a mowing action will be given to the weapon. In carrying out this part of the invention the bore is made much smaller than usual, and the length of the shot or projectile may be increased in order to obtain the requisite weight. By thus increasing the strength of the gun a larger charge than usual of powder may be employed, and therefore increased range may be obtained. When it is proposed to use several projectiles in this manner they are to be arranged one behind the other, and either cemented together in a long line, or rolled up in a strip of paper, linen, cloth, or some other suitable substance. The effects of the recoil are lessened by the employment of an internal breech buffer or recoil brake, consisting, in a nail arms, of a central piston placed within the body of the bisected breech stock, to one section of which the said piston is firmly attached and fitted to work in a cylinder placed on the other section, and against a buffer spring placed therein. The length of stroke of the piston is limited by a cross pin passed through the stock, and through slots in the piston and cylinder. The locking and unlocking of this piston is effected by means of a spring pin and lever operated from the outside of the stock and working in a hole or shoulder in the piston. The cartridge case is permanently attached to or made in one piece with the bullet or shot and is made of metal, so that when the explosion takes place the sides of the case will be forced into the rifle grooves, and increased accuracy of flight will be thereby insured. The explosion of the charge may be effected in any of the usual ways.—*Not proceeded with.*

85. H. D. P. Cunningham, *Bury, near Gosport, "Shot or ammunition lifters or holders, and carriages for the same."—Dated 12th January*, 1867.

Under the First head of this invention the patentee uses a tong or forcep-like kind of instrument to go over and grasp, nip, or embrace the shot, projectile, or ammunition. And the improvements consist in the use and application of a bolt or pin, which, when the lifter is made to embrace the shot or projectile, is inserted through the movable leg of the tongs, and also through a bar which connects the two legs together. Or the bolt may be inserted through the two legs arranged to be brought together or lock into each other for that purpose. By the introduction of this bolt the legs are securely prevented from spreading asunder when the weight of the shot or projectile is supported upon the lifter. To obtain this security with further simplicity and with reference to the "going over" action of the shot lifter—that is, when it is passed over the shot or projectile without opening out the legs—he also proposes to form the lifters without any joint, the legs being fixed and immovable. The carriage for taking up and transporting shot, projectiles, or ammunition is so arranged that the body of it in combination with its handle or shaft forms a lever wherewith to lift or raise the shot, projectile, or ammunition. The wheel and axle form the fulcrum of the lever. The shot or projectile is lifted in the shot lifter by the insertion of the ends of the lever in suitable holes for the purpose.

89. W. S. Mappin, *Birmingham, "Improvements in breech-loading fire-arms, and in cartridges for breech-loading fire-arms."—Dated 14th January*, 1867.

This invention consists, First, of the arrangement or combination hereinafter described of the parts of breech-loading fire-arms in which the breech is opened for loading and closed for discharge by means of a block hinged to the end of the barrel. In constructing a breech-loading gun according to this invention the inventor fixes to the breech of the barrel a shoe or breech chamber, the right-hand side of which is considerably lower than the left-hand side. The hinged block, moving in a vertical plane, shuts down into the said shoe, and closes the breech behind the cartridge. The face of the rear end of the shoe against which the free end of the block shuts has a projection upon it nearly as wide as the said block, and the free end of the block is formed of a corresponding figure to shut against the said projection. The end of the barrel has a conical seat, and the joint end of the block has a conical ring screwed upon it, which, when the block is shut down, accurately fits upon the conical seat, and on the discharge of the gun effectually prevents the escape of gas. The said conical or gas ring can be replaced, when worn, by a new one. The gun is discharged by an oblique pin or striker in the block, its outer end being struck by the hammer, and its inner end thereby made to strike and ignite the self-ignition cartridge in the barrel, and thus discharge the gun. When shut down the block is held in its place by a snap bolt in the rear of the shoe taking into a shallow depression in the free end of the said block. The said block on the discharge of the gun is securely fastened down by means of a bolt connected to the tumbler of the gun, which, on the discharge of the gun, is projected through the rear end of the shoe, and made to enter an opening or recess in the block. By this arrangement the gun cannot be discharged unless the block is properly shut down. A gun constructed according to this invention is especially fitted to discharge paper cartridge or cartridges in which all the matter composing them is projected from the barrel or discharge. In order to fit the gun to discharge cartridges having metallic or rigid cases which require to be extracted after discharge, he connects to the joint of the closing block a cartridge case extractor constructed in the following manner: The said cartridge case extractor consists of a horse-shoe-formed plate, the semicircular part of which is of somewhat less diameter than the bore of the cartridge chamber. The inner edges of the arms of this extractor are parallel, and one of the said arms is of such a length that when the extractor is fitted to the gun the end of the said arm reaches to the bottom of the shoe. The extractor has a knuckle or eye on either side at its top by means of which it is jointed to the pin on which the block turns. The said knuckles or eyes have shoulders, against which the block bears when the block is raised for recharging the gun. When the cartridge is put into the barrel, its rim bears upon the semicircular part of the extractor; and when, after discharge, the block is raised, it presses against the shoulders described, and causes the extractor to turn upon its joint and rise, assuming an oblique position in the shoe. In its motion the extractor withdraws the case of the exploded cartridge from the barrel, and by the length of its arms withdraws it so far from the barrel that by inclining the gun it will fall from the shoe. The invention consists, Secondly, in making the metal cases of cartridges for breech-loading fire-arms in the following manner:—The inventor makes the said cases from two strips of thin sheet metal, the said strips being made to cross each other at their middle. By means of a press and press tools he raises the said strips into a tube in which the projectile and powder are placed, the open end being closed by a metal cap of the ordinary kind. On discharge, the case is carried out of the barrel with the projectile, and the case opens and separates from the said projectile, the closing cap only being left in the barrel. Instead of two strips of metal a thin cruciform plate of metal may be employed.—*Not proceeded with.*

112. C. W. Lancaster, *New Bond-street, London, "Breech-loading fire-arms."—Dated 16th January*, 1867.

This invention relates to breech-loading arms in which a breech bolt or other closing appliance is withdrawn or drawn back when the empty cartridge case is to be removed and a fresh charge inserted. The invention consists in apparatus for extracting the empty case and forcibly ejecting it from the gun. Under the shoe of the action the inventor fits a lever, the fore end of which is attached by a screw or otherwise, while the rear end has an undercut or curved projection or toe which passes through an aperture in the shoe; this lever acts, as hereafter explained, in combination with an extractor composed of a semicircular plate, and of a bar which is drawn back by the bolt so as to extract the empty case from the barrel. When the extractor has been drawn back a certain distance the rear end of the bar strikes against the toe of the lever, so that the fore end of the extractor with the empty case is forced up and the case thrown out of the gun. The bar of the extractor may be allowed to run in a groove in the action of the gun, or may be fitted in a groove in the bolt; or the groove may be partly in the action and partly in the bolt. The lever is by preference a spring lever, or instead of a lever the projecting toe may be a fixture, a corresponding groove being cut in the bolt or closing appliance. The invention further consists in forming the exploding pin in central fire-arms independent from the hammers actuated by the spiral spring. Near the rear end of the pin there is a shoulder to prevent it being driven back by the discharge beyond the face of the bolt or closing appliance, and a small spiral spring may be fitted between the shoulder and a perforated screw in the face of the closing appliance.—*Not proceeded with.*

114. G. Hookham, *Summertown, Oxford, "Fire-arms and ordnance."—Dated 16th January*, 1867.

In constructing breech-loading fire-arms or ordnance according to this invention the inventor forms at the breech end of the barrel a chamber of larger diameter than the bore of the barrel, so that a greater quantity of powder in proportion to the weight of the projectile may be used than is now practicable, and the breech block which closes the breech he forms with a thin ring or band of metal projecting from its forward end; the exterior of this ring is made just to fit within the rear end of the enlarged charge chamber, and by expanding when the explosion takes place makes a perfectly gas-tight joint. Another improvement relates to the barrels of rifles and ordnance. In all ordnance and fire-arms where the projectile fits the barrel closely only a certain length of barrel is advantageous for velocity. The limit in each case being discovered, it is proposed to continue the barrel to a greater length, but at the same time of a slightly larger diameter than the first part. The projectile fits the barrel closely so long as it is advantageous for it to do so, but after this point it does not quite touch the barrel, and therefore moves on it without friction. The projectile being only slightly smaller than the bore the gas is still partially confined, and moving with a velocity higher than that of the projectile it increases the velocity of the latter beyond the degree that is possible in a tight-fitting barrel. In order to steady a rifle whilst shooting, and to allow of its being readily held in position for shooting with one hand only, in order to leave the other hand free for loading or for pulling the trigger, he connects to the under side of the butt of the stock a small iron rod, which is capable of being slid out so as to project from the stock, in order that it may come under the shoulder when firing, and prevent the stock from turning upwards. To the forward end of the rifle, in front of where it is held by the left hand, a strap is connected; this strap is passed through a belt around the wrist of the person, and goes to a stirrup under his foot, or is otherwise attached to his leg. In order to obtain increased accuracy in shooting, the trigger may, while firing, be artificially lengthened by a key or handle held in the hand. The trigger may thus be pulled back very steadily. In constructing cartridges for breech-loading ordnance and fire-arms the inventor places around the exterior of the case of the cartridge a spring clip of steel, or other elastic material. The spring is so made that to insert the cartridge case the spring must be opened, hence, on the explosion of the charge the spring clip will first open out and fit the barrel, and will then immediately spring together again, and the cartridge case will thus become perfectly close in the barrel, so that the spring and burnt cartridge case may be readily shaken out or withdrawn.—*Not proceeded with.*

Class 7.—FURNITURE AND CLOTHING

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

13. A. Ward, *and* C. G. Verdo, *Bradford, Yorkshire, "Scarfs."—Dated 2nd January*, 1867.

The patentees claim the construction of scarfs in such a manner that two or more different surfaces or patterns may be presented when in use in one or the same scarf by the first method, and two by the second or alternate methods, thereby making one scarf answer the same purpose as several scarfs, whether the scarfs be of a uniform or of variegated colours, or of uniform or variegated patterns or designs, such scarfs being folded and arranged in any of the methods shown and described in conjunction either with an ordinary neckband secured by eyelets and hook, the ordinary cycle, or the winged cycle, as shown and described, without confining themselves to the precise details shown.

31. J. H. Schucht, *Store-street, Bedford-square, London, "Action of upright pianofortes."—Dated 4th January*, 1867.

In arranging the action of upright pianofortes, according to this invention, the inventor mounts all the working parts above the finger keys on one rail, in place of employing several rails, and he arranges the hammers in an inverted position, or to strike upwards or towards the shorter end of the strings in place of downwards, as is usual in upright actions. He arranges the striker to step on to the inner end of the finger key, a peg being driven into the end of the key which enters a hole or recess in the foot of the sticker, and to prevent noise a piece of felt is interposed between the key lever and the sticker. On the upper end of the sticker the outer end of a bent or L-shaped lever rests, and to keep the parts in position a screw passes loosely through a hole in the end of the lever into the top of the sticker. The other or upper end of the lever is jointed to the main rail, which is at the top of the action, and to this rail also the inverted hammer is jointed. The lever on its horizontal limb carries the fly or hopper, which acts on the hammer butt, and this fly or hopper works with an escapement button on the main rail. The stem of the hammer passes down through a slot in the horizontal limb of the lever, and at the front end of the slot is a soft adjustable stop for the hammer to rest against, and the upper end of this stop also serves as a check to the recoil of the hammer, the hammer butt, after the blow has been struck, remaining in contact with it until the finger key is allowed to rise. The damper is fixed to the lever near its angle.—*Not proceeded with.*

41. C. Kelly, *Berners-street, and* C. Laurent, *Marylebone, London, "Harmoniums and organs."—Dated 7th January*, 1867.

This invention has reference to new arrangements of mechanism for obtaining a "forte" action in harmoniums and organs, which is much more simple and effective than any arrangement heretofore employed, and which is perfectly under the control of the performer. It consists, according to one arrangement, in fixing above the "vibrators" in harmoniums, and in any part of the box enclosing the pipes in organs, a solid cover entirely enclosing the works. In this cover are formed one or more openings with bevelled or conical sides, in which fit valves with correspondingly backed or conical sides, so that by the simple weight of the valves they wedge themselves to such an extent into the openings or seats as to close the latter in the most perfect manner. This particular form of the valve and its seat is an essential feature in this invention, as all valves made heretofore have been formed on the principle of "lower boards," turning on hinges or centres in the middle of the opening, and requiring more or less pressure by a spring to be closed effectually. The aforesaid valves are attached to levers working on fixed fulcra upon which the valves consequently hinge when they are opened and closed. They have attached to them for this purpose one or more arms connected to a double-ended lever, which in its turn is acted upon so as to open and close the valves either by a "draw-stop action," or by a rod actuated by the pressure of the air in the bellows or reservoir. When two or more such valves are employed they are connected together by rods, so as all to be opened or closed at the same time by one and the same action.—*Not proceeded with.*

66. A. Foucaut, M.D., *Paris, "Waterproof and other articles of wearing apparel."—Dated 10th January*, 1867.

In performing this invention the inventor fits or attaches to the garment an air chamber or vessel preferably of lenticular form in section, and placed in the arm pit; such chamber or vessel is made wholly or partly of flexible material, so that it may contract when emptied of air and expand when filled with air. The chamber communicates at one end with a pipe or passage which opens into the garment, and at the other end the chamber communicates with another pipe or passage which communicates with the outer atmosphere, fresh air entering through the neck or other openings of the garment. The pipes are provided with valves which open and close communication with the air chamber, the valves opening in such manner that one will only allow air to enter the chamber, and the other only allows air to escape thence, each resisting respectively a reverse action. As the wearer moves his arm he compresses the chamber, or else allows it to expand to its original position, so that it acts like an air pump, alternately drawing in and expelling the air, and thus keeping up circulation or respiratory action.—*Not proceeded with.*

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

152. J. Rowley, *Grosvenor terrace, Camberwell, "Process for hardening, bleaching, and sweetening crude paraffin."—Dated 21st January*, 1867.

The patentee claims the hardening of paraffin wax, by putting into it an article known in commerce as "Carnauba wax," in the manner set forth.

164. J. Patison, *Airdrie, Lanark, "Illuminating gas."—Dated 22nd January*, 1867.

This invention consists, First, essentially, in the use of hydrocarbon, rock, or mineral oils, commercially known as shale or coal oils and petroleum, for the production of illuminating gas The inventor saturates dry peat or bog (in blocks) with the said oils, the oils being used in a heated state. The blocks are next dipped in hot bitumen or pitch, and then rolled over in saw-dust, and subsequently heated in the same manner as cannel and other coals for producing illuminating gas. The invention consists, Secondly, in the direct application or introduction of the said oils into retorts when at a great heat.—*Not proceeded with.*

Class 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

16. G. B. Smith, *Birmingham, "Improvements in supports for the insulators of electric telegraphs, and in affixing the said supports to the posts of the said telegraphs."—Dated 3rd January*, 1867.

In making supports for the insulators of electric telegraphs according to this invention the inventor employs tubing of wrought iron, the said tubing being by preference rectangular and oblong in cross section. He cuts the said tubing into lengths equal to the length of two of the supports and the diameter of the post at the point where the supports are to be fixed. He closes each end of the piece of tubing by means of a solid block of iron, which he welds in the end of the tube. Or solid wrought iron bars may be employed instead of the said tubes; but he prefers tubes. Holes are made near the ends of the tube and through the solid blocks for the reception in the ordinary manner of the pins on which the insulators are supported. Holes are also made near the middle of the tube for the reception of pegs in fixing the supports to the posts. All the said holes are made across the tube in the direction of its longer diameter. In affixing supports for insulators of electric telegraphs made according to this invention to telegraph posts the inventor forms a hole near the top of each post for the supports to pass through, the said holes being of the same shape as the cross section of the supports, the longer diameter of the holes being situated vertically. The support is passed into the hole in the post, and the middle part of the support is fixed to the post by two taper pegs or keys being inserted or driven in the hole formed near the middle of the support. These pegs or keys are situated respectively on either side of the post, and the support is thereby firmly fixed in the hole across the post. The support thus fixed forms a double support, that is, forms arms projecting respectively from either side of the post.—*Not proceeded with.*

177. A. Apps, *Strand, London, "Electrical apparatus."—Dated 24th January*, 1867.

This invention cannot be described without reference to the drawings.

181. C. E. Brooman, *Fleet-street, London, "Working electric telegraphs."—A communication.—Dated 24th January*, 1867.

This invention comprises, Firstly, a special instrument for the previous com-

posing of telegrams by the aid of particular signs traced on a strip of tin paper. Secondly, a special instrument for receiving, by the telegraphic conductor, the telegrams upon a strip of tin paper capable of serving as an original for a second transmission like the strips obtained by the composing instrument. Thirdly, an instrument comprising an automatic transmission or reception of the metallic strips, and an electro-chemical reception in a spiral form of the signals sent. Fourthly, the manufacture of the strips of tin paper for use, as hereafter described. Fifthly, an improved arrangement for effecting the deposit of the ink upon the strip of tin paper, and, Lastly, the particular working of the electric current, all as described.

Class 10.—MISCELLANEOUS.

Including all Specifications not found under the preceding heads.

3392. S. F. SCHOONMAKER, *Euston-square, London*, "*Coating for paper and other materials designed to receive lead pencil marks, which may be repeatedly expunged with moisture.*"—*Dated 24th December*, 1866.

This invention relates more particularly to a coating for paper and other materials, which is composed of a resin having incorporated into it a white, soft, and non-gritty material, by means of which the resinous coating is rendered capable of receiving distinctly the marks of a lead pencil.—*Not proceeded with.*

3393. R. H. ASHTON, *Ashton-on-Mersey, Cheshire*, "*Producing printing surface and carvings from moulds obtained by the aid of photography.*"—*Dated 24th December*, 1866.

According to this invention the inventor uses moulds the different depths of which correspond to the lights and shades of a photograph, such moulds being well-known and in use for purposes apart from this invention. From these moulds he obtains printing surfaces by passing the tracer known as Jordan's, or other similar ruling machine, over them, and which tracer being acted upon by the different degrees of depression alters the direction in which the etching point moves. Beneath this etching point is placed a sheet of copper, steel, or other metal, coated with a protecting medium—wax for instance—after the usual manner adopted by engravers, and the design which is cut through the said coating may therefore be etched, as is well understood. In producing carvings he employs moulds as above described; but causes the tracer to regulate the depth to which a rotatory or other cutting tool acts upon the material to be carved.—*Not proceeded with.*

3396. A. MACKIE, *Warrington*, "*Apparatus for distributing type, &c.*"—*Dated 26th December*, 1866.

The patentee claims, First, the arrangement and combination of apparatus for distributing type, either by means of a "step like" series of fingers having a regular reciprocating motion, and operating upon the type as it passes in front thereof, or by means of a regular line of such fingers having a reciprocating and a retrograde movement, and acting upon the top types as they rise up the channels; and, Secondly, the peculiar arrangement and adaptation of receivers or shelves which receive the type as it is extracted from the channels or case; and also the method and means of displacing such shelves as they become filled, and the means of preventing the passage of more than one type at once from the same channel, as described.

3399. W. BROOKES, *and* J. MAYES, *Loughborough*, "*Manufacture or production of needles.*"—*Dated 27th December*, 1866.

This invention consists in forming a groove or grooves in the needle of sufficient depth to allow the thread used in the needle to lie in such groove or grooves, whereby the substance or fabric through which the needle is passed in sewing or stitching will not abrade or chafe the thread. The said groove or grooves is or are made from or near the point of the needle, and by the edge thereof, and extend along the stem of the needle to any required length; a portion of the stem of the needle has one or more turns or twists given to it, according to the work upon which the needle is intended to be employed.

3400. B. SHAW, *and* J. APPLEYARD, *Lockwood, near Huddersfield*, "*Safety bottle case.*"—*Dated 27th December*, 1866.

This invention consists in constructing or arranging the compartments of bottle cases in two or more parallel tiers, each compartment holding a bottle on its side, and the neck of the bottle. Also in having two or more tiers of compartments in height, which may be either hinged to the sides of the case so as to open to allow the lower tiers to be filled and emptied, or such upper tiers may be portable. The case is closed with a lid to which a lock may be attached if desirable. By this invention no packing of the bottles is required.

3401. W. BRADBURN, *Wednesfield, Wolverhampton*, "*Treating excrementitious matters, and other refuse matters for the purpose of obtaining valuable products therefrom.*"—*Dated 28th December*, 1866.

The patentee claims the application of heat for effecting the objects of this invention. He also claims the arrangement of apparatus employed for the purpose. The details of the invention are too voluminous to be produced here.

3405. W. CLARK, *Chancery-lane, London*, "*Valves.*"—*A communication.*—*Dated 28th December*, 1866.

This invention consists in the employment of a pair of metal plates or discs fitted in a box or shell, in such manner as to close against seats with their outside faces when the plates or discs are moved forward by means of a wedge introduced between them, which opens and spreads the valve plates, and presses them against their seats, and they also open and recede from their seats when the plates or discs are moved backward by the same means, thus acting as a double valve, which completely and positively closes a passage way on both sides when in one position, and when in another position leaves the passage way clear of all obstructions, with an undiminished area for the direct inlet and outlet of the full volume of steam, water, or other fluid or gas which may be conveyed to the passage.

3409. W. H. CUTLER, *Eton, Bucks, and* T. BROWN, *Grove-villas, Victoria Park*, "*Cocks for stopping and regulating the flow of steam, water, &c.*"—*Dated 20th December*, 1866.

This invention relates to cocks whose apertures or passages are closed by a valve instead of the ordinary conical plug, and consists chiefly in constructing the said valve with a flat surface fitted to bear upon a hollow or cup-shaped seat, or in making the said valve in the form of a cup-shaped seat, or in making the said valve in the form of a cup or basin whose edges fit evenly upon a flat seat or face.—*Not proceeded with.*

3410. F. WATKINS, *Birmingham*, "*Machinery for cutting, punching, and shaping metals for screw nuts, &c.*"—*Dated 28th December*, 1866.

The patentee claims the general arrangement of machinery for cutting, punching, and shaping metals for screw nuts and like articles, as described. He also claims in machinery for cutting, punching, and shaping metals for screw nuts and like articles the linking the tool or punch which cuts off the metal and forces it into the die or mould with the tool or punch which forms the movable bottom of the said die or mould in such a manner that the former in receding may cause the advance of the latter, so as to eject the finished nut or article from the die or mould.

3408. A. V. NEWTON, *Chancery-lane, London*, "*Dyeing apparatus.*"—*A communication dated 28th December*, 1866.

This invention cannot be described without reference to the drawings.

3412. F. WATKINS, *Birmingham*, "*Machinery for shaping and forging metals into rivets, bolts, screw blanks, &c.*"—*Dated 28th December*, 1866.

The patentee claims, First, the general arrangement of machinery described for shaping and forging metals into rivets, bolts, screw-blanks, and like articles. Second, the combining for shaping and forging metals into rivets, bolts, screw blanks, and like articles of a rotating disc, having certain bores or tools at its periphery, with a heading tool and plungers, as described. Third, the combining for shaping and forging metals into rivets, bolts, screw blanks, and like articles, of a rotating disc having certain bores or tools at its periphery, with a hollow tool through which the rods of metals are fed, and which acts with the bores or tools to cut the metal into lengths, which remain in the said bores or tools and are headed therein.

3421. W. SIMONS *and* A. BROWN, *Renfrew*, "*Construction of dredgers.*"—*Dated 29th December*, 1866.

The First part of this invention has for its essential object the combination together, so as to constitute one apparatus, that which has hitherto consisted of two separate and distinct appliances used for the dredging and conveying away of the material dredged—namely, the steam dredger proper and the hopper barge. In carrying out this part of the invention the hull of the dredger is built with a well to receive the ordinary bucket ladder in the usual manner, and the aft or forward end of the hull is formed of larger capacity than usual, constituting, in fact, and forming the hopper cavity or space into which the dredged material is discharged from the buckets, to the entire exclusion of the hopper barges or mud punts at present in use. As soon as the hopper is full the bucket ladder is raised into the well, the combined dredger and hopper is propelled or navigated by a screw or screws out to sea, *or* to any place where it is desired to deposit the dredgings, on arriving at which the doors at the bottom of the hopper are opened and the contents, or "dredgings," discharged, after which being effected the doors are closed and the vessel returns to carry on the dredging, for which purpose the bucket ladder is lowered as before to continue operations. The Second part of this invention relates to so constructing the dredger that it may be used (in addition to the ordinary dredging operations) for the purpose of excavating or cutting land above or at the surface of the water, the sides of canals, rivers, embankments, and coasts. The ladder is so arranged to any required position projecting over one end of the hull, so that the bucket may be brought to act upon the part above water requiring to be excavated or undercut. It is intended with this second modification of the invention to undercut the parts requiring removal, thus allowing the upper portion to break off or be detached through its own weight, on which, having fallen in the water, the bucket ladder is lowered to raise it in the ordinary manner.

3424. C. HARRISON, *Manchester*, "*Cocks or valves.*"—*Dated 29th December*, 1866.

This invention relates to cocks or valves for regulating the transmission of fluids, steam, air, and gases, and the object is to obtain a much greater area of passage through the cocks or valves in proportion to their sizes and weights of metal than in cocks or valves of the ordinary construction. The patentee makes the plug of each cock or valve hollow, with a transverse bridge or stop in the middle, and forms screws when required at each extreme end of the plug for uniting it to the pipes of supply and discharge. At each side of the bridge he makes two apertures opposite each other, and fits on the plug a barrel having two opposite chambers, each opening over the bridge with their edges agreeing with the apertures in the plug, and when required the barrel and chambers are in connection with a disc or handle wheel. The pipes of supply and discharge are always open to the ends of the plug, and when the barrel is in such a position that the chambers are full open to the apertures there is a free passage through the cock or valve; but when the barrel is turned so as to place the opening of the chambers on the plain part of the plug between the apertures, the passage is entirely closed, and all areas of passage between the full, open, and entirely closed are regulated by turning the barrel, and causing the chambers to be more or less open to the apertures in the plug.

3426. W. WILBY, *Dublin*, "*Straps or belts for driving machinery.*"—*Dated 29th December*, 1866.

This invention cannot be described without reference to the drawings.

3428. F. LEONARDT, *Birmingham*, "*Metallic boxes.*"—*Dated 29th December*, 1866.

This invention consists in improvements in the manufacture of metallic boxes from sheet metal. Boxes made according to this invention are fitted to hold steel pens, leads, pins, matches, and various other small articles. The patentee prefers to manufacture the metallic boxes of an oblong figure, and to give them more or less the form of a clasped book, but square boxes may be made according to this invention.

3429. G HASELTINE, *Southampton-buildings, Chancery-lane, London*, "*Fastenings for pocket books.*"—*A communication.*—*Dated 29th December*, 1866.

This invention consists in the arrangement of one or more strips of spring steel, or other elastic sheet metal, or other suitable material, in combination with the closing flap of a pocket book or other similar article. The said strips are secured in the cage or edges of the flap, and act in the proper direction to keep the pocket book or other article closed without the aid of the usual clasps, strings, or other fastenings, and if a portion of the pocket book or other article be unfolded or opened, the remaining portion will still be kept closed by the action of the elastic strip or strips, and the accidental falling out of the contents of the said pocket book or other article is prevented. By the action of the said elastic strip or strips the closing flap is strengthened, and the pocket book or other article is rendered durable without losing its pliability.

3437. T. W. COULDERY, *Old Kent-road, London*, "*Manufacture of trousers.*"—*Dated 31st December*, 1866.

This invention consists in the employment of leather, leather-cloth, &c., for cloth in the waistbands of trousers, and in substituting studs in the place of buttons.

3440 T. W. PLUM, *Threadneedle-street, London*, "*Taking off liquids from casks, &c.*"—*Dated 29th December*, 1866.

In performing this invention the patentee uses a tube of any suitable length, made of wood, or gutter-percha, or india-rubber, or other suitable material, or of two or more of such materials combined, according to circumstances, as a "floating end" for taps, suction pipes, syphons, and other pipes for drawing off liquids from casks, vats, cisterns, tanks, and other vessels. He causes one end of the said tube to float upon or towards the top of any liquid into which it may be inserted, either by its own gravity giving it the requisite form and material for that purpose, or he uses cork of suitable shape, or he forms air spaces in or around the tube.

3441. H. ALLMAN, *Ampthill-square, London*, "*Locks and keys.*"—*Dated 31st December*, 1866.

These improvements relate to the form of locks commonly called lever or tumbler locks, and to the keys used therewith, and may be detailed as follows:—First, the inventor forms the levers and tumblers in a way and of such a configuration that the key in making one revolution round the drill pin comes more than once in contact with the said tumbler or levers. Secondly, he uses spring or plain washers between the said levers or tumblers, so as to enable the tumblers to work free one of other, and enable them to retain the position which may be given them by the action of the key, but when the tumblers are without springs. Thirdly, he uses in the construction of the said levers or tumblers, or other parts of the said locks, the material commonly known as yellow metal or Muntz's metal. Fourthly, he coats or electrotypes sheets of metal, with tin, zinc, copper, brass, or silver, and presses the herein described tumblers from the said sheets of metal so prepared. Fifthly, he makes one or more of the said levers or tumblers longer from the centre of rotation to the stump face than the remainder of the said levers, so that when the stump is pressed against the levers, it will reach the longer ones first, compelling such long levers to be adjusted for the passage of the stump first or before the others. Sixthly, he forms one or more of these said longer levers of such a shape or configuration that when they are lifted or adjusted by the key or picklock to admit of the passage of the stump, they will then assume or occupy such a position as to close or block the keyhole. Seventhly, he employs two or more sets of tumblers or single tumblers gearing into each other so that the action of the one moved by the key or picklock shall cause the other, or others to close the keyhole, or otherwise impede the action of a picklock. Eighthly, he constructs the key tubes of steel tube and solders thereto the bits and bows. Ninthly, he employs a spring or pressure on the levers, so that they will remain under the influence of friction in the position into which the said levers may be moved by the key or picklock. Tenthly, he polishes, scours, or burnishes the plates of sheet metal, and of which he presses the various parts of the locks previous to or before such act of pressing or cutting. Finally, he stamps the keys in some instances out of the before specified yellow metal.—*Not proceeded with.*

3443. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Apparatus for advertising.*"—*A communication.*—*Dated 31st December*, 1866.

This invention consists, essentially, in the application to mechanical horses or carriages of a box or case of polygonal, cylindrical, or other form, and composed of transparent or translucent material, to the exterior of which are attached the placards or notices to which publicity is to be given, a light being placed in the interior of the box or case at night time, so as to render the letters easibly visible. In addition to the progressive motion which this advertising transparent box receives in company with the travelling mechanical horse or carriage, it also receives a rotatory motion derived from the propelling mechanism of the vehicle, so that the various advertisements on the sides of the box or case will be displayed in various different directions.—*Not proceeded with.*

3446. J. T. GRIFFIN, *Fleet-street, London*, "*Calender movements for clocks.*"—*A communication.*—*Dated 31st December*, 1866.

This invention cannot be fully described without reference to the drawings.

3451. J. MILLER, *and* J. MILLER, jun., *Park-road, North Bow, London*, "*Manufacture of elastic gussets.*"—*Dated 31st December*, 1866.

According to this invention the patentee secures the vulcanised india-rubber springs between two pieces of woven fabric, leather, or other material by stitching with a sewing machine, the stitches running in parallel lines and passing through the two pieces of woven fabric or material between. The india-rubber springs and the springs, in place of being each a separate piece, are in one piece, the length of vulcanised india-rubber cord at the end of each traverse across the gusset being wound round and caused to return parallel to itself, thus the liability of the india-rubber to slip and work out of the gusset is much reduced. When gussets made in this manner are worked into boots or other articles, the stitches by which they are secured are passed through a margin on each side of the gusset, and not through the india-rubber part of the gusset as heretofore.

2. W. MUIR, *John-street, Adelphi, London*, "*Improvements in planing machines, which improvements are also applicable to other machines and engines in which sliding surfaces are employed.*"—*Dated 1st January*, 1867.

This invention consists, essentially, in making sliding surfaces partly of cast iron or other hard metal, and partly of block tin or other anti-friction metal.—*Not proceeded with.*

3. A. D. CAMPBELL, *Manchester*, "*Bench planing machine.*"—*A communication.*—*Dated 1st January*, 1867.

This invention is designed to effect a ready means for forming and smoothing the sides, ends, or angles of wood or other material by means of a certain arrangement of plane adapted for the purpose. The improvements consist in the use of a plane having one or two cutters projecting or acting at the side of the plane block, instead of at the bottom. The plane block is mounted on parallel rails or bars, on which it may be moved to and fro by hand. The bed or platform which supports the wood whilst under operation is rendered adjustable vertically by slotted links and screws, or other equivalent, and at the end thereof a stop-piece is provided, which is also adjustable laterally so as to suit any angle to which the wood under operation is to be formed or planed When the wood is placed upon the bed and the other stop-piece adjustable, and the bed if necessary, if the plane be moved backwards and forwards the wood will be reduced to the desired angle and the surface smoothed, which is particularly useful in the formation of mitre or other angular joints.—*Not proceeded with.*

4. G. STUART, *Aberdeen*, "*Manufacture of combs, and in the machinery or apparatus therefor.*"—*Dated 1st January*, 1867.

This invention has for its essential object a certain arrangement of comb-cutting mechanism whereby a greater number of combs can be cut in a given time than by other means for effecting this mechanical operation at present in use. In carrying this invention into practice double in place of single jaws are provided in which the cutters are placed, the jaws forming a part or parts of levers, which are moved up and down by a crank to revolve in any convenient manner. At the centre of the bed two gauges are placed in lieu of one gauge at the side of the bed, as in other machines at present in use. The cutters are made slightly inclined and curved at the ends to enable the proper form of tooth for the comb to be produced. After the cutters have completely effected the cutting through the teeth there is a very small portion of the end of each tooth left uncut; this, however, splits through after the cutting has been effected and leaves the comb detached.

7. H. W. HART, *Clapham*, "*Apparatus for containing advertising and address cards for public distribution.*"—*Dated 1st January*, 1867.

The object of this invention is to construct an apparatus in which advertising and address cards may be so exposed for public distribution that any person may take one at a time. To this end the apparatus consists of a box, the sectional area of which shall be about equal to the superficial area of the cards to be exposed and sufficiently deep to receive a large number of cards. This box may be made of metal, wood, or any other suitable substance, and should be provided with an opening at the top or back for the purpose of placing the cards in the apparatus. The front of the box may, if desired, be made with a glass panel, through which may be seen one of the cards, which may be placed in a vertical position so that it may be easily read. The box is open at bottom, and the cards are made to rest on ledges at the sides and back. A notch or thumb opening is cut out of the front panel, so that a card may be laid hold of and pulled out. The front panel is brought down to within the thickness of a card to the ledges on which the cards rest, so that there is sufficient space to draw out a card, but only one.—*Not proceeded with.*

8. G. B. WOODRUFF *and* G. BROWNING, "*Construction of button-hole sewing machines*"—*Dated 1st January*, 1867.

The chief object of this invention is to ensure that the edges of the button-hole to be sewn shall before the act of sewing commences, be in the exact position required relatively to the reciprocating movements of the needle. This end the patentees propose to obtain by cutting the button-hole while the work is held firmly in the clamp which presents it to the action of the needle, and when requisite the cut hole they propose to expand by the lateral expansion of an upper and lower pair of clamping jaws of peculiar construction, which, under all circumstances, will impart the requisite pressure to the work.

14. B. NOKES *and* T. SANDERS, *Birmingham*, "*Lady's companion, consisting of call bell reel stand, and pin-cushion.*"—*Dated 3rd January*, 1867.

In performing this invention a suitable metal framework is provided, which has a strong cast bottom. Through the centre of this goes a strong metal pin, upon which the call-bell is afterwards suspended. Around the said call-bell are arranged several reels (the number of which will of course vary with the size of the apparatus) working upon metal pins, the said metal pins being loose, so that they may be taken off and again replaced without difficulty; upon the top of the apparatus is placed the pin-cushion, which is secured and kept in its place by a pin or burr screwed to the upright. A handle by which the apparatus may be more conveniently held may be added if necessary.—*Not proceeded with.*

20. W. G. HELSBY, *Liverpool*, "*Apparatus for manufacturing photographic pictures.*"—*Dated 3rd January*, 1867.

This invention consists in causing a large number of impressions, say fifty, to be produced or made closely together on one sheet of paper or flexible material, properly sensitised or prepared so as to economise or prevent waste of material, and save labour, and thereby be enabled to produce such pictures at a greatly reduced price The pictures can be cut or stamped out of the sheet, and mounted or used in any ordinary or desirable manner. For the production of these pictures simultaneously, and that they may be of uniform depth of shadow all over the sheet, the patentee employs the apparatus hereinafter described. The apparatus consists of a camera, in which there is mounted the desired number of lenses, say fifty. These lenses touch or are near to each other, and are fitted in either unsymmetrically to produce like pictures, or symmetrically to produce pictures of different size and shadows. That an equal quantity of light may pass to every picture, no matter how the lenses are mounted, he fits a sliding shutter to the object piece of the camera, in such manner that it can be opened and closed in the same direction. He thereby renders it certain that the extra quantity of light allowed to enter through at one side of the object-piece aperture during the opening is compensated for by being shut off earlier in the closing movement. A convenient arrangement of the sliding shutter is to fit it closely on a pin, and to operate quickly by a lever or toggle joint, but many other arrangements of operating the shutter could be used.

21. W. LAMOREUX, *Charing Cross Hotel, Strand, London*, "*Applying teeth to saws.*"—*Dated 3rd January*, 1867.

This invention cannot be described without reference to the drawings.—*Not proceeded with.*

25. J. WILKINS, *Wolverhampton*, "*Mould for making cigarettes.*"—*Dated 4th January*, 1867.

This improved mould consists of three tubes, made of wood, brass, German silver, silver, gold, or of any suitable material; each tube is of any and of different size, and of any length and thickness, and is so constructed that the three shall fit together similar to a telescope, so that, when not required for use, they may be closed together, and the mould be rendered compact and convenient for carrying in the pocket.—*Not proceeded with.*

34. G. LOGAN, *Kelsoe, Roxburyshire*, "*Apparatus for working punkahs.*"—*Dated 5th January*, 1867.

In any convenient position the inventor arranges toothed gear driven by hand power, in particular cases but specially adapted for horses, or, by preference, bullocks. This machinery gives motion by endless bands to pulleys in the rooms or barracks. These give a rectilinear motion by means of eccentrics or cranks, and connecting-rods or levers attached to one end of the punkahs which are hinged so as to allow them to move freely. The punkahs are stiffened by rods or battens of thin wood, or other material running down the sides. Where two sets of punkahs are used two eccentrics may be employed, and may be set opposite each other, so that one set of punkahs may be going in one direction and the other in the opposite. The Second portion of the invention relates to the watering of "tathes." This is accomplished by similar machinery, but in place of the rectilinear motion given by the eccentrics the inventor employs a revolving band with buckets attached, which dip in a reservoir of water, and so convey it to the top of the room or apartment over a pulley, and empty it into a cistern for holding it, whence it is allowed to fall regularly into the tathe.—*Not proceeded with.*

36. E. K. DUTTON, *Manchester*, "*Water delivery 'nozzles' employed in the extinction of fire.*"—*A communication.*—*Dated 5th January*, 1867.

This invention is designed for the purpose of spreading or breaking up the jet of water as it leaves the delivery nozzle, and is applicable in all cases where a jet of water is used for the extinction of fire. The improvement consists in the adaptation to the delivery nozzle of a set of levers or fingers, arranged in a circle around the nozzle, the lines of motion of the levers being radial to the centre of the nozzle. The upper ends of the levers have projections on their inner sides, which are preferably formed of a wedge shape, and act as spreaders when moved into the jet of water issuing from the nozzle, the said motion being effected by a grooved cam acting on the lower ends of the levers, or in any other suitable manner. Any convenient number of levers may be employed, and they may be moved altogether, or in two or more sets as preferred, the grooves in the cam being formed to give the desired motion.

38. T. W. LAMB, *Leicester*, "*Knitting machines.*"—*Dated 5th January*, 1867.

This invention consists in the employment of two classes of needles in the same machine and in the same needle plate, the one class being the ordinary self-acting needle, and the other class being a double self-acting needle, or a needle with a hook and latch at each end. By the employment of the double needles the inventor is enabled to produce either plain or ribbed work, and to change from the one to the other at pleasure without removing the work from any needles. The invention further relates to the manner of operating the double needles and to the method of transferring them from one needle plate to the other, from one jack to the other; and also to the production of a knitted fabric, one part of which is ribbed and the other portion plain, without removing the work from the machine. The invention cannot be fully described without reference to the drawings.—*Not proceeded with.*

39. B. BIGGS, *Laurence Pountney-hill, London*, "*Improvements in and applicable to candles.*"—*Dated 7th January*, 1867.

The patentee claims the adaptation and application to the lower ends of candles of capsules and of cups or discs, or of a double capsule with a partition formed by a shallow cup, or by a flat disc made of metal, or other suitable material (of the forms described), capable of receiving such lower ends of candles, and forming when so applied a kind of "save all" to each candle, admitting of the entire candle being consumed.

40. C. J. POWNALL, *Union Club, London*, "*Means of saving life in pits and mines*"—*Dated 7th January*, 1867.

This invention has for its object to prevent the effects of carbonic acid gas, generally known as choke damp, after damp, and black damp, and consists in forming chambers in the sides of the workings, which chambers may be of wrought or cast iron, brick or stone, placed in recesses at the sides of the workings. The chambers and door or entrance may be fire and waterproof, and are to be as gas-tight as possible. A loaded valve is applied to each chamber for the escape of vitiated air. The chambers are to be supplied with pure air by air pumps, fans, or blowers, worked by the winding or pumping engine of the pit or otherwise. Pure air may be conducted to the chambers through wrought iron, cast iron, or india-rubber pipes, laid under the floor or surface of the working, and carried in at the back of the chambers. The miners will seek refuge in these chambers.—*Not proceeded with.*

43. F. B. DŒRING, *Bayswater*, "*Engines for boring and working rock, &c.*"—*Dated 7th January*, 1867.

The patentee claims, First, constructing engines in which a distribution of steam, air, or other fluid is required to work different parts of the mechanism at different parts of the stroke of the engine, with one or more cylinders for distributing the steam or other fluid to one or more other cylinders, the pistons of the first-named cylinder or cylinders being worked by a crosshead or similar appliance from the piston rod of the engine, all substantially as described. Secondly, constructing engines for working or boring rock and other material with one or more distributing cylinders to distribute compressed air or other fluid for working the valve of the ordinary cylinder, and for working the pistons of two other cylinders, or either of them, for producing respectively the rotary motion of the ordinary piston and tool and the advance motion of the engine, all substantially as described and represented in the drawings. Thirdly, constructing stands for boring engines with three or more legs connected to each other like the legs of a tripod, one of such legs being composed of the two side supporting shafts of the engine, and the other legs, or some of them, being telescopic, substantially as described and represented in the drawings. Fourthly, constructing stands for engines for working in a heading, substantially as described and represented in the drawings.

46. W. E. NEWTON, *Chancery lane, London*, "*Augers.*"—*A communication.*—*Dated 7th July*, 1867.

The patentee claims First, an auger having a twist, whose front or working faces are concave and whose rear surfaces are convex, as set forth; Second, an auger constructed as shown and described, which permits the formation of cutting lips at any point in its length by simply cutting off the twist at any

given point on a line parallel, or nearly so, with the axis of the auger, and sharpening its edges; Third, a cutting lip formed by the concavity of the twist terminating on a line parallel, or nearly so, with the axis of the auger, the sharpened edge of the lip following the concavity of the twist from the screw or cutting points to the periphery, and inclined to the axis of the auger, substantially as described; Fourth, the combination of the twist, the cutting lip, and the cutting edge of the twist, substantially as shown and described.

48. C. F. CLAUS, *Middlesboro'-on-Tees*, "*Mode of raising brine in or from boreholes of great depth.*"—*Dated 7th January*, 1867.

The patentee claims applying a cap or cover to the borehole and forcing water or air into it in such a manner as to expel the brine by a pipe passing from the bottom of the borehole to the surface, or to the place to which the brine is required to be raised. He also claims the closing of the bore at any convenient distance from the surface with a cap or cover, and applying a lift-pump above such cap or cover either to assist the force pump to raise the brine to the surface or place where it is required, or as a substitute for the said force pump, as decribed.

50. W. MARTIN, *Birmingham*, "*Stalls or boxes and seat of treadwheel and crank sheds or houses.*"—*Dated 8th January*, 1867.

The patentee claims constructing and arranging the said stalls and boxes or seats substantially as described and represented in the drawings, so that the prisoners or persons occupied at the said treadwheels, or at other associated labour, may pass to and from their work without seeing each other, and without leaving any unoccupied places where the labour is applied.

51. R. ROBINSON, *Preston*, "*Apparatus for regulating, controlling, and for varying the speed of shafts and machinery.*"—*Dated 8th January*, 1867.

This invention cannot be described without reference to the drawings.

55. W. E. NEWTON, *Chancery-lane, London*, "*Pneumatic apparatus for the treatment of diseases in an attenuated atmosphere.*"—*A communication.*—*Dated 8th January*, 1867.

This invention cannot be described without reference to the drawings.

63. A. V. NEWTON, *Chancery-lane, London*, "*Artificial legs.*"—*A communication.*—*Dated 9th January*, 1867.

This invention cannot be described without reference to the drawings.

65. G. INDERWICK, *Princes-street, Leicester-square, London*, "*Tobacco pouches.*"—*Dated 10th January*, 1867.

These improved tobacco pouches are made, according to one arrangement, principally of india-rubber of the ordinary kind used for that purpose, but other materials may be employed. The inventor makes them somewhat of an oblate spheroidal form, but very much flattened, the access being by a circular, oval, or other shaped opening in one of the flattened sides. For this purpose he provides the opening with a metal rim, on which he applies a metal disc, secured thereto by a pivot at one side, on which pivot the disc cover may be moved round so as to disclose and uncover the opening to the pouch. This cover, instead of revolving in a lateral direction, may be hinged so as to rise up or close like a snuff-box lid, a suitable spring being applied in the hinge to keep it closed; or it may be secured with a snap.

68. J. SILVESTER, *Westbromwich*, "*Weighing machines.*"—*Dated 11th January*, 1867.

This invention consists of the arrangement or combination of the parts of a spring weighing machine hereinafter described, whereby the machine is made very compact and portable. A weighing machine constructed according to this invention consists, essentially, of the following parts:—A nearly rectangular frame capable of a vertical motion carries at its top a rod on which is the platform or scale pan for receiving the article to be weighed. At the bottom of the said frame is a rod similar to that at its top. The said frame and lower rod are concealed in the case of the machine. The said frame is suspended in the case by two coiled springs, to the lower ends of which the frame is attached. The upper ends of the springs are connected to a fixed cross bar in the case of the machine. The article to be weighed on being placed on the platform or scale pan depresses the frame and elongates the springs to an extent greater or less, according to the weight of the article. The distance to which the frame is depressed, and, consequently, the weight of the article, is indicated on a vertical graduated plate. The axis of the said index figure carries a pinion with which a rack carried by the frame engages. The frame is guided in its motion by means of four horizontal guide rods. Two of the said guide rods are situated in a vertical plane parallel to the dial plate of the machine, and the other two in a vertical plane at right angles to the dial plate of the machine. Two of the guide bars are jointed at one end to the top rod, and the two are jointed at one end to the bottom of the lower end. The other ends of the guide bars are jointed to the case of the machine. The case of the machine is supported on a foot.

69. E. T. HUGHES, *Chancery-lane, London*, "*Differential pump for pumping and discharging varying quantities of liquid, and producing varying pressure.*"—*A communication.*—*Dated 11th January*, 1867.

The patentee claims, First, the construction, adaptation, and arrangement of pumps called differential pumps, in which two pumps connected together are made to discharge at pleasure varying quantities of liquids, or to produce varying pressure, substantially as described and illustrated in the drawings; Secondly, the mode of varying the discharge and pressure obtained from such differential pumps by varying the relative length of stroke of each pump piston, substantially as set forth.

70. E. M. CHAFFEE, *Providence, U.S.*, "*Elliptic or other elastic springs.*"—*Dated 11th January*, 1867.

This invention consists in the introduction of rubber, or any of its allied gums, between the plates or lifts of the spring, for the purpose of reducing or preventing the consequent results of friction between the plates.

72. S. P. WIDNALL, *Granchester, Cambridgeshire*, "*An improved form or bench with back to fold, so as to occupy only a few inches in thickness.*"—*Dated 11th January*, 1867.

This invention cannot be described without reference to the drawings.

74. J. DARLANG, *Stane, Lanark*, "*Improvements in penholders, and in the means or apparatus for supplying ink to pens.*"—*Dated 11th January*, 1867.

This invention has for its object the supplying of ink to pens used for writing without the necessity of dipping the pen into the writing fluid, as the body of the penholder is constructed so as to contain and supply the ink to the writing points or nibs. This part of the invention is based upon another invention for which provisional protection was granted to the present inventor the 6th December, 1866 (No. 3215). The Second part of this invention relates to the means or apparatus to be employed in charging the reservoir penholder.—*Not proceeded with.*

77. M. HENRY, *Fleet-street, London*, "*Improvements in the mode of and apparatus for manufacturing beton, and in the method of applying beton for certain constructive or structural purposes.*"—*A communication.*—*Dated 11th January*, 1867.

This invention relates to the beton respecting which patents were obtained by F. Coignet, respectively dated 26th November, 1865 (No. 2659), and 6th December, 1859 (No. 2757), and also a patent in the name of the present patentee as a communication from the said F. Coignet, dated 29th April, 1863 (No. 1086). The main principle of manufacture of this beton consists in bringing the mixed ingredients into a pulverulent paste or pasty powder by considerably reducing the quantity of water as compared with what is used in ordinary mortars, betons, or concretes, so that the said improved beton may be agglomerated into moulds by ramming. The present improvements relate, First, to the apparatus for mixing and triturating the materials; Secondly, to an improvement in the mode of manufacturing the beton; and, Thirdly, to various modes of applying the same for constructive or structural purposes. The specification of the invention is too elaborate to be quoted here in detail.

78. M. H. SIMPSON, *Boston, U.S.*, "*Improvements in the construction of seats or chairs suitable for preserving life in case of shipwreck, and also for being used as bathing chairs.*"—*Dated 11th January*, 1867.

According to this invention the principal means of floatation are placed at the arms of the chair, the body of the person acting as ballast.—*Not proceeded with.*

80. J. TOMLINSON, *Manchester*, "*Improvements in bakers' and other ovens, and also in scrap and other furnaces.*"—*Dated 11th January*, 1867.

This invention cannot be described without reference to the drawings.

84. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Railings or fences.*"—*A communication.*—*Dated 12th January*, 1867.

This invention has for its object the obtainment of a firm and strong fencing, which may be easily and rapidly constructed or taken in pieces and packed in a small compass when required for transport. According to this invention the vertical rails or bars of the fence may be made either solid or tubular, but in lieu of supporting and maintaining them in their relative positions by passing them through holes made for that purpose in horizontal continuous bars situate near the upper and lower ends of the vertical bars, as in the ordinary area or house railings as at present employed, it is proposed to keep the several vertical bars in their places by introducing between them short lengths of tubular bars, the extreme length of which is about equal to the distance from centre to centre of the vertical bars. These intermediate tubular distance pieces may be so shaped at their extremities as to fit accurately against and partly embrace the opposite sides of the vertical bars, and the whole of the parts are held together by long bolts passing through transverse holes in the upright bars, and through the intermediate tubular distance pieces near the upper and lower ends thereof, the parts being tightened up by nuts on the outer ends of the long bolts.—*Not proceeded with.*

90. F. BRAMPTON, *Birmingham*, "*Compound material or substance to be used for binding books, for panelling, and for other purposes where strength and lightness are required.*"—*Dated 14th January*, 1867.

This invention consists of a compound material or substance made by coating or covering millboard on one or both sides with veneers or thin layers of wood, which said compound material or substance is very strong and very light, and is well adapted for covers of books, for panels, and for a great variety of other purposes. In making the said compound material or substance the patentee takes by preference millboard, of the kind commonly called panel board, and which consists of millboard made from the fibre of cotton, and steeped in drying oil, and stored or dried. He also takes thin veneers of wood, and by means of glue or other adhesive material he glues or affixes the said veneers to one or both sides of the said millboard. The surface of the veneer may be smoothed and varnished or polished, or ornamented in any desired manner. The veneers employed may be cut from blocks of one kind of wood, or from blocks composed of several kinds of wood, so glued or joined together as to produce when cut into veneers ornamental patterns or designs.

92. C. J. POWNALL, *Union Club*, "*Facilitating the removal of snow, hail, or ice from streets, &c.*"—*Dated 14th January*, 1867.

In performing this invention the inventor constructs of iron or timber or other material, a steam-tight vessel of suitable shape and size, which, if necessary, may be mounted on a carriage to facilitate the removal of it from place to place. This vessel may be divided into two or more compartments, the object being that while the process of conversion is proceeding in one the others are being filled with snow. Each of these compartments is to have a perforated lining inside, with a space between the lining and the sides of the vessel, so that the steam or hot air may circulate on all sides. Or, if found more suitable, pipes for injecting the steam or hot air upon the snow may be employed, or the arrangement of perforated linings may be used in conjunction with the injection pipes. Each chamber is to have a door or lid for filling in the snow, which shall be capable of being readily secured, so as when shut to make a tight joint all round, and also to have a valve or cock at the bottom for the escape of the water produced by the conversion. A steam boiler or hot air apparatus capable of generating a sufficient supply of steam or hot air is to be provided, having a force pump and all other necessary fittings. This boiler may be either on the same carriage as the snow chamber or separate from it, with suitable connections for the passage of the steam between them. The *modus operandi* is to fill one of the compartments with snow from the streets or other places whence it is desirable to remove it; then shutting down and securing the door or lid, the inventor turns on the steam or hot air from the boiler in such a quantity as to thoroughly dissolve or melt the snow, during which the filling of the other compartment may be proceeded with, and this process may be thus repeated *ad infinitum.*—*Not proceeded with.*

94. A. H. BRANDON, *Paris*, "*Carriage lifting jack.*"—*A communication.*—*Dated 14th January*, 1867.

This invention consists in the employment of one or more stationary uprights, over which is adapted a sliding sleeve, and between the uprights surrounded by the sleeve is inserted an upright movable bar, fitted with teeth on one of its faces, and connected to the sleeve by a spring pawl, or other analogous mechanism, in such a manner that when the sleeve is raised or lowered by means of a lever or other agent, the upright toothed bar will also be raised or lowered, whilst the bar can be raised independently of the sleeve by lifting it with the hand, and lowered again by its own gravity by simply disengaging temporarily the pawl from the teeth cut on the side of the bar.

98. S. DE WILDE, *Hatcham Park-road, Hatcham*, "*Apparatus used when probing for balls or projectiles.*"—*Dated 14th January*, 1867.

The patentee claims the arrangement of apparatus used when probing for balls or projectiles, as set forth, and the arrangement of the probe, consisting of two insulating conducting blades fixed in a handle and enclosed in a non-conducting tube, which protect their points, whilst they are introduced into the wound, and can then be drawn back, as described.

99. W. CLARK, *Chancery-lane, London*, "*Pipe moulding and casting apparatus.*"—*A communication.*—*Dated 14th January*, 1867.

That branch of this invention relating to the moulding and casting of pipes consists in an improved arrangement of the pit or trench, and its appurtenances employed in casting pipes on the vertical method, whereby the several operations of clamping, moulding, facing, drying, coring, casting, and stripping are enabled to be performed consecutively and without interference one with the other, the same resulting in a saving of time, space, and labour, and particularly of the more costly labour of the moulders. In pits of this class now and heretofore employed the drying portion or oven has had but one single outlet, namely, that communicating with the moulding pit, the latter connecting at its end most remote from the oven with the casting pit. A consequence of this arrangement has been that the moulding pit has had to do the double duty of a channel of communication between the casting pit and the oven, and of a moulding pit proper, the effect being either to throw the moulders out of work whenever the casting pit has had to be filled from the oven, or to oblige them to assist in the operation of shifting, to which duty the lower paid caster is fully competent. A serious expenditure of time and labour is also incurred by the necessity of twice handling with both cranes and two gangs of men of every flask conveyed from the oven to the casting pit, or from the casting pit to the oven. That branch of the invention relating to the black washing of pipe moulds consists in the employment or use of a casing fitting nicely over the sprinkler, and arranged in such a manner that when the casing covers the sprinkler the latter can be filled with black wash, and nothing is allowed to escape; and after the sprinkler has been adjusted in the proper position over the centre of the mould, the said casing can be readily removed. The application of the black wash to the outside of the mould can thus be effected in a short time, with little trouble, and without danger of injuring the interior of the mould. The invention consists also in the combination with a sprinkler of a conical guide piece or head, in such a manner that the sprinkler is retained in the centre of the mould, and prevented from damaging its sides. The invention consists, finally, in a fender placed under the mould into a suitable tank, and used in combination with the sprinkler in such a manner that the said fender, after having passed through the mould, is still kept in the centre, and prevented from floating off to any other part of the tank, whence it cannot conveniently be fetched out.

101. J. M. HOCKING, *Poplar*, "*Apparatus for condensing smoke and vapours.*"—*Dated 15th January*, 1867.

The invention has for its object to condense the smoke and vapours of various descriptions arising from furnaces, or from chemical, metallurgical, and other processes, for preventing both the loss arising from the passing away of such smoke and vapours, as also the nuisance and injury present arising therefrom. For this purpose the inventor causes the said smoke or vapour to pass through one or more closed receptacles containing water, either by producing a partial vacuum above the surface of the water in such receptacles by means of any suitable known arrangement of pump, whereby the said smoke or vapours will be drawn through the water in the form of bubbles, and will thereby be effectually condensed; or he draws the smoke or vapours directly from the furnace or apparatus by means of the pump, and forces it through the water in the said receptacle or receptacles; or he first draws the smoke or vapours through the water in one receptacle by means of the pump, which is then made to force the uncondensed portion through the water in one or more other receptacles.—*Not proceeded with.*

104. E. B. TAYLOR *and* F. WINTER, *Gresham-street, London*, "*Construction of fire screens, fans, &c.*"—*Dated 15th January*, 1867.

This invention has for its object, First, to render these articles portable, so that they may be easily put away in the pocket, and, Secondly, to so construct the article that it may be used, either as a fan, fire screen, parasol, or sun shade, as may be required. To this end the article is constructed on the principle of a folding fan, but instead of being made to open to only the segment of a circle, as is usually the case, it is made to open and form a whole circle; and in order that it may be kept open in its expanded form, the ends of the fan are secured to two rigid ribs, which can be temporarily secured together by means of a cord, hook, button, catch, or other suitable contrivance that can be easily attached and detached when the fan or other article is in its expanded state. In order that the article may be conveniently held by the hand, it is provided with a handle, which may be jointed so as to fold like an ordinary parasol handle or stick. The stick is jointed at its upper end to one of the rigid ribs, so that the article, when expanded, may be placed either in a horizontal, a vertical, or an inclined position, according to whether it is to be used as a fan, a hand screen, a parasol, or sun shade.—*Not proceeded with.*

105. M. HENRY, *Fleet-street, London*, "*Improvements in the means whereby tools or operating implements, instruments, appliances, or parts of machinery or apparatus may be moved to and worked at various parts of articles or surfaces to be operated on by the same.*"—*A communication.*—*Dated 15th January*, 1867.

The patentee claims the employment of a jointed or articulated frame, or of a number of frames, bars, arms, or rods, or rods jointed or articulated together, such frame, frames, arms, bars, or rods, carrying gear, appliances, or means by which motion is transmitted to a tool, instrument, implement, or operating appliances or part connected with such jointed frame frames, arms, bars, or rods, so that such tool, instrument, implement, or operating appliance or part may be moved to and worked at various parts of articles or surfaces to be operated on by the same, substantially as described.

108. J. J. E. R. HANDIN, *Paris*, "*Clocks.*"—*Dated 15th January*, 1867.

This invention relates to applying a remontoir to clocks, the advantages of this new application being manifold, as will be understood from the following description:—First, the opening of the rim is dispensed with, which very often is not an easy matter, and may occasion the breaking of the glass, or sometimes the same being not so tightly closed as to exclude dust will necessitate frequent cleanings and repairs. Secondly, there shall no longer exist any keyholes in the dial, and, consequently, no key shall be wanted, which very often does not fill the square properly or may be mislaid. Thus likewise will be avoided the inconvenience of having two keys, one for the striking part, and the clock movement, and another for the "fast and slow" device, all which difficulties are obviated by improved remontoir. Thirdly, a peculiarity of remontoir is to permit either the simultaneous winding up of the two barrels, or their winding up separately, or one at a time. This quite peculiar arrangement in connection with or independent from the two barrels allows of their being wound up to a different pitch, or the one more than the other when not in concordance, or when the striking part is deficient, or when the clock is repeating, in which case the barrel for the striking part having been unwound a greater quantity has to be wound up, of course, either more frequently or a greater quantity. Fourthly, by this system the clock is most easily wound up, and set right, and the "fast and slow" device is readily adjusted. Fifthly, as the rim no longer requires to be opened, the hands are free from any contact with the fingers, and are not liable to be made crooked or otherwise damaged as they are operated mechanically by means of a knob. The improved remontoir as applied to a clock, consists, First, in a knob for winding up the barrels provided with a toothed or brequet gear, fitted to the lower part of the rim, so as to avoid holes in the marble or other case. Secondly, in a similar knob likewise fitted to the upper part of the rim for setting at the right time by a first index being acted upon, or for imparting a forward or a backward movement to the setting rod by a second index being operated.

109. C. COLVILL, *Paris*, "*Meters for gas and liquids.*"—*A communication.*—*Dated 16th January*, 1867.

This invention consists in causing the rotation of the axle of a metre for gas or other fluids by the flow of a fluid acting on vanes which are extended and collapsed in such a manner that the quantity of fluid passing through the meter will be recorded by an ordinary counter. The meter is constructed by mounting upon an axle enclosed in a cylindrical case connected with pipes for the admission and delivery of the fluid to be measured, a series of vanes, which are intended to receive the impulse of the flow of the fluid entering the case, and which remain extended while impelled by the flow until it passes from the case, when they are folded or collapsed until, by the rotation of the axle, they are again in succession presented to the action of the entering fluid.—*Not proceeded with.*

110. W. A. LYTTLE, *General Post-office, London*, "*Improvements in and connected with the folding of newspapers, &c.*"—*Dated 16th January*, 1867.

In performing this invention the inventor folds each sheet of paper by creases in the direction of the length of the columns of printed matter, in such a way that two adjacent portions of one surface of the paper shall be brought face to face in making one fold, while two adjacent portions of the back surface of the paper will be superimposed in like manner by the next fold. The third fold will bring a further portion of the front surface of the paper into face-to-face contact, and the succeeding fold will again bring together a like portion of the back surface. This folding resembles the crimping or "gophering" of a piece of ribbon or muslin, and a transverse section of the newspaper, when so folded, will therefore be a zigzag line like the same section of lady's fan, or of an old-fashioned door screen when shut up.—*Not proceeded with.*

117. R. JAMES, *Poole, Dorset*, "*Apparatus for ventilating mines.*"—*Dated 17th January*, 1867.

According to this invention the inventor arranges a series of pipes passing down the shaft or shafts and main passages of the mine, with branch pipes leading into the workings, whereby they have openings provided with regulating valves, through which series of pipes the foul air is drawn out of the mine by means of any suitable known arrangement of pumps or exhausting fans; and he arranges another similar series of pipes passing down the shaft or shafts and main passages with branches extending into the workings, also having openings provided with regulating valves, through which series of pipes fresh air is forced into the passages and workings by means of one or more other pumps or fans. By thus simultaneously supplying fresh air to all parts of the mine, and exhausting the foul air therefrom, a most perfect ventilation of the mine is attained. The said two sets of pumps or fans for blowing in the fresh air and exhausting the foul air are both, by preference, placed at the top of the pit and worked by one and the same steam engine, the exhaust steam of which may, with advantage, be caused to escape from a jet situated in the upcast shaft of the mine, so as to increase the upward draught therein.—*Not proceeded with.*

118. W. STAFFORD and W. P. MCCALLUM, *Blackburn*, "*An improved bolt.*"—*Dated 17th January*, 1867.

This invention has for its object the construction of bolts in such manner that the nut when screwed up cannot move on the thread or become loose. In constructing bolts according to this invention the end of the shank is split, after which it is chased, or a thread formed thereon in the ordinary manner. On the nut being screwed up, a wedge of iron or other material is driven into the slit in the end of the shank projecting through or from the nut, thus wedging and expanding the end of such shank, and effectually preventing any movement of the nuts. When it is necessary to remove a nut, a side blow on the wedge will displace it, and the nut is then removed by a key in the ordinary manner.—*Not proceeded with.*

122. R. NEWHALL, *Astwood Bank, Worcestershire*, "*Receptacles for needles, pins, &c. &c.*"—*Dated 17th January*, 1867.

This invention consists in so forming the cases or receptacles for the articles above enumerated that such cases may be in part self-acting by means of a spring To effect this an outer case or envelope is formed to receive an inner case, and an elastic spring is connected to both cases in such manner as to keep them open whilst requisite, and to withdraw the inner case within the outer when required to be closed.

124. H. STARR, *Cheapside, London*, "*Safety match box.*"—*A communication.*—*Dated 17th January*, 1867.

This invention relates to the construction of a box for holding matches in a safe and convenient manner, and consists, chiefly, in the combination of an inner and outer case. The former, which is provided with conical ends, slides within the latter, and by the aid of a rod or pin extending through its lower or inner end ejects the matches singly through an aperture formed in the lid or cover on its outer end. The inner case is kept up or in its normal position by means of a spring, and is pressed down by the hand when a match is to be taken from the box.

126. A. BERENS, *Liverpool*, "*Filling splints into the dipping frames used in the manufacture of matches.*"—*A communication.*—*Dated 18th January*, 1867.

This machine consists of a suitable framing supporting a shaft which drives two short transverse shafts by means of four mitre wheels. Each of these transverse shafts carries a cam or lift wheel, and one of them is provided (outside the framing) with a fly-wheel and handle. From two brackets (placed one on each side of the machine), extend in contrary directions four arms resting upon the cam or left wheels, and upon these arms rest two shafts connected to two shaking boxes placed on the top of the machine. These shaking boxes are capable of being removed from the machine, and are so hinged together by means of one of the two shafts last named as to be capable of opening out like a book. The lower box consists of a square wooden frame, having a perforated plate at top and bottom, and these two perforated plates (the upper one having rather larger openings than the lower one) are connected together by a series of slightly conical or taper tubes, soldered or otherwise fixed to the two plates, one to each perforation. Beneath the lower surface of the tube-box is a metal slide, capable of being drawn out or pushed in so as to open or close the perforations. The upper or supply box is a wooden frame with vertical division plates, from which short transverse division plates stand out, also vertically, but at right angles to the latter. Close under the lower of these two boxes is a grating, having forty-five divisions, and beneath this is a second grating, having a similar number of divisions. In the space between these two gratings the dipping-box, which is to receive the splints, is placed. The dipping-box consists of a square frame provided with forty-five laths running at right angles to the lower grating, and capable of being separated to receive the splints, and pressed closer together to hold the same firmly. These laths are opened out to receive the splints by means of two rows of vertical fingers, the upper ends of which, passing upwards through the lower grating, are wedge-shaped, and which are capable of rising and falling, being actuated by a toothed rack and pinion driven by a winch handle, and upon their being raised an interstice is formed between each two laths. When the fingers are withdrawn the laths are pressed together, so as to hold the splints by means of a sliding bar and crosshead, to which latter a bar of wood is fixed, the sliding bar being actuated by a rack and pinion driven by a winch handle. The mode of working is as follows:—The two boxes are raised and opened out to an angle of about thirty degrees, the upper one leaning against the wall or other convenient place. The tube-box is then lowered again, and the upper or supply box is filled with splints; between the divisions and the upper empty space above the divisions is also filled by means of a box constructed with a false bottom for that purpose. The tube box is then again opened, and also the upper grating, turning on its backward edge. A dipping box, as above described, is then placed on the lower grating, and its laths opened out by raising the fingers, and the upper grating is then lowered, whereby a number of square openings (about two thousand) will be formed for the reception of the splints. Upon these squares the tube box is then lowered, the openings accurately corresponding, and which, when the slide is opened, can be tested by means of a piece of wire. The tube box is now raised up into contact with the supply box, and both boxes brought down together, the slide being opened. The cam or lift wheels are now brought into operation, which will have the effect of shaking the splints from the supply box into the taper tubes, and through them between the laths of the dipping frame. Upon now raising the upper box it will frequently be found that some of the tubes contain double splints, that is to say, a splint and a small splinter which prevents it from falling; in that case the latter must be removed, and the box being again closed, a few strokes of a mallet on the box will shake these remaining splints down and the dipping box is then filled. The fingers are now withdrawn from between the laths, and the latter are pressed up closely, so as to hold the splints firmly by means of the sliding bar and crosshead, and after having been fixed by means of pins passing through holes made in the frame for that purpose, the dipping frame with its splints may be removed from the machine, and the operation be repeated as before. The lower surface of the splints will be found to be exactly even and ready for dipping.

149. G. M. WELLS, *Aldermanbury, London*, "*Lasts for boots and shoes.*"—*Dated 21st January*, 1867.

This invention relates to certain improvements in the construction of metal lasts for boots and shoes, whereby greater facility is afforded for withdrawing the last and holding the parts together, and provision is made for shaping or forming the leg of the boot thereon. In carrying out the invention the patentee proposes to construct the last in two sections, each cut or formed with corresponding junction surfaces, such junction surfaces being either curved or straight, and neither carried entirely through the leg of the last, or being diverted at any angle therewith, either upwards or downwards, or carried off in a horizontal direction at any convenient distance below the top of the leg, the leg being wholly or partly formed, as the case may be, upon the upper section of the last. Male and female dovetails are cast on each of the junction surfaces of the sections of the last respectively so as to hold the parts securely together when adjusted. A slot or opening is cast down the leg portion of the last into the lower section thereof, into which fits or is inserted the standard which supports the last when in use, and thereby in connection with the dovetail locks, or holds the two sections of the last securely together.

150. W. E. GEDGE, *Wellington-street, Strand, London*, "*A two-branched or double-hooked fish-hook.*"—*A communication.*—*Dated 21st January*, 1867.

This invention cannot be described without reference to the drawings.

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

(From our own Correspondent.)

ON 'CHANGE IN WOLVERHAMPTON: *Another Brown Failure*—ON 'CHANGE IN BIRMINGHAM: *The Orders for Iron for Canada: Prospects of the Market: Good Demand for North County Iron and Stone: Great Inquiry for Tin Plates*—THE TRADE ABOUT DUDLEY: *Iron and Coal*—HARDWARES: *Continued Improvement* — FAIRFAX AND CO.'S AFFAIRS — GOVERNMENT MINES INSPECTOR AND THE COLLIERY AGENTS: *Dispute*—THE MIDLAND BOILER ASSOCIATION: *Great Success: The Meeting.*

THE meeting of ironmasters on 'Change in Wolverhampton on Wednesday was not numerously attended, but considering the attendance, the amount of business done, though slight, is encouraging. The tone was not, however, cheerful, it having become known that another failure had occurred in Birmingham. The concern is that of Mr. William Shaw, of Old Park House, Park-street, Birmingham, railway stores contractor. His suspension is understood to be due to the difficulties of railway contractors of great eminence, with whom, up to the time of their stoppages, he did a large business.

The meeting of ironmasters on 'Change in Birmingham yesterday (Thursday) was not attended with much business, nor was the tone of the market more satisfactory than last week. Whilst the failure made known in Wolverhampton yesterday was not likely to affect the trade to any considerable extent, still it produced an unfavourable feeling. The stoppage is supposed to be due to the difficulties under which the large contracting firms have recently succumbed. There is still a good trade being done in the best qualities of pig iron produced in the north of England, and also in hematite stones brought into this from other districts, and high prices are obtained. Activity is manifested at the mills and forges where the Canadian orders are usually got out, every effort being put forth to get the iron away at the close of this week, the latest date at which shipments can be made by sailing vessels. So bare, however, have the different works been of orders, that the firms at which the finished iron has usually been rolled for Canada have been turning out only half as much as they usually make for that market at this season of the year, other firms taking the specifications at lower figures than these have been willing to accept. Sheets of all kinds, with strips and rods, are much in request, and the tinplate works are overstocked with orders, even with prices at 24s. for I. C. The completion of the British American trade for the season, with also the closing of the Baltic and Black Sea ports, will leave but few orders upon the books for the foreign markets, and the fear is being expressed that the recent dulness will again appear, without any favourable change until spring. The masters, who are more cheerfully inclined, point to the favourable prospects of the East Indian and United States markets, in addition to the impetus to the home trade which will be given by the excellent harvest in Great Britain.

From Dudley the report is:—West of this town there has been a better demand this week for plates, and the large mills have been doing more work than of late, the small mills are still well occupied, and the men are doing generally four and five turns per week. Things look rather more cheering, but the general opinion of those who are likely to be well informed upon the subject is that there will not be any great improvement this year. Pig iron is a little stiffer in prices, but consumers are only purchasing from hand to mouth, probably expecting that it may be bought in a short time on easier terms; but the price of the raw material is not likely to be lower at present. The consequence will be that the producers of pig iron will not be able to give way in price if they are to secure to themselves any profit. Some wealthy pig masters still hold largely and refuse to sell except on a moderate scale at existing rates. There is no coal in this locality equal to "thick coal" for general purposes, hence the demand which, considering the period of the year, continues very good, and large quantities are still being raised in the district for the foreign as well as the home markets. A good quantity of hematite, hydrate, and Northamptonshire ironstone is being brought into this locality, but the native produce still holds its position, and where it can be had is largely bought up by certain parties to use as a mixture with the former qualities.

The slight improvement in the hardware trades in Birmingham and South Staffordshire continues. Sales of copper are taking place notwithstanding the advance in price, and tin-plates cannot now be had for prompt delivery even at 24s. per box, I. C.

The liabilities of Messrs. Fairfax, Bryson, and Co., are shown to be £45,000, and the assumed assets, 12s. in the pound, but many creditors would gladly take 6s. An assignment has been made to the manager of the Midland Bank, to Mr. William Barker (electro-plater), and to Mr. Broughton (Broughton and Smith.)

The question of legal responsibility in the management of coal and stone mines in this district is again to come before the police courts here, upon proceedings instituted by the Government Inspector of Mines, who has already been successful in showing that certain responsibility rests not upon the underground workers, but upon the owners and upon the managing engineers. Against such a rendering of the Act the mine agents of South Staffordshire and East Worcestershire have combined, and they are now an incorporated society, with Mr. Johnson, mining engineer, of Dudley, as their secretary. Last Monday Mr. Johnson was summoned before the stipendiary for South Staffordshire, at Sedgley, as "agent" at the Moor-lane Colliery, Brierley-hill, and so also was Emanuel Baker, as "owner" of the colliery, both for the same offences, namely, not having fenced off a fly-wheel, and not supplying an indicator to an engine. The inspector had experienced some difficulty in ascertaining upon the colliery the facts that would have enabled him to fix the responsibility upon one of the two, and so consulted the Home-office, when he received instructions to summon both. The facts were not gone into, and were postponed till next Friday at Wolverhampton.

A half-yearly meeting of the Midland Steam Boiler Assurance and Inspection Company was held in Wolverhampton on Wednesday afternoon, at which the subjoined satisfactory reports were adopted, and special thanks voted to the board of directors and the assistant engineer, by whom the business in that part of the kingdom is managed. The secretary's report was:—"The profits of the financial year ending June 30th, 1867, are £627 15s. 1d., a result which the directors consider very satisfactory. Your directors recommend the declaration of the usual dividend of 10 per cent. on the capital paid up, that the reserve fund be made up to £1000, and that £300 be written off the account for preliminary expenses, reducing that account to £21 14s. 4d. This will leave a balance of £13 0s. 1d., which it is proposed to carry forward. The business arising from the north of England, and which is carried on by a committee of gentlemen in that locality, has largely increased, and promises to be of very great importance to the future prospects of the company. The list below gives the number of boilers now under the care of the company on July 1st, 1867:—Southern Division: boilers assured, 674; boilers inspected, 876. Northern Division: boilers assured, 695, boilers inspected, 204. Total, 2449. "The directors have much satisfaction in noticing that since the formation of the company in 1862, they have been enabled to discharge, within a very trifle, the large preliminary expenses incident to the commencement of a company of this description, that they have paid a fair dividend to their shareholders, and have, by the careful attention given by their engineers and inspectors to the boilers under their charge, had only one accident entailing any considerable loss on the company during that time. They trust that the same care and the same exemption from accidents will continue." The engineer's report states, "that up to June 30th, 1867, there were 1580 boilers under inspection, and 1369 under assurance, making a total of 2449 boilers under the care of the company. This number has since been increased. There has been no explosion of any boiler under the care of the company. During the half-year there were made 6909 inspections of boilers, and of these 671 were inside and 702 in the flues; and 740 reports were sent to owners as to matters needing attention. Many engines have been indicated, and the usefulness of the informaion thus supplied appears to be much appreciated.

WALES AND THE ADJOINING COUNTIES.

(From our own Correspondent.)

THE IRON TRADE: *Buyers not so Backward of Entering into Fresh Transactions: Cheerful Aspect of the Home Trade: Continuation of Favourable Advices from Foreign Markets: Anticipated Increase of Exports*—THE BLAINA AND CWM CELYN WORKS: *A Sale not yet Effected*—THE DOWLAIS IRON COMPANY: *Exclusive Right of Working Bessemer's Patent*—THE NEWPORT AND PILLGWENLLY WATER WORKS: *Declaration of Dividend*—THE CAMBRIAN RAILWAYS: *Meeting at Crewe*—THE TAFF VALE RAILWAY: *Appointment of Secretary*—MONMOUTHSHIRE WAGON COMPANY: *Declaration of Dividend.*

SINCE last report a slight improvement has taken place in the iron trade, but trade generally is quiet. Buyers of iron are not so backward as they were a few weeks since of entering into new transactions, more especially for miscellaneous qualities; and, upon the whole, a better feeling prevails. On home account matters are looking a little more cheerful, and as soon as the railway companies are able to exercise the borrowing powers granted to them by Parliament, it is expected that considerable orders for rails will be given out; and once the necessary funds are forthcoming, the present low quotations for iron will, no doubt, prove a strong inducement to make large purchases. Already there is a little more doing in rails, but until the companies can fully exercise their borrowing powers, orders will not be given out very freely. From the foreign markets the advices continue tolerably favourable as regards future requirements. The United States are likely to be large buyers of railway iron; and as South Wales enjoys a high reputation in the markets of the United States, for her tough "Erie" iron, and has better access to the trans-Atlantic seaboard than any other iron-making district, there is every probability of anticipations as to the increase of exports to America being realised. Considerable supplies will also be required for India, Russia, &c., and as extensive purchases have hitherto been made for these countries, it is only reasonable to anticipate a fair share of future requirements. For bars of repute the demand is increasing; and shipping parcels have been more sought after than for some weeks past, but there is no change in prices to note. In pig iron a fair amount of business is being done, and prices remain firm.

No suitable offer has yet been made for the Blaina and Cwm Celyn Works, although several parties have gone over them, which is much to be regretted, as the prosperity of Blaina and the neighbourhood will be effected to a very serious extent by the stoppage of the ironmaking branch of so large and important works. The collieries are still being worked, and it is intended to keep them going, at least for some time to come.

The Dowlais Iron Company, it is reported, have made arrangements for the exclusive right of working Bessemer's patent in Glamorganshire, £10,000 being the amount paid for the concession.

There is a good demand for tin plates, both coke and charcoal selling freely at the current rates.

In the steam coal trade the slight improvement which took place about a week ago is, to a great extent, maintained, and the collieries are better employed than they were a short time ago.

The half-yearly meeting of the Newport and Pillgwenlly Waterworks Company was held at Newport on Monday, and a dividend at the rate of £7 per cent. upon the original capital per annum was proposed and carried unanimously.

A meeting of debenture holders and others interested in Cambrian railways has been held at Crewe, in order to receive a report from the accountants as to the financial position of the undertaking. In the absence of Earl Vane, Mr. J. Bancroft occupied the chair. The report of the accountants (Price, Holyhead, and Waterhouse), showed that the total capital raised on account of the Cambrian railways amounted to £3,434,837, of which £824,205 was in ordinary stock, £1,760,170 in preference stock, and £850,462 in mortgages. For the Aberystwith and Welsh coast section the total capital raised amounted to £1,394,332, of which £265,420 was in ordinary shares, £300,460 in preference shares, and £106,088 in mortgage bonds. The works on the several lines had been executed by Mr. Savin, but it did not appear that a proper contract had been entered into until a few days previous to Mr. Savin's suspension. The report goes on to give details of the position of Mr. Savin, with several undertakings, and the conclusion arrived at is, that at the time of the suspension he was indebted to the companies to the extent of £203,513. The accountants conclude by stating that the Amalgamation Acts, under which the Cambrian Company had been constituted, were perfectly unintelligible, and the interests of the various classes of shareholders appeared in several instances to be in direct conflict, and consequently it was of the utmost importance that an endeavour should be made to re-arrange the interests of the proprietors under a scheme which should be acceptable to all. The chairman said the object of the meeting was a friendly conference between the parties interested in the Cambrian property. He suggested that the present Amalgamation Acts should be repealed, and that powers should be obtained to merge all the sections into one company. The capital, which now amounted to £3,600,000, should be reduced to £2,250,000, and this could be accomplished by an equitable reduction, according to priorities, in every class of preferences. It was not proposed to interfere in any way with the bonded debt. The ordinary stock would also be largely reduced, and, as soon as 2½ per cent. was paid upon it, then all the additional profits would go back again to the preferences. The object of the plan was two-fold—first, with a capital so large they could not expect to declare any considerable dividend and maintain a good credit before the public; secondly, if the London and North-Western or any other large company desired to purchase the Cambrian they would be more likely to look at it with a capital account in an intelligible state. Capt. Johns, a director, disagreed with the plan, and maintained that the accountants' report was inaccurate in many respects. Mr. Mann advised a conciliatory course on all sides. After a long discussion seven gentlemen were appointed a committee to confer with the directors as to the best means of re-constituting the company.

Mr. Marwood, accountant of the Somerset and Dorset Railway, has been elected secretary to the Taff Vale line, to fill the vacancy caused by the death of Mr. Kenway. There were 150 applicants for the post.

At the Monmouthshire Wagon Company's half-yearly meeting held at Newport, a dividend at the rate of £5 per cent. per annum for the half-year was declared. The profits of the Company would have enabled the directors to have declared a larger dividend, had it not been that some exceptional expenses were required to be met.

SCOTLAND: ITS TRADE AND OPERATIONS.

(From our own Correspondent.)

THE GLASGOW PIG IRON MARKET—MANUFACTURED IRON—THE COAL TRADE—MINERS' MEETING—THE LONDON AND GLASGOW ENGINEERING AND IRON SHIPBUILDING COMPANY, (LIMITED)—CONTRACT FOR GUN BOATS—LETERKENNY AND GLASGOW STEAM PACKET COMPANY—LAUNCHES DURING THE PAST WEEK.

THE pig iron market has been more animated during the past week than for many months past, and a large business has taken place daily. Prices have advanced 1s. per ton, and most of the leading makers have advanced their prices 1s. to 2s. per ton. To day (Wednesday) over 10,000 tons were done at from 54s. to 54s. 3d. cash; 54s. 3d. to 54s. 4½d. one month. Full quotations are as follows:—Pig iron: Mixed Nos. warrants, 54s. 1½d. to 54s. 3d.; No. 1, g.m.b., 54s. 6d. to 54s. 9d.; No. 3, 53s. 6d. to 53s. 9d.; Gartsherrie, No. 1, 62s.; Coltness, No. 1, 61s. The shipments of the week still continue above those of the corresponding week of last year.

For manufactured iron there is a better feeling in the market, and considerable orders have been given out within the last two days for shipment. The smaller makers are almost all fully employed, and generally there is more doing at all the works. Prices continue much the same, but the tendency is in favour of sellers, and with a continuance of trade we may look for some slight advance on the cheaper brands.

In shipbuilding iron there is more inquiry, but not sufficient to influence prices. We quote the following as current rates:—First common bars, £7 5s.; second, £6 17s. 6d. to £7; nailrod, £7 5s.; angle iron, £7 2s. 6d. to £9; plates, £8 2s. 6d. to £10, all f.o.b. here, less usual discount.

Coals continue in steady demand for home use and for export at the following prices:—Coals, Main and Common hard for shipping, per ton of twenty hundred weight laid down, 6s. 6d. to 7s.; best splint, do., 7s. 3d. to 7s. 9d.; Wishaw and Household, for shipping, 7s. to 7s. 9d.; dross, laid down, 3s. 6d. to 5s. 6d.; household, best quality delivered, per wagon of 24 cwt., 10s. to 12s. 6d.; second qualities, per do., 9s. to 12s.; quarter, best quality, delivered per wagon, 13s.; steamboat, per 24 cwt., 10s. to 12s.

The advices of coal shipments at the principal ports still show an amount greatly in excess of that of the corresponding week of last year.

On Thursday a meeting of delegates from the several collieries in the districts of Larkhall, Motherwell, Hamilton, and Wishaw was held in the Brandon Hotel, Motherwell, to consider the proposals now before the districts by certain of the masters, with a view to putting an end to strikes and lockouts, in order that a proper understanding might be arrived at in regard to them. Mr. John Smith was called to the chair. After several reports had been given, and some conversation taken place, Mr. Joseph Orr moved "That we accept the terms offered by the masters, to commence on or before the 1st September, and that the men do not enter into a strike before that." Mr. Thomas Robertson seconded the motion, which was carried unanimously. Mr. Steel then proposed, "That, on 2nd September, every work in the four districts, viz., Hamilton, Larkhall, Motherwell, and Wishaw, should send a delegate to a meeting to be held in this place to receive the answers from the various masters." Mr. Andrew McCowie seconded the motion, which was carried unanimously.

The chairman then intimated the arrangement made with regard to giving Mr. McDonald a valedictory demonstration in the City Hall, before his departure for America, after which the meeting broke up.

The following is a report of the directors of the London and Glasgow Engineering and Iron Shipbuilding Company, Limited, to be presented to the shareholders at the fifth ordinary meeting to be held to-day:—"Your directors have to submit for the information of the shareholders the annexed statement of accounts, showing the result of the working for the past year. The directors believe that when the unprecedented depression that has so long weighed on the shipbuilding trade is taken into consideration the shareholders will concur with them in opinion that the statement submitted must be viewed with satisfaction. After payment of all current expenses and charges, including interest on the balance of purchase money, reserving £4970 for depreciation of buildings, plant, tools, &c., and writing off £1000 from preliminary expenses, there remains a net balance of profit amounting to £9098 10s. 7d. This balance the directors recommend should be appropriated as follows:—Dividend of £1 per share, being at the rate of 42 per cent. for the past year, free of income tax, on the paid-up capital of the company, £4483, income tax, £74 14s. 4d., balance of profit carried forward, £4540 16s. 3d.; total, £9098 10s. 7d. In recommending that this amount should be carried forward, the directors have to call the shareholders' attention to the present condition of the trade, which they consider likely to continue depressed for some time to come, and therefore it would be imprudent to pay a high rate of dividend. The balance remaining, with the present available capital, will be sufficient to enable the directors, satisfactorily, to conduct the business of the company. The directors who retire by rotation upon this occasion are William Hamilton, jun., Esq., and David Smith, Esq., who, being eligible, offer themselves for re-election. Your directors have to deplore the loss during the past year, by death, of one of their colleagues, Robert Walker, Esq., whose place it is not proposed to fill up. The auditors, Messrs. Coleman, Turquand, Youngs, and Co., of London, and Messrs. Kerr, Anderson, and Brodie, of Glasgow, also retire from office and are eligible for re-election. The dividend warrants will be payable on and after the 9th proximo.—By order, Edward Coleman, Sec.

Messrs. Wm. Denny and Brothers, Dumbarton, have contracted to build for the Viceroy of Canton, China, two composite gunboats of 350 tons each, and with engines of 60-horse power.

The Letterkenny and Glasgow Steam Packet Company, which was lately established to promote direct steam communication between Letterkenny and Glasgow, not having secured sufficient support, has abandoned the original intention of the managers. It has, however, been determined to run a steamer between Letterkenny and Farland-point, in connection with the trains on Lough Swilly Railway, from that place to Londonderry.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

LIVERPOOL: MERSEY DOCKS AND HARBOUR BOARD—RAILWAY PROGRESS IN LANCASHIRE—RAILWAY COMPENSATIONS—MIDLAND RAILWAY—MANCHESTER INSTITUTION OF ENGINEERS—VIADUCT OVER THE DERWENT AT HUTTON—NORTH-EASTERN DISTRICT: *Hexham and Allendale Railway: The St. Lawrence (s. s.): Blythe and Tyne Railway: Blythe Harbour: Cleveland Iron Trade, &c.*—STATE OF TRADE: *Sheffield: South Yorkshire*—THE AKS COLLIERY.

AT the last meeting of the Mersey Docks and Harbour Board a letter was read from Messrs. Wilson, Son, and Walter, and Messrs. Fletcher and Parr, drawing attention to the combination of railway companies whose lines connect Liverpool with the east coast, and several steamship proprietors at those ports, in opposition to the direct lines of steamships between Liverpool, Rotterdam, Antwerp, and Hamburgh. Rates, it was stated, were so reduced that goods were now conveyed by rail and steamer through to Rotterdam, Antwerp, &c., on lower terms than had for many years been charged for railway carriage alone, the reduction on some goods being equal to 50 per cent. on previous existing rates, and vastly out of proportion to the charges for the conveyance of similar goods to Manchester and other places not one-tenth of the distance; the letter was referred to a sub-committee. The Mersey Docks and Harbour Board has established an electric time gun, which has been placed on the north pier of the Morpeth Dock, Birkenhead. The arrangements for utilising this time gun are now nearly completed, and it is expected to be ready next month. It is to be fired daily at one p.m. The net receipts derived by the Mersey Docks and Harbour Board for the use of the appliances provided for the shipment of coal at Birkenhead, for the year ending June 24th, 1867, were £1016 as against £428 in 1865-6. The report of Mr. Lyster, the dock engineer, on the dock works at Liverpool and Birkenhead, during the year ending June 24th, 1867, states that the north river wall has been completed to its northern extremity,

a total length of 1596ft., and a raised terrace with a retaining wall had been formed at the back of the parapet. Every precaution had been taken to ensure its stability. The dock lines of railway had been extended to the timber storage yards at Bootle; and the Lancashire and Yorkshire and London and North-Western Railway Companies had opened new communications with the north docks. At Waterloo Dock works, the whole of the internal masonry and excavations are completed, and the laying of the gas and water mains and the paving of the quays are in progress. The river entrances are drawing towards completion, the whole of the masonry, with the exception of a portion of the surface finishing in the north island, is completed. A great portion of the south island is also completed, and the remainder at the west end is finished to the level of about 8ft. below the coping. About 140ft. of the south wing wall, to form a junction with the river wall at Prince's pier, has yet to be carried out. The whole of the gates, bridges, and capstans of the several entrances, with the hydraulic machinery for working the same, are advancing towards completion. The east block of the corn warehouses is completed, and the cement flooring of the several rooms is in hand. The west block is nearly completed, the roof is in an advanced state, the whole of the ironwork being nearly fixed or on the ground; the arching for the third and fourth floors and the whole of the sixth floor is in progress. The walls, iron beams, and columns of the north stack are completed to the level of the fourth floor.

The works of the Aston, Runcorn, and Ditton Railway, one of the London and North-Western's new branches, are sufficiently advanced to allow of the permanent way being laid on the greater portion of the line, while the materials are in course of delivery. The viaduct, consisting of ninety-eight arches, through Runcorn and over the marsh on the Lancashire side of the Mersey, is nearly completed; of three openings in the bridge over the river two are finished, while the scaffolding for the third or last opening is being erected. The Sandbach and Northwich Railway, nine miles in length, is completed, and will be opened for traffic on the 1st of September.

The Railway Compensation for Injuries Act appears to be pressing harder and harder upon the railway companies. In the past half year the London and North Western paid £75,000 under this head, as compared with £48,000 in the previous half-year. The additional cost of labour involves an extra outlay to the London and North Western Company at the rate of £150,000 per annum.

The expenditure on the Bedford and London section of the Midland Railway to June 30th was more than £3,000,000. During the past half-year nearly £1,500,000 was expended by the company on new lines and works.

The Manchester Institution of Engineers has just held a general meeting. The secretary (Mr. W. E. Dando) read the first annual report, which stated that since the Institution was formed in March its progress had been in every respect satisfactory. At the first meeting there were present eighteen gentlemen, who formed from themselves a committee, and appointed that committee to draw up rules and to lay down a basis for the permanent establishment of the Institution. At the second meeting the number of members had increased to forty-eight, and from time to time sixty-four members, eight associates, and one graduate had been enrolled. The chairman said he had been requested to add that a library would be established and a room opened as soon as possible. The report was adopted.

The last of sixteen great girders for a new viaduct building on the Scarborough Railway across the Derwent at Hutton has been safely placed in position. In a few weeks it is expected that the viaduct will be ready for traffic.

A portion of the Hexham and Allendale Railway from Hexham to Langley, a distance of nine miles, has just been opened for goods and mineral traffic. A screw steamer named the St. Lawrence, built by Mr. Lindsay, of the St. Lawrence shipbuilding-yard, and engined by Messrs. Pattison and Atkinson, of the Mushroom-quay, has made a satisfactory trial trip on the Tyne. The St. Lawrence is intended to be employed in the coasting trade. It is understood that the extensive rolling mills belonging to Messrs. Pile, Spence, and Co., are likely to pass into the hands of a London firm, Messrs. Higgins and Co., who want them for the manufacture of steel. The dividend of the South Shields Gas Company does not exceed 3 per cent. per annum, and the directors have been "reluctantly obliged" to raise the price of gas to 4s. per 1000 cubic feet. The Blyth and Tyne Railway Company will shortly open a new branch to Cambois colliery; the Blyth and Tyne, it is satisfactory to observe, maintains its dividends. One of the arches on the Lune Viaduct on the Tees Valley Railway gave way on Friday. The number of furnaces in blast in the Cleveland district is 89, while the number out of blast is 45. Cleveland appears to have obtained its full share of recent foreign rail orders. The Cleveland pig iron trade is in a steady state; the stock in the warrant stores at Middlesbro' is stated to be 75,006 tons, as compared with 65,000 tons in January. The shipbuilding yards on the Tyne and Tees show slight indications of improvement. Shipments of coal are not very active just now, especially as regards the Baltic ports. The shipments of coal from Blyth harbour during the first half of this year amounted to 117,282 tons, against 121,966 tons in the corresponding six months of 1866. During the past half-year the completion of the wave-trap has been effected, and the wharfing on the north side has been sufficiently advanced to admit of the erection of two spouts; it is intended to continue this work during the autumn. A dredger, the hull built by Messrs. Robinson, of Blyth, and the machinery by Messrs. Hawks and Co., of Gateshead, has just been delivered to the company; two hopper barges for disposing of the material dredged have also been contracted for with the Floating Dock Company, of Blyth, and one of them has been delivered. The cost of this plant is estimated at about £5000. The Xantha, a handsome screw yacht, built for Lord Alfred Paget, is receiving the finishing touches at the hands of the builders, Messrs. Palmer and Co. The works of a new line of railway between York and Doncaster are making great progress at the hands of the contractor, Mr. T. Nelson, of Carlisle. The contractors for the Hull and Doncaster line, Messrs. Brassey and Co., have made considerable progress with a great bridge across the Ouse at Howden.

Mr. J. Brown, of the Atlas Works, Sheffield, has received the honour of knighthood. There is but little change to report in the state of business affairs at Sheffield. Complaints are general as to the scarcity of orders, especially in the cutlery and edge tool branches, and with the exception of the American trade there is but little doing in files. There is only a moderate demand for steel for manufacturing purposes, most of which is for the Continent and America; but for steel railway *matériel*, there continues a good inquiry. The iron trade is dull, and there have not recently been any large castings.

The iron trade of the South Yorkshire district continues quiet in all departments. For railway *matériel* such as tires, axles, &c., there is a better demand. In the steel trade, also, there is a good demand for railway materials.

On Saturday a meeting in connection with the re-opening of the Oaks Colliery was held on the Oaks premises, and was attended by three Government inspectors and twenty-two mining engineers, and others interested in the mine. After a discussion which lasted three hours, the following resolution was adopted:—"That the process of opening be proceeded with and a report forwarded daily to the chairman, with a view to his summoning another meeting whenever he may think it necessary; and that it be the duty of the acting engineer to stop the works if any unfavourable symptoms be observed, and to report the same to the chairman, Mr. T. E. Foster, who is competent to confirm the stoppage of the works, and call a general meeting if he thinks fit; and that it also be competent to the chairman to stop the works if he see it necessary at any time from the results of the daily reports. The meeting was divided in opinion as to the prevalence of fire in the mine. As the contractor has got as far as the archway at the bottom of No. 1 shaft, an entrance to the mine is expected to be shortly accomplished.

FOREIGN TARIFFS ON METALS AND METAL GOODS.

Articles.	New Duty. Foreign Measures and Money.	New Duty. English Measures and Money.
THE ZOLLVEREIN.	per centner Thlr. sgr	per cwt. £ s. d.
Raw of all kinds, and old broken iron	0 7½	0 0 9
Hammered and rolled iron (except shaped) in bars, iron in lumps, rails for railways, raw and cemented, and cast and refined steel	0 25	0 2 6½
Iron and steel wire of more than ¾ of a Prussian line diameter	0 25	0 2 6½
Ditto of ¾ of a Prussian line and less	1 05	0 3 6½
Wrought iron for the coarse parts of machinery and carriages, cranks, axles, &c., provided each part weigh one centner or more	0 25	0 2 6½
Notes.		
(1) Raw steel imported by sea from the Russian frontier as far as the mouth of the Vistula, by special permission for the use of steel manufactories	0 15	0 1 6½
(2) Lump iron, not purified from the dross, in masses or prisms	0 17½	0 1 9¼
(3) Hammered and rolled iron and steel of ½ a Prussian line in thickness, or of more than 7 Prussian inches in width, pays as iron or steel plates.		
Iron shaped in bars, wheel tires for railway carriages, iron for ploughshares, black sheet iron, raw sheet steel, raw unpolished iron and steel plates, and anchors and anchor chains	1 05	0 3 6½
Varnished iron plates; polished steel and iron and steel plates	1 22½	0 5 4
Tin plates, and rolled or drawn wrought iron pipes	2 15	0 7 7
Iron and Steel Wares:—		
Very common cast wares, as stoves, plates, railings, &c.	0 12	0 1 2½
Common of wrought or cast iron, or of iron and steel, of tin plate, or of steel and iron wire, combined or not with wood, but not polished:—		
(*a*) Anvils, crowbars, roasting spits, wire gauze, tripods, harrows, traps, pitchforks, rakes, cramp irons, trowels, kettles, chains (other than ships' chains), kitchen ranges, nails, brads, tags, screws, pans, ploughshares, flat irons, common rings, gridirons, shovels, rough cast wares, tilt hammers, screwbolts and boxes pokers, large scales, carriage and door handles, carriage springs, &c., provided that these articles are neither wholly polished, varnished, coppered, nor tinned	1 10	0 4 0¾
(*b*) Other common articles; also all articles wholly polished, varnished, coppered or tinned, such as hatchets, sword-blades, files, hammers heckles, planes, coffee-roasters and mills, locks, vices, common knives for artisans, scythes, sickles, curry-combs, tower clocks, tailors' and cloth-makers' shears, tongs, &c. &c.	2 20	0 8 2
Fine; of fine cast iron, of polished iron or steel; also of iron or steel mixed with other materials (except those which pay as "Small Wares")—		
(*a*) Lacquered iron ware, knives, knitting needles, bodkins, scissors, sword makers' work, &c. (and except those under *b*)	4 00	0 12 2
(*b*) Sewing needles, steel and other common metal pens, watch cases and watch works of common metals, weapons of all kinds, and small articles not included under "Small Wares"	10 00	1 10 6
Instruments, surgical, mathematical, mechanical, &c.	Free	Free
Small wares not otherwise enumerated	15 00	2 5 9
Arms and Ammunition:—		
Firearms and swords. See Fine Iron Wares.		
Sword-blades. See Common Iron Wares.		
Shot	1 00	0 3 0½
Machinery:—		
Locomotives, tenders, and boilers	1 15	0 4 6¾
Other machinery pays according to the weight of the predominating material.		
Cylinders, for printing and for dressing tissues:—		
Engraved	2 00	0 6 1
Plain	0 15	0 1 6¼
Cards	6 00	0 18 3
AUSTRIA.	Fl. kr.	£ s. d.
Iron and Steel Wares:—		
(*c*) Iron rails for railways	2 50	0 5 1
(*d*) Steel raw, cemented, cast, and refined	2 50	0 5 1
(*e*) Iron plate, black, iron, and steel plate, raw, unpolished, and tires	3 50	0 7 1
(*f*) 1. Iron plates, polished, tinned, lacquered, or varnished; steel plates, polished; also iron wire, and unpolished steel wire	4 00	0 8 2
2. Iron, refined in shaped bars	4 00	0 8 2
(*g*) Curse wrought iron, parts of machines, carriages (axletrees, &c.), the component parts of which weigh respectively one centner and upwards; ploughshares, anchors, anchor and ships' chains	3 50	0 7 1
(*h*) Steel wire polished, and steel strings for instruments	5 00	0 10 2
(*i*) Coarse cast wares; as kettles, stoves, plates, wheels, pipes, and grates, each piece weighing more than 25 lb., and parts of machinery, each part weighing above 100lb.	1 00	0 2 0½
Iron Wares:—		
(*j*) Most common: not partly or wholly polished, smoothed, varnished, enamelled, or lacquered, and not named under (*f*), (*g*), (*i*), (*k*), and (*l*)	5 00	0 10 2
(*k*) Common: 1. Axes, saws, scythes, sickles, chopping knives, chisels, planes, coopers' knives, files, rasps, clothmakers' and tailors' shears, large knives for trade purposes, and pruning knives, polished or not; and wire brushes and sieve bottoms	6 00	0 12 2
2. All wares named under (*j*) and (*k* 1), combined with common wooden wares	6 00	0 12 2
(*l*) Fine: 1. All articles polished (except those under (*k* 1), painted, lacquered, or varnished (except sewing needles), but not really gilt or silvered, or coated with a gold or silver lacquer	15 00	1 10 6
2. Articles in combination with other materials (except those which come under the head of Fine Leather, India-rubber, or Small Wares) or articles named under (*i*, *j*) table knives, scissors, wire gauze and fine wire work (except sieve bottoms); clasps, hooks, wire covered with paper, carding irons, and scrapers	15 00	1 10 6
3. Arms and parts thereof, crochet and tambour needles, knitting needles, watch springs and watch and clock works, and steel beads	15 00	1 10 6
Sewing needles	25 00	2 10 10
Small wares, gilt, plated, or lacquered	50 00	5 1 7
Machines and Mechanical Instruments:—		
Of cast iron	2 50	0 5 1
Of wrought iron or steel	4 00	0 8 2
Of other common metals not specified	7 50	0 15 3
Instruments, mathematical, surgical, &c.	4 50	0 9 2
Arms and Ammunition:—		
Shot	3 50	0 7 1
Percussion caps	16 00	1 12 6
Arms and parts of arms	See Fine Iron Wares	

Note.—Machinery for the use of national industries may, by special permission, be imported at a reduced rate of duty.

BRASS AND COPPER.—THE ZOLLVEREIN.

Articles.	New Duty. Foreign Measures and Money.	New Duty. English Measures and Money.
	per centner Thlr. sgr	per cwt. £ s. d.
Copper, Brass, &c.:—		
Raw, old broken copper, and old coin (by special permission)	Free	Free
Hammered or rolled, in bars or sheets, and wire	1 22½	0 5 4
Sheets and wire, plated	4 0	0 12 2
Copper and Brass Wares:—		
Wire gauze	3 0	0 9 2
Coppersmiths' works, such as stills, pans, irons, weights, hooks, hinges, taps, trowels lamps, candlesticks, snuffers, mortars, bolts, tubes, locks, clasps or handles, scales, and similar coarse wares, not polished or varnished, combined or not, with wood or iron	2 20	0 8 2
Other kinds, plain or in combination with other materials (except those included under "Small Wares"	4 00	0 12 2
Small wares not otherwise enumerated	15 00	2 5 9
AUSTRIA.	Fl. kr.	£ s. d.
Brass or Copper:—		
Pure or mixed, in blocks, cakes, bars, lumps, &c.; also old broken copper, and copper ash	Free	Free
In sheets or plates, wire and strings for instruments; also large castings, as bells and tubes, weighing more than 25 lb., and other articles weighing more than 10 lb each	6 00	0 12 2
Note.—Copper cylinders, engraved or not, may be imported, by special permission, for the use of national stuff printers, at a duty of 75 kreutzers per centner, is. 6d. per cwt.		
Brass and Copper Wares:—		
Cylinders, boilers, bowls, plates, pots, and other kitchen utensils, not otherwise specified	7 50	0 15 3
Other kinds, of pure or mixed metal, not gilt, silvered, or lacquered, combined or not with other materials (except fine leather, india-rubber, or small wares): bronze powder and metal foil, writing pens, watch and clock works, and sheets, plates and wire, plated or silvered	15 00	1 10 6

LEAD.—THE ZOLLVEREIN.

	Thlr. sgr.	£ s. d.
Lead:—		
Raw, in blocks and pigs, and old broken lead	Free	Free
Rolled, and printing types	0 15	0 1 6¼
Lead Wares:—		
Coarse, as kettles, pipes, shot, wire, &c, not polished or lacquered; also in combination with wood or iron	1 00	0 3 0¾
Fine, and lacquered wares; also if combined with other materials (except those included under "Small Wares")	4 00	0 12 2
Small wares not otherwise enumerated	15 00	2 5 9
White lead	1 00	0 3 0¾
Red lead	0 7½	0 0 9¾
AUSTRIA.	Fl. kr.	£ s. d.
Lead:—		
Raw, old lead, refuse, and type metal	0 75	0 1 6¼
Rolled: also printing type and stereotype plates	3 00	0 6 1
Cast, as pots, tubes, pipes, shot, &c.; also wire	3 50	0 7 2
Lead Wares—Toys, wholly or partly of lead, varnished or not, and common wares	12 00	1 4 5
White lead	2 50	0 5 1
Red lead	1 50	0 3 0¼
Litharge	1 00	0 2 0¼

TIN.—THE ZOLLVEREIN.

	Thlr. sgr.	£ s. d.
Tin:—		
Rolled, sheets	0 15	0 1 6¼
Tin Wares—Coarse, as wire, pipes, dishes, plates, kettles, and other vessels, not polished or lacquered, also in combination with wood or iron	1 00	0 3 0¼
Fine, and lacquered tin wares, plain or mixed with other materials (except those which come under "Small Wares")	4 00	0 12 2
Small wares not otherwise enumerated	15 00	2 5 9
AUSTRIA.	Fl. kr.	£ s. d.
Tin:—		
Raw, in blocks and bars, and old broken tin	Free	Free
Drawn or rolled, as sheets, plates, or wire, and coarse cast tin articles	3 00	0 6 1
Tin Wares—Common, such as cylinders, kettles, plates, &c., and other kitchen utensils	5 00	0 10 2
Fine tin wares, not gilt or silvered	15 00	1 10 6

ZINC AND ZINC WARES.—THE ZOLLVEREIN.

	Thlr. sgr.	£ s. d.
Zinc:—		
Raw and old broken	Free	Free
In sheets	0 15	0 1 6¼
Wares—coarse, not polished or lacquered; also in combination with wood and iron; and wire	1 00	0 3 0½
Fine and lacquered wares, plain or mixed with other materials (except those which come under "Small wares")	4 00	0 12 2
Small wares not otherwise enumerated	15 00	2 5 9
AUSTRIA.	Fl. kr.	£ s. d.
Zinc:—		
Raw and old broken refuse	Free	Free
In plates or sheets	2 00	0 4 0¾
Wire, tubes, and coarse castings, plain or combined with common wood or iron	2 50	0 5 1
Zinc Wares—Common	5 00	0 10 2
Fine, not plated nor gilt	15 00	1 10 6

PRICES CURRENT OF METALS.

	1867. £	s.	d.	£	s.	d.	1866. £	s.	d.	£	s.	d.
COPPER—British—cake and tile per ton	79	0	0..	80	0	0	86	0	0..	0	0	0
Best selected	80	0	0..	81	0	0	89	0	0..	0	0	0
Sheet	81	0	0..	83	0	0	91	0	0..	0	0	0
Bottoms	85	0	0..	0	0	0	95	0	0..	0	0	0
Australian, per ton	82	0	0..	86	0	0	85	0	0..	91	0	0
Spanish Cake	73	0	0..	0	0	0	82	0	0..	0	0	0
Chili Slab	73	0	0..	0	0	0	80	0	0..	0	0	0
Do. refined ingot	76	0	0..	0	0	0	0	0	0..	0	0	0
YELLOW METAL, per lb.	0	0	7	0	0	7¼	0	0	7¼	0	0	8
IRON, Pig in Scotland, ton	2	14	0 cash				2	12	6 cash.			
Bar, Welsh, in London	6	15	0..	7	0	0	7	5	0..	7	15	0
Wales	6	0	0..	6	5	0	6	5	0..	6	10	0
Staffordshire	7	10	0..	0	0	0	8	10	0..	8	15	0
Rail, in Wales	6	0	0..	6	5	0	6	5	0..	6	10	0
Sheets, single in London	9	5	0..	9	10	0	10	10	0..	0	0	0
Hoops, first quality	8	5	0..	8	10	0	9	10	0..	9	15	0
Nailrods	7	10	0..	0	0	0	8	10	0..	8	15	0
Swedish	10	5	0..	10	10	0	0	10	0..	11	5	0
LEAD, Pig, Foreign, per ton	19	5	0..	0	0	0	19	10	0..	0	0	0
English, W. B.	21	10	0..	0	0	0	22	5	0..	22	15	0
Other brands	19	10	0..	19	15	0	20	0	0..	20	7	6
Sheet, milled	20	15	0..	0	0	0	21	0	0..	0	0	0
Shot, patent	23	0	0..	0	0	0	24	0	0..	0	0	0
Red or minium	21	0	0..	0	0	0	22	0	0..	0	0	0
White, dry	29	0	0..	29	10	0	31	0	0..	32	0	0
ground in oil	28	0	0..	30	0	0	29	0	0..	32	0	0
Litharge, W.B.	25	0	0..	0	0	0	24	15	0..	25	0	0
QUICKSILVER, per bot.	6	17	0..	0	0	0	6	19	0..	7	0	0
SPELTER, Silesian, per ton	20	15	0..	21	0	0	19	10	0..	19	15	0
English sheet	26	0	0..	0	0	0	27	0	0..	0	0	0
White zinc, powder	0	0	0..	0	0	0	0	0	0..	0	0	0
STEEL, Swedish faggot	0	0	0..	0	0	0	0	0	0..	0	0	0
Keg	15	5	0..	15	10	0	0	0	0..	0	0	0
TIN, Banca, per cwt.	4	12	0..	4	12	10	4	4	0..	4	5	0
Straits, fine—cash	4	9	0..	0	0	0	4	4	0..	0	0	0
For arrival	4	9	10..	9	0	0	8	5	0..	4	6	0
English blocks	4	11	0..	0	0	0	4	5	0..	0	0	0
Bars	4	12	0..	0	0	0	4	6	0..	0	0	0
Refined, in blocks	4	14	0..	0	0	0	4	8	0..	0	0	0
TINPLATES, per bx of 225 sheets												
IC coke	1	3	6..	1	6	0	1	5	0..	1	7	0
IX ditto	1	9	6..	1	12	0	1	11	0..	1	13	0
IC charcoal	1	9	0..	1	11	0	1	12	0..	1	13	0
IX ditto	1	15	0..	1	17	0	1	18	0..	1	19	0