ENGLISH PATENTS IN 1881.

It is somewhat remarkable that so promising a subject as the "geographical distribution" of patents—to borrow a phrase from the biologist—should have been almost entirely neglected by statisticians. With the exception of a series of tables issued by the late Mr. Woodcroft about thirty years ago, we cannot call to mind any attempt to discuss and compare the relative number of applications for patents from various localities. Patents have increased so rapidly of late that the analysis for a single year is no light task, although the necessary material is very accessible, and is in such a form as to give little trouble beyond that of mere careful counting. In view of the importance of the question we have undertaken an elaborate investigation into the place of origin of the applications for British patents during the past year, the basis of our analysis being, of course, the *Journal*, published by the Commissioners of Patents. Before proceeding to state the results of our labours it may be well to mention the principles on which the work has been performed. The total number of applications during the year, which reached 5751, the largest ever known, is obtained at once, each patent being numbered consecutively in the official lists. The number of foreign applications was ascertained in the first instance by direct computation, the result being checked by counting the number of applications from the United Kingdom and deducting it from the whole number for the year. If the work was accurately done, these two figures should have exactly agreed, but there was a discrepancy of 1, which we are unable to account for. This is the only inconsistency we are aware of, and we feel bound, as a matter of conscience, to admit it. The work has been most carefully checked, and we believe the results to be thoroughly trustworthy. The frequent occurrence of joint patents, the parties to which reside in different quarters of the world, in different divisions of the United Kingdom, and in different counties, has rendered necessary a continual process of "correction." For instance, an application for a patent by a German and a Frenchman—such a conjunction does occur now and then—would be counted under both Germany and France when estimating the number of patents from those countries, but it would only appear once in the list of "foreign" patents. A similar rule has been followed in the case of joint patents originating, say, in Scotland and Ireland, or in Warwickshire and Staffordshire. No other course suggested itself of dealing with applications of this nature, and it was obviously impracticable to count "half" patents. The occurrence of these dual patents will account for the apparent discrepancies in the figures which follow. In the case of "communications from abroad," the domicile of the person communicating the invention, who is the real inventor, has alone been regarded. No notice whatever has been taken of the residence of the agent in this country. When a town extends over two or more counties, as is the case with Birmingham, care has been taken to duly apportion the patents when dealing with statistics of counties. The limits of the Parliamentary boroughs have been taken as the standard unless otherwise expressed. The first and most obvious step is, of course, to separate the foreign from the home patents. The following is the result :—

United Kingdom :	
England	3263
Scotland	270
Ireland	63
Wales	46
Corrected total	3633
Foreign	2139
Total for the year	5751

One cannot help being struck by the very large number of foreign applications, which reaches 2139, or more than 37 per cent. of the whole. They are distributed as follows :—

Europe :—	
Austria-Hungary	70
Belgium	70
Denmark	12
France*	552
Germany	464
Holland	7
Italy	19
Luxemburg	2
Malta	1
Norway	14
Russia	24
Spain	7
Sweden	32
Switzerland	40
Turkey	2
Asia :—	
Ceylon	1
China	1
India	15
Manila	2
Singapore	3
America :—	
Canada	34
Guatemala	2
Mexico	1
Newfoundland	1
Nova Scotia	2
South America	10
United States	745
West Indies	3
Australasia :—	
Australia	8
New Zealand	5
Tasmania	1

The above figures suggest some very interesting reflections, the most obvious of which is that an English patent is highly prized by foreigners. With one exception, we have, unfortunately, no statistics of the number of foreign patents granted to Englishmen; but we are able to assert most positively that our countrymen do not show anything like the eagerness to secure patents abroad displayed by foreigners to obtain protection for their inventions here. The exception above alluded to is the United States; and we learn from the report of the American Commissioner that in the year 1881 the number of patents granted to foreigners was 995, out of a total of 16,584, or 6 per cent. As regards Great Britain, only 343 patents were issued, or just 2 per cent. On the other hand, 745 applications out of a total of 5751, or nearly 13 per cent., came to us from America during last year. From the manner in which the returns are made we are obliged to compare the relative number of *grants* in the United States with *applications* at the Patent-office here, but the percentages furnish a perfectly trustworthy basis of comparison. It is possible, however, to obtain approximately the total number of applications for patents by British subjects by a very simple calculation. The total number of applications in the United States reached 26,059, whilst the grants were, as previously stated, 16,584. Assuming the same proportion to subsist between the applications and the grants in the case of British subjects, as we may safely suppose was the case, the actual number of applications from this country would amount to 542, against 745 applications for British patents by Americans.

* Including 4 from Algiers.

Those who have followed the course of the patent law controversy during the last few years, are aware that the United States have been held up as a sort of land of Canaan for inventors, especially for English inventors, who were supposed to be driven out of their own country in shoals by oppressive taxes upon genius. The figures we quote above do not in the least bear out what we have always characterised as a fond delusion. On the contrary, Brother Jonathan makes much greater use of our patent laws than we do of his, whether we take the absolute or the relative numbers of applications, and this in spite of the higher fees which prevail here.

It may also excite surprise that more than ten patents per week should come from France, and nearly an equal number from Germany. The forty applications from Switzerland show a somewhat curious amount of eagerness to take advantage of that protection which she denies to strangers. Holland, too, which has abolished her own patent laws, does not hesitate to avail herself of our laws.

We must leave the professed political economist to explain the extraordinary rush of foreign patentees to our shores. If it means that foreigners only wish to secure an exclusive market here, preferring to manufacture abroad on account of the cheapness of labour, then the patent laws would seem to be operating somewhat unfairly upon home trade. We by no means imply that this is our own view, and the facts are quite susceptible of being explained by pointing to the great wealth and enterprise of this country, which is regarded as a promising field for disposing of a meritorious invention.

We have no detailed statistics for former years, but from a rough estimate we are able to say that the proportion of foreign to home patents is increasing. In other words, we are being gradually invaded by the Americans, the French, and the Germans—particularly the latter. It is, however, an invasion which need not be regarded in a spirit of hostility.

The large towns of the United Kingdom placed in order are as follows :—

1.	London (Postal District)	1260
2.	Manchester and Salford	240
3.	Birmingham	220
4.	Glasgow	130
5.	Liverpool	109
6.	Leeds	70
7.	Sheffield	54
8.	Bradford	44
9.	Nottingham	37
10.	Edinburgh	34
11.	Bolton	33
12.	Coventry	32
13.	Bristol	31
14.	Newcastle-on-Tyne	28
15.	Huddersfield	24
16.	Halifax	24
17.	Oldham	21
18.	Dublin	21
19.	Sunderland	20
20.	Blackburn	18
21.	Leicester	18
22.	Belfast	18
23.	Brighton	15
24.	Hull	15
25.	Keighley	15
26.	Rochdale	14
27.	Preston	13
28.	Wolverhampton	13
29.	Stockport	12
30.	Accrington	11
31.	Warrington	11
32.	Tipton	10

The remaining towns are all under 10.

It will be interesting to compare the order of succession of the large towns for 1881 with their relative position in Mr. Woodcroft's table above referred to. The order, as determined by the total number of applications from the earliest period down to the end of the year 1858, was as follows :—

1. London	17. Halifax
2. Manchester and Salford.	18. Oldham
3. Birmingham	19. Huddersfield
4. Glasgow	20. Derby
5. Liverpool	21. Wolverhampton
6. Leeds	22. Bury
7. Sheffield	23. Blackburn
8. Bristol	24. Brighton
9. Bradford	25. Accrington
10. Nottingham	26. Belfast
11. Edinburgh	27. Ipswich
12. Newcastle-on-Tyne	28. Dudley
13. Dublin	29. Hull
14. Rochdale	30. Preston
15. Leicester	31. Plymouth
16. Bolton	

The first seven places are occupied by the same towns in both lists. Bristol has gone down to the thirteenth place, whilst Bradford, Nottingham, and Edinburgh still continue to occupy their same relative positions as they did twenty years ago. Bolton rises from 16 to 11, whilst Coventry, which was not within the limits of the old list, takes the twelfth place. This is almost entirely due to the bicycle trade. Putting aside the first seven towns, which maintain their position, all the Lancashire and Yorkshire towns have advanced.

Confining our remarks to England alone, the distribution of patents by counties is very instructive. Omitting Middlesex and the other home counties as being entirely swallowed up by London, the following is the order :—

Lancashire	589
Yorkshire	380
Warwickshire	247
Staffordshire	81
Cheshire	71
Durham	56
Nottinghamshire	51
Hampshire and Isle of Wight	42
Gloucestershire	40
Worcestershire	40
Somersetshire	35
Northumberland	34
Sussex	31
Lincolnshire	29
Leicestershire	28
Devonshire	27
Derbyshire	19
Hertfordshire	17
Suffolk	16
Norfolk	14
Bedfordshire	14
Wiltshire	13
Monmouth	13
Cornwall	13
Cambridgeshire	13
Buckinghamshire	12
Shropshire	10
Berks	10
Oxfordshire	9
Cumberland	4
Northamptonshire	3
Rutlandshire	3
Herefordshire	2
Dorsetshire	1
Westmoreland	1
Isle of Man	1

Lancashire, as will be seen, stands far ahead of its competitors, the total being largely made up by the important contributions of Manchester and Liverpool. The Yorkshire patents are almost entirely from the West Riding, and, as will be seen from our list of towns, Leeds, Sheffield, Bradford, and Huddersfield together make up more than one-half of the total. Warwickshire depends upon Birmingham and Coventry for its place in the list. After a long interval comes Staffordshire, closely followed by Cheshire. We should hardly have assigned the next place to Durham, which owes its position to the fact that no less than twenty applications came from Sunderland. Hampshire comes high in the list, and Somersetshire precedes Northumberland. The position of Lincolnshire is largely due to the various manufactories of agricultural implements. Without these its place could hardly be before Leicestershire. Many counties which are generally looked upon as purely agricultural come out comparatively high in the list. Did space permit we could show that this is generally due to some flourishing but partly-forgotten industry. On the other hand, some counties which include at least one well-known manufacturing town do not make much show. For instance, the busy town of Northampton only contributed two patents during the year; but perhaps the attention of the citizens has been too exclusively directed towards an object which need not be more particularly alluded to.

Statistical writers have always a tendency to push matters too far, a fault we have endeavoured to avoid. We do not say that the number of patents granted is an unfailing test of commercial prosperity, but it is at any rate a tolerably sure index of activity. Some interesting conclusions might be drawn by contrasting the number of patents with the population. As our article is already long enough, we must leave our readers to discover these for themselves, contenting ourselves with this one observation, that the most "inventive" town in the United Kingdom is Birmingham.

THE FOUNDATIONS OF MECHANICS.

By WALTER R. BROWNE, M.A.

No. VII.

103. *Principle of Equivalence of Work and Vis Viva.*—There is yet another caution which needs to be given before leaving the question of nomenclature. Mention is often made of the principle of the equivalence of work and *vis viva*, and this is stated to be that the work done on the system is equivalent to the change in the *vis viva*. Now as we have defined the work done to be represented by Ps, it would follow from the principle, as thus stated, that Ps is equivalent to Bv^2, whereas in reality it is (P—Q) s which is its equivalent. What is meant by the work in this case is, therefore, the net difference between the total work done by the effort and the work done upon the resistance; in other words, it is the kinetic work only, as above defined. This fact should always be made clear when the principle is used as stated. In this, its correct form, the principle has, of course, been already proved in article 95.

104. *Conservation of Energy.*—We have now seen that, in the simple case under consideration, the following changes have taken place. There has been an exertion of energy on the part of the body A acting upon B, which is represented by Ps, and which may be looked upon as the action of a cause. Again, the effect due to this cause, or the work done, is divided into two parts: (a) the potential work represented by —Qs, which means that the force Q of the centre C has been overcome through the distance s; (b) the kinetic work represented by Bv^2, which means that the velocity of the centre B has been increased from O to v. Now, by the general principle of conservation, namely, that effects live, we should expect that these two effects would be capable in themselves of acting as causes, to produce equivalent effects; and we have to see whether this is the case.

105. Let us first take the potential work Qs. In order to examine this effect by itself, let us suppose that, when B has traversed the space s, the velocity v and the force P are both annihilated, so that B is left at rest, exposed solely to the attraction of C, which, as before, we may assume to act by a series of impulses. It follows that A

will begin to move backwards towards C; and since the action of C, by our definition of matter, is independent of time, and is always the same at the same distance, it follows that the first impulse given to B, on its returning road, will be exactly the same in magnitude and direction as the last impulse which it received on its outward journey. Similarly the second impulse of the new set will be precisely the same as the last but one of the old set, and so on throughout; so that when B has reached the point from which it started there will have been an exertion of energy on the part of C, which is represented exactly by Qs, and which is, therefore, precisely the same in amount as the energy which was exerted by C during the previous movement, and was neutralised by the greater force of A. At the end of this time B will have a velocity V, which is such that $B V^2 = Qs$.

106. We have here spoken of C as remaining fixed and B moving towards it, because that was the assumption with which we set out. But of course we may just as well assume B to be fixed and to draw C towards it by the equal mutual attraction subsisting between them; or—which would really be the case if B and C were left to themselves—that they both move towards each other under the influence of that mutual attraction. The only difference will be, in that case, that the distance s, instead of being measured along B's path only, will be measured partly along B's and partly along C's; being, in fact, in all cases, the distance by which the two centres have approached each other during the motion.

107. We may therefore say that on our definition of matter the potential work done upon B in the course of its motion renders possible the exertion of a precisely equivalent amount of energy, due to the mutual attractions between B and C.

108. Let us now consider the kinetic work Bv^2. To examine this question by itself, let us suppose that at the end of the space s the centres A and C are replaced by a single centre at C, acting with a force (P — Q), that is equal in amount, but opposite in direction, to the net force which has generated the kinetic work $B v^2$. As before, we may suppose this force P — Q to act by impulses at intervals $d s$. Then, by the Second Law of Motion, each of these impulses will produce its full effect upon B, irrespective of the fact of B's present motion; it will therefore destroy a portion of B's kinetic energy precisely equivalent to that which was generated by any one of the n equal impulses which acted on B during its motion along the space s. Hence, by the time that n of these equal impulses, due to P — Q, have acted upon B, the whole of its kinetic energy will have disappeared, and it will be at rest. But in the meantime it has overcome the force P — Q through the distance s, precisely as the force Q was overcome through the distance s in the former motion; and therefore, as explained in the last paragraph, the kinetic energy $B v^2$ in disappearing must have generated an amount of potential energy, due to the mutual attraction between A and C, which is represented by (P — Q) s. This is therefore precisely equal in amount to the energy by which the velocity v was originally generated in B.

109. Here, as before, for the sake of clearness, we have represented the energy as being destroyed by precisely the same steps as those by which it was generated; but if we only grasp the principle that the kinetic energy $B v^2$ fully represents the effect of the energy originally expended upon B by P — Q, it will be evident that this representation is in no wise essential to the proof. We may suppose, for instance, that A and C are both annihilated, and that B flies on in a straight line, with undiminished velocity v, until it comes into the range of another centre D, whose force R may be a repulsive one. The centre B will then be gradually stopped, and will come to rest in a distance S, which will depend on the value of R, but which will certainly be such that $R S = B v^2$; inasmuch as R S is known to represent the energy which R will, during the passage over the space S, have exerted on B, and this energy has been expended in destroying the whole of the kinetic energy represented by $B v^2$.

110. We may, therefore, say that, on our definition of matter, the kinetic work done upon B in the course of its motion renders possible the exertion of a precisely equivalent amount of energy, due to the mutual action between B and any other centre within whose range it may come.

111. Let us now gather our results together. We started with an amount P s of energy exerted by A. We saw that the effect of this exertion was the performance of work, but work under two different forms, namely, potential work, represented by Q s, and kinetic work, represented by $B v^2$. We then found that the performance of each of these amounts of work rendered possible the exertion of a fresh amount of energy, not due like the first to the action of A, but precisely equivalent in amount to the original energy exerted by A in the two cases. In other words, the kinetic work $B v^2$, done by A upon B, gave B the power of subsequently doing the potential work represented by (P — Q) s or R S respectively, in the two cases described in Art. 108, 109; and the potential work Qs, done by A upon B, gave B the power of subsequently doing the kinetic work represented by $B V^2$ (Art. 105), which can, of course, by a further operation, be converted also into potential work of equivalent amount. Hence, if we define energy, which we have not yet defined, as the power of generating potential work, we see that the energy of A with regard to B has, indeed, been reduced in the original action by the quantity P s, since the impulses which have gone to do that work have had their effect, and cannot, by any action of A and B, be again renewed; but that the energy of B, or its power of doing work upon other centres, has been augmented by precisely the same amount. Hence, we see that, taking the system as a whole, there has been no gain or loss of energy during the action. This is the principle of the Conservation of Energy as applied to this particular case.

112. It will now be advisable to recur to the assumptions—Art. 84—with which we started on this investigation, and see how far they affect the generality of the principle we have just stated. In the first place we assumed that A is fixed. Since in every case of mechanics it is necessary to assume some fixed point, and to consider the motions relatively thereto, there is no difficulty in making A that point. In practice the centre of the earth may be considered as fixed for all questions of terrestrial mechanics, and the centre of the sun as fixed for the purposes of astronomy.

113. Again, we assumed that C is fixed; but if C have a motion in the direction C A, the only effect will be that we shall have to diminish the quantity Q s, expressing the energy imparted by C, by the quantity Q s^1; where s^1 is the space described by C, during the time of the motion in the direction C A. The effect will therefore be the same as if C were at rest, while the amount of Q was diminished in the ratio $s - s^1 : s$. There would thus be a diminution in the potential work, and, of course, a corresponding increase in the kinetic work. If C has a motion in the opposite direction, the potential work will be in like manner increased.

114. Further, we supposed C and A to have no mutual action. In reality this is not, of course, true, by our definition of matter; but in many cases C and A may be fixed with regard to each other—as where coals are wound up from a pit by a steam engine at the surface, which is fixed with regard to the earth—and this amounts to the same thing. Moreover, as we shall see hereafter, the forces of cohesion are very great at insensible distances, but are quite inappreciable at sensible distances; hence, in considering, for instance, the case of a rope in tension, we may treat any section as being influenced by the two sections on either side of it, but not by those beyond. If, however, A does attract C, the effect is to move C in the direction of A, and thereby make the distance between B and C, at the end of the motion, less than in the former case. Thus, let R be the force with which A acts on C, and S the distance through which C has moved along the line C A. Then A will have exerted the additional energy R S, which will all take the form of kinetic work done upon C. On the other hand, the energy P s exerted on B will be just the same as before; but the part of it which takes the form of potential work will be reduced from Q s to Q (s — S), because the number of impulses distributed over the space S will not have been given. Now the effect of this on B will be exactly the same as if, C remaining fixed, the strength of each impulse had been reduced in the proportion $s - S : s$; for in that case the total effect would be represented by $Q \frac{s - S}{s} \times s = Q(s - S)$ as before. But if the resistance be reduced from Q to $Q \frac{s - S}{s}$, then the unbalanced effort will be increased from P — Q to $P - Q \frac{s - S}{s}$; and the kinetic work, due to this unbalanced effort, will be increased from $(P - Q)s$ to $\left(P - Q \frac{s - S}{s}\right)s$, or $(P - Q)s + QS$. Thus the kinetic work will be increased by Q S, which is exactly the amount, as shown above, by which the potential work is diminished. Hence the assumption that A acts on C does not introduce any gain or loss of energy on the whole; the energy exerted on C takes the form of kinetic work, and the energy exerted on B partly of kinetic and partly of potential work as before, but divided in different proportions.

115. The assumptions still remaining to be considered are (1) that B is initially at rest; (2) that the forces P and Q are constant. Now with regard to the first, let us suppose that instead of being at rest the centre B has an initial velocity V in the direction B A. If the velocity is in the opposite direction B C, the demonstration will be the same, simply writing — V for V throughout. Then, by virtue of this velocity, it will also have kinetic energy represented by $B V^2$ (if B is half B's mass), which can be converted into potential work, as explained in Art. 108. Let t be the interval of time considered. Then, by Art. 69, since the net moving force (P — Q) has been acting on the mass 2 B during the time t, it will have generated in B—irrespective of B's initial motion—a velocity represented by $\frac{P - Q}{2B} t$, and will have caused B to describe a space represented by $\frac{1}{2} \frac{P - Q}{2B} t^2$. In addition to this B will have described, by virtue of its initial velocity, a space Vt. Hence the total energy exerted by A will now be represented by $P\left(Vt + \frac{1}{2}\frac{P - Q}{2B}t^2\right)$; and the total amount of energy which has to be accounted for at the end of the motion, is

$$BV^2 + P\left(Vt + \tfrac{1}{2}\frac{P - Q}{2B}t^2\right).$$

Now the energy left at the end of the motion is as follows: (1) The potential energy, due to the potential work done in moving B through the space $\left(Vt + \frac{1}{2}\frac{P - Q}{2B}t^2\right)$ in opposition to the force Q. This is represented by

$$Q\left(Vt + \tfrac{1}{2}\frac{P - Q}{2B}t^2\right).$$

(2) The kinetic energy, due to the final velocity of B, or to $\left(V + \frac{P - Q}{2B}t\right)$. This is represented by

$$B\left(V + \frac{P - Q}{2B}t\right)^2 = BV^2 + VPt - VQt + \frac{(P - Q)t^2}{4B}P - \frac{(P - Q)t^2}{4B}Q$$

Adding the two expressions, we get for the energy left

$$BV^2 + VPt + \frac{(P - Q)t^2}{4B}P.$$

This is exactly the same expression as that given above for the total energy which has to be accounted for. It appears, therefore, that there is again no loss of energy during the motion, and therefore the principle of the conservation of energy is not affected by the initial velocity of B.

116. Lastly we have the assumption that the forces P and Q are constant. This of course is never exactly true in the universe, although it is true within our limits of measurement in many cases, *e.g.*, that of a stone falling to the earth. But we may always assume it to be true for an indefinitely small interval of time. Hence for each such interval the conservation of energy will hold, and if so it must also hold for the sum of the intervals; that is for any particular time that is considered. The energy exerted must of course be determined in this case by the methods of the integral calculus.

117. We have thus proved that the principle of the conservation of energy is true, with complete generality, for the case in which there are only three centres of force, A, B, C, lying in the same straight line. The extension from this to the general case of a free system of any kind, and with any number of centres, all of which act upon each other, we shall not give in detail, since it is to be found in any standard work on higher dynamics, and also comprises more analysis than comes within the scope of this treatise. The essential features of the method are briefly as follows. By the principle of the composition of forces, we resolve all the forces acting on any given centre, and also the motion of that centre, into three directions, along three rectangular axes. By this means we reduce all the forces and motions to three straight lines, and consider these separately as in the simple case. Then, taking an indefinitely small interval of time, we class the forces which tend to move the centre in the direction of its actual motion as efforts, and those tending in the opposite direction as resistances. By the geometrical principle of the centre of position we can consider all the efforts as if they were a single effort, acting from a centre whose position and motion is known; and similarly we can consider all the resistances as a single resistance. The problem is then reduced to the simple case of three centres, in which the principle has already been proved; and the methods of the integral calculus enable us to combine the three equations found for the three axes into one general equation, which expresses, with the utmost generality, the principle of the Conservation of Energy.

118. Before taking leave of this much canvassed principle, it will be well to state it in its most general form, and recall briefly the definitions, &c., which it involves. The statement may be as follows:—"The energy of any isolated system of matter remains always constant, unaffected by the mutual actions of the forces which exist in the system."

199. Now, in this statement the following things must be borne in mind:—

120 (*a*). The energy of the system means the power of doing potential work, or of overcoming force through distance—that and nothing else. It can be measured, like any other power, only when it has been exerted, and it is then measured by the amount of work it has done.

121 (*b*). The word force means force as defined in this treatise—that and nothing else; in other words, it means the cause of motion.

122 (*c*). The word matter means matter as defined in this treatise—that and nothing else; in other words, the system is a system of centres of force, acting upon each other by equal and opposite forces, which do not vary with the time, and therefore are always the same when the distances apart are the same. These are the forces which are spoken of at the end of the statement.

123 (*d*). By an isolated system is meant one which is not acted upon by any forces from centres external to the system. Therefore, the principle is not strictly true of any body of matter less than the whole material universe, since the phenomena of light and gravitation show that every part of this universe is at least capable of being acted upon from every other part. There are, however, many cases where a system may for all practical purposes be treated as isolated, the actions of the rest of the universe being either allowed for or neglected.

124. It will be found that each one of the definitions just given are employed and needed at some point or other of the proof. If, in stating some proposition which is called the Conservation of Energy, the same terms are employed with any meanings at variance with the above, then that proposition does not express the principle of the Conservation of Energy, as it is quoted and applied by the great writers on mechanics throughout the world. This second proposition may, of course, itself be true, but it needs proof before it can be accepted, and certainly it cannot be accepted because the real principle of the Conservation of Energy has been proved.

THE ENGINE, BOILER, AND EMPLOYERS' LIABILITY INSURANCE COMPANY, LIMITED.—The annual meeting of this company was recently held at the head office, 12, King-street, Manchester, Mr. R. B. Longridge, the managing director, presiding. The annual report, which was taken as read, showed that the progress of the company had been greater than that of any other company of the same kind. A comparison was made with the two largest and most successful companies, from which it appeared that in the one case the total income was about 38·5 per cent., and in the other only 19·8 per cent. of the income of this company for the same period. The gross income for the year 1881 amounted to £16,929, being an increase of £4720 as compared with the previous year. The claims for breakdowns of engines had been heavy, more especially for the latter half of the year, the amount paid for the same amounting to £4985. The chairman stated that there had been no explosion of any boiler insured by the company from its formation up to the present time, and he hoped with the careful inspections make by the officers of the company that explosions, if not entirely prevented, would at least be of very rare occurrence. He did not anticipate much reduction in the number of accidents to engines, as there were few engines without one or more weak parts, and even with the strongest accidents were of common occurrence, owing to want of care on the part of the attendants. During the last twelve months 161 breakdowns had occurred among the engines insured by the company, in addition to which many engines which the company had declined to insure had since broken down. A dividend at the rate of three per cent. was declared, making with the interim dividend previously paid four per cent. for the year. Mr. Walter Fletcher, the retiring director, and Mr. W. Aldred, the auditor, were re-elected.

RAILWAY MATTERS.

THERE are now 2195 miles of steel rails on the London and North-Western Railway.

A TRIAL of the electric light is being made in a train running between Calais and Brussels.

AT a cost of £88,000 nearly 1900 miles of railway have been interlocked on the London and North-Western Railway.

ELECTRIC lighting is being tried in a thirteen-carriage train on the Eastern of France Railway between Paris and Gretz.

THE Geneva correspondent of the *Daily News* says the Mont Cenere tunnel on the St. Gothard line was opened on Sunday last, and a train ran for the first time from Giubasco to Lugano.

THE decrease in the number of second-class passengers, and the receipts from them, continues on the London and North-Western Railway, but at present Mr. Moon does not think it advisable to do away with that class.

ON the Alsace-Lorraine railways mineral oil has been substituted for colza in lubricating the rolling stock, with a saving in cost of 60 per cent. The Bavarian lines have followed suit, with the same excellent results.

THE endless rope system of hauling tram-cars is about to be fully tried in Chicago. It has long been in successful use in San Francisco, as illustrated by us, and does away with all questions as to form of locomotive or adhesion.

THE Belgian Government is engaged upon a scheme for promoting a complete system of tramways throughout the country, as feeders to the railways, the work to be done by the various communes interested, either singly or in combination, and assisted where necessary by subventions from the State.

MR. EDISON has taken out a patent for an electric brake which consists essentially of a large horseshoe field magnet, much the same form as those used in his dynamo-machines, but instead of the ordinary armature a disc on the railway axles runs partly between the cheeks of magnetic poles, and when a circuit is made the disc, of course, revolves under a magnetic resistance, and so brings its axle to rest.

THE report of the "City Day Census," 1881, published by Messrs. Longmans, Green, and Co., gives the total number of foot passengers at the various railway termini and stations during sixteen hours. The totals are as follows:—Liverpool-street, 32,324; Broad-street, 29,506; Cannon-street, 20,471; Ludgate-hill, 18,390; Fenchurch-street, 15,242; Mansion House, 13,528; Moorgate-street, 12,634; Aldersgate-street, 8812; Bishopsgate, 8272; Blackfriars, 3541; Holborn Viaduct, 2777; Snow-hill, 2532. The aggregate number of persons resorting to the City daily was taken at sixty points of inlet, including the above stations, and was, for the sixteen hours between five a.m. and nine p.m. 739,640, and of this total no less than 128,000 were brought by the various railways.

THE following table gives the average miles of railway to each square mile in the State and countries named—A = the area in square miles, B = miles of railway, and C = square miles to one mile of railway:—Massachusetts: A, 7800; B, 1803; C, 4·12. Belgium: A, 11,373; B, 2672; C, 4·26. England and Wales: A, 58,320; B, 12,547; C, 4·64. New Jersey: A, 8320; B, 1701; C, 4·89. Connecticut: A, 4750; B, 954; C, 4·98. Rhode Island: A, 1306; B, 210; C, 6·21. Ohio: A, 39,964; B, 5912; C, 6·75. Illinois: A, 55,414; B, 7955; C, 6·96. Pennsylvania: A, 46,000; B, 6243; C, 7·36. Delaware: A, 2120; B, 280; C, 7·57. Indiana: A, 33,809; B, 4454; C, 7·59. New Hampshire: A, 9280; B, 1015; C, 9·14. Switzerland: A, 15,233; B, 1598; C, 9·53. New York: A, 47,000; B, 6019; C, 9·80

IN his recent report on the collision by which five people were killed and many injured, which occurred on the 25th of November, 1881, near Tayport station, on the North British Railway, Major Marindin, speaking of one of the signalmen, says: "At the time of the accident he had been on duty for nearly thirteen consecutive hours, while his daily work on week days, exclusive of the time he may have taken in walking to and from his home, would average over fifteen and a-half consecutive hours, even if the last train, the arrival of which he had to await, was punctual to the minute. It is hardly too much to say that it is a scandal that such an amount of work, as is implied by these hours, should be exacted from any man upon whose vigilance depends the safety of the public, and who, by a momentary act of forgetfulness, may, as in this case, cause a fatal catastrophe; and I was glad to learn that since the date of this accident an improvement in this respect has been made at Tayport."

THE proposed tunnel through the Pyrenees is beginning to attract the attention of French politicians, and especially of the representatives of the departments which have most to gain by this important scheme. A number of senators and deputies for the Hautes Pyrenees, the Gers, the Lot-et-Garonne, the Dordogne, recently, the *Pall Mall Gazette* says, waited on M. Varroy, Minister of Public Works, to impress upon him the advantages of constructing the tunnel at the extremity of the railway which runs through those departments. General Deffis, senator for the Hautes Pyrenees and governor of the Military School at St. Cyr, produced several sketch maps of the proposed routes, urging the adoption of that which, passing through the valley of the Neste, enters the Pyrenees at a point almost equidistant from the Mediterranean and Atlantic coast. This point is in direct communication with Paris by railway through Auch, Agen, Limoges, and Orleans. M. Varroy promised that the question should be studied in all its bearings, before the final adoption of any proposed trace.

THE colour of the painting of a locomotive engine is a question of some economical as well as ornamental importance. A correspondent of the *English Mechanic* recently gave the following description of the colours used in painting engines on different railroads in Great Britain. The North-Eastern engines are of light green, with broad lines of darker green picked out with black and white; the frames are of a light red colour. The number-plates are, as a rule, red, but I have noticed lately that some of them are painted black. London and North-Western and Caledonian goods and mineral engines are black, picked out with red and white. The London and North-Western passenger engines are also black; the number-plates are red, and name-plates polished black. The plainness is somewhat relieved by the coat of arms of the company being painted on the splasher. The Midland and Great Northern are of light green colour; the frames of the latter are coloured not unlike those of the North-Eastern engines, but darker; both the Midland and Great Northern engines are picked out with white and red; Great Eastern black, with broad red lines; London, Brighton, and South Coast, yellow, with black and crimson lines; Highland, much the same, some black picked out with white; North British, olive green, broad lines of black, edged with red, name gilt, number-plate polished brass. This colour is now dying out among the North British passenger trains, and will soon be seen on the goods only. Now the colour is light yellowish green—or greenish yellow—and frames and lines ruby colour. Great Western, green, yellow lines, frames dark brown; London, Chatham, and Dover, olive green, dark green borders, picked out with red; South-Eastern, dark green, with broad lines of darker green and white lines; London and South-Western, dark blueish green, broad black lines, white edges. Those of Lancashire and Yorkshire engines, which I have seen, were like the Great Southern and Western, or black, like London and North-Western locomotives; Manchester, Sheffield, and Lincolnshire engines, green; London and South-Western, brown; Furness, iron ore colour; Maryport and Carlisle, dark green; Caledonian passenger, blue, broad black lines, picked out with white. Single engines of this railway have lion of Scotland in gilt and red on splasher of driving-wheel, coupled engines on splasher of trailing-wheel. Of course this only applies to such classes as run main line traffic.

NOTES AND MEMORANDA.

AT a recent meeting of the Academie des Sciencés a new pump for compression of gases was described by M. Cailletet. A special feature is the presence of mercury above a plunger piston, with which the mercury moves. An hour's work will give 400 or 500gr. of liquid carbonic acid or protoxide of nitrogen. The author stores compressed gases in bundles of metallic tubes communicating with each other, and each holding about four litres. Pressures of several hundred atmospheres are attained.

A RUSSIAN naval officer has invented a very ingenious apparatus for ascertaining the depth of the sea without the use of a costly and heavy line. Indeed, no line at all is used. The instrument is described by *Nature* as consisting of a piece of lead, a small wheel with a contrivance for registering the number of revolutions, and a float. While the apparatus sinks, the wheel revolves, and the registered revolutions indicate the depth. When the bottom is reached, the lead becomes detached, the float begins to act, and the machine shoots up to the surface, where it can easily be fished up by a net and the register read off.

THE use of a basic lining for copper-refining furnaces has been described by M. Jules Garnier. He has described the results of experiments in a patent specification. The copper when introduced into the furnace contained 0·320 per cent. of iron, whereas at the close of the operation it contained but 0·030 per cent. He states that it is generally preferable to refine the copper on a siliceous hearth until it contains not more than about one half per cent. of iron, and then to refine it on a basic hearth as above-mentioned, so as to eliminate the remainder of the iron and sulphur it contains, and particularly the arsenic, antimony, or phosphorus.

THE following formula for a good varnish for writing on glass is given by M. Crova in the *Journal de Physique*:—Ether, 500gr.; sandarac, 30gr.; mastic, 30gr. Dissolve, then add benzine in small quantities, till the varnish, spread on a piece of glass, gives it the aspect of roughened glass. The varnish is used cold. To have a homogeneous layer, pour over that already formed some oil of petroleum, let it evaporate a little, then rub in all directions with cambric cloth till all is quite dry. With ink or lead pencil lines can be produced on this surface as fine as may be desired. Thus a drawing may be prepared in a few minutes and immediately projected.

THE following for silvering glass have been given by Mr. A. A. Common, F.R.A.S.:—Solution 1: Nitrate of silver, 1oz.; water, 10oz. Solution 2: Caustic potash, 1oz.; water, 10oz. Solution 3: Glucose ½oz.; water, 10oz. The above quantities are those estimated for 250 square inches of surface. Add ammonia to solution No. 1 till the turbidity first produced is just cleared. Now add No. 2 solution, and again ammonia to clear; then a little solution, drop by drop, till the appearance is decidedly turbid again. Then add No. 3 solution, and apply to the clean glass surface. A film was obtained in forty-three minutes at a temperature of 56 deg. Fah.

AT a recent meeting of the Société d'Encouragement, Paris, M. Dumas in the chair, Colonel Goulier brought forward, in the name of the committee of mechanical art, a new instrument invented by M. Cuvillier for measuring considerable thicknesses correct to $\frac{1}{100}$ of a millimetre. It consists of a divided rule with two fingers, one fixed and the other movable. The former is cylindrical and capable of revolving on its axis but excentrically, the excentricity being a millimetre. After measuring the thickness of an object within a millimetre by the rule, the cylinder is turned until the piece is held tightly between the two fingers, and the angle through which the cylinder has turned gives the fraction of a millimetre making up the correct dimension.

A NEW apparatus for the determination of melting points has been described by Mr. C. F. Cross and E. J. Bevan. The apparatus consists of a small platform of thin ferrotype iron or silver, having an opening for the reception of a thermometer bulb and a small indentation or depression about 1·5mm. deep and 2mm. in diameter. A very small quantity of the substance is melted in the little depression, and while still liquid a thin platinum wire, bent like an L and fused in a glass float, is immersed in the liquid and held there until the substance solidifies. A thermometer is then inserted in the opening, and the whole apparatus plunged under mercury. The mercury is gently heated, and the thermometer carefully watched. As soon as the substance melts the float rises instantly, and the temperature is noted. Stirring is unnecessary, the whole of the substance is surrounded with mercury, and the attention can be concentrated on the thermometer.

AT the meeting of the Physical Society, March 11, Mr. Newth showed some experiments illustrative of the fact announced by M. Mascart in 1875, that solid particles in the air are necessary to the formation of fogs; and secondly, that certain gases, such as sulphurous acid gas, also cause fogs in the same way, by permitting the moisture to condense upon these particles. The experiments consisted in passing an electric light beam through large bulbs of glass containing air and a small quantity of water. When the air in the bulbs was washed with the water, and thus freed from motes, the fog produced in the bulb by slightly exhausting it with an air pump was much less than when the air of the room, or smoke, or sulphurous acid gas, was admitted into the bulb. The dust on a platinum wire, rendered incandescent within the globe by an electric current, also caused a sensible fog. It follows that with gas fires instead of coal, there would still be fogs, though not so black.

AN explosion caused by lightning in winter is recorded by the New York *Times*. The accident happened in the new tunnel of the New York, Ontario, and Western Railroad, above Hoboken, February 21st. From inquiries made it appeared that the wires usually employed to supply the electric lamps in the excavation, were used for the purpose of firing the charges, being disconnected from the electric light system for the moment and connected with the explosives. As a rule, six charges were fired together, those of the afternoon relay of men being exploded at very regular hours—the last six usually at 5.45 p.m. There were only sixteen men in the shaft, and the work of connecting the wires had commenced, when the flash of lightning that occurred at 5.42 p.m. suddenly charged the conductors and produced the explosion. There were two flashes of lightning between the hours of five and six o'clock, the first taking place at 5.23, and the second nineteen minutes later. The former simply caused a slight perturbation of the lights in the tunnel, but did not extinguish them. It would thus appear to be well to suspend blasting during storms in winter as well as in summer.

ALCOHOL is found present in nearly all waters. The Paris correspondent of the *Lancet* says M. Muntz, director of the laboratory of the Institut Agronomique, has discovered this by means of a new apparatus. It is true the proportion is almost infinitesimal, yet it is sufficiently appreciable for him to have fixed it at one hundred-thousandth part and even less. He finds it in all the natural waters—such as those of the rivers and the sea, and in rain water and melted snow. For instance, in the water of the Seine and in rain water the proportion of alcohol was about one-thousandth, or one gramme to each cubic metre. The proportion was about the same in the sea water, but a little greater in cold rain water; the proportion was also sensibly greater in sewage water. From the presence of alcohol in rain and river water, M. Muntz concludes that it must also exist in the air, and even in the interior of the earth; so that it may be said to exist everywhere in nature, but he is at a loss to explain its origin. He, however, sets forth the hypothesis that it is produced by the decomposition of organic matter existing on the surface of the globe, in the depths of the sea, and in the different strata of the soil, and after its production, and in obedience to the laws of the tension of vapours, it is diffused in the atmosphere, from which it is eliminated with the meteoric waters.

MISCELLANEA.

THE Gerard Electric Light patents for France have been purchased by the Société Anonyme d'Electricité for the sum of 500,000f.

HAMMERSMITH Bridge will be closed on the occasion of the ensuing University boat race for two hours before until two hours after the time appointed for the race.

THE new turret ship Colossus—9160 tons, 6000 indicated horse power—was successfully launched shortly before noon on Tuesday at Portsmouth Dockyard. Lady Emma Baring named the vessel.

WE are asked to mention that as Lord Rosebery has now decided not to build his mansion at Albert-gate, Mr. J. C. Humphreys, of New Bridge-street, E.C., will again occupy the premises he formerly held there.

A NEW kind of folding packing case and crate, Billings' patent, is being made by Messrs. J. Walsh and Co., 33, New Broad-street. When folded for return they occupy about one-fifth the space when open. They are strong, easily put together or folded up, and seem to recommend themselves for transport of electric lighting fittings and lamps.

THE British Electric Light and Power Generator Company will shortly light the Pentonville-road with its system of incandescent lamps. The contract is for twelve months, and the cost is three times that at present paid for the gas, but ten times the quantity of light will be given. The cost of the light is thus to be about one-third that of gas.

SOME time since Messrs. Wolff and Son, of 55, Great Queen-street, sent us a bottle of liquid Chinese ink. We have tried it, it is good, it sticks to the paper, will not wash, and flows well; and if it is always the same as the makers say the process of manufacture insures, then it secures all the advantages of a liquid as against a solid ink.

THE production of pig iron in the United Kingdom in 1881 has been 8,377,364 tons, being an increase of 655,531 tons, or 8·4 per cent. on the make of the previous year. This increase is the largest that has ever occurred in any one year except that of 1880, when the production of pig showed an advance of 1,712,399 tons, or 28·1 per cent. on that of 1879.

AT last Friday's meeting of the Metropolitan Board of Works a report of the Bridges Committee recommending that Hammersmith Bridge be reconstructed, with an increased width of carriage-way and footways, and that the foundations of the southern pier of the bridge should be straightened, at a total estimated cost, approximately, of £80,000, was unanimously adopted.

GREAT strides having of late been made in instantaneous photography, the lessees of the Alexandra Palace have offered prizes of gold, silver, and bronze medals for competition among professionals and amateurs, for the best photographs of the crowds assembled on Easter Monday. Last Easter Monday 76,824 persons visited the Palace, and it is intended to summon the whole number of visitors on the southern slopes of the park at a certain moment for the views to be taken.

THE Chinese or some others equally well informed of the character of the English at home have some curious ideas on our treatment of each other. After reading some statements made at a recent meeting of the Bermondsey Vestry by a deputation which appeared before the vestry to point out the numerous accidents to children playing in the neighbourhood of the sewer works going on, they will be confirmed in their ideas. One child, the deputation said, had been run over and killed, owing to the want of a proper hoarding; and a member of the vestry said that "one of his vans had run over three children in one day in consequence of the horse being frightened at the engine used in the sewer." In commenting on the latter statement the *Pall Mall Gazette* asks:—"If one van runs over three children a day owing to the sewer works, what is the whole number of children run over by vans and other vehicles in a week?" This is a little beyond us—it must be given up.

THE third annual ordinary general meeting of the shareholders of the Newcastle Steam Boiler Insurance Company, Limited, was held at the offices of the company, 34, Grey-street, Newcastle-on-Tyne, on the 2nd inst. A dividend at the rate of 5 per cent. on the paid-up capital of the company was declared. The report showed that the number of boilers under insurance had increased during the year by 35 per cent., and in addition the company has considerably increased the number of boilers for inspection only. The engineer, Mr. W. B. Campbell, reported that the company had had only one accident, being the collapse of both furnace flues of a Lancashire boiler, which arose from the stoker inadvertently using his hammer to adjust the front manhole door, as it was letting water escape. The result of this incautious proceeding was to further displace the door, the boilers being then under 40 lb. pressure of steam, so that the attendants were driven back, unable to prevent the collapse which immediately followed. The compensation for this accident was paid out of revenue.

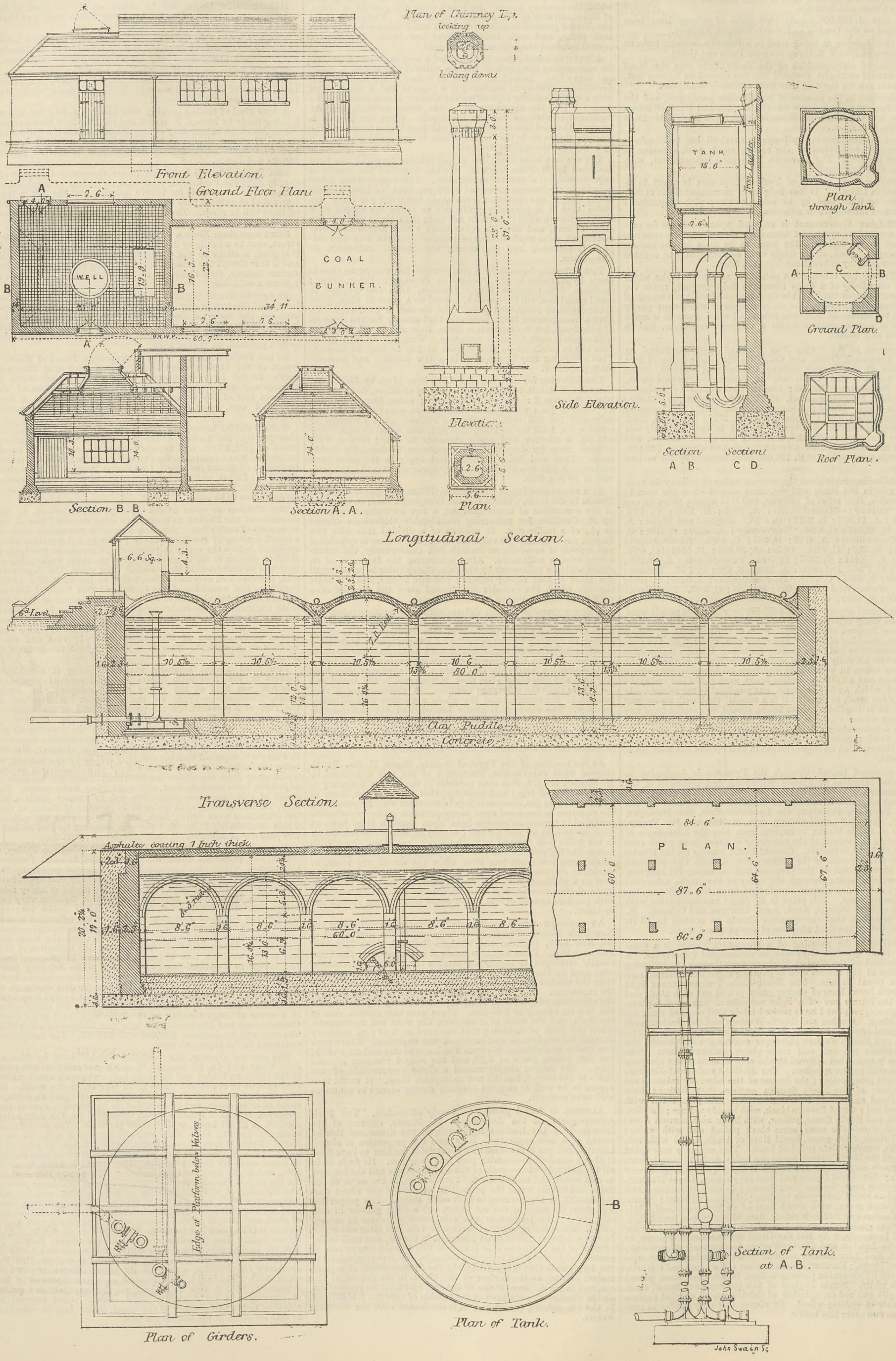
AT a meeting of the Metropolitan Board of Works on Friday, a report was presented from the Works and General Purposes Committee, which also contained a supplemental report by the chief engineer, on the means to be adopted for the discharge of the storm waters into Deptford Creek during the period of heavy rainfall. With the object of averting the evils of flooding they had before them the construction of an additional outlet into the creek at the Deptford Pumping Station, at an estimated cost of £75,000. The Greenwich Board of Works had obtained injunctions restraining them from forming new outlets; but the board had from time to time under their consideration the formation of outlets in lieu of them into the new sewer now in progress from Lee Bridge to Deptford-broadway, which, while bringing more sewage and rainfall into the high-level sewer in the neighbourhood of the creek, would give additional means for the discharge of storm waters. The engineer was of opinion that a relief from such additional storm waters would be best afforded by the construction of a sewer of large capacity north of the high level sewer down Church-street and Deptford-green into the Thames at this point. The cost will be between £30,000 and £40,000. The committee concurred in the engineer's view.

THE new tea steamer, the "Stirling Castle," built by Messrs. John Elder and Co. for Messrs. Thos. Skinner and Co., was tried in the Clyde on Friday and Saturday last, and gave a speed which shows her to be the fastest ocean-going steamer in the world. In the course of a run of six hours on Friday, she gave an average speed of 18·18 knots, and on Saturday six consecutive runs at the measured mile gave a mean speed, calculated on the Admiralty method, of 18·418 knots, or $21\frac{3}{10}$ miles per hour. The actual time taken in running each mile respectively was 3 min. 13 sec.; 3 min. 23 sec.; 3 min. 12 sec.; 3 min. 18 sec.; 3 min. 13 sec.; and 3 min. 18 sec. On the trial there was a cargo of 3000 tons dead weight on board ready for the voyage out. Her length is 430ft., breadth 50ft., and depth 33ft., and she registers 4300 tons. Her engines are the three-cylinder type, and have developed 8237-horse power. The diameter of the high-pressure cylinder is 62in., and the two low-pressure 90in., with a 5ft. 6in. stroke. Surface condensers are used with Gwynne's "Invincible" circulating pumps. The boilers are of steel, and present a total heating surface of 21,161ft.; the grate surface is 787 square feet; and the working pressure 100 lb. to the square inch. The propeller is made of manganese bronze, is 22ft. 4in. in diameter, with a pitch of 31ft. The maximum number of revolutions at the trial was $66\frac{1}{2}$ per minute, accompanied by absolutely no vibration, except in the immediate vicinity of the screw shaft. The hull is built of steel, on plans approved by the Admiralty, with a view to national requirements, and is capable of carrying coal for a twenty days' cruise. Great interest is attached to the performance of the vessel, as she may be regarded as first favourite in the annual tea race.

FRITH HILL, GODALMING, AND FARNCOMBE WATERWORKS.

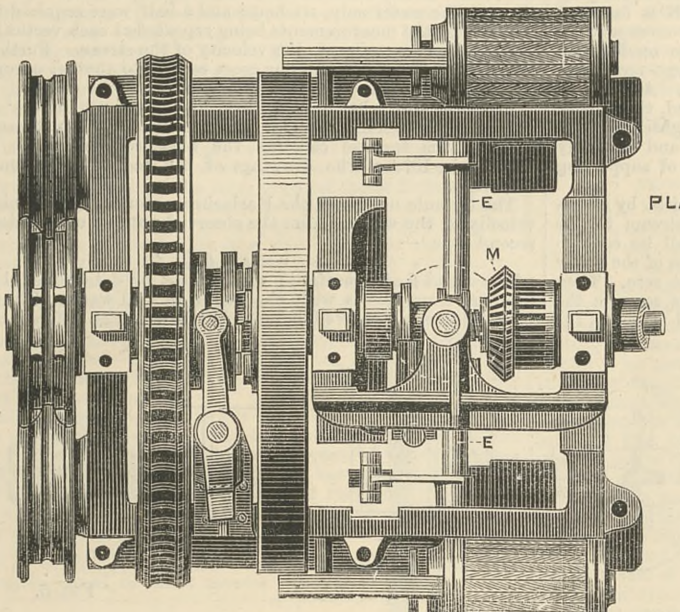
MR. JABEZ CHURCH, M.I.C.E., WESTMINSTER, ENGINEER.

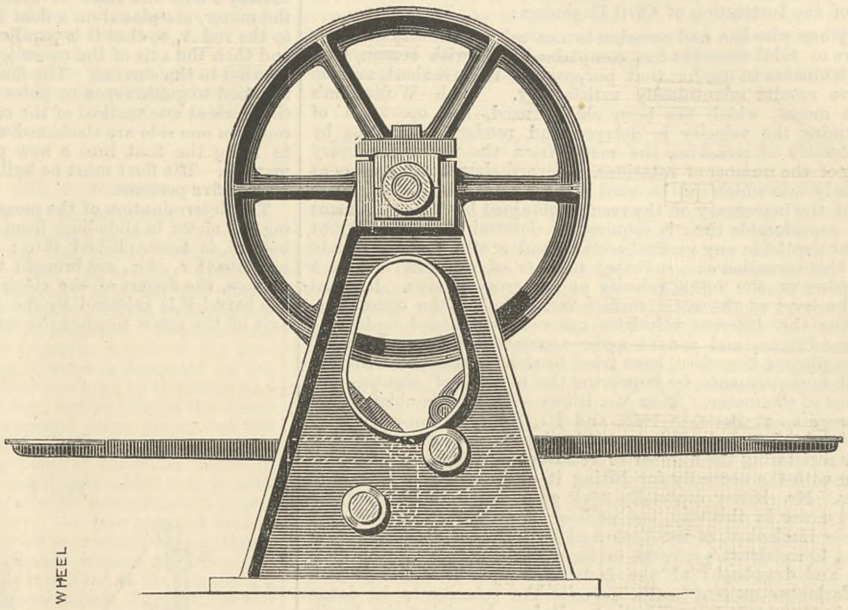
(*For description see page 215.*)



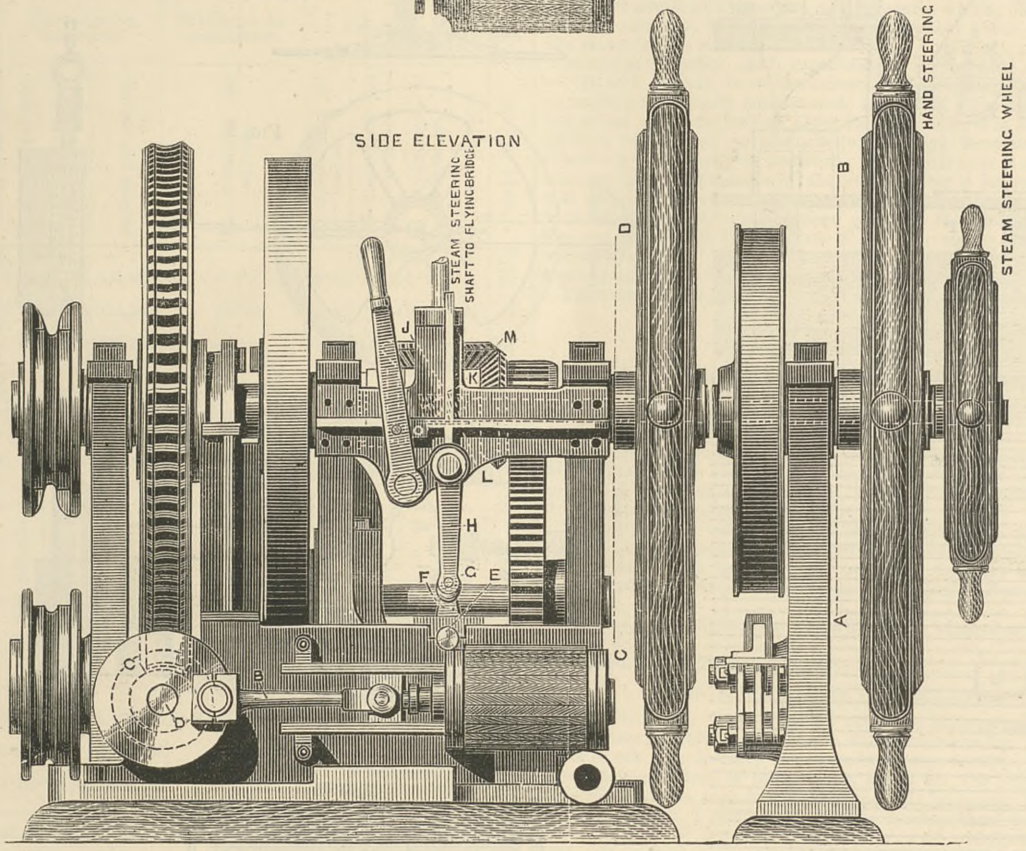
STEAM AND HAND STEERING GEAR.

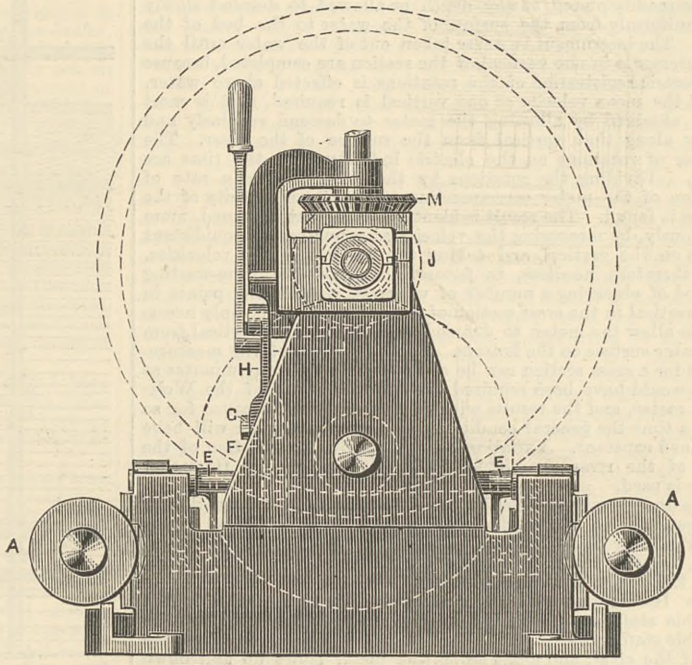
MESSRS. J. H. WILSON, LIVERPOOL, ENGINEERS.





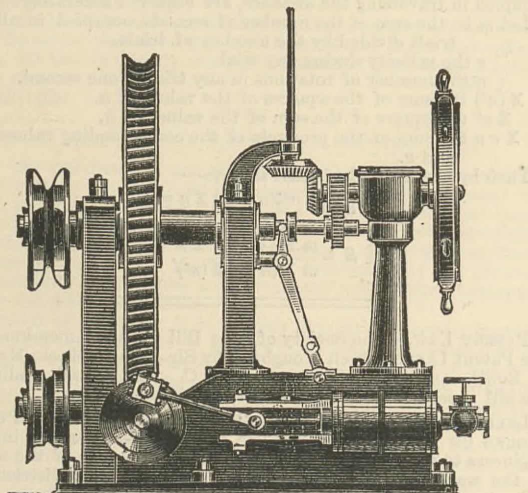
SECTION THROUGH LINE A.—B.





SECTION THROUGH LINE C.—D.

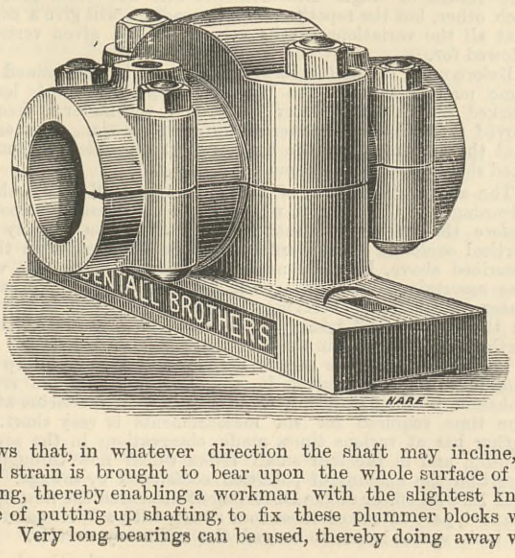
DURING the past few years many improvements have been made in steam and combined steam and hand steering gear, and amongst those who have taken up this branch of marine engineering are Messrs. J. H. Wilson and Co., Sandhills, Liverpool. The accompanying engravings fully illustrate the steam and hand steering gear made by them and as already fitted to about one hundred steamships, from ocean-going liners to coasting craft. From the engravings it will be seen that the transition from manual to steam working is the work of but one movement, namely, throwing a clutch into or out of gear. On turning the steam steering wheel the helmsman at will gives the desired direction



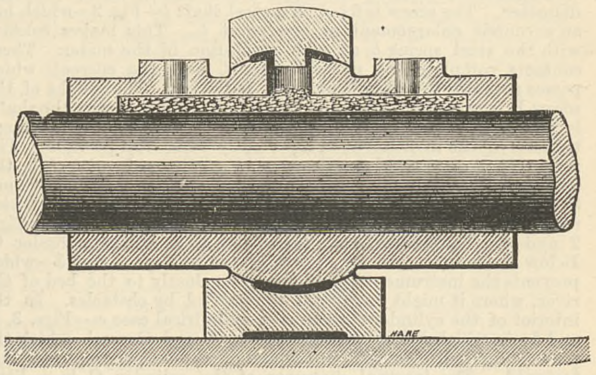
to the helm, and also supplies from the engine just the necessary force either to port or starboard from half a link length to full extent of helm. For working in a heavy sea a brake and lever is provided, which being actuated by the helmsman's foot secures for him safety, comparative ease, and complete control of the helm. At the top of the wheel column or standard there is provided a quadrant tell-tale marked port, starboard, and steady, which accurately pourtrays by an index pointer the varying position of the helm. Two steam cylinders A A, placed respectively at each side, act by connecting rods B B direct on to the crank discs C C keyed to and acting on the worm shaft D D, which is turned in one piece. An ordinary D slide valve with link motion is provided to each cylinder with a weigh-bar shaft E—common to both engines—to which is attached a short lever F F, with a slotted head G G, on to which a clutch lever H H is pinned. The short or clutch end of this lever works into a cod-head or clutch J J, which forms a portion of the horizontal shaft K K, and travels on a short length of a differential screw, on which is attached one of the pair of mitre wheels M M, to which motion is imparted direct from the steam steering wheel. The apparatus is, of course, capable of being worked as easily from the bridge as the main deck, the change being made instantaneously if required. The helm can, we understand, be brought over from hard-a-port to hard-a-starboard or reversed in ten seconds. The engine being connected through the medium of a worm, it will be seen that this acts as a continuous pawl, and no slip or back-lash of the cable can take place. The arrangement and design are good, and when kept in proper working order the gear should work noiselessly, while it takes little more room than ordinary gear.

BENTALL'S UNIVERSAL JOINT PLUMMER BLOCKS.

THE accompanying engraving shows a new form of plummer block manufactured by Messrs. Bentall, Brothers, Fullbridge Works, Maldon, Essex. The advantages claimed for this bearing consist in the fact, that its construction, as may be seen from the section, being of the nature of a ball-and-socket joint, it



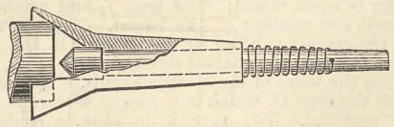
follows that, in whatever direction the shaft may incline, an equal strain is brought to bear upon the whole surface of the bearing, thereby enabling a workman with the slightest knowledge of putting up shafting, to fix these plummer blocks with ease. Very long bearings can be used, thereby doing away with brass bushes. To lubricate the bearing a dovetailed slot running nearly the whole length of the top half of the bearing, as shown in the above section, is packed with cotton, which, becoming



saturated with oil, and being in contact with the shaft, the latter is continually kept moist, and a film of oil is kept spread over the entire wearing surface of the bearing.

CENTREING CENTRE PUNCH.

WE illustrate herewith a small centreing centre punch made by Mr. R. K. Jones, Birkenhead. The specimen which has been sent us is for diameters up to 1in., though they may, of course, be made for sizes as much above this as is desirable. Beyond about 3in. however, the advantage of greater accuracy, and saving of time over the ordinary method of centreing spindles and



other pieces for turning, would not be so great. For centreing small work, however, the punch we illustrate is effective of great saving of time, and in careful hands would last a very long time. Our sketch shows the apparatus partly in section, and as in use, except that it would almost always be used vertically, centreing a piece about half the greatest diameter of the guiding bell. The little tool is well made, the bell and guide being of gun-metal.

THE CURRENT METER OF PROFESSOR A. R. HARLACHER.

THE following paper, by Herr Richard Blum, City Engineer, Leipzig, has appeared as a "selected paper" in the "Proceedings" of the Institution of Civil Engineers:—

Every one who has had occasion to measure the velocity of water in rivers or tidal currents has complained, and with reason, that the instruments in use for that purpose are inconvenient, and do not give results scientifically satisfactory. With Woltmann's current meter, which has been chiefly used, the operation of determining the velocity is delayed and rendered laborious by the necessity of removing the meter from the water for every reading of the number of rotations. Nevertheless, this instrument is the only one which can be used in large and deep rivers. One cause of the inaccuracy of the results obtained by this instrument is that considerable time is required to determine the velocity at different depths in any vertical section, and a still longer time to repeat this operation at a sufficient number of verticals to give a good value of the mean velocity at the cross section. In most cases the level of the water surface varies during the operations, and thus the different velocities are not ascertained under the same conditions, and cannot agree accurately with each other. Some engineers, therefore, have tried to shorten the time required for such measurements, by improving the method of counting the rotations of the meter. Thus Mr. Ritter—engineer-in-chief, Ponts et Chaussées—at Paris, in 1859, and Mr. Henry, when measuring rivers flowing into Lake Erie in 1867, adopted a method for electrically registering the number of rotations of the meter, and dispensing with the necessity for lifting it out of the water for each reading. Mr. Ritter especially took great pains to improve the current meter in this way, but arrived at no satisfactory results. Professor Harlacher, of the Technical High School at Prague, was the first to construct a current meter which obviates all the difficulties and drawbacks of the instruments previously employed. The Harlacher current meter permits the velocity to be determined in the shortest possible time. Before describing the details of the instrument a general statement may be given of its merits and advantages.

The current meter is a screw meter on the same general principle as the old instrument of Woltmann. Connected with it is an indicator or clock actuated electrically, which shows the number of rotations of the screw. The meter is suspended in the water by a cord so that it can be raised or lowered at will. It can therefore be readily placed at any depth or allowed to descend slowly and uniformly from the surface of the water to the bed of the river. The instrument is never taken out of the water until the measurements in one vertical of the section are completed, because the electric registration of the rotations is effected above water. When the mean velocity at one vertical is required, that is most easily obtained by allowing the meter to descend regularly and slowly along that vertical from the surface of the river. The number of rotations on the electric indicator and the time are noted. Dividing the rotations by the time, the mean rate of rotation of the meter corresponding to the mean velocity of the stream is found. The result is identical with that obtained, more laboriously, by measuring the velocity at a number of equidistant points on the vertical and taking the average of the velocities. It is therefore needless, in future, to adopt the time-wasting method of observing a number of velocities at different points in each vertical in the cross section of the stream. It is only necessary to allow the meter to descend once along each vertical from the water surface to the bottom. Thus the whole of the measurements for a cross section can be completed in as many minutes as hours would have been required with the old form of the Woltmann meter, and the results will be more reliable, because for so short a time the general conditions of flow of the river will have remained constant. Variations of velocity due to variation of the level of the river are virtually eliminated when the Harlacher meter is used.

It is unnecessary to describe all the stages in the invention of the present form of the Harlacher meter. It is sufficient to say that Professor Harlacher worked for several years at its improvement, and that his success was acknowledged by the award at the Paris Exhibition of two gold medals.

The Harlacher meter is constructed as follows:—For the movable staff, on which the Woltmann meter is fixed, an immovable staff or rod is substituted, which is planted firmly in the bed of the river, and along which the meter slides up and down during the observations on any one vertical. This rod is a cast iron tube with a solid point at the lower end A A, Fig. 1. The other parts of the apparatus, except the electric battery and indicator, are fastened to the tube, so that the whole can be moved from one vertical to another without having to be taken apart. The screw of the meter B is two-bladed. For very small velocities it would be preferable to adopt a four-bladed screw of larger diameter. The screw is fixed on a steel shaft b—Fig. 2—which has an excentric enlargement at one point b_3. This makes contact with the steel spring b_4 at each revolution of the meter. These contacts complete the electric circuit, and the current which passes actuates the electric clock or indicator. The weight of the screw B, the shaft b, and the brass box b_2, which carries the shaft, is balanced by a counterweight b_5, Figs. 1, 2, and 3. This keeps the axis of the instrument in a perfectly horizontal position. The screw b_6 serves to regulate the pressure of the spring b_4, while the two screws b_7 fasten the spring to the brass frame which surrounds and protects the shaft. The shaft is square at the end which receives the screw, which is put on and held fast by a nut b_8, Figs. 2 and 3. The brass frame b_2 is fixed to a hollow cylinder C. Below the hollow cylinder C is a plate C_1—Figs. 2 and 3—which prevents the instrument approaching too closely to the bed of the river, where it might be injured or retarded by obstacles. In the interior of the cylinder C there is a cylindrical case c_2—Figs. 3, 4, and 5—in which a brass spring is fastened and through which the pin c_3 is carried. To this pin the end of the suspending rope D is fastened. The internal diameter of the cylinder C is a little larger than the outside diameter of the hollow rod A on which it is to slide. The part c_2, to which the rope is attached, is connected with C by an arm which passes through a vertical slit in the hollow rod A. Thus the instrument is kept always—if the pipe A is properly placed—with its axis normal to the plane of the cross section. The cylinder C is also fitted with rollers c_6 c_6, which render the motion on the fixed rod easy. After the instrument has been placed on the rod or staff, a bracket E—Fig. 1—with a pulley e_1 is attached at the top, and the rope is carried over this pulley. The rope D is wound on a barrel F. This barrel is fixed with the frame f_1 and the pin f_2 on the arm G—Figs. 1, 6, and 7—which is firmly fastened to the hollow rod A. With the barrel is connected the apparatus f_3, registering the depth at which the meter is at any moment. The fan f_4 and gearing f_5 regulate the rate of rotation of the barrel and permit the adjustment of the speed of the meter in its descent along the rod A. By the handle f_6 the meter is again raised. The lever f_7 and ratchet wheel f_8—Fig. 6—arrest the rotation of the barrel. The movement begins as soon as the ratchet is lifted by the lever. On the frame of the barrel F are fastened the contact screws 1, 2, 3—Figs. 1, 6, and 7—for attaching the wires of the electric circuit. The screw 1 is connected with the rope D, which is a copper wire rope covered with insulating material. The rope is in electric contact with the shaft of the screw through the spring c_3—Fig. 5—because an insulated wire c_7—Figs. 5 and 3—connects the lower end of the pin c_3 and the loop of one of the screws b_7—Figs. 2 and 3—which fasten the spring to the brass frame b_2. The other conductor is the cast iron pipe A, which is in contact with the rest of the apparatus through the parts C, G, f_1, f_2, and F—Figs. 6 and 7. These parts are connected with the screw 2—Figs. 1, 6, and 7. By putting a wire into the loop of screw 3 the depth of the meter below the water line can be registered electrically. The registering apparatus H—Fig. 1—has two dials, one marking single revolutions and the other hundreds of revolutions. If desired, a recording arrangement can be added, the rotations of the meter being marked on a slip of paper in the same way as in a writing telegraph or chronograph. Professor Harlacher used this arrangement in determining the variation of velocity at a given fixed point. The battery I and the clock or indicator H, with the rod A carrying the meter, are placed on a float P. The sight vane K is fastened to the rod A, so that it is parallel to the plane of the cross section, and then the axis of the screw is normal to the cross section and parallel to the current. The float is anchored in large rivers and fastened to guide ropes or poles in smaller streams. As soon as the work at one vertical of the cross section is finished, the anchor ropes on one side are slackened and on the other tightened, so as to bring the float into a new position in an easy and a speedy manner. The float must be built so as to be capable of supporting four or five persons.

The determination of the mean velocity at one vertical, by allowing the meter to slide once from the surface of the stream to the bottom, is accomplished thus: The meter B and all its connections C, c_1, &c., are brought to within a few inches of the water surface, the fingers of the electric clock being set at zero. Then the barrel F is released by the lever f_7—Fig. 6. As soon as the axis of the screw touches the water surface a signal is given, the electric clock is brought into the circuit by a spring lever, and begins to count the rotations of the screw. It is necessary to commence with the meter some small distance above the water surface, in order that it may acquire the proper descending velocity previous to the counting of the rotations. In a certain number of seconds the meter descends from M to N—Fig. 1—having at each point in its descent acquired the velocity of rotation corresponding to the velocity of the water at that depth. Dividing the number of revolutions by the number of seconds, the rate of rotation corresponding to the mean velocity at that vertical is found. The fact that the disc c_1—Figs. 1, 2, and 3—prevents the meter from descending exactly to the bottom entails a small correction. This correction, however, will be more insignificant the larger the difference of the heights M N and N O, that is, the deeper the river in which the observations are made. It is a matter of course that the readings of the instrument at each vertical should be repeated, and the average of the results taken for the true mean velocity. The results of single measurements will not differ much from each other, but the repetition of the readings will give a certainty that all the variations of the velocity at the given vertical are allowed for.

Before using the meter, its constants must be determined in the same manner as with the Woltmann apparatus. A length is marked out in a still-water basin, and the meter is frequently moved through this distance at different speeds. It is essential that the movement of the boat or float on which the meter is fixed should be a uniform one.

The above description of the apparatus will prove that the advantages of this form of meter are of considerable importance. Before the author was satisfied that the mean velocity in one vertical could be determined by a single observation in the way described above, he made numerous experiments. The velocity was ascertained by allowing the meter to descend through the water, and also by observing the velocities at equidistant points on the vertical and taking the mean. The results of the two methods differed only in the fourth or fifth decimal place.

The Harlacher meter may be employed in large and deep rivers. The inventor has used it in the Elbe and Moldau rivers in Bohemia, in the Danube, near Vienna, and in the Seine at Paris. The time required for the measurements is very short. The author has at various times made observations in the sewers of Leipzig, and in the four small rivers which flow through it, to ascertain the amount of pollution occasioned by sewage. In the year 1878 an officer of the Government measured the flow in a mill channel, part of one of these four rivers, with a Woltmann meter. It took seven hours to record the necessary results. In the author's investigations on the four rivers, at points lying at an extreme distance of 3000 yards apart, twelve hours were required, when determining the mean velocity both by allowing the instrument to slide down through the water, and by noting the velocity at every 2in. of depth. For those observations in which the mean velocity was determined by allowing the meter to descend through the water only, six hours and a-half were required for the four rivers, the measurements being repeated at each vertical three to ten times, according to the velocity of the stream. Further, the transport of the float from one cross section to another occupied in all about one hour of the time given above.

Professor Harlacher has described his meter in a treatise* which can be recommended to every engineer interested in these questions. This treatise contains the measurements made in the Danube in 1878. The drawings of the meter are taken from this work.

The formula used with the Harlacher meter for determining the velocity of the water v from the observed number of rotations per second n, is:—

$$v = \alpha + \beta n,$$

where α and β are constants which must be determined by preliminary experiments with the meter in still water. The meter is towed over a measured distance in still water at different speeds, the speed in each trial being, however, as uniform as possible. The number of rotations of the meter, and the number of seconds occupied in traversing the distance, are observed accurately.

Let m be the sum of the number of seconds occupied in all the trials divided by the number of trials.
v the velocity during any trial.
n the number of rotations in any trial in one second.
$\Sigma (n^2)$ the sum of the squares of the values of n.
Σn^2 the square of the sum of the values of n.
$\Sigma v n$ the sum of the products of the corresponding values of v and n.

Then by the method of least squares—

$$\alpha = \frac{\Sigma n^2 \Sigma v - \Sigma n \Sigma n v}{m \Sigma n^3 - \Sigma n^2}.$$

$$\beta = \frac{m \Sigma n v - \Sigma v \Sigma n}{m \Sigma (n^2) - \Sigma (n^2)}.$$

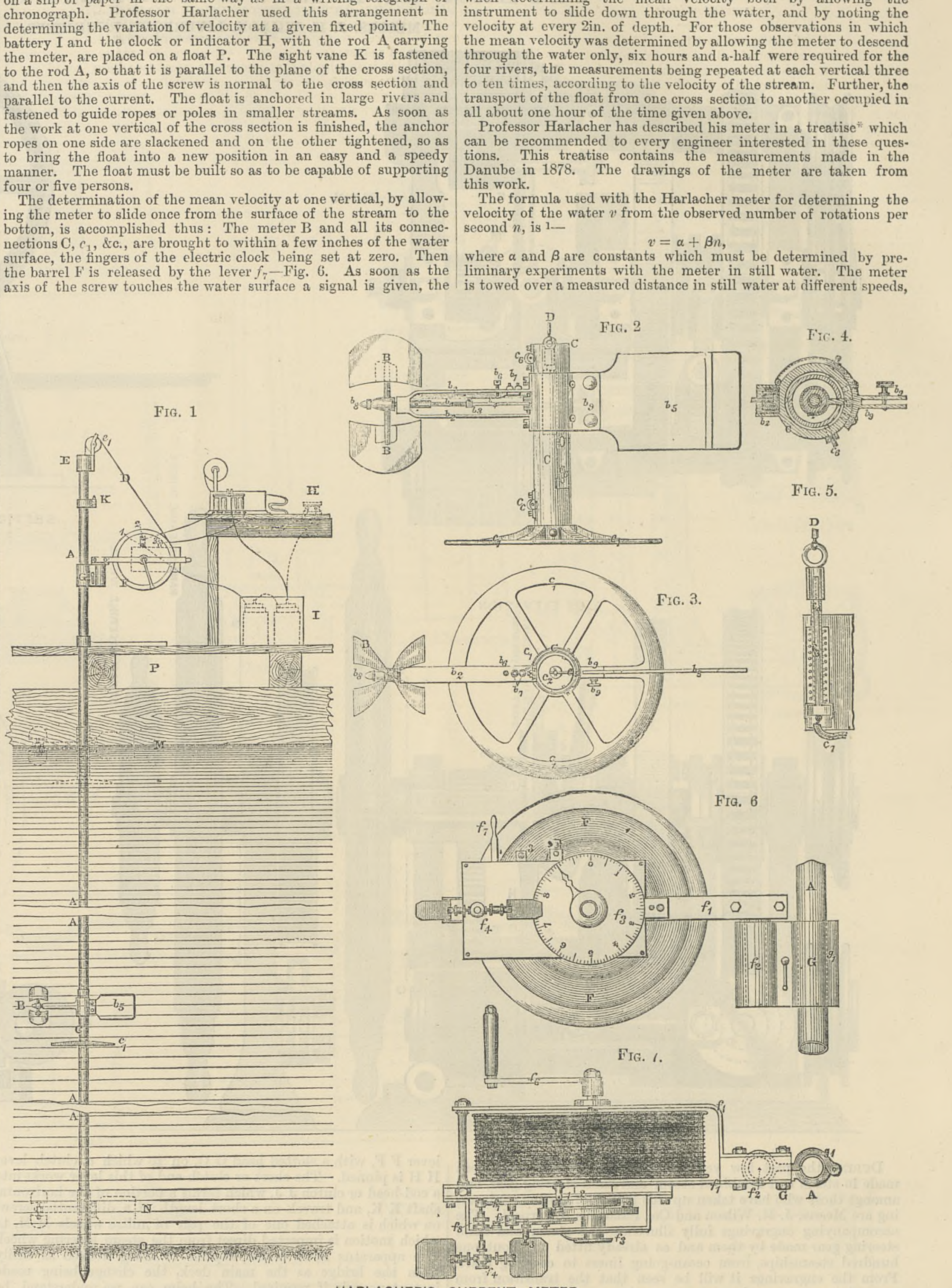


FIG. 1 FIG. 2 FIG. 3 FIG. 4. FIG. 5. FIG. 6 FIG. 7.

HARLACHER'S CURRENT METER.

* "Die Messungen in der Elbe und Donau und die Hydrometrischen Apparate und Methoden des Verfassers." Von A. H. Harlacher. 4to Plates. Leipzig, 1881.

PATENT LAW.—The Society of Arts Bill for the Amendment of the Patent Law has been brought in by Sir John Lubbock, Mr. W. H. Smith, and Mr. J. C. Lawrence, Q.C. The second reading of the bill is set down for Wednesday, April 5th.

LEYLAND LOCAL BOARD: COMPETITIVE SCHEMES FOR PUBLIC WORKS OF WATER SUPPLY.—The board having recently invited engineers to send in plans and estimates of the cost of the whole of the works necessary for the water supply of this district, the following gentlemen submitted schemes, viz.: Mr. Henry Bancroft, Manchester; Mr. P. L. Edinger, Wolton-le-Dale; Messrs. Gotto and Beesley, Westminster; Messrs. Goodison, Atkinson, and Forde, Liverpool; Mr. Joseph Harding, Preston; Mr. George Heaton, Wigan; Messrs. Moorson and Sacré, Manchester; Mr. Alfred Moore, Manchester; Mr. E. Timmins, Runcorn; and Mr. William Wrennall, Liverpool. The board have held special meetings to consider these schemes, and from the closeness of the estimates and general excellence of the plans the competition has been keen. The board ultimately at their meeting on Thursday last decided to adopt the scheme submitted by Mr. William Wrennall, of Liverpool, who is consequently selected to carry out the works. The scheme submitted by Messrs. Goodison, Atkinson, and Forde was considered to be second, and they were consequently awarded the sum of £20.

LETTERS TO THE EDITOR.

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

THE WATER METER QUESTION.

SIR,—In your issue of the 3rd inst., in your article on "Meters or Rates," you state—with reference to a paper on "Water Waste and Water Meters," by Mr. M. W. Kingsley, published by the Civil Engineers' Club of Cleveland, U.S.)—"experiments are given in the paper which show that a pipe even $\frac{1}{16}$in. diameter will discharge about 322,000 gallons per annum, if open constantly; and a pipe of $\frac{1}{4}$in. diameter nearly 40,000,000 gallons."

There is evidently some mistake or misprint regarding the latter noted "discharge" said to obtain in the United States. The average working pressure of the large towns of Great Britain would be overstated to give one-tenth that quantity by a pipe $\frac{1}{4}$in. diameter, even assuming the discharge correctly speaking not by a pipe, but by an orifice, $\frac{1}{4}$in. diameter, in the side or end of an ordinary house service pipe. 40,000,000 gallons per annum by a $\frac{1}{4}$in. orifice require a velocity of 596ft. per second, equal to a theoretical head of 5515ft. 4,000,000 gallons per annum would require 55ft. of head—theoretical—and actual nearly 135ft. of head. The discharge set against the pipe $\frac{1}{16}$in. diameter requires—theoretically—a head of 90ft., and—actually—of 178ft., on condition that the coefficients are something between 0·640 and 0·740 for the diameters and discharges.

The following table of results was obtained from experiments I made—a number of years ago, and have since repeated—for the purpose of ascertaining the discharge, or waste of water by small openings or orifices in service pipes, and bears on the point to which reference is made. I only give the results of my investigations with openings of corresponding diameters, viz., $\frac{1}{16}$in. and $\frac{1}{4}$in :—

Diameter of Orifice, $\frac{1}{16}$in. Lead Service $\frac{1}{2}$in. diameter, 3ft. 2in. length, joined to Street Service Pipe 3in. diameter.

Pressure		Discharge as measured.			Discharge by calculation.	Velocity.			Head divided.	
Pounds.	Feet.	Cubic feet per min.	Gallons per day.	Gallons per annum.	A.—Difference per centum.	B.—Actual feet per second.	C.—Theoretical due to pressure.	D.—Coefficient of discharge.	Due to friction.	Due to velocity.
									ft.	ft.
20	46·22	0·0510	4590	167,535	$(d = \sqrt{h} : \sqrt{h} :: d :)$	39·90	54·68	0·729	21	25
40	92·44	0·0714	6426	234,549	+0·62	55·85	77·04	0·725	44	48
80	184·88	0·0998	8982	327,743	+2·22	78·07	109·14	0·715	90	94

Diameter of Orifice, $\frac{1}{4}$in. Lead Service $\frac{1}{2}$in. diameter, 3ft. 2in. length, joined to Street Service Pipe 3in. diameter.

Pressure		Discharge as measured.			Discharge by calculation.	Velocity.			Head divided.	
Pounds.	Feet.	Cubic feet per min.	Gallons per day.	Gallons per annum.	A.—Difference per cent.	B.—Actual feet per second.	C.—Theoretical due to pressure.	D.—Coefficient of discharge.	Due to friction.	Due to velocity.
									ft.	ft.
30	69·33	0·914	8226	3,017,090	$(d = \sqrt{h} : \sqrt{h} :: d :)$	44·68	66·82	0·668	36	33
40	92·44	1·023	9207	3,360,555	+ 3·00	49·74	77·04	0·646	52	40
50	115·55	1·120	10080	3,679,200	+ 3·00	55·72	86·26	0·646	68	47

Theoretical velocity = $\sqrt{29\,H} = 8·025\sqrt{H}$.
Actual velocity = $\sqrt{29}\,H = 8·025\sqrt{Hc}$.
Theoretical head = $\frac{V^2}{64·4}$
Actual head = $\frac{V^2}{64·4 \times C^2}$
$D = \frac{B}{C}$

V = Vel. per feet per sec.
H = Head in feet.
c = Coefficient of discharge
B = Actual vel.
C = Theoretical velocity.
d = Discharge.

The discharge opening was formed in the end or side of a lead house service pipe $\frac{1}{2}$in. in diameter, 3ft. 2in. in length, connected to and supplied by a 3in. diameter cast iron street service pipe, a tested pressure gauge being placed 2ft. from point of discharge. While the ratios between pressure, discharges, and diameter do not theoretically quite agree, the results practically and accurately indicate the discharges when the drawing off does not more than perceptibly affect the gauge.

I expected to have said something on the question of domestic supply by meter, and as to my experience of the Tyler and other meters, but having already occupied so much of your space I defer for the present. W. J.

March 14th.

SMITH AND MOORE'S METHOD OF GETTING COAL.

SIR,—As unauthorised and imperfect notices of the new process of coal getting by Smith and Moore's patent have appeared in several journals, the proprietors of the system—which has been patented in all countries where coal mines are worked—have resolved, in consequence of the numerous communications they have received, to publish the following description of the process and its results, as proved by several months' continuous working at Shipley Collieries, near Derby.

The mode of operating is to employ lime in a specially caustic state. This is ground to a fine powder, and consolidated by a pressure of over thirty tons into the form of cartridges, which are packed into air-tight boxes ready to be conveyed to the mine for use. Holes are first drilled by means of a light boring machine. An iron tube, having a small external groove and a cap of calico on the end, and fitted with a tap, is first inserted along the whole length of the bore-hole. The cartridges are then introduced and lightly rammed, so as to ensure their completely filling the bore-hole. After the cartridges have been tamped up in the ordinary way as when using gunpowder, a pump is connected with the tap at the end of the tube, and a quantity of water equal in bulk to the quantity of lime used is forced along the tube, and escapes through the calico cap into the lime, saturating the whole of the charge. The tap is then closed, so as to prevent the escape of the steam, and the pump is detached.

By this system the water is at once brought into contact with the cartridges in a closely confined condition, immediately creating a large volume of steam at a high pressure, and the great force thus produced, followed by the expansion of the lime, is sufficient to bring down the coal.

The following are some of the advantages obtained by its use:—Absolute immunity from explosion of gas, there being no fire or flame; absence of smoke or noxious smell; the roof is not shaken; the coal can be got with much less exertion to the collier than by wedging; the apparatus is simple and inexpensive. The men need not leave the stalls or discontinue working, as is the case with gunpowder, and they can by its use avoid all risk of injury while the coals are falling. The results, when compared with wedging, show a considerable increase in the percentage of large coal got.

On and after April 3rd, the proprietors have made arrangements to send on payment of railway fares only, to any colliery where it may be desired to try the system, competent workmen, with cartridges and necessary tools, who will show how to use the patent. The process is so simple that one or at most two days would probably suffice to demonstrate its practical value.

All communications should be addressed to me; and men will be sent to collieries wishing to try it according to priority of application. SEBASTIAN SMITH.

Shipley Colliery, Derby, March 15th.

FRIGORIFIC ACTION OF THE CONDENSER.

SIR,—As the important subject of condensation in steam cylinders is now attracting much attention, will you allow to me to state that so long ago as 1843 my late father published in Weale's "Quarterly Papers on Engineering" an article, "Hints on some Improvements of the Steam Engine," in which the phenomenon of loss of heat in the cylinder, due to internal condensation and re-evaporation, is pointed out and investigated. The following brief quotations will show that the frigorific action of the condenser is no new discovery:—"A film of water is deposited on the surface of the piston and cylinder, which are kept by the steam at a temperature, we will suppose, of 212 deg., and as long as the steam presses on the liquid very little evaporation takes place; but the moment the pressure of the steam is removed, on opening the passage to the condenser, the boiling point of the water suddenly becomes about 110 deg., and as the metal with which it is in contact remains at 212 deg., there is an almost instantaneous excess of about 100 deg. of temperature above the now reduced boiling point of the liquid, which must cause its immediate evaporation." "This reduced temperature of the cylinder causes a corresponding condensation of the steam with which it is filled at the succeeding stroke, and so on until an equilibrum is established. The cylinder will now have acquired a constant temperature, which, independent of exterior causes of cooling, will be considerably lower than that of the steam in the boiler."

In the same paper, 1843, superheating is proposed as a remedy:—"It will, I think, be evident from the foregoing remarks, that, as engines are usually constructed, we cannot expect to obtain the full effect of steam unless, after its formation, it is heated out of contact with water, so as to acquire a high temperature with a relatively low density or pressure. . . . All that is required is to increase the temperature of the steam after it leaves the boiler, and one simple mode of effecting this would be, as suggested above, to cause the heated gases before entering the chimney to act on the steam through the medium of any convenient arrangement of metallic surfaces," as "a system of small tubes through which the steam might pass immediately on leaving the boiler."

Palermo, March 6th. ROBERT GILL.

FAURE BATTERIES.

SIR,—At the meeting of the Society of Engineers on Monday night, it was stated by one electrician of repute that it is possible to charge a Faure battery and at the same time to use the charging current for generating the electric light. It seems to me that this proposition runs counter to the conservation of energy theorem, which has already been disputed by some physicists on the Continent, who assert that if it be true, the received dynamical theory of the energy of a perfect gas must be wrong.

The proposition concerning the Faure battery to which I have alluded was vigorously disputed by another electrician, who asserted that "we cannot have our cake and eat it." Perhaps some of your readers well versed in the subject will say which view is right.

Perhaps some of your readers will tell me where I can get a Faure battery to try. LUX.

London, March 22nd.

THE FOUNDATIONS OF MECHANICS.

SIR,—Will you permit me to say that, before replying to Mr. Ramsbottom's letter, published in THE ENGINEER for March 17th, I would ask him to carry his remarks a step further, and explain how it is that a load is raised from a coal pit, the pull at opposite ends of the wire rope being the same. If he asserts that it is not the same, then I would ask him to answer these questions: (1) Given a load of 1 ton, moving upwards at a uniform velocity of 16ft. per second, what is the strain on the rope, neglecting the weight of the rope? and (2) assuming that the strain is more than 1 ton, will Mr. Ramsbottom give me a formula for calculating the additional strain, and will he refer me to some authority on the subject?

What I have said to Mr. Ramsbottom will apply to the letter of Mr. Adams. Φ. H.

London, March 21st.

THE PRIMING OF BOILERS.

SIR,—Your correspondent "G. F. B. L.," in last week's issue, requests information as to the cause of priming in the boilers of H.M.S. Polyphemus. Perhaps the following remarks may throw some light on the subject. The air forced into the boiler-room was equal to 6$\frac{1}{2}$in. of water. This would cause very rapid combustion in the fire-box, and expose the tube plates to a very high temperature. On entering the tubes the flames would become broken up into small sections, and before they had passed half through would become extinguished, rendering the temperature irregular, the local heat disturbing the water and saturating the steam—in fact, causing the water to foam about even to the top of the steam chamber. I have seen this demonstrated with the manhole cover off, when the action could be clearly seen. The appearance of flames issuing from the funnel is caused by re-ignition of the gases in the smoke-box—a common occurrence with the ordinary marine boiler. The temperature in the fire-box would probably be about 2400 deg.—in the tubes 800 deg. The locomotive, having the blast in the funnel and carrying a thicker fire, produces a steadier boiling action than can be obtained by forcing air into the boiler-room, as in the case of the Polyphemus. W. A. M.

London, March 22nd.

VACUUM BRAKES ON THE MIDLAND RAILWAY.

SIR,—Having read the letter in your issue of March 17th, purporting to have been written and signed by "A Guard," giving you a proof of trains running frequently without vacuum, and mentioning as an illustration the working of the 12 noon St. Pancras to Liverpool on the 23rd or 24th of February, I beg to inform you that I was the guard of the train mentioned, and also beg to give an emphatic denial to your correspondent's letter as to the means taken to stop this train at Garston. He states that by mistake the driver went on to Cressington. I will allow this; but when he states it was owing to the inefficiency of the brake, I beg to contradict his statement.

If your correspondent had the same aptitude for veracity that he has for writing letters, your valuable columns need not have been taken up in contradiction. I hope in future "A Guard" will give his name as I give mine. TOM SEESON.

Liverpool, March 21st.

[Why did not Mr. Seeson put on the brake when he found his train running through?—ED. E.]

THE LEAVITT PUMPING ENGINES.

SIR,—The writer from Mr. Leavitt's office, whose letter you publish in your last number, in impugning the correctness of my figures on the Lawrence engines in your issue of February 10th, has fallen into the error of calculating the foot-pounds duty from the sectional area of pump, neglecting the slip; in other words, calculating from the theoretic instead of actual lift of pumps. The foot-pounds per 112 lb. coal are correctly stated by him at 124,934,796, theoretic. The efficiency of pump as given in the report = 91·64 per cent. of theoretic efficiency. 124,934,796 × ·9164 = 114,550,247 foot-pounds. My figures therefore stand correct. I should like to ask if the two diagrams engraved with the letter are from the Lawrence engine or the other one referred to at Calumet, as the writer does not make this plain?

Nottingham, March 20th. REGINALD BOLTON.

THE INSTITUTION OF CIVIL ENGINEERS.

THE DESIGN OF STRUCTURES TO RESIST WIND PRESSURE.

AT the ordinary meeting on Tuesday, the 14th of March, Sir J. W. Bazalgette, C.B., vice-president, in the chair, the first paper read was on "The Design of Structures to Resist Wind Pressure," by Mr. Chas. B. Bender. It was observed that wind pressure was as often overrated as underrated. Instruments to measure the velocity and force of the wind were not very reliable, on account of the frequent change of direction of the wind, and of its action by sudden gusts, and not by mere statical pressure. The most trustworthy experiments, made with falling plates by General Didion, yielded pressures of 40 lb. per square foot on a test plate having an area of 10·76 square feet, for a velocity of 111 miles per hour. The size of the test plate was very material. Had Didion used plates 12in. square, the pressure would have been only 32 lb. The form of surface exposed to the wind was also of importance. Hollow cups experienced double pressures, cylinders only one-half of the test pressure, and there were forms which reduced it to less than one-fourth of that on a flat plate. Since hurricanes generally acted with great lifting power, in calculating the wind pressure upon a structure the most dangerous direction of the wind must be considered. For bridge floors, wind coming from below at an angle of about 25 deg. was the most trying. Now, assuming the wind to blow in this direction, and a little from one side, the total opposing surface of a structure, having regard to the size, position, and form of its members, and, in the case of railway bridges, carrying a light passenger train on the floor, must be considered. Engineering structures must be so built that there should not be any movement, either of shifting, turning on a pivot, or tilting of the whole structure. Further, lateral and transverse wind-bracing must not be strained beyond one-third of the calculated breaking strain. Since the horizontal wind-bracing might experience strains from the vertical loads, those strains must be deducted from the specified maximum; and it would be found that for short spans there would remain available for wind proper five tons, and for large railway bridges six tons per square inch of lateral wind diagonals. The transverse bracing might be influenced by the vertical loads, and it must likewise be designed to stand strains arising both from wind and from moving loads. The wind pressure of the top lateral bracing of a bridge had to be carried to the lower floor, and each end must be sufficiently strong and stiff. As regards details, it was essential to provide strong plates or pins for joint connections, so as to absorb additional or secondary strains upon the members. In the case of eccentric connections, the moments of flexure arising from the application of forces must not be neglected, and there should be members strong enough to transfer the wind strains to the central joint. Iron piers, also long span bridges, must be carefully examined as regarded tilting, and the danger must be met by giving a sufficient base, or by anchoring to heavy blocks of masonry, well proportioned and well executed, or by both of these methods. The consideration of the action of wind materially influenced the proportion of the width of a bridge to its depth, and the latter was limited long before the maximum height was reached, as regarded vertical loads, in a bridge of most economical design. For instance, in a girder bridge of 400ft. span and 18ft. wide, the truss could not with safety be deeper than 45ft.; if built 50ft. deep, a width of 21ft. was advisable. As the force of the wind upon a large railway bridge amounted to about the load of an ordinary train, it followed that its design for carrying vertical loads was only part of the problem to be solved.

RESISTANCE OF VIADUCTS TO SUDDEN GUSTS.

The second paper was on the above subject by Prof. Jules Gaudard In order to ascertain the stability of a structure exposed to wind, it was necessary to find the greatest pressure to which it might be subjected by sudden squalls. The maximum wind pressure in England has been stated by Rankine to be 55 lb. on the square foot, but a pressure of 71 lb. was observed at Liverpool in September, 1875. Tornadoes in America were reckoned to have exerted pressures of from 84 lb. to 93 lb., though allowance for pressures of only from 33 lb. to 50 lb. was made by American engineers in designing bridges. In order to procure more precise data, it was urged that suitable apparatus should be at once established in various places, for recording the pressures attained during severe gales. Suspension bridges, owing to their flexibility, were most affected by wind, as evidenced by the injuries inflicted by gales on the Roche-Bernard and Menai bridges. This class of bridge had been stiffened by additional cables from the top of the piers to the roadway, by stays underneath, by cross-bracing between the suspension rods, by stiffening the sets of chains themselves, or by spreading out the cables laterally at the tops of the piers.

Thibault found that with two square screens placed at the distance apart of one of their sides, and one completely covering the other, the wind pressure on the two screens was 1·7 of that upon the exposed screen. The pressure, however, upon two plate girders connected by a platform was evidently less, and when the roadway was at the top or bottom of the girders might be reckoned as 1·2 of the pressure on the windward girder. In the case of trellis girders each opening might be regarded as an orifice with thin sides, in passing through which the stream of wind experienced a certain amount of contraction, which occasioned a somewhat greater resistance than the proportion of solid to open would indicate.

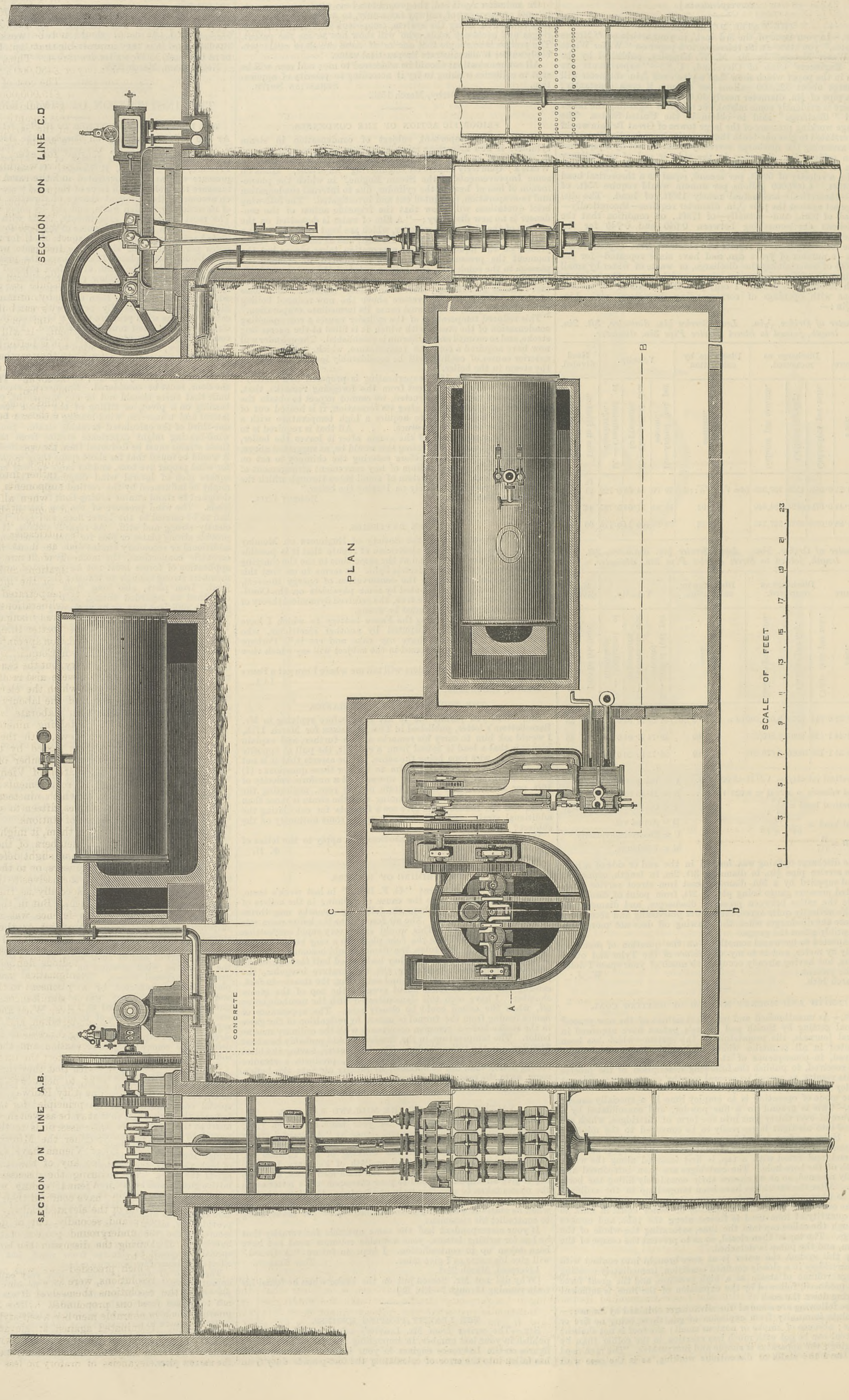
An arch had the merit of opposing less surface to the wind in the central portion of the span; whereas the reverse was the case with a bow-string. Two narrow iron arched bridges of large span at Oporto and Montereale had been secured against the wind by special contrivances; the first, by spreading out the iron ribs towards the springings, so that the ribs, though only placed 13ft. apart at the crown, were 49ft. apart at the springings; and the second, by placing side buttresses against the haunches of the arch, thus providing a wider base. Trains passing along a lattice girder bridge increased the surface exposed to the wind. In the case of high viaducts, the greatest strain was thrown upon the anchorage of the piers. The strains upon the Bouble viaduct, having lattice girders and braced iron piers 189ft. high, were investigated, and it was shown that in the extreme case of a wind pressure of 55·3 lb. and a train on the viaduct, a strain of 24$\frac{3}{4}$ tons would be thrown on the anchorage. The strain on the anchorage might be provided for, either by stays fastened near the tops of the piers and secured to the ground, or by widening out the base of the piers by buttresses. High timber stagings, with their broad surfaces were specially exposed to damage from wind, but they might be effectually braced by iron-wire cables.

The force of waves, beating against very exposed structures, appeared occasionally to have attained a pressure of about 6000 lb. per square foot, but in general the shock of waves was estimated not to exceed from 600 lb. to 1000 lb. Even with this latter pressure, the blow of a wave against the lower portion of a lighthouse was more to be dreaded than the pressure of the wind above, unless the tower was exceptionally high. On the contrary, in the case of a high viaduct, the effect of the wind on the lofty superstructure was more dangerous than the beating of the waves against the narrow piers.

FRITH HILL, GODALMING, AND FARNCOMBE WATERWORKS.

MR. JABEZ CHURCH, M.I.C.E., WESTMINSTER, ENGINEER.

(For description see page 215.)



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W. H. (Blackburn).—*If you will send models or drawings they shall have our attention.*

J. D.—(1) *Ground ganister is used for lining Bessemer converters, and cupolas. It has been made into bricks, used as a wash for the inside of steel ingot moulds, and as an ingredient in crucibles.* (2) *There is no book on the use of ganister.* (3) *It can be ground in a suitable mill. We scarcely know what "an ordinary" pug mill means. When ganister was first used it was put on the high roads as metal and ground down by passing vehicles into mud, which mud was collected and used as a fire-clay.*

SUBSCRIBER.—*We are obliged for the extract you have sent us. It would, perhaps, have been more instructive had the writer given a few particulars. We see no reason to modify the opinion we have always held that the simple engine is just as economical in fuel when properly made as the compound engine, but that the latter gives more regular turning and gets on with a much simpler valve gear than the single engine requires. The modern compound marine engine is nothing more than two simple engines, one of which has a larger cylinder than the other, and to such an arrangement no exception can be taken. But it does not follow that it requires less steam than, let us say, a two-cylinder Corliss engine would need. Corliss valve gear has not succeeded on board ships; but the durability of a valve gear is one thing, economy of fuel another.*

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, March 28th, at 8 p.m.: Papers to be discussed:—(1) "The Design of Structures to Resist Wind Pressure," by Mr. Charles B. Bender; (2) "On the Resistance of Viaducts to Sudden Gusts of Wind," by M. Jules Gaudard.

SOCIETY OF ARTS.—Monday, March 27th, at 8 p.m.: Cantor Lectures, "Hydraulic Machinery," by Professor John Perry. Lecture IV.—Lifts. The new balance method, as applied in bridges, canal boat, and other lifts. The transmission of power to machines at a distance by means of water. Applications to various tools. Comparison of hydraulic and electrical methods, and the part which each is likely to play in the future. Wednesday, March 29th, at 8 p.m.: Seventeenth ordinary meeting, "A New Antiseptic Compound and its Application to the Preservation of Food," by Professor Barff, M.A. Dr. W. J. Russell, F.R.S., will preside.

THE ENGINEER.

MARCH 24, 1882.

CAPTAIN EADS' SHIP RAILWAY.

CAPTAIN EADS, an American engineer, whose claim to that title has been disputed in the United States, proposed long ago to construct a railway across the Isthmus of Tehuantepec, on which railway ships weighing as much with their cargo as 6000 tons could be carried. The line is to run from the Bay of Campeachy to the Bay of Tehuantepec, about longitude 95, and between 15 and 20 deg. north latitude, and will be about 150 miles long. Instead of going round the whole coast of South America to reach the Pacific, a New York steamship could be transferred bodily overland by the Eads Ship Railway. This attractive proposal was suffered to lie dormant for a long time. Recently it has been revived, and is now being run, to use a Yankeeism, in rivalry with the scheme of M. de Lesseps. A Bill for its construction has found its way into Congress, and has been referred to the United States Senate Committee on Commerce. This Committee has introduced a few modifications into the Bill, and has recommended its passage. In order to help the Bill through the House of Representatives, Mr. Eads has printed a pamphlet in which he publishes in a compact form the opinions of several English shipbuilders and engineers whom, it appears, he has consulted. Thus, for instance, we find Mr. Barnaby saying, "The problem of constructing a car on which a fully loaded ship can be safely transported over such a railway is soluble, and the solution is, in my opinion, fairly indicated in your—Captain Eads'—plans." Mr. John Fowler says: "I have satisfied myself that there is no mechanical difficulty in carrying ships of any size without injury to themselves in a properly designed car or cradle over a solidly constructed railroad." Many other authors are quoted, who all speak cautiously enough. Given the car and the railroad, and the thing can be done. No one we fancy disputes this; but the construction of the car, to say nothing of the railroad, involves some matters of detail about which it would be imprudent to speak too positively. The only Englishman of repute who has fully endorsed Captain Eads' views is Sir Edward Reed, who, according to the pamphlet from which we are quoting, says: "I am of opinion—after making some guiding calculations—that the weight of a car and cradle, of ample strength to carry a ship of 4000 tons weight, need not exceed 500 tons; if to carry a ship of 6000 tons, it need not exceed 750 tons." Sir Edward, it will be seen, has made some calculations. He has not spoken without thinking, and yet there can be no doubt but that he is completely mistaken, and that no car could be made weighing but 750 tons to carry a dead weight of 6000 tons. It may be said that this is a matter of but little importance; nothing more is needed than to make the car heavy enough. But it will be conceded that the heavier the load to be transported the greater will be the cost of transport. The Eads Railway is a commercial scheme; and so long as it was fathered by American engineers we had no remark to make. But the undertaking assumes a different aspect if the weight of the authority of English engineers is to be used to back up Mr. Eads in getting capital. Under such circumstances the scheme is one about which we may have a good deal to say.

We may as well here state once for all that we have no doubt of any kind that it is quite possible to lift a ship weighing 6000 tons out of the water, put her on a car, transport her 150 miles by rail, and put her into the water again. In other words, Captain Eads' idea is quite sound. Whether the things to be done can be done in the way he proposes to do them, and by the means he has suggested, is quite another matter, concerning which we do not feel called upon to express any opinion whatever. If it is essential to the success of his scheme that his transport car should not weigh more than 750 tons, then the scheme will be a failure; and as Sir Edward Reed has spoken on this point, we shall speak too. The United States *Railroad Gazette* has already exposed the fallacy of Sir Edward Reed's assumptions. A 5ft. driving wheel with its tire may be taken as weighing a ton. A load of 10 tons is quite as much as such a wheel can carry. To support a load of 4000 tons, four hundred wheels would be required, representing as many tons. But the wheels must have axles, and axle-boxes, and springs, and frames to which to fasten these things. It is not too much to assume that they will weigh as much as the wheels, and we have thus a gross load of 800 tons, before a portion of the cradle proper in which the ship is to rest has been touched. Our American contemporary puts the question in a different and still more telling aspect:—"Taking the carrying capacity of ordinary car wheels, and—for reasons which will be given hereafter—assuming the weight of a ship cradle at one-half that of the ship and its load, we would have for a 4000-ton vessel a total load of 6000 tons, or 13,440,000 lb., which would require 1792 ordinary car wheels to carry it. A 6000-ton ship would require the movement of a load of 9000 tons, or 20,160,000 lb., or 2688 wheels. Having this data it is comparatively easy to get at the weight required for certain parts of the running gear, from the weight of these parts now in use. The following are the weights of the standard parts now recommended by the Master Car-builders' Association:—33in. wheel, 530 lb.; standard journal box, 74 lb.; standard journal box cover, 10 lb.; standard journal box bearing, 9 lb.; standard journal box key, 4 lb.; standard pedestal, 141 lb.; standard axle (one-half), 173 lb., or in all 941 lb. Now, $941 \times 1792 = 1{,}686{,}272$ lb. = 752 tons; and $941 \times 2688 = 2{,}529{,}418$ lb. = 1128 tons. In other words, the weight of wheels, and other parts enumerated, is alone 50 per cent. greater than that which Sir Edward J. Reed—'after making some guiding calculations'—estimated as the whole weight of the cradle." In practice it is well-known that the tare of a goods wagon is at least one-half the weight of the load the wagon will carry—a 10-ton wagon weighing 5 tons, and so on. We cannot see why Captain Eads' car should be an exception to the rule. Thus, then, it may be looked on as certain that the car alone will weigh nearly or quite 2000 tons if 4000 tons are to be carried.

To haul this enormous load will be no light task. It appears that no definite route has yet been fixed upon, but Captain Eads admits that he will have to get up inclines of 1 in 100. It requires a locomotive with 18in. cylinders, 2ft. stroke, and 5ft. wheels. to take with certainty 200 tons up such an incline as this. Thus thirty very heavy engines would be required to haul the ship and cradle. There are to be twelve lines of rail, on which will run twelve sets of bogies, carrying the cradle and ship above. It will be very difficult to keep the load equally distributed among all these bogies, and it is probable that the resistance will be much greater than that of a goods train. But assuming that thirty engines suffice, it is easy to see that the cost of working must be enormous. At 5s. per mile per engine, each trip of 150 miles will cost £1125. If to this sum be added the cost of lifting and lowering the ship; maintaining the mechanism in order; keeping up the road, and so on in a country where the cost of everything, and especially of labour, is enormous, it is clear that nothing but a very large traffic can make the enterprise pay. But this is just what the railway cannot carry. It appears to be impossible to do more than take a 4000-ton ship out of the water, lift her 40ft., put her on a cradle, carry her 150 miles across country and put her afloat again in less than twenty-four hours. Thus but one ship can be carried each way in the day with a single car and railroad. The toll paid by a 4000-ton steamer in going through the Suez Canal is about £2700. A return ticket for such a ship can be had for £2700. If the toll were raised the canal would not be worked to its full capacity, and it is very improbable that Capt. Eads would get more than £3000 for a return ticket. Thus, the maximum earnings would be £1500 a day or £450,000 a year, assuming 300 working days in the year. The cost of the railway is estimated at 75,000,000 dols., or £15,000,000. There is no evidence to prove that the earnings would suffice to cover all expenses and leave a profit on this gigantic capital; nor is there any reason to conclude that the carriage of one ship each way per day would meet the wants of the shipowners. It is more than probable that for every ship weighing 4000 tons which wanted carriage five weighing a good deal less would present themselves, and the earnings of the railway would be proportionately reduced; and it is not improbable that not one, but several cars would be required to conduct the traffic, because it would not be reasonable to send a 2000-ton car with a 1000-ton ship.

Putting the commercial aspect of the railway on one side, we have nothing to urge against it. On the contrary, the scheme is daring and clever, and presents a splendid field for the display of engineering talent. As we have said, we do not for a moment dispute its practicability; but Captain Eads will gain nothing by minimising the difficulties to be overcome. They are very great, but in no wise insurmountable. Nothing but skill and very large sums of money are needed to get over them. It will not do, however, to start with the idea that it it is better to say that the loads to be hauled will be less than they can be. On the contrary, it will be best in the long run to exaggerate difficulties rather than make light of them. The Eads Ship Railway must be something more than a toy; and its making and working will not be child's play. This truth ought to be put very plainly before those who are asked to subscribe to its construction.

VIENNA CITY RAILWAYS.

THE dilemma in which the project for the elevated railway in Vienna now stands, or rather into which it has been brought by a host of factious opponents, is apparently one of endless entanglement; but when all its bearings are taken into consideration, and some slight knowledge of the conditions of commercial life in Vienna is brought to throw light on its intricacies, the situation is by no means so complicated as it at first appears. The vote lately passed by the Town Council, after four postponements for further investigations and six months' delay is, to say the least of it, one of the most grotesque acts of self-stultification ever perpetrated by a body corporate. The result of their deliberations is the more astonishing as the commencement was inaugurated with a show of earnestness that promised better things.

Not only was a Railway Commission appointed, consisting of eighteen members of the Town Council, whose labours only ended on the 6th of February, but the Stadtbauamt, or Metropolitan Board of Works, were also requested to prepare a list of conditions under which the elevated railway could be accepted. The result of the labours of these two independent commissions was an elaborate report on the part of the Stadtbauamt, containing nineteen cardinal points representing their own views, with the addition of about thirty different resolutions passed by the Austrian Institute of Civil Engineers, the Chamber of Commerce, and by the Commercial Association of Vienna in 1875; and a still more detailed list of requirements on the part of the Railway Commission, in which nineteen paragraphs were devoted to general principles, fifteen to special conditions, and three to the question of stations.

With all this matter before them, it might have been reasonably expected that the members of the council in full assembly would have paid some slight deference either to the opinions of their own engineers, or to the resolutions of the committee appointed by themselves to decide on the merits of the project, more especially as the latter had taken six months to prepare them. But in the discussion, which lasted four sittings, no reference was made to the resolutions of either the Stadtbauamt or the committee. The greater part of the time was occupied by mutual recriminations between the holders of opposite political views; and the results of their tedious deliberations were embodied in the following enigmatical resolutions:—(1) "As the Corporation can only consent to the construction of a City Railway when, simultaneously with its execution, the regulation of the river Wien and the demolition of the octroi lines be undertaken, and, because the present laws relating to granting concessions for railways, especially in regard to expropriation and the control of construction, do not sufficiently protect the interests of the commune, they declare herewith that they can give their consent, at the present moment, to neither of the projects now before them for a Vienna City Railway." (2) "The Corporation declares itself 'in principle' for the construction of a City Railway." It may be as well here to remark that, in spite of numerous false assertions to the contrary, both spoken and published, neither the Minister of Commerce nor the Municipality of Vienna have ever investigated or paid any attention to any of the numerous so-called "projects" which, during the discussions in the several scientific bodies in Vienna, sprang up with the rapidity of mushrooms, but have confined their researches, first of all, to the merits of the elevated railway of Messrs. Bunten and Fogerty; and, secondly, out of deference to native talent, to the underground project of the Vienna Baugesellschaft. During the discussion the latter scheme was not even alluded to.

The arguments which preceded—we will not say produced—the above resolutions, were as wild and as far from the mark as the resolutions themselves from the reply expected to the questions propounded by the Minister of Commerce. One honourable member, a self-styled disciple of the "æsthetic," fulminated against an elevated railway as a "barbarism" and an "outrage," and with all the ardour of a man who has made himself immortal in stucco, and mastered the elegancies of oratory no less than those of art, surpassed himself in his happiest conception of the fitness of form, by designating London "the ugliest city in the world," and New York "the dungheap of all the garbage of Europe," and appealed to his hearers to suffer rather the stagnation of all commerce than to promote the prosperity of the city by adopting the ideas and innovations of such examples of bad taste and iniquity. Many other speakers followed in similar strains; but to the initiated ear the key-note of personal hatred against one or other of their political opponents could be distinguished throughout.

It would tax the ingenuity of the Delphic Oracle to produce more enigmatical resolutions; but they are at the same time, fair samples of municipal "decisions," where the members are swayed by the terrorism of a democratic section, whose sole hold on power consists in the readiness to hurl accusations broadcast on the personal integrity of anyone rash enough to oppose them. The tactics of this party, as shown by a late trial—in which their ringleader was condemned in costs—are directed against every improvement that is calculated to enlighten and elevate the masses. The corruption they pretend to discover among other members of the community exists only in their own imaginations. They view the upright conduct of others with the jaundiced eye of their own disease, and seek only, by threats of denunciation, to intimidate the majority into abject silence. This is, however, only one side of the question, as it now stands; and it would, indeed, be a sad one, did the welfare of Vienna and the chances of the railway depend alone on such representatives at so important a juncture. But the entire intelligence of the city, the whole of the ministerial departments, the Society of Engineers and Architects, the Chamber of Commerce, the commercial associations of nearly every district and of the whole of the suburbs, nearly all the political clubs in the city and environs, the whole of the railway companies in Vienna, to say nothing of 400,000 inhabitants of the suburbs through which the line is projected to run, and who have presented a petition to the House of Representatives praying the same to support Mr. Fogerty's railway, are all in favour of the project. They see in it a temporary advantage, by the employment of thousands during its construction, who are now so borne down by the taxes imposed on them by the municipality that they can scarcely earn their daily bread; and a permanent advantage in the influx of an enormous capital, in improved means of communication, by a decentralisation of the population—the bugbear and dread of the houseowners in the city, who form the majority of the Town Council—and in the erection of a monumental undertaking that demands no sacrifice from town or State, and will, at the end of the concession, become the property of the Empire.

The higher authorities, in whose hands the final decision rests, are by no means blind to the numerous benefits to be derived from so useful and important a construction; they have, from a feeling of deference to the wishes of the municipality of so important a capital as Vienna, offered them the opportunity of displaying their loyalty, their patriotism, and their care for the improvement of the city committed to their charge, and have asked their opinion; but they are by no means bound to be guided by so negative an expression. Their feeling of justice is far too high to saddle an undertaking that promises to raise Vienna to the level of an actual and not a fictitious capital with all the shortcomings of the Corporation for centuries past. They have too high a sense of their own dignity to submit to the dictation of an irresponsible body to alter the laws of the country to suit personal requirements, and their duty to the town and their allegiance to the State must compel them, as there is no doubt it will, and as speedily as the forms will allow, to treat with dignified silence the implied refusal of the municipality to assist them, and the covert attempt to wrest concessions for party aggrandisement at the expense of the State; and they must sanction the construction of, to use the Minister of Commerce's own words, "the only project that is suited to the requirements of Vienna, and on the execution of which the future prosperity of the city depends."

THE BUILDING EXHIBITION.

THE annual Building Exhibition was opened on Monday, and this year it is well worth a visit. This is seen to be the case immediately upon entering the Agricultural Hall, as, although the character or class of the leading articles shown is the same as in the two former exhibitions, there is a much larger display of good representative work, and Mr. Black has succeeded in persuading several firms to go to considerable expense in arranging attractive stands. There is a very marked absence of irrelevant shopkeeping displays as compared with those of last year and 1880, and the Building Exhibition may now be said to be organised and arranged in a manner which will make it of value not only to those engaged in the building trades, but to everybody. It is, however, it must be remarked, purely a trade exhibition, and therefore is essentially practical in its instructive capacity. There are, for instance, no displays of woods of different and little-used kinds from various parts of the world intended to show what there is in colonial or other lands awaiting application. There are few architectural drawings showing systems of ventilation and heating, and so on; but there are plenty of wooden articles made from the timbers which the builder or manufacturer can at present most economically obtain or use to the best advantage, either as to original cost, cost of working, or appearance, and there are plenty of ventilators and ventilating apparatus. In fact, so numerous are these, that it would fill much space to describe those of recent origin only. There are several good displays of building stones and marbles, some of which are not much used though very nice looking; not high in cost and apparently durable, the marbles being of Belgian production. An indirect illustration of the difference between the population of Belgium and that of Ireland, where some deposits of beautiful and easily accessible marbles exist suitable for chimney-pieces and clocks, of both of which there is a large display in the Exhibition. There are several buildings in the Hall illustrating the employment of stone and iron for lodges, conservatories, balustrades, gates, &c., as designed by well-known artists of modern architectural taste, and there are very numerous structures in concrete of various compositions and colours, after the manner of Lascelles' coloured concretes, and also exhibiting the value of concrete as a material for building houses, cottages, stairways, and so on, with great facility and strength. Cornices and other ornamental work in cement of different, and of some new kinds, are well shown by structural illustrations; and terra-cotta occupies considerable space. There is a very large display of fireplaces and cooking ranges, exhibiting no marked improvement, unless it be increased simplicity in the details of the interchangeable open and closed fire ranges; and we need hardly say that gas fittings and fixtures are, as usual, in great strength, and onstands from a few feet square to those of many yards, with really fine displays. The electric light is to be seen on a small scale. Hoisting machinery and grindstones and other tools are well represented, and some novelties shown, while there is a display of wood-working machinery, though it contains no features of special novelty to engineers. There are novelties in water and sanitary appliances, one water-closet flushing and waste-water preventer being shown which has not a single valve, but which acts with a syphon and water-displacing vessel, which on being depressed starts it into action.

THE NORTHERN STEEL WORKS.

NOT the least interesting of the tables that have been issued of the production of last year is that dealing with Bessemer steel. That part referring to the production of the North is of special value, because it shows the result of the efforts that have been begun in recent years to render the north-eastern district one of the great Bessemer steel-making districts of the kingdom. Although we believe that one of the earliest of the licenses that were issued for the use of the Bessemer process was granted to a firm in Durham, it is only within the last three or four years that there has been any production of moment of Bessemer steel. But the efforts that have been made to extend the steel manufacture in the district have been so successful, and the four works that are now in existence between Tudhoe and Eston have been so well worked during the year, that not less than 264,986 tons of ingots have been made last year. This was an addition of not less than 120,000 tons to the yield of the previous year—the largest addition made by any British district. In the current year there is full ground for the belief that the production will considerably exceed that of the past. In the first place six out of the fourteen converters were not erected last year till part of the time had gone, and as these have been fully employed there will be this year a gain from that cause; and in the second, there are four or five converters to be started this year, which towards the close may add to the yield. It is evident that the steel manufacture has planted itself firmly in the North of England now, and that there may be looked for that growth which the large resources of the district in iron and coal seem to promise. Already works are erected, or are in course of erection, in which six additional converters are to be placed, and the proved success of the basic process will in all probability stimulate the building of works in the North. That process opens out the vast fields of ironstone in Cleveland to the uses of the steel trade; and though as yet the great bulk of the steel produced by it has been used in the rail manufacture, it seems to be contemplated that there will be speedily a use found for it in the steel plate trade. If this is so, it would lead to an immense development in the North-east, of the steel manufacture; because of the consumption of steel plates in shipbuilding in that locality. It may be too soon to speculate on the nature of the steel trade that will grow in the North-east, but one fact cannot be overlooked. In the production of rails, Cleveland has to compete with many districts, some of which are more advantageously situated than it for the supply of certain markets. This would not be the case in the plate trade, for the consumption would be largely local. But the growth that has been noted in the past two or three years may be expected to continue, though the precise form of the additional trade may not be discernible.

NEW NORTHERN RAILWAYS.

THE North-Eastern Railway Company is now bringing towards completion two of the largest of the works it has long had in hand—the Pickering and Seamer, and the Whitby, Redcar, and Middlesbrough branches. The opening of the first is the event of a few weeks, and that of the other—though later—is expected to take place in the current year. It is thought that the two lines will for years to come complete the service of the agricultural part of the North Riding, so far as the North-Eastern is concerned. The Pickering and Seamer branch runs through an exclusively agricultural district from near Pickering to Seamer Junction, close to Scarborough, and it is intended to expedite the traffic to that queen of the northern watering-places. It has been several years in course of construction, and has up to the end of last year caused the expenditure of £134,719. In the current half-year it is estimated that £10,000 more will be expended on it, and that afterwards £6982 will be needed to complete it, so that its cost may be put, in round numbers, at £151,000. The other branch is a much more costly line. At the end of last year the North-Eastern Railway Company had expended not less than £186,742 on it since it took the undertaking in hand, and £56,000 were estimated to be needful to complete the line from that period. The share capital of the original railway company was a quarter of a million, so that with debentures, the cost of the line, originally planned for sixteen miles long, is fully half a million sterling. It will serve as a link in the chain of coast communication, and will open out for passenger and mineral traffic a valuable tract of country between the pleasant watering-place of Saltburn and Whitby. With these works, the bulk of the important lines for developing North Yorkshire must be looked upon as finished, and the North-Eastern Railway Company will be able to turn its attention a little more to parts that yield it at the present time a very large traffic, the coast of Durham, and the coal-fields that send thereto for shipment—a district for which it has recently done little. The past ten or twelve years have filled up many of the Yorkshire dales, and now what the North-Eastern Railway has in some degree to look to is the provision of facilities such as we have hinted at, and also the formation of fresh routes from the great centres of its import and export trades to the manufacturing centres of the midland districts. It is evident that there will be proposals on the part of other companies to enter this field if it is not more fully served, and it would be well if there were that fuller provision for the growing trade of the north-eastern ports that the changed circumstances of the last few years have rendered indispensable.

THE ARLBERG TUNNEL.

AT a recent meeting of the Société des Ingénieurs Civils, Paris, under the presidency of M. Emile Trélat, M. Mallet presented an abstract of a paper by M. Meyer, engineer-in-chief of the railways in Western Switzerland and the Simplon, on the works of the Arlberg tunnel. This paper is of considerable interest, and contains many particulars of this work. The tunnel is to be 10,270m.—11,231 yards—long. The heights above datum at the ends are 1302m.—4572ft.—on the east and 1215m.—3986ft.—on the west. The highest point inside the tunnel is 1310m.—4298ft.—so that the longitudinal section shows a rising and a falling gradient. The height of surface above the centre of the tunnel is 800m.—2624ft. It was at first intended to drive an inclined shaft to the middle of the tunnel, but this was abandoned on account of its cost, and the tunnel is being driven from the two ends. The rocks to be passed through consist of crystallised and micaceous shales containing a variable proportion of quartz. The quartz is most abundant on the east, and the rock there approaches the gneiss. Mica predominates in the west, where the rocks are softer and less compact, giving rise to infiltrations of water and necessitating the use of timbering. The English method of driving has been adopted, and the heading at the bottom is 2·75m. wide by 2·30m. high—9ft. by 7ft. 6in. Every 50m.—55 yards—there is a chimney or upbrow communicating with a drift in the upper portion of the section 2m. wide by 2·30m. high—6ft. 6in. by 7ft. 6in.—which follows closely upon the heading. The rock-drills and appliances for ventilation are driven by water-power. Two systems of rock-drills are in use; on the east a percussive drill worked by compressed air, and on the west a rotary drill worked by a water engine. The daily advance—24 hours—from 1st February, 1881, has been 3·3m.—10ft. 10in.—and the cost is estimated at 34,711,000f.—£1,388,440.

AN ORNITHOLOGICAL DANGER TO BRIDGES.

IN foreign climes the engineer has much to contend against. Elephants pull down telegraph poles; monkeys short-circuit wires; white ants devour sleepers; snakes bite him; scorpions sting him; natives rob him; indigenous labour carries wheel-barrows on its head with two shovelsfull of earth, and holds that it does well. He is starved, and roasted, and roundly abused. Taking one thing with another his life is not a happy one. In certain districts it is worse than in others; thus white ants may be found superadded to scorpions in some places, while snakes and tigers go together in others; and in South America a danger appears to exist about which nothing has been heard hitherto. Mrs. M. G. Mulhall has written a very amusing book published by Stanford last year, and entitled, "Between the Amazons and Andes; or, Ten Years of a Lady's Travels in the Pampas, Gran Chaco, Paraguay, and Matto Grosso." From Mrs. Mulhall we learn that on the line of the San Louis Railway the ostriches are so numerous as to cause much trouble; "for whenever a workman left any bolt or screw out of his hand, were it only for a moment, they disappeared, being swallowed up by these birds, and one of the engineers declared that they even went so far as to pick the bolts out of the iron bridges if they were left by chance unrivetted!" As no one ever heard of an engineer telling an untruth, especially to a lady, it must be taken for granted that this is true; but certain speculations arise in the mind which has absorbed such facts. What for example, we may ask, is the biggest bit of iron an ostrich can get down? Could a large one manage to swallow a rivetter's hammer? Given sufficient time, could an ostrich get out a rivet which had been closed, and swallow it? How many ostriches would be required to eat up a lattice bridge, 100ft. span, in a year, giving them a fair chance at it?

LITERATURE.

On the Treatment of Steel. Issued by Messrs. Miller, Metcalf, and Parkin, Pittsburgh, U.S. 1882.

THIS little volume professes to be a reprint of circulars issued at various dates by the firm whose name it bears, and who are steel makers at the Crescent Works, Pittsburgh. It also includes a paper entitled "Why Does Steel Harden?" read by Mr. Metcalf before the Engineers' Society of Western Pennsylvania. The former part consists mainly of remarks on the treatment of tool steel in the various processes to which it is subjected. These are eminently pithy and to the point; and we cannot do better than quote a few of them. The firm hold very decidedly the view that pure steel is simply a compound of iron and carbon, and with regard to the percentage of carbon they give a series of analyses showing how accurately it can be judged by a skilled eye. In a series of specimens arranged by eye, according to the carbon they contained, careful analysis failed to detect a single error in the arrangement. They then go on to annealing, and their advice on this head is well summed up as follows:—"To anneal any piece of steel, heat it red hot—and no more—heat it *uniformly*, and heat it *through*, taking care not to let the ends and corners get too hot. As soon as it is hot take it out of the fire, the sooner the better, and cool it as slowly as possible." Next, as to heating steel—with the three-fold object of forging, hardening, and tempering—they lay down the two following principles:—(1) The effect of too high heat is to open the grain, *i.e.*, to make the steel coarse; (2) the effect of irregular heat is to cause irregular grain, irregular strains, and cracks. Hence they declare that steel should never be heated higher than is necessary for the end in view, that it should be heated all through, and that when hot enough it should be forged immediately, never being allowed to "soak" in the fire; or, if for hardening, should be quenched immediately with an ample supply of the cooling medium. For tempering the rule is the same, with the addition that the cooling down should be as slow as possible.

From experiments on the results of heating different parts of the same bar of steel to different temperatures, and then quenching, the following general rules are deduced:—"(1) Any difference in temperature sufficient to be seen by the colour will cause a difference in the grain, and this variation in grain will produce internal strains and cracks; (2) any temperature so high as to open the grain, so that the hardened piece will be coarser than the original bar, will cause the hardened piece to be brittle, liable to crack, and to crumble on the edges in use; (3) a temperature high enough to cause a piece to harden through, but not high enough to open the grain, will cause the piece to *refine*, to be stronger than the untempered bar, and to carry a keen edge; (4) a temperature which will harden and refine the corners and edges of a bar, but will not harden it through, is just the right heat for taps, rose-bits, &c., as it will harden the teeth sufficiently without risk of cracking, and will leave the mass of the tool soft and tough."

Passing on to the usual mode of using steel, the authors lay down that a piece of steel properly tempered should always be finer in grain than the bar it is taken from. If this cannot be done, consistently with the hardness necessary, the steel is too low in temper originally, that is, contains too little carbon, and this should be altered. Steel high in carbon should be worked at a lower heat, whereas the smith, being "generally the most hurried and crowded man about the establishment," naturally tries to harden all tools at about the same heat. To avoid this trouble, the purpose for which a bar of steel is wanted should always be stated with the order, which is very little trouble to the buyer, but is an immense relief to the maker.

The authors next treat the question of gauges, and descant upon the absurdity of the three systems of gauges in use, and the still greater absurdity of graduations between these, distinguished by such phrases as tight, easy, &c. As they pertinently ask, "How is it possible for a roller to know just how many millionths of an inch another man, whom he never saw, means when he says 'No. 28 full' or 'No. 27 easy?' and how is he to guess how many thousandths of an inch the other man's gauge is wrong in its make." The authors advocate getting rid of this by the use of the micrometer sheet-metal gauges, which are simple, and measure thousandths of an inch.

The paper on the hardening of steel criticises the various theories propounded, without actually endorsing any, and also gives the results of a number of experiments, chiefly on the specific gravities of steel under different circumstances. Into these we cannot enter, but may quote the following general laws, which, it is held, have been made out:—(1) The specific gravity of the ingot varies with the quantity of iron present; (2) the greater the quantity of carbon the greater the amount of work necessary to produce change of form; (3) the greater the quantity of carbon the greater the change of volume due to a change of temperature. The last law is very important, as indicating why steel high in carbon is so much more apt to crack in working than a lower quality. With regard to the cause of hardening, the writer leans rather to the view that the quenching suddenly stops the molecular motion within the steel, and thus produces great internal tension, with consequent hardness and brittleness, as is known to be the case in hardened glass. This molecular action, as is remarked, may very possibly be combined with a chemical action, causing that difference in the condition of the carbon which the recent experiments of Professor Abel appear to have proved to exist between hardened and unhardened steel.

WATER SUPPLY OF SMALL TOWNS.

No. II.

FRITH HILL, GODALMING, AND FARNCOMBE WORKS.

IN continuation of the articles commenced in our impression for the 10th March, 1882, we now give illustrations and particulars, with cost of the works carried out under Mr. Jabez Church, M.I.C.E., Westminster, for the supply of Frith Hill, Godalming, and Farncombe in 1878-9. The supply in this case is from a deep well, and the works afford a good example of what may be done in the supply of small communities at a cost easily dealt with.

Well.—After trial borings were taken, the well was sunk at the foot of Frith Hill, in the lower greensand and rock which crops out here. The depth of the shaft is 70ft., the upper portion of which was formed for 16ft. of brickwork in two rings of 4½ work with an inch of cement between the two rings. In the first place only the outer ring was put in, so as to allow the iron cylinders to be carried down, when these were in their place the inner ring of brickwork was built up to form a foundation for the stone curb. The cylinders are 1in. thick, and were to have been 6ft. 6in. external diameter to a depth of 54ft. below the brickwork, but it was found that only a portion of the 6ft. 6in. cylinders could be got in when internal ones were used to get to the depths required. This well was a most difficult one to construct, as the cylinder had to be sunk through live sand by the aid of a diver. When the cylinders were in place and the bottom made sound with concrete, 1in. holes were drilled as shown in the section, page 212, letting in the water. The water came through a large fissure in the rock running under Frith Hill, which was cut through by the cylinders. Powerful temporary pumps were then fixed, and the water, full of sand, was pumped down as low as possible, when manholes were cut in the cylinder just opposite the fissure. All the sand and rock in the neighbourhood of these holes was taken out and ballast put in its place, so as to keep up the surrounding sand and form a water-way. When this was done and the sand in the fissure pumped away, perfectly clean and high-classed water was obtained in large quantities, and, in fact, could not be pumped down below the level of the fissure. The contract for the well was £767, not including the pumping, &c., and was carried out by Messrs. T. Docwra and Son.

Tower, Reservoir, and Buildings.—At the top of Frith Hill, 161ft. above the well, the reservoir and the tower were constructed, as shown in the engravings—the tower for the supply of the high district of Frith Hill, and the reservoir for the supply of Godalming and Farncombe. The tower buildings were designed by Mr. C. F. Hayward, F.S.A., who has a residence on Frith Hill, and was one of the early promoters of the company. The reservoir was constructed by Messrs. T. Docwra and Son at a cost of £3109, and was somewhat expensive owing to inaccessible position of the site. The tower and buildings, with chimney shaft and flue, were built by Mr. Pink, a local builder. The flue was formed of "rock concrete," and was carried up the side of the hill some distance. The cost of the builder's work was £1658.

Pumping Machinery.—The engine, boiler, and pumps were erected by Messrs. Young and Co., of Pimlico. All the work is arranged with a view to ultimate duplication of the machinery. The engine is horizontal and non-condensing, though a condenser may be added at some future time. The cylinder is 12in. diameter by 24in. stroke, fitted with an expansion valve, with an arrangement for altering cut-off equally by a right and left-hand screw. The fly-wheel is 8ft. 6in. diameter, and weighs about 3 tons. The boiler is a single-flue Cornish boiler, 15ft. long, 5ft. 6in. diameter. The pumps, illustrated on page 212, three in number, are on the bucket and ram principle. The buckets are 9in. and the rams are 6⅜in. diameter by 21in. stroke. The pump buckets and the suction valves are of the double-beat description. The cost of the machinery was £1188. The engine consumes exactly 3 lb. of coal per horse-power per hour. The total cost of these works, including Parliamentary expenses and land, is £12,000 for a scattered population of 700, or at the rate of £1 14s. 3d. per head, which is very satisfactory, especially when it is remembered that the area supplied is large in proportion to the population.

TENDERS.

AT a meeting of the Harbour Commissioners, held last Friday evening, the tender of Mr. William Rigby, of Worksop, Nottinghamshire, to construct the Dock, Railway, and Swing Bridge for £80,200, was accepted. The work to be commenced at once, and completed in twenty-one months. W. H. Wheeler, M. Inst. C.E., engineer.

	£	s.	d.
James Dixon, Swansea	116,995	0	0
W. Rigby, Worksop—accepted	80,200	0	0
John Scott, Wigan	141,506	19	11
Whittaker Bros., Leeds	89,833	0	0
Kirk and Parry, Sleaford	97,010	0	0
Appleby and Laughton, Ledbury	120,654	0	0
Benton and Woodiwiss, Derby	103,955	4	2
H. Lee and Son, Westminster	94,000	0	0
S. Sherwin, Boston	112,693	0	0
Patterson Bros., Ruskington	84,535	9	0
Kellet and Bentley, London	87,708	19	6
John Jackson, Westminster	97,522	17	8
Pearson and Son, Bradford	101 850	0	0
W. Hill and Co., Gosport	85,970	0	0
W. E. Jackson, Newcastle	100,526	0	0
Holme and King, Liverpool	105,620	0	0
Walter Scott and Co., Newcastle	91,035	4	6
Thomas Monk, Liverpool	82,813	14	0
James Young, Glasgow	104,218	18	1
William Webster, London	106,069	0	0
Charles Brand and Son, Glasgow	130,298	1	1

NORTHAMPTON.

For the erection of a new brewery for Messrs. Ratliffe and Jeffery. Messrs. Davison, Inskipp, and Mackenzie, consulting engineers and architects, 62, Leadenhall-street, E.C. Quantities—for No. 1 contract—by Messrs. Curtis and Sons.

CONTRACT No. 1.—BUILDING.

Additional for Cellar Floor.

	If paved with blue brick. £	s.	d.	If paved with Claridge's Seyssel asphalte. £	s.	d.	£	s.	d.
Martin, H., Northampton	145	0	0	320	0	0	5840	0	0
Smith Bros., Northampton	135	0	0	53	0	0	5585	0	0
Casford, T., Northampton	128	0	0	305	0	0	5560	0	0
Heap, G., Northampton	130	0	0	50	0	0	5550	0	0
Dunkley, Blissworth	93	16	6	309	0	0	5090	0	0
Watkins, J., Northampton	93	0	0	307	0	0	5089	0	0
Branson & Sons—accepted	136	0	0	200	10	0	4975	0	0

CONTRACT No. 2.—COPPER.

	No. 1. £	s.	d.	No. 2. £	s.	d.
Siddeley	650	0	0	760	0	0
Blundell Bros.	635	0	0	739	0	0
Bindley and Briggs	600	0	0	670	0	0
H. Pontifex and Son	540	0	0	665	0	0
Shears and Sons—accepted	504	0	0	639	0	0

CONTRACT No. 3.—BACKMAKER'S WORK.

	£	s.	d.
Bennett	450	0	0
Church	410	14	0
Oxley—accepted	384	0	0

CONTRACT No. 4.—MILLWRIGHT'S WORK.

	£	s.	d.
Bennett	1057	0	0
Thornewill and Warham	960	0	0
Oxley—accepted	928	0	0

CONTRACT No. 5.—PIPE CONNECTIONS.

	£	s.	d.
Blundell Bros.	1112	0	9
Pontifex and Sons	958	0	0
Bennett	945	0	0
Oxley	918	0	0
Bindley and Briggs—accepted	900	0	0

For levelling, forming, and sodding proposed Recreation Ground for the Barmouth Improvement Committee. Mr. Thomas Roberts, Assoc. M. Inst. C.E., engineer.

	£	s.	d.
Powell, Barmouth	250	0	0
Williams, Harlech	230	0	0
Owen, Portmadoc	200	0	0
G. Williams, Harlech	182	16	0
Morgan, Dolgelly	165	0	0
Thomas and Davies, Barmouth—accepted	150	0	0
Engineer's estimate	225	0	0

THE ROYAL INSTITUTION.

MR. SWAN ON THE ELECTRIC LIGHT.

LAST Friday night Mr. J. W. Swan, of Newcastle-on-Tyne, lectured at the Royal Institution on the electric light to the largest audience of the session, considerable numbers of those present being unable to find more than standing room.

Mr. Swan first described the electric lights of Davy and Faraday at the Royal Institution. Sir H. Davy, he said, produced a stream of white hot gas between two pieces of carbon; the stream was produced horizontally, and it was called the "electric arc" because the currents of warmed air acting on it bent it upwards. The arc light being suitable only for the illumination of large areas, inventors had to turn their attention to the principle of incandescence to obtain a lamp suitable for domestic use. In heating lengths of wire or carbon by electricity, there was neither gain nor loss, in proportion as greater lengths were heated; a ten times longer wire would give out ten times more light, and consume ten times more energy. The more a metal resisted the passage of a current without melting the better could it be used for illuminating purposes; platinum was good in this respect, but an alloy of platinum with 20 or 25 per cent. of iridium was better; still the resistance of metals was not high enough to give an adequate return in light for the amount of energy expended, when the lighting of rooms had to be effected. The power used in heating the wire was lost so far as the production of light was concerned; he illustrated this by passing the current first through two filaments and then through one, obtaining much more light thereby from the single lamp. If two units of power gave the light of two candles, three units, he said, would give the light of thirty-five candles, with the same lamp.

Carbon had long been attempted to be used for incandescent lamps, but practical difficulties stood in the way of it until a recent date. Within the last three or four years it had been discovered that carbon could be produced in thin filaments possessing much elasticity and spring. Carbon filaments, made from bamboo fibres, had these properties; also carbon made from cotton thread, treated with two parts of sulphuric acid mixed with one of water, a mixture which had the curious property of parchmentising blotting-paper, and other fabrics made of vegetable fibre. The speaker here exhibited a carbon filament $\frac{1}{100}$in. thick, which acted like a spring. The permanence of these films when incandescent was due to the perfect nature of the vacuum now obtainable in glass bulbs; this was due to the invention of the Sprengel pump, followed up by the beautiful experiments of Mr. Crookes. In the present incandescent lamps there were no screw joints; they had no joints but those made by the glassblower. It was due to Mr. Edison to say that he had conceived the idea at the same time as himself—Mr. Swan—of making lamps on this principle. He believed that the first lamp of the kind ever exhibited in public was one of his own, which was used at a meeting of the Newcastle Literary and Scientific Institution, in October, 1877. He thought that the expense of incandescent electric lights would not compare unfavourably with that of gas, and some works were being erected in America which would settle the question of relative cost. Incandescent lamps could be cheaply made to last for 1200 hours; it was not certain that the limit of durability had yet been reached in their construction. In connection with the system the renewal of lamps was a point which had to be considered.

In the course of the evening, Mr. Swan lit up the theatre by means of clusters of incandescent lamps.

CRYSTAL PALACE ELECTRICAL EXHIBITION

No. IV.

WHETHER a good light can or cannot be obtained from electricity is no longer an open question. Instead we have now as a problem for discussion, the cost of electric lighting. It happens that very little definite information exists on this point. It may be urged as an explanation of the fact that the light has not been long enough in existence to permit any accurate information to be obtained concerning its expense. But this is hardly true. The cost of the light may be classed under three heads, namely (1) the first cost of the plant; (2) the cost of fuel, lamps, and attendance; (3) the cost of maintenance. Hitherto statements concerning these things have emanated principally from gas engineers on the one hand, and electricians on the other. The gas folk hold that electricity is dearer than gas, while the electricians maintain that it is cheaper. The utterances of both parties are obviously tinged with a suspicion that they are prejudiced; yet it ought not to be difficult to arrive at the truth. If we take lamps for example the power required to work them can be ascertained, also the cost of carbons and attendance; while to find out what annual outlay maintenance represents is surely easy enough.

By the courtesy of Messrs Hammond and Co., and Messrs. Davey Paxman, and Co., we were enabled on Friday to carry out at the Crystal Palace an instructive experiment, the results of which throw a good deal of light on the points to which we have referred. In our last impression we briefly noticed a semi-portable engine by Messrs. Davey Paxman, and Co., which is to be found in a shed at the side of the corridor leading from the low level station. This engine we illustrate. It has a single unjacketted cylinder, 12in. in diameter and 14in. stroke; it is fitted with Paxman's patent valve gear, which has already been described in our columns. The valve chest is fitted with a species of inner lid, in which are several small ports—on which slides a little gridiron valve. The inner lid is close to the back of the main slide valve, and the small gridiron valve serves to cut off the steam. This valve is worked by an excentric mounted on a countershaft, and making two revolutions for one of the engine, motion being imparted to it by a pair of engine-cut toothed wheels. On the countershaft a sheave is keyed beside the excentric. This sheave is fitted with a hoop, and a rod from it extends to one end of a link, while the excentric rod is secured to the other end of the link; a lever from a high-speed loaded governor is coupled to the link, and by this means the travel of the gridiron cut-off valve can be varied in a way which will be understood without further explanation by engineers. The cut-off takes place very quickly, the gridiron valve having a stroke of but half an inch, and the engine drives the dynamo with remarkable regularity, the hand of the tachometer fitted to the machine remaining at rest—a wonderful result with a single cylinder engine. Distributed through the Palace, Messrs. Hammond and Co. have forty-eight double-carbon Brush lamps, and on Friday they placed at our disposal thirty-two of these lamps for the purpose of experiment. All the lamps are fitted with short carbons. It was not deemed advisable to try an experiment at night, when the Palace was crowded with visitors, so the lamps could only be used for one hour, as otherwise there would not be carbons enough left to maintain the light from 6 p.m. to 9.30. It would, of course, have been desirable to make a more prolonged experiment, but it will be seen that a great deal can be learned even from an hour's run concerning the electric light.

We stated in our last impression that the Davey Paxman engine was driving one 7A Brush dynamo. This is not sufficient load for the engine, so a spare dynamo was put down, and driven by a riding belt. The engine has only one fly-wheel, and one belt had to run on top of the other, the arrangement being as in the accompanying

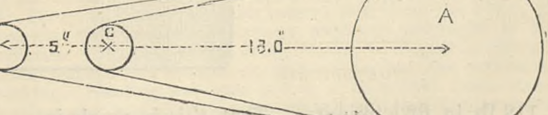
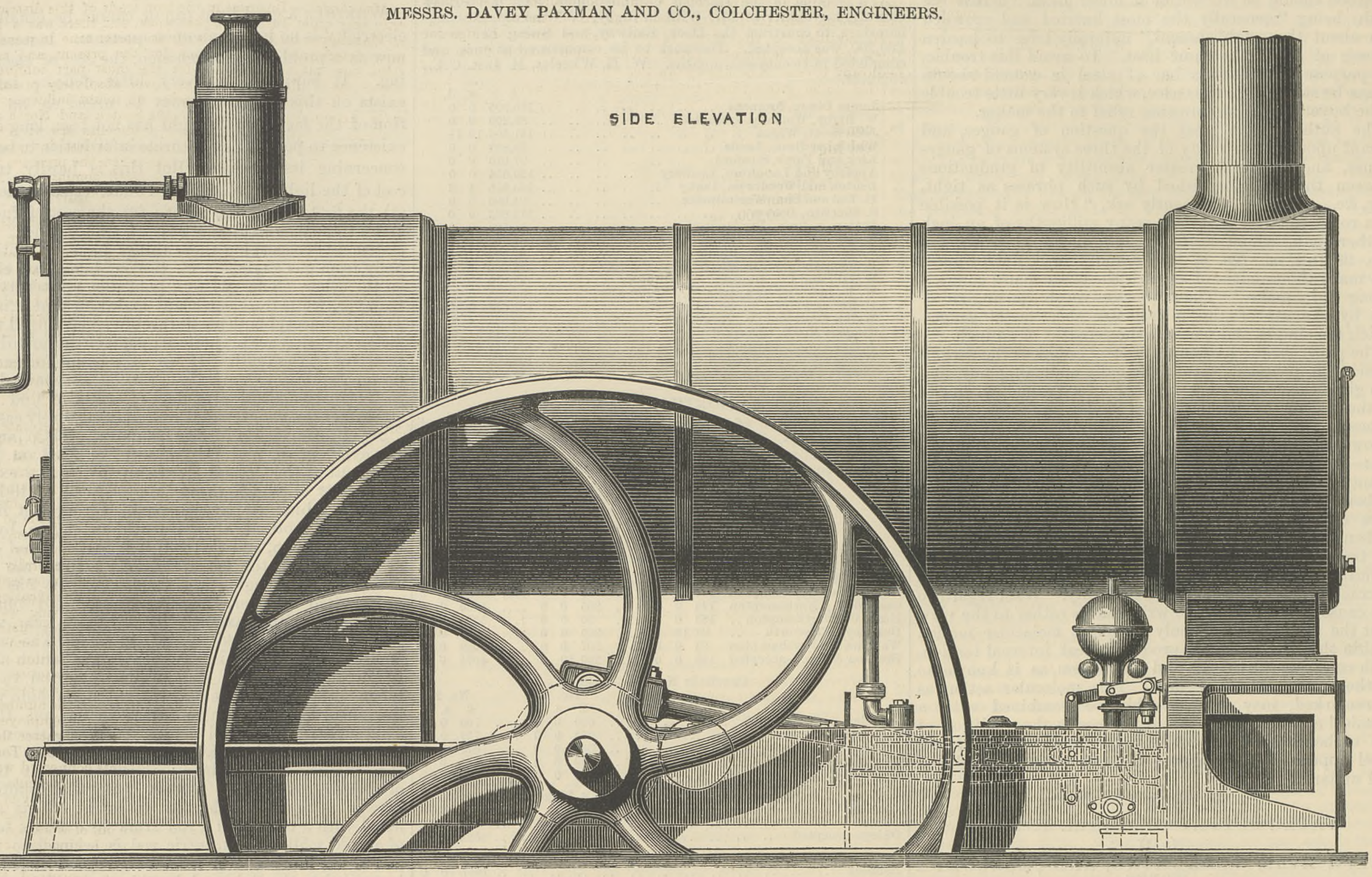


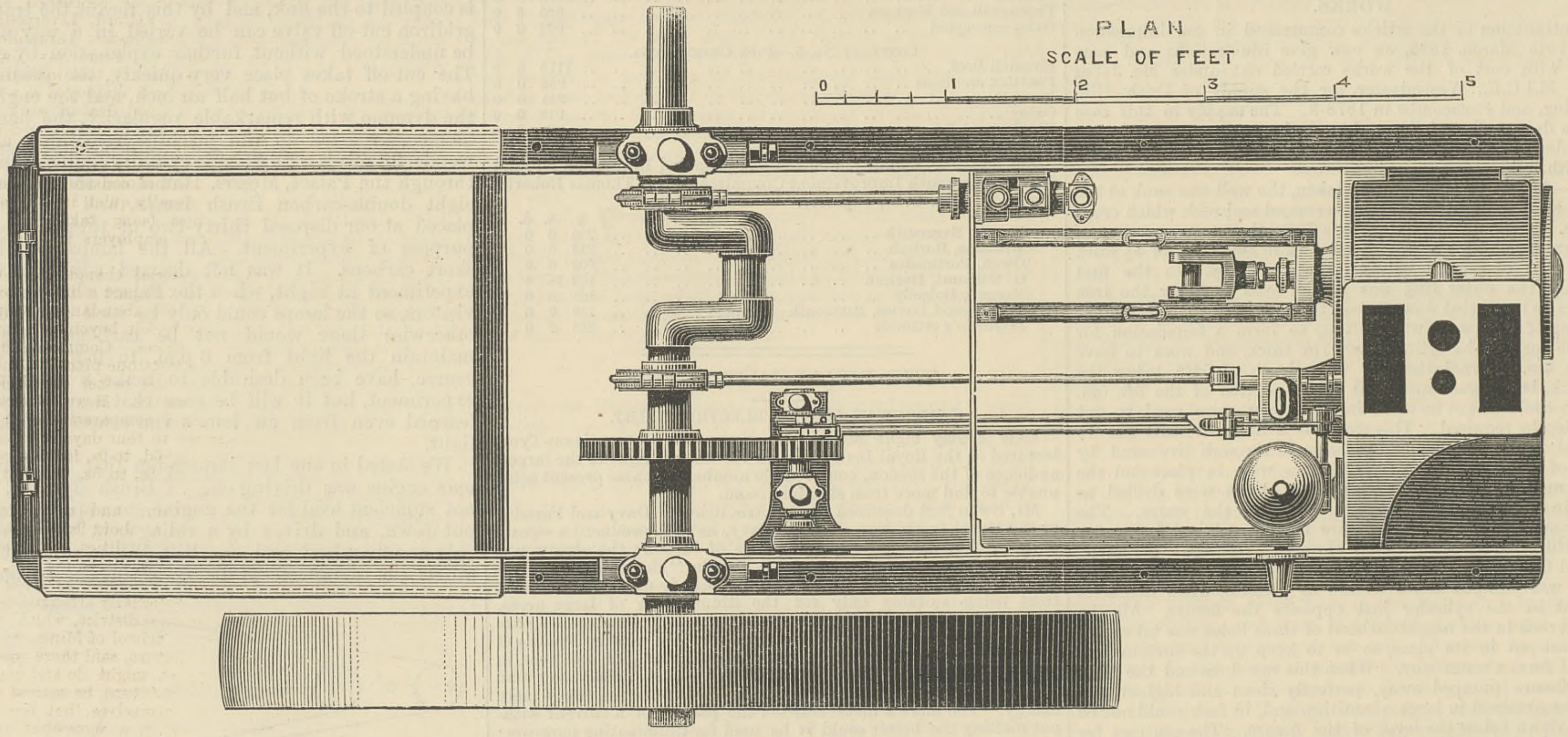
diagram. Here A is the fly-wheel, B is the dynamo regularly used, and C is the dynamo added for the purpose of experiment. It will be seen that this was unfair to the engine, as one crank shaft bearing had to stand the strain of two double 8in. belts; but there was no approach to heating. The sixteen lamps ordinarily driven by Messrs. Hornsby and Son's engine, were coupled on to the extra dynamo.

At 2.20 p.m. the engine was started, the gauge standing at 70 lb., and but little fire on the grate. At 2.26 p.m. the counter was put in gear and firing commenced with Welsh coal; we could not ascertain what coal, but we believe Powells Duffryn, and of excellent quality. Steam was gradually raised to 75 lb., and at that it was kept by a very skilful fireman with great steadiness. The dynamo made 650 revolutions per minute; the engine 122·1. Exactly 1 cwt. of coal was put into the fire-box between 2.26 and 3.15 p.m. The engine continued to run from 3.15 to 3.26, when the pressure had fallen to about 72 lb. The indicator was then thrown out of gear, and the experiment concluded. About a dozen diagrams were taken during the run, but it was soon found that they were all practically alike, as was to be expected, because the load and boiler pressure were steady. The average of several gives 43-horse power. Thus it would appear that 43-horse power could be had for 1 cwt. of coal per hour, which is equivalent to 2·6 lb. per horse per hour. So far as could be judged by the eye, the fire was in the same condition at the end of the hour as on starting; but in order to eliminate any chance of error on this point, we shall reject the last ten minutes of the run, and take the consumption as

SEMI-PORTABLE ENGINE AT THE CRYSTAL PALACE.

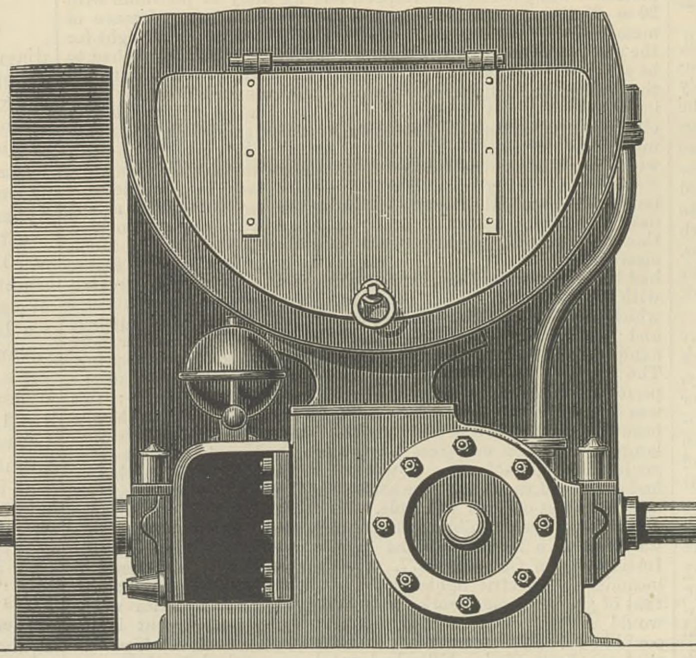
MESSRS. DAVEY PAXMAN AND CO., COLCHESTER, ENGINEERS.





112 lb. in fifty minutes. That this is ample is certain, for the pressure tended to rise after the last shovelful of coal had been put on, and at the end of the experiment the pressure was a couple of pounds higher than at starting. On the other hand, the water had fallen a very little in the gauge, which may be set against the extra pressure. Taking, then, the consumption at 112 lb. in fifty minutes, we have a consumption of, in round numbers, 134 lb. per hour, equivalent to 3·1 lb. per I.H.P. per hour—an admirable result, considering that this is an ordinary commercial engine, not made for exhibition, and that the feedwater was not heated in any way.

Thus, then, it is clear that two No. 7A Brush dynamos can be driven by 43-H.P. It would have been desirable to run these machines a little faster—say, 680 to 700 revolutions—but the governor could not be altered without some trouble to let the engine run at a higher speed, and the safety valve would not allow a higher pressure than 75 lb. to be carried without risk of blowing off. Against the lower speed must be put the resistance incurred by driving with a riding belt. All things considered, it is clear that with this plant 43-H.P. is ample for the dynamos, and this corresponds very closely with the statement of the makers of the Brush machines, who say that 19 to 20 indicated horsepower is absorbed by a No. 7A machine. The difference represents engine friction.



The forty-eight lamps require, we understand, the constant work of two men for about nine hours per day to keep them cleaned and trimmed. There is besides an electrician, Mr. Goldenberg, who is fully occupied in testing insulation, &c. It may, however, be taken for granted, we think, that two men can keep thirty-two lamps trimmed and in order and look after two dynamos as well. The cost of carbons is three farthings per lamp per hour. With these facts before us, we are able to form some definite idea of the cost of lighting on the Brush system.

Engine, two dynamos, and thirty-two lamps, with wires, ought not to cost more than £1000 complete and ready for use. Of this sum the engine would represent about £300. We shall say nothing concerning lamp-posts or their equivalent, because their cost depends on the character given to them. Interest on £4000 at 4 per cent. amounts to £40 per annum. If we assume that the engine fire is alight for five hours daily and that the engine runs for four hours, the cost of coal at £1 per ton, will be, in round numbers, 6s. per day, and 1s. 6d. per hour while the lamps are alight. The driver's wages will be, at 5s. per day, 1s. 3d. per hour while the lamps are alight. Cost of maintenance, which includes depreciation and outlay for repairs and renewals of all kinds, at 20 per cent. per annum, is £200 a year, and 2s. 8·87d. an hour. The cost of carbons, at ¾d. per lamp per hour, will be 8d. per day, or £146 per year. Wages of two lampmen, at 7s. per day, £255 10s. Something may have to be added for rates and taxes, water, and rent of premises; but in the country £100 per annum ought to be sufficient. The whole bill then stands at £942 5s. per annum for working thirty-two Brush arc lights every day in the year for four hours. Adding £58 for oil and contingencies, we have a total outlay of £1000 a year. We have collected the several items for convenient reference into the following table of total expenses :—

	Per year.			Per day.			Per hour the lamps are alight.	
	£	s.	d.	£	s.	d.	s.	d.
Interest at 4 per cent. on £1000...	40	0	0	0	2	2·6	0	6·65
Coal at £1 per ton	109	10	0	0	6	0	1	6·00
Driver's wages	91	5	0	0	5	0	1	3·00
Cost of maintenance at 20 per cent.	200	0	0	0	10	11·5	2	8·87
Do. of carbons	146	0	0	0	8	0	2	0·0
Wages of two men	255	10	0	0	14	0	3	6·0
Rent, taxes, and rates ...	100	0	0	0	5	5·75	1	4·43
Total cost of working 32 arc lights	942	5	0	2	11	7·85	12	10·195

It will be seen that the cost of carbons for the lamps considerably exceeds that of the coal for the engine. We have charged the coal at £1 per ton, but this is a very high price for engine coal. If we take 10s. as a fair price, it will be seen that coal becomes quite an insignificant item. We believe that all our figures will be found trustworthy. The item for lamp-men would, perhaps, be best divided into two sums of 10s. and 4s. per day, the man who received the highest wages being supposed to know enough about electricity to test for insulation, &c., while the other would be little more than a labourer, or a stout lad learning his business.

With the data before us we can draw a comparison between the cost of street lighting for a small town with gas and electricity. The plant required to make gas for, let us say 500 street lamps, which will suffice for, say, five miles of streets, cannot be less than £2000. But instead of giving all the items of the cost of making gas as we have done in the case of the electric light, we shall take gas at 5s. a thousand cubic feet—and no small town can expect to obtain gas for less, because it is only when manufactured on a large scale that the bye products become of much value. Each lamp will use five cubic feet per hour, or in all, 2500 cubic feet. The cost of lighting will therefore be 12s. 6d. per hour, or within a trifle of the sum named in the last column of the preceding table. But to this must be added something for cleaning, lighting, and repairing the lamps, so that the whole cost will be considerably in excess of 12s. 11d. per hour. But for 12s. 11d. per hour the electric arc gives us the light of 64,000 candles, while the gas gives the light of but 10,000 candles, if the best possible burners are used. Thus estimated, in terms of candle power, gas is actually 6·4 times dearer than the electric light. It may be argued, and with some force, that 500 street lamps will be on the whole better adapted to the wants of a small town than thirty-two arc lights. But it does not appear to be necessary to use lamps of 2000-candle power. Messrs. Siemens have at the Crystal Palace a street lamp which appears to be just what is wanted. We have not measured its intensity, but it is probably less than 1000-candle power. Sixty four such lamps would, if judiciously distributed, light up a small town very well indeed.

It will be seen that we have said nothing concerning the incandescent lamp. As yet we have had no opportunity of testing the power required to work it. Its suitability for lighting large places is now being tried at Victoria station by the London and Brighton Railway Company, and at another time we may have something to say concerning it. Meanwhile we venture to hope that the figures we have placed before our readers may be found useful. That they are trustworthy concerning all that came under our immediate observation there can be no doubt; and we feel certain that engineers generally will admit that the estimated figures, such as the allowance for maintenance and wages, are consistent with the best practice and with their own experience.

THE SWAN GARDEN IRONWORKS.

Four years ago Mr. John Lysagh, proprietor of the St. Vincent's Galvanised Ironworks, Bristol, purchased the Swan Garden portion of the ironworks at Wolverhampton, carried on for so many years by the late firm of G. and B. Thorneycroft and Co. After putting them in repair and making very considerable alterations and additions, he started them for the purpose of supplying the works at Bristol with sheet iron of a superior quality and finish. This resulted in such an increase in the demand for the "Orb" galvanised sheets, both at home and abroad, that it became necessary, in order to meet that demand, to increase the number of sheet mills from seven to eleven. For this purpose the following additional new plant has been put down during the last nine months, and has recently been successfully started :—A forge, consisting of eight puddling and two ball furnaces, five horizontal furnace boilers with double flues and Galloway tubes, a 50 cwt. double-acting steam hammer, a horizontal high-pressure steam engine, 25in. cylinder, 4ft. stroke, driving a fly-wheel 30 tons weight, from which a train of bar rolls is worked direct. This forge is very compactly arranged in a semicirclar form, with the steam hammer in the centre. A set of guillotine cutting-down shears driven by an independent engine, two double sheet mills—equal to four single mills—each consisting of two pairs of chilled rolls and one pair of bar rolls, with suitable arrangement for working hot iron shears, two pile-heating furnaces and two open annealing furnaces, two horizontal furnace boilers with double flues and Galloway tubes. These two boilers are attached to the pile-heating furnaces; one in each mill has also been put down. The two double mills are driven by two horizontal steam engines, 36in. cylinders, 5ft. stroke, with equilibrium valves and other arrangements of the most modern and approved principle. Each engine has a fly-wheel 26ft. diameter, 65 tons weight, the rims of which are in one piece, and weigh 45 tons each; the boss and arms are in one piece also, and weigh 20 tons each. The moulds for the wheels were struck up in loam sand, or in other words, were formed of brickwork covered over with loam sand, and then properly dried and prepared to receive the molten metal, which was run from three air furnaces, the time occupied being in each case about six minutes. The rim and arms of each wheel remained in the mould for a week before they were sufficiently cool to be removed to their respective positions, which latter was a very tedious process. Each mill is worked direct from the fly-wheel shaft at a speed of thirty-five revolutions per minute. The sheet iron shears for both mills are driven by an independent horizontal steam engine. There is also a very complete arrangement for close annealing the sheets from these mills, consisting of a chamber large enough to contain four annealing boxes, with suitable appliances for charging and drawing, also for putting on and taking off the covers.

In addition to the seven furnace boilers mentioned above there are two horizontal firing boilers with double flues and Galloway tubes. The flues from the whole of these boilers are carried under ground into two chimney stacks, each 120ft. high from the floor line, with a 7ft. opening from the bottom to the top. The base of each stack is 14ft. 6in. square outside measure.

The whole of these works are roofed over with galvanised sheets fixed upon wrought iron principals and girders made at the Bristol works of the firm. The engines and steam hammers were supplied by the Lilleshall Company, Limited, Shropshire, and have given the greatest possible satisfaction, all having started to work without a single mishap. The whole of the castings used in putting down these works, including the large fly-wheels, were made at the Swan Garden Ironfoundry, belonging to the firm, and reflect great credit upon all concerned.

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

(*From our own Correspondent.*)

Prices, neither of finished nor of pig iron, were stronger on 'Change in Birmingham to-day—Thursday—nor yesterday in Wolverhampton; nor were they very sensibly weaker. The closeness of Lady-day kept consumers from giving out orders. They mostly desired to hold back from buying till the Ironmasters' Quarterly Meetings are over. Meanwhile the finished iron establishments, which are wanting specifications for their mills, are keeping their forges at full work accumulating puddled bars for use in the mills when the specifications are to hand, and to afford raw materials for the mills when the hot weather virtually closes the forges.

Bars were not difficult to buy to-day at from £6 10s. to £6 15s. for common sorts; medium qualities were from £6 15s. to £7; and good bars ran up from £7 to £7 10s. and £8 2s. 6d. per ton. There was a tolerably good business done in bars of light sections.

Hoops were again inquired for on account of United States; but makers' prices were declared to be too high. The business now doing is mainly on account of Australia, New Zealand, Italy, and Spain. Hoops of the usual sections were easy to buy at from £7 2s. 6d. to £7 5s.

Sheets were in quiet sale both yesterday and to-day, but there was hardly so much complaining that the galvanisers were withholding specifications. Singles might have been been bought at from £8 to £8 5s.; doubles, £9 5s., and trebles down to £10 5s. to £10 10s. and upwards. There were few firms who were stickling for the 30s. difference between these three gauges. Stamping sheets were procurable for deep stamping at from £12 to £15.

Boiler plates were £8 10s. to £9 and £9 10s., with a quiet sale. Tin-plate of the common quality was dull.

Pigs were to be had below most vendors' open market quotations. Good sales have in the past few days been made by the chief local smelters. Of Spring Vale qualities 5000 tons have been sold since March came in for delivery during the ensuing six months. The prices of this brand are—all-mine, £3 7s. 6d.; hydrates, £2 17s. 6d., and part-mine, £2 7s. 6d., though less by half-a-crown would have been occasionally taken from good customers.

All-mine iron of the firms generally was quoted at £3 10s. easy, and cold-blast £4 10s.; part-mines were 52s. 6d. to 55s.; and cinder sorts were procurable at from 42s. 6d. to 48s. per ton. Northampton qualities were 58s. to 52s. 6d. in the open market, but favoured buyers declare that their offers of 47s. 6d. were not invariably rejected. Derbyshire pigs were less yielding at 50s. to 52s. 6d. per ton. So stoutly are some of the firms contesting the ground with their customers that yesterday an agent reported the loss of an order for 500 tons because he declined to accept the 3d. per ton less which a competitor took. Hematite qualities were to be had at from 72s. 6d. down to 70s. Taken as a whole these pigs must be reported a shade easier on the week. Nevertheless the Barrow smelters have so much confidence in the future, and are already so well sold, that in the past day or so two lots of 1000 tons each have been allowed to pass because a trifling drop upon the smelters' terms offered by a customer would not be accepted. The production of all-mine hot-blast pigs will be increased three weeks hence by the blowing in at Willenhall, by Messrs. Ball, of one of their two furnaces, which have been standing idle for some years.

Little or no change was reported in coal, but the more winterly weather and the attempt to get the colliers in the Dudley district to demand higher wages had together a strengthening tendency.

The miners of the Rowley and Old-hill districts gave notice last Saturday for an advance of 6d. in thick, and 3d. in thin coal. The action is condemned throughout the other districts of South Staffordshire, and there is no likelihood of the demand being conceded.

At a representative meeting of ironworkers' delegates held on Monday at Walsall the wages' question was considered. The secretary to the Mill and Forge Wages' Board said he would bring forward information showing that the men were entitled to a better basis than that which had hitherto regulated wages. The suggestion was adopted by the meeting.

The proposals for insurance put forth by the Employers' Liability Assurance Corporation, Limited, have been brought before the South Staffordshire ironworkers this week, with the result that it was resolved that the operatives' secretary should wait upon the masters, with the view of favourably recommending the scheme to their notice.

Amongst the contracts which are on hand at some of the big galvanising works in this district, it may be mentioned that Messrs. Davies Bros. and Co., of the Crown Ironworks, Wolverhampton, are engaged on contracts for the Bengal Railway Company and the Mexican Railway Company, embracing galvanised corrugated sheets, gutters, ridge capping, and the fittings. One of the items is guttering and ridging ⅛in. thick, which is something unusual in this trade, and roofing the new works of a large firm in the iron trade in London.

The interests of the bicycle and tricycle trade, which is fast becoming an increasingly important industry in Coventry, Birmingham, and Wolverhampton, will, it is hoped, be materially promoted by an exhibition of such machines, which has this week been opened at Bingley Hall, Birmingham. In Coventry alone between 4000 and 5000 operatives are engaged in this trade, and it is probable that in Birmingham this number is equalled if not exceeded.

Muntz's Metal Company, Limited, have made a profit on the year of £28,685.

The Birmingham Proof-house authorities made a profit on last year's trading of £3591. The definitive proofs included 105,375 best double birding barrels, and 17,318 single barrels of the same description; 1233 common double barrels; 119,673 breech-loading birding barrels; 13,456 breech-loading military barrels; 21,819 breech-loading choke-bore barrels; 102,514 saddle-pistol barrels; and 4467 of the same description of foreign barrels.

South Staffordshire manufacturers learn with much satisfaction that Mr. Jno. Collett, the Director of Navy Contracts, has, in response to the invitation of the Wolverhampton Chamber of Commerce, consented to visit the district to hear manufacturers' views on Navy contract tendering.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Business in the iron trade of this district has been only very quiet during the past week, and there was a flat market at Manchester on Tuesday, with an easier tone in prices. Buyers seem determined to hold back for the present, and any transactions now taking place are for the most part confined to small cheap lots of district brands to cover absolutely pressing requirements. The close of the quarter no doubt influences buyers to some extent, but the state of the Scotch and North of England markets where, although heavy shipments are at present being made, the general tone of the reports is less favourable than of late, gives rise to the suspicion that when the pressure to complete Austrian orders prior to the new tariff coming into operation is over, there will be a collapse in the market so far as the foreign trade in this direction is concerned.

Lancashire makers of pig iron are doing extremely little, and, as I have already pointed out, the new business coming in is so limited that the output is gradually overtaking the deliveries. For local pig iron, delivered equal to Manchester, makers have been holding for 49s. to 50s., less 2½ per cent., for forge and foundry qualities; but at these figures they are not able to book new orders, owing to the lower figures at which district brands, especially Lincolnshire, are offered, and there would be a disposition to entertain offers.

Lincolnshire brands, delivered into this district, can be bought at as low as 47s. 6d. to 48s., less 2½, with quotations for Derbyshire brands ranging from 48s. to 50s.. less 2½; but these do not represent the figures at which all the makers are disposed to sell, as, where they have still large deliveries to make, higher rates are being asked. For Middlesbrough iron, delivered equal to Manchester, quotations nominally are about 51s. 10d. to 52s. 4d. per ton, net cash; but these figures do not lead to business in this district.

In the finished iron trade there is still a fair amount of activity, and the leading makers generally are kept well employed. Tolerably large shipments of hoop iron are being made to America at prices equal to about £7 2s. 6d. to £7 5s. per ton, delivered at Liverpool, but there are sellers for local delivery under these figures, and in the manufactured iron trade generally the amount of new business coming in is only limited in extent. In some cases makers are getting rather short of specifications, and are easier to deal with, but there is no actual giving way in quoted prices, which, for delivery into the Manchester district, average about £6 15s. and £6 17s. 6d. up to £7 per ton in some cases.

Judging from the reports sent in by the various districts connected with the iron and engineering trades' societies, an improvement in these branches of industry is evident to a moderate extent, and there is a continued gradual reduction in the number of men out of employment. The reports made by the employers also show trade to be better, but not in so marked a character that it can be followed up by better prices for the finished work. The reports for the past month from the various districts connected with the Ironfounders' Society, which, to some extent, represents the basis of the engineering trades, return work as good in only one or two of the really important centres of industry, and the number of men in connection with the society who are out of work shows a decrease of not more than forty-one over the whole kingdom, the respective figures being 584 this month as compared with 625 last month. So far as the Lancashire district is concerned the society's reports show trade to be good in Salford, Liverpool, and Rochdale, but only moderate in Manchester, Birkenhead, Bolton, Barrow, Oldham, and Stockport. From my own inquiries in the district I find general engineers, tool makers, locomotive builders, and boilermakers to be well employed as a rule; cotton machinists generally have also a good deal of work in hand, but the activity in this branch is due more to foreign orders than to a really large amount of home work, although the number of new mills either projected or being actually erected must necessarily bring local orders into the market of considerable weight. With regard to wages, matters are generally quiet in Lancashire, but in other districts the attitude now being taken by the men is operating rather as a check upon employers in tendering for new work.

The coal trade is without material change. A continuance of the colder weather will no doubt impart a little more activity to the house coal trade, but with the abundance of supplies in the market this will not be appreciably felt beyond a temporary check to the downward tendency of prices. Common round coals for iron making and steam purposes continue plentiful and very low in price, but engine fuel, so far as the better qualities of slack are concerned, show a tendency to harden. Heavy stocks of coal are held throughout the district, and comparatively very few of the pits are working more than three to four days a week. Prices at the pit mouth remain at about 8s. 6d. to 9s. for best coal; seconds, 6s. up to 7s.; common round coal, 5s. to 5s. 6d.; burgy, 4s. 6d. to 5s.; good, 3s. 6d. to 4s. per ton.

Local made coke for ironmaking and other manufacturing purposes continues in fair demand at about 9s. to 10s. for common up to 12s. 6d. to 13s. for the better qualities, at the ovens, but gas coke is a drug.

"How we Ventilate our Mines by Machinery" was the title of another of the series of lectures specially arranged for the miners engaged at the pits in the Dukinfield district, which was delivered by Mr. C. M. Percy, of the Wigan School of Mines, on Wednesday. Mr. Percy, in the course of his lecture, said there was a very great deal that the mechanical engineer might do and ought to do at collieries. Pumping would, in the future, be carried on with appliances perhaps not cheaper in themselves, but less expensive in working. Hauling was even yet in a somewhat crude state of development, and afforded great scope in the way of improvements for energetic engineers and enterprising colliery proprietors. Coal-getting under existing arrangements was carried on in a barbarous fashion, and the danger with explosives was very great, and the waste with the very handy but obsolete tool, the pick, was frightful. This state of things certainly could not and would not continue. In ventilation, the mechanical engineer had, during the last thirty years, done a great deal, and, on the whole, had done it well. So far as simply producing a current of air was concerned, nothing could surpass the excellence of the furnace, and especially in deep mines, because the efficiency of the furnace increased with the depth; but there was the danger of setting something on fire in the vicinity or in the shaft, and there was the injurious influence upon winding ropes, conductors, &c., by the products of combustion passing away by the up-cast shaft. No doubt except for shallow pits the mechanical system of ventilation was more expensive, but with really good appliances worked by condensing engines, mechanical ventilation even for deep mines would come very nearly to the furnace. Mechanical ventilators might either act to compress the air or to exhaust it, and in several respects forcing air in was more effective than sucking it out, but the inconvenience of effectively closing in the top of a down-cast shaft for forcing arrangements had led to the almost universal adoption of exhausting appliances placed at the top of the up-cast. Mechanical ventilators might be divided into three classes—first, pumps with clacks; second, revolving wheels sweeping out a fixed quantity of air at every revolution; and third, fans working on the centrifugal principle. Fans on the last-named principle were, however, those most generally in use, and those most in favour were the Guibal, the Waddle, and the Schiele, all of which in practice had given very excellent results. The Guibal and the Waddle were made any size up to 50ft. diameter and worked slowly, the engine being connected direct. The Schiele was a small fan rarely exceeding 15ft. or 16ft. diameter and worked quickly, power being communicated from a large pulley on the engine shaft by means of a strap to a small pulley on the fan shaft. Mr. Percy had no strong preference for either large or small fans, but his opinion was that the blades should be inclined backwards, and that the fan should either discharge freely all round the circumference or have a complete spiral casing opening into an enlarging chimney.

A meeting of the Executive Committee of the Manchester and Salford Trades' Council was held on Wednesday evening preparatory to a special meeting to be held in Manchester on Saturday, when delegates representing upwards of 50,000 trades' unionists in the immediate district will be present, and an address will be delivered by Mr. Broadhurst, M.P., after which a committee will be appointed to carry out the necessary arrangements for the forthcoming Trades' Union Congress to be held in Manchester.

Barrow.—Judging from the extra animated character of the demand noticeable in hematite pig iron at the beginning of the week I thought the week's notes would have chronicled a much better aspect in inquiries for iron; but the slightly better inquiry with which the week opened has not been maintained, and the position of the market is practically the same as last reported. The "spurt" on the part of buyers was of very short duration, and even when contracts have been tendered for at lower figures the result has not been the securing of many orders. Stocks are increasing, and unless the demand shows some signs of improving, stocks will increase to such an extent that makers will be under the necessity of restricting the output. The demand all round is very quiet, and although the shipping season is now open America shows no sign of increasing her inquiries. A better sale of iron on American account can hardly be looked for now unless freights are lowered; then our English markets will be in a better position to compete with producers across the Atlantic. Prices are again down, No. 1 Bessemer being quoted at 57s. 6d.; No. 2, 56s. 6d.; No. 3, 55s. 6d., net f.o.b. West coast ports, delivery over the next three months. Steel mills are in full work, but the demand has diminished slightly. Steel rails are quoted at £6 2s. 6d., but I believe that £5 15s. has been quoted. Iron shipbuilders are likely to be more actively employed, as they have lately secured a few orders of fair tonnage. Other industries are in receipt of a fair amount of work. Iron ore is a shade lower to buy, being from 14s. to 15s. per ton on trucks at the mines. Coal and coke in good consumption.

At the Ronhead mines, owned by Messrs. Kennedy Brothers, the underground men have had an increase of wages given them equal to 3s. per week. The advance has been given unsolicited by the men.

The development of the iron ore industry in South Cumberland is making rapid strides, and efforts are being pushed to get at some of the veins of ore which are known to abound in the Millom district. On the Hestham and Langthwaite estate, and at Ravenglass, boring operations are being carried out on a pretty large scale.

The Lonsdale Iron Company at Whitehaven is about to follow the example of the Distington Iron Company in the same neighbourhood, by blowing out its two furnaces, with a view of effecting necessary repairs and relining the furnaces. This will result in the blowing out of four of the furnaces in West Cumberland.

Some very heavy classes of work being now on hand in the Barrow shipyards, the platers in the employ of the company did not return to their work after breakfast-time on Saturday last, as they were anxious to have some arrangement as to the prices at which the work shall be done. A satisfactory result was, however, come to, and the men went on with their work on Monday, the arrangement being satisfactory to all parties.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE event of the week has been the announcement of Messrs. Charles Cammell and Co., Limited, the Cyclops Steel and Ironworks, that they propose to purchase the Dronfield Steel Works, and the Derwent Hematite Iron Ore Company, at Workington, where they intend to carry on the export rail trade. It has been known for some time that Messrs. Wilson, Cammell, and Co., of the Dronfield Steel Works, had finally resolved to transfer their rail business to the coast. The report was repeatedly contradicted, but information in my possession caused me to adhere to what I originally announced—that the steel rail business at Dronfield would eventually go to the coast. Messrs. Cammell and Co.'s announcement is the vindication of that statement.

The removal, however, has come about in an unexpected way. It was believed that the business at Dronfield would simply be taken to the coast, and that there would be an end of it. Now, however, the proposal assumes a far more important shape. Practically, the Dronfield Steel Works and the Derwent Iron Company will be extinguished in Messrs. Charles Cammell and Co., whose immense undertaking—£800,000 paid-up capital, and £350,000 debentures—will be augmented by the creation of £350,000 new stock to accomplish the purchase of the two works. The object in view is to retain the Sheffield export trade in rails. Sheffield commenced the manufacture of steel rails some twenty years ago, and had a monopoly of it for some years, when Barrow-in-Furness broke in, and afterwards South Wales, Middlesbrough, and continental houses. Gradually the export portion of the trade has drifted away from Sheffield, owing to the cost of bringing the hematite irons from Cumberland to Sheffield, and taking the rails to the ports of delivery. There was thus a double carriage to pay, equal to about 18s. a ton, *i.e.*, 8s. a ton for bringing the bar to Sheffield, and 8s. to 10s. a ton to get the rails on board ship. To a company with a heavy turnover of weight—some 120,000 tons of material—this is, of course, a great matter. To Messrs. Cammell and Co. it means £50,000 to £60,000 a year. By taking the works to the blast furnaces, and thus combining the production near the sea, the whole of the railway carriage on the pig iron would be saved, and the cost of shipping very materially reduced. At Workington there are three blast furnaces, and it is intended to erect steel works capable of producing 2500 to 3000 tons of steel rails per week, on land close to the furnaces. The new works will simply be the Dronfield machinery and plant put down at Workington. The material will run into the Bessemer converter red-hot from the blast furnaces, without any necessity for re-melting. The works are within a few miles of the Cumberland hematite iron ore field, and the Cleator and Workington Junction Railway, which intersects that field, runs into the company's premises, which are also connected with the London and North-Western Railway.

Messrs. Cammell and Co., it should be added, intend to use the Workington establishment exclusively for making rails for the export trade. This is a very important branch of their business, which is rapidly increasing. Their extensive establishments at Penistone and Sheffield will remain as before, with the exception that they will cease making rails for export, except in the case of those foreign firms who insist on Sheffield made rails. These orders, with all contracts for home delivery, will be carried out at the home establishments. Two important points remain to be noticed with regard to the Penistone Works; Messrs. Cammell and Co. believe that a great development of the Bessemer steel trade is yet to come in the manufacture of sleepers for the permanent way of railways. Wooden sleepers will be ultimately replaced by steel sleepers, as has already been done in France and Germany. For this work the company will be favourably situated at Penistone. Then in regard to the dephosphorising process, the Penistone works would be in a good position in reference to the Lincolnshire ore, which is believed to be better adapted for the process than Cleveland. The company expect that the general effect of this energetic and plucky enterprise will be to lift their company into the first position as regards the steel rail trade, and to secure to them ultimately command of all the raw material they require. To the Midland Railway Company the removal will be interesting, as the two works, Cammell's and Dronfield, paid £120,000 a year for carriage, which will cease when the Workington establishment is in operation. It was impossible, however, for the railway companies ever to have reduced the charges of transit sufficiently low to admit of successful competition with houses on the coast. Another question suggests itself: Will other steel houses have to follow in self-defence?

Several local reports are important enough to be summarised here. Messrs. Cammell and Co. have had a very prosperous year, and are able to pay 7½ per cent. for the twelve months, their total profit for the period being £60,686, making, with £20,685 brought forward from last year, £81,371. After paying the dividend and other charges, there remains to be carried forward to the current year the sum of £21,371.

Messrs. William Jessop and Sons, Limited, Brightside Steel Works, have made a profit—including £3067 brought forward—of £44,572, of which £37,323 is available for disposal. £4000 is set aside for depreciation of buildings and machinery; £5000 is written off to extinguish formation expenses, and the reserve fund is increased to £5000, leaving £25,830 for dividend, which is declared at the rate of £9 3s. 4d. per cent. on the paid-up capital, carrying forward a balance of £4691 to next account. On the other hand, Messrs. Cocher Brothers, Limited—files, &c.—report a loss on the year's trading of £928; Messrs. Unwin and Rodgers, Limited—cutlery—a loss of £260, which added to a loss of £345 in 1880 makes £606, which absorbs within about £100 of the balance standing at the credit of the profit-and-loss account on December 31, 1879. The directors ask the shareholders to say whether under these circumstances they will continue to carry on business.

The Bilbao Iron Ore Company, which is mainly owned in this district, pays no dividend for 1881. Their sales, the directors say, have greatly diminished, owing to the high rates of freights, while the price of ore has fallen at the same time. The two causes account for the unsatisfactory result.

Messrs. Newton, Chambers, and Co., Limited, Thorncliffe and Chapeltown Ironworks and Collieries, are offering £160,000 in 6 per cent. debentures of £50, £100, and £500 each, redeemable in three, five, or seven years. The business was recently converted into a select limited company, which purchased the undertaking for £448,963 1s. 8d.

The colliery trade is exceedingly languid, so languid that a colliery proprietor told me this week he knew of only two collieries which were yielding a profit.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE Cleveland iron market, held at Middlesbrough on Tuesday last, was remarkably quiet and steady in tone, and previous prices were maintained. Not much business was, however, transacted. The smelters held the weekly meeting, or conference—which has now become habitual with them—before the market, and decided to adhere to their quotations of the week before. Those quotations were 43s. 6d. per ton for prompt f.o.b. delivered of No. 3 g.m.b., and other qualities in proportion. Owing to the briskness of shipments during the present month, the stocks at the blast furnaces have become very bare, and consequently the warrant stores are very largely drawn on. The stock in Connal's Middlesbrough store has declined during the week no less than 4154 tons, an amount which largely exceeds anything experienced for some time. An increased demand for warrants has naturally arisen, and this is likely to continue so long as they can be obtained, as at present, at less than makers' prices.

The manufactured iron trade continues steady, with some signs of improvement. There is very considerable pressure for quick delivery of specifications against current contracts, and not a little inquiry on account of the future. Some "bearing" transactions in plates are reported. Glasgow merchants have appeared on the Tyne and elsewhere, offering and selling plates, in quantity, at considerably below current prices. It is believed that these sales are not covered, and should the market rise, or even remain steady, the operators will certainly be caught. Ship plates are still quoted at £7 5s., and angles and bars at £6 10s., f.o.t. Middlesbrough. Old rails command 77s. 6d. for flat bottoms, and 80s. for double heads, c.i.f. Tees, net cash. Puddle bars are in demand at 87s. 6d., and steel rail ends at 70s., f.o.t. maker's works.

The coal trade is weak in tone, and there is a manifest tendency towards lower prices.

The annual report of the Tees-side Iron and Engine Works Company, Limited—late Hopkins, Gilkes, and Co.—has been itsued. It is not a very encouraging one. The company made a loss on pig iron until September, when the restrictive policy was adopted. A profit was then obtained, which has wiped out a portion of the previous loss, and it is hoped that perseverance in the same direction will obliterate the remainder. Arrangements are being made to take the slag away in craft and tip it out at sea, by which a saving will be effected. The engineering and foundry departments have been well occupied, but unfortunately not at a profit hitherto. The bar and angle mills have been set to work, but too recently to say anything about results. It it intended to borrow a further sum of money on mortgage to meet the needs of the concern, and the shareholders are asked to sanction the intentions of the directors in this respect. The net loss is £5890 3s. 10d., but this, together with some portion of the accrued dividend on preference shares, the directors hope to wipe off before the end of the present year. Of the directorate, Messrs. Putnam, Smith, and Swan retire, and the last two offer themselves for re-election.

At the last meeting of the Cleveland Institution of Engineers an interesting paper was read by Mr. James Taylor on improved appliances for conveying and shipping iron. Mr. Taylor, who is general manager of the Tees Union Shipping Company, has devoted considerable attention to this subject; and has devised a truck wherefrom the iron load can be slung and lifted out bodily with the greatest ease. From the discussion which ensued it was evident that Mr. Taylor's ingenious efforts were cordially appreciated by the Cleveland Engineers.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

AS was anticipated, the export trade in pig iron has continued to expand, and the shipments during the past week have amounted to upwards of 17,500 tons, which is the largest that has been despatched from Scotland for at least eighteen months. This great extension in the export trade is the result of a very brisk demand from the Continent. France, Italy, and Germany have each been taking larger quantities of iron than usual. On inquiry, however, I find that the new orders booked from the Continent are not so numerous as they were a few weeks ago. This fact would seem to indicate that in coming weeks the shipments will not be quite so large. Indeed, we have probably almost reached the heaviest export of the spring season. The quantity of pigs despatched during the week to the United States was rather over 2000 tons, which compares favourably with that of the corresponding week of 1881. The import trade from Cleveland districts has likewise somewhat improved, and consumption in Scotland continues steady. The transactions in the market have not been quite so numerous, and as a consequence prices at the beginning of the week showed a decline of about 6d. on the highest point touched last week. The stocks of pig iron in the public stores show only the small reduction of 50 tons, and still amount to about 630,000 tons.

Business was done in the warrant market on Friday morning at 49s. 3d. to 49s. 4½d. cash and 49s. 5d. to 49s. 7d. one month, the afternoon's quotations being 49s. 4d. to 49s. 1d. cash, and 49s. 6d. to 49s. 4½d. one month. On Monday the market was quiet with business in the forenoon at 49s. 1d. to 48s. 10d. cash, and 49s. 3d. one month, and in the afternoon at 48s. 10½d. cash, and 49s. 1½d. one month. On Tuesday the market was flat with, business in the morning at 49s. 1½d. to 48s. 9d. one month, and 48s. 10d. to 48s. 6d. cash, while the afternoon's quotations were 48s. 7½d. to 48s. 6d. one month, and 48s. 5½d. to 48s. 3d. cash. Business was done on Wednesday at 48s. 1½d. cash, and 48s. 4½d. one month. To-day—Thursday—owing to the reduction of the bank rate, the market was firmer, with transactions up to 48s. 4½d. cash, and 48s. 8d. one month.

Owing to the slight relapse which has taken place in the warrant market, the values of makers' iron, which had improved towards the close of last week, now show little change upon the quotations noted a week ago. The figures are as follows:—Gartsherrie f. o.b. at Glasgow, per ton, No. 1, 58s. 6d.; No. 3, 51s.; Coltness, 59s. 6d. and 53s.; Langloan, 59s. 7d. and 53s. 6d.; Summerlee, 57s. 6d. and 50s.; Calder, 57s. 6d. and 51s. 6d.; Carnbroe, 53s. and 50s.; Clyde, 51s. and 49s.; Monkland and Quarter, each 49s. 6d. and 47s. 6d.; Govan at Broomielaw, 50s. 6d. and 48s.: Shotts at Leith, 59s. and 53s. 6d.; Carron at Grangemouth, 50s. 6d. (specially selected, 55s.) and 49s. 6d.; Kinneil at Boness, 49s. and 47s. 6d.; Glengarnock at Ardrossan, 53s. and 50s.; Eglinton, 49s. 6d. and 47s.; Dalmellington, 49s. and 48s.

There is no change to report this week in the condition of the malleable iron trade. The works still continue busy, but there is a lack of new contracts, and prices are a shade easier.

Throughout the engineering trades activity still prevails, and since last report a number of good orders have been placed in the shipbuilding trade, which will tend to prolong the prosperity of the marine engineering department. It may be accepted as an indication of the confidence felt by the shipbuilders in the condition of the trade, that they have conceded an advance of wages to the operative engineers. Slackness is felt in the light department of the foundry trade, and some of the pipe founders also find themselves running short of work.

The coal trade is, if anything, rather better, taking the whole country together, although in some of the districts full time is not being obtained at the collieries. In some places miners have been making a virtue of necessity, and declaring that they have entered upon a policy of restricting the output, when the truth is that they are not able to work on account of want of facilities for getting the mineral away from the pits. Competition is very keen in the trade, and prices are without alteration. It appears from statistics made up for the month of February that the total amount of coal shipped to foreign ports from Scotland was 58,483 tons, as compared with 48,429 in February, 1881. On the other hand, the shipments of coal from Scotland to London and other ports in the United Kingdom amounted to only 66,968 tons, against 87,939 in the same month of last year.

Throughout the eastern mining counties the coal trade has been dull, and the Associated Colliery owners of Fife and Clackmannan have intimated a decrease on the miners wages' of 12½ per cent. In these counties prices have fallen during the past three months from 1s. 6d. to 2s. per ton. The men profess to be taken by surprise by the reduction, and an effort is proposed to at least effect a compromise. It is pointed out by them that the official returns of the output of coal in Fifeshire for 1881 were very satisfactory, showing that 2,198,601 tons were raised, being an increase of 94,593 over the production of the preceding year.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

ALL interest this week is centred upon the results of the Parliamentary Committee's inquiry into the various bills before them. The first, so far, the Glyncorrwg and Swansea bill, and the Rhymney and Merthyr, are very engrossing. The best evidence in support that could be obtained has been tendered, and the promoters are hopeful. The Glyncorrwg and the Swansea Bay bills fairly divided public favour. In support of the second I shall expect excellent testimony from Mr. T. Joseph, one of the best authorities in South Wales on the coal system.

By the withdrawal of the Great Western connection with Cyfarthfa, the Taff Vale and Rhymney railways are left in opposition, but it is understood that the Great Western will unite with the Rhymney. A severe contest may be expected, but I should not be surprised if both succeed. There is no reason why both lines should not be carried out, but if only one, then the Taff Vale has the strongest claim, as for several years it has attempted to get Mr. Crawshay to join in forming a railway connection, and thus facilitate its traffic.

Efforts are on foot to form an important coal company. Those who are on the search may be satisfied that the proposed tract is the finest in South Wales. An immense capital will be required. I pointed out in these columns several years ago the merits of the scheme, and suggested that its embarkation was only a question of time. Coal speculations, however, are flagging again, for the industry is beginning to wear a less prosperous aspect. The business of the three principal ports shows this. Cardiff, from an export varying from 115,000 to 125,000 tons, has fallen off to 90,000 tons; Newport, from 29,000 to 21,000 tons; and Swansea, from 26,000 to 20,000 tons. This looks serious. I do not, however, regard it as due altogether to a falling off in trade. Cyfarthfa, for instance, has been working short time of late; but there are plenty of orders on the books, and the slackness is due to the non-arrival of steamers at Cardiff.

The machinery is being placed at the Prince of Wales's dock, Swansea. I hear high praises of its excellence, and shall shortly devote a little time to give a more circumstantial account.

Swansea has again met with a reverse in failing to get the Mumbles tramway converted into a railway. I have not seen the proposed plans; but if the railway was intended to be an open one, I am not surprised at failure; but if enclosed—and it is possible to do so—the strongest objection against it fails. Business is rather dull at Swansea, and the storms this week preventing shipping from leaving, are doing anything but improving matters; but, notwithstanding this, the revenue of the port is excellent.

All doubts may now be safely dispelled as to the future of Cyfarthfa, by the counsel's speech for promoting the Rhymney Bill. In this he distinctly stated that Cyfarthfa would re-start with steel works. I hear also of a movement at Cardiff for giving Cyfarthfa an independent Penarth wharf, which looks well.

Meetings continue to be held in connection with the sliding scale agitation, but it is not known whether Mr. Jenkins, of the Ocean Collieries, will modify the scale in use there. Perfect security against a recurrence of hostilities between master and man will never be granted until the coalowners form a compact, harmonious body, governed and governing by one sliding scale, accepted by the whole of the colliers. A leading colliery agent of the Rhondda, referring to the pacific attitude of the men at present, said, "But we are never certain of them. They are as ready now as ever they were to assume hostile attitude if the occasion offered."

Some of the leading authorities in tin-plate, Mr. Spence amongst them, advocate unity amongst tin-plate workers. It is owing almost entirely to a lack of co-operation amongst makers that buyers succeed so well. A fine vessel—the Cohanim—3000 tons burden, is now loading tin-plates at Swansea for New York.

ENGLISH *versus* AMERICAN STEEL.—The quality of American steel must be sadly belied in its own country if it is not much inferior to English steel. Upon the Navy question which is now occupying the attention of a Committee of the House of Representatives, who are taking evidence, a New York daily paper publishes as follows:—"It would be particularly unwise to build American men-of-war of American steel; for however good our iron may be, we have not been able to produce steel that is at all equal to English steel; and Mr. Vanderbilt prefers to import steel rails for his road at a very much higher price than he would have to pay for home-made protected steel." Doubtless some excellent steel is made in America, but in proportion to the whole output it would seem to be small in quantity. Why, however, the Navy project if carried out should not afford that encouragement to the American steelmasters which by that project they are seeking, is another matter. Meanwhile their peculiar domestic policy in repressing iron shipbuilding puts them to a serious disadvantage in competition with the steelmaster of Great Britain.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

14th March, 1882.

1216. Rivetting, E. Austin & F. Jackson, Manchester.
1217. Bleaching Fibres, N. J. Holmes, London.
1218. Knife Cleaners, H. Beech.—(*E. Ferguson, Canada*)
1219. Smith's Forge, W. Roberts, South Wales.
1220. Chlorine, C. Wigg, Liverpool.
1221. Roller Bearings, T. Hemmich, Reading, U.S.
1222. Signals, H. H. Lake.—(*A. L. Parcelle, U.S.*)
1223. Malting Grain, A. Perry, Roscrea.
1224. Furniture Tufts, G. Doolittle, Bridgeport, U.S.
1225. Gauging Wire, M. Evans, Wemyss Bay, N.B.
1226. Propelling Ships, W. T. Lithgow, Renfrew.
1227. Paste, &c., E. L. Loxton, Horbury.
1228. Glazing, &c., J. Chaffin, Charlcombe.
1229. Fluids, &c., A. W. Lake.—(*T. Hyatt, U.S.*)
1230. Lifts, P. M. Justice.—(*G. C. Tewksbury, U.S.*)
1231. Grinding Mills, L. Gathmann, Chicago, U.S.
1232. Walls, J. H. Johnson.—(*F. Bauder, Paris.*)
1233. Tapestry, A. J. Boult.—(*C. T. Wheeler, U.S.*)
1234. Pumps, G. V. Fosbery, Britton.
1235. Rousing Beer, H. Long, Bristol, and H. Aplin, Redfield.
1236. Blinds, W. R. Lake.—(*A. H. Lindstedt, Sweden.*)
1237. Producing Light, A. Reckenzaun, Leytonstone, and J. H. Redfield, London.
1238. Fasteners, H. Andrews, Birmingham.
1239. Railway Collisions, E. Clarke, Liverpool.
1240. Sewing Apparatus, W. Hollingworth, Bradford.
1241. Brooms, J. G. Horsey, London.
1242. Musical Instruments, V. I. Feeny, London.
1243. Looms, J. C. Fielden, Manchester, and R. H. Harrison, Dukinfield.
1244. Valves, J. Hopwood, Poulton-le-Fylde.
1245. Creels, W. Lake.—(*J. O'Neill & G. Stewart, U.S.*)
1246. Musical Instruments, H. H. Lake.—(*G. W. Turner, U.S.*)

15th March, 1882.

1247. Cutting Shafts, W. Cook, Glasgow.
1248. Rotating Drum, T. Cope & W. Brewer, Liverpool.
1249. Magneto-electric Machines, C. L. Levey and E. Lumley, New York, U.S.
1250. Water Brushes, J. T. Todd, Edinburgh, N.B.
1251. Roadways, &c., J. T. Todd, Edinburgh, N.B.
1252. Spring Clips, W. D. Saull & W. Brooks, London.
1253. Labels, S. Arnold, London.
1254. Telegraph Relay, J. Ebel, New Charlton.
1255. Gun, F. J. Cheesbrough.—(*J. Nemetz, Vienna.*)
1256. Looms, L. Greenwood, Hawick, N.B.
1257. Stop Valve, W. Whiteley.—(*R. N. Pratt, U.S.*)
1258. Inhaling Air, E. Chabot, London.
1259. Tape Ladders, J. Carr, Manchester.
1260. Type Moulds, E. A. Brydges.—(*H. Hagemann, Vienna.*)
1261. Preserving Designs, E. Cutler, Birmingham.
1262. Knitted Fabrics, R. Mackie, Stewarton, and W. Start and H. Scattergood, Nottingham.
1263. Signal Levers, W. Stroudley, Brighton.
1264. Zinc Furnaces, W. R. Lake.—(*La Société Oeschger Mesdach et Cie., Paris.*)
1265. Chain Clips, J. Smith, Thornliebank, N.B.

16th March, 1882.

1266. Indigo, J. H. Johnson.—(*Badische Aniline and Soda Fabric, Germany.*)
1267. Tools, R. Davidson, Glasgow.
1268. Furnaces, M. Watts and E. Swindells, Macclesfield.
1269. Tuning Pegs, G. Wilde, Selston.
1270. Tent Peg, J. Jaques.—(*J. Wixler, Switzerland.*)
1271. Telephones, A. W. Rose, London.
1272. Urine Protector, C. Rubens, London.
1273. Looms, T. Knowles, Blackburn.
1274. Electric Lamps, F. Wright & M. Mackie, London.
1275. Lamps, H. F. D. Miller, Birmingham.
1276. Gas Burners, J. W. Willmot, Brixton, and T. Leehmann, London.
1277. Products from Furnace Gases, J. and J. Addie, Glasgow.
1278. Cigar Cap, H. J. Haddan.—(*O. Ehrentraut, Germany.*)
1279. Lifting Jacks, F. Engel.—(*J. Schultre, Hamburg.*)
1280. Colouring Matter, D. Dawson, Milnsbridge.
1281. Compression Apparatus, E. W. Harding and W. Watkins, Sunderland.
1282. Fire-arms, L. Gye, London.
1283. Fog Signals, J. Natt, London.
1284. Pianofortes, H. Witton, London.
1285. Grinding Stones, G. Nawrocki.—(*G. Oest, Berlin.*)
1286. Sizing Hanks, J. Conlong, Blackburn.
1287. Pistons, J. Tobin, London.
1288. Lamps, J. B. Rogers, London.

17th March, 1882.

1289. Perambulators, W. H. S. Aubin, Bloxwich.
1290. Grogs, H. Bonneville.—(*D. Cornilliac, Paris.*)
1291. Beverages, H. Bonneville.—(*D. Cornilliac, Paris.*)
1292. Liquors, H. Bonneville.—(*A. Ralu, jun., Paris.*)
1293. Cutting Machine, H. A. Bonneville.—(*G. Dubois and J. François, Belgium.*)
1294. Fire-arms, H. W. Holland, London.
1295. Chairs, E. Smith, West Dulwich.
1296. Getting Coal, W. H. Harbottle, Orrell, and C. McLeod Percy, Wigan.
1297. Fabrics, J. Imray.—(*T. Grison, Paris.*)
1298. Metal Lasts, J. Markie, London.
1299. Drafting Patterns, W. T. Philpott.—(*J. A. Wilson, California.*)
1300. Wall Paper, A. M. Clark.—(*E. Leissner, U.S.*)
1301. Metallic Boxes, G. F. Griffin, London.
1302. Electrolier, R. Brougham, London.
1303. Telegraphic Systems, P. M. Justice.—(*Fr. Van Rysselberghe, Schaerbeek.*)
1304. Thrashing Machines, T. & W. Nalder, Wantage.
1305. Purifying Ores, D. Watson, Manchester.
1306. Hearthstone, W. Simmons, Maidstone.
1307. Foot Skate, J. M. Gorham, Lincoln.
1308. Shutting-off Heat, M. Arnold, Acton.
1309. Measuring Distances, J. P. Nolan, Tuam.
1310. Bobbin-net Machines, W. H. Beck.—(*W. Dawson, St. Pierre les Calais.*)

18th March, 1882.

1311. Mules, W. T. Watts, Stalybridge.
1312. Carriage Heads, T. C. Towns, Birmingham.
1313. Wire-rope Couplings, E. A. Lietzmann and O. Borchardt, Königswusterhausen.
1314. Coal Gas, R. Morton & C. Williams, Nine Elms.
1315. Condensed Milk, W. F. Sweetland, Hendon.
1316. Setting Type, W. Barlow.—(*J. Liwczak, Vienna.*)
1317. Coloured Devices, H. Kaltwasser, Hamburg.
1318. Gas Motor Engines, C. G. Beechey, Liverpool.
1319. Fire Escapes, G. Lakeman, Exeter, and G. Jelly, Liverpool.
1320. Small-arms, W. M. Scott, Birmingham.
1321. Scoring Apparatus, F. Dening, Chard.
1322. Drying Printing, H. Mathieson, London.
1323. Transferring Designs, H. Mathieson, London.
1324. Electric Lamps, J. D. F. Andrews, Glasgow.
1325. Sewer Pipes, C. Slagg, Leeds.
1326. Traps for Drains, C. Slagg, Leeds.
1327. Electric Currents, L. J. Crossley, Halifax, J. F. Harrison, Bradford, and W. Emmott, Halifax.
1328. Electric Signalling, L. J. Crossley, Halifax, J. F. Harrison, Bradford, and W. Emmott, Halifax.
1329. Woven Fabrics, R. Bailey and W. Walker, Ovenden, and L. J. Crossley, Halifax.
1330. Driving Belts, J. Appleyard, Bradford.
1331. Tires, J. Haynes, Silkstone Common.
1332. Braces, M. Stellman, London.
1333. Ink Holders, E. G. Brewer.—(*C. S. Bleton and A. Maleville, Paris.*)
1334. Oysters, A. J. Boult.—(*A. Laurent, Bordeaux.*)
1335. Springs, A. J. Boult.—(*J. D. Thomas and L. F. Requa, New York, U.S.*)
1336. Wire, A. J. Boult.—(*J. Thomas & L. Requa, U.S.*)
1337. Fabrics, A. M. Clark.—(*A. Urbahn and A. G. Jennings, U.S.*)
1338. Helmets, J. W. Towell, London.

20th March, 1882

1339. Utilising Fabrics, G. Rydill, Sheffield.
1340. Excavating Trenches, J. W. Wailes, Walsall.
1341. Thrust Bearings, J. Wills, Leicester.
1342. Glass, C. Schön.—(*G. Leuffgen, Berlin.*)
1343. Dust Collectors, L. Varicas.—(*S. Bean, U.S.*)
1344. Supporting Apparatus, H. S. Whitehouse, Birmingham.
1345. Joining Wire, D. Bremner, Brixton.
1346. Bottles, C. M. Taylor, Snaresbrook.
1347. Electric Currents, S. E. Phillips.—(*W. C. Johnson, Mentone.*)
1348. Gas Lighting, T. Thorp, Whitefield.
1349. Railway Signals, J. Livesey, Blackburn, S. Whitehall and R. Becconsall, Summerseat.
1350. Looms, A. Priestman and J. Ackroyd, Bradford.
1351. Scaffolding, J. Rettie, London.
1352. Checking Apparatus, H. T. Davis, Newington.
1353. Lifts, A. Clark, London.
1354. Flour, F. Engel.—(*F. Lange, Neumühlen.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

1190. Scraping Cane, W. R. Lake, Southampton-buildings, London.—A communication from F. F. Raymond, Newton, U.S.—*11th March*, 1882.
1196. Car Couplings, J. E. Carmalt, Scranton, U.S.—A communication from M. R. Thurber, Scranton, U.S.—*11th March*, 1882.
1221. Roller Bearings, T. F. Hemmich, Reading, U.S.—*14th March*, 1882.
1224. Furniture Tufts, G. Doolittle, Bridgeport, U.S.—*14th March*, 1882.
1245. Reels, W. R. Lake, Southampton-buildings, London.—A communication from J. O'Neill and G. M. Stewart, St. Louis, U.S.—*14th March*, 1882.
1257. Stop Valve, W. Whiteley, Lockwood.—A communication from R. N. Pratt, Hartford, U.S.—*15th March*, 1882.
1264. Zinc Furnaces, W. R. Lake, Southampton-buildings, London.—A communication from La Société Oeschger Mesdach et Cie., Paris.—*15th March*, 1882.
1292. Alcohols, H. A. Bonneville, Cannon-street, London.—A communication from A. Ralu, jun., Paris.—*17th March*, 1882.
1293. Cutting Machine, H. A. Bonneville, Cannon-street, London.—A communication from G. Dubois and J. François, Belgium.—*17th March*, 1882.
1300. Wall Paper, A. M. Clark, Chancery-lane, London.—A communication from E. Leissner, U.S.—*17th March*, 1882.

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

1002. Shaft Couplings, H. M. Butler, Kirkstall Forge, near Leeds.—*13th March*, 1879.
1008. Cutting Apparatus, O. L. Deschamps, St. Pierre-les-Calais.—*14th March*, 1879.
1032. Earthenware, W., A. and W. Gray, Portobello and Musselburgh.—*15th March*, 1879.
1051. Separating Stout, &c., from Sediment, J. F. C. Farquhar, London, and W. Oldham, Balham.—*17th March*, 1879.
1178. Steel, J. T. King, Liverpool.—*25th March*, 1879.
1199. Chimney Cowls, J. M. Lamb, South Hampstead.—*26th March*, 1879.
1567. Carding Machinery, H. J. Haddan, London.—*21st April*, 1879.
1033. Engraving Compositions, F. Kaiser and A. A. Duplessy, Havre.—*15th March*, 1879.
1062. Cleansing Round Bars, A. B. Perkins, Bradford.—*18th March*, 1879.
1107. Cocks, &c., B. Rhodes, London.—*20th March*, 1879.
1290. Printing Presses, H. P. Trueman and J. G. New, Birmingham.—*1st April*, 1879.
1334. Vegetable Substances, B. Rhodes, Bow.—*4th April*, 1879.
1044. Electrical Apparatus, E. Tyer, London.—*17th March*, 1879.
1079. Steel, S. G. Thomas, Battersea.—*19th March*, 1879.
1080. Furrow Ploughs, J. C. Richardson, Slough.—*19th March*, 1879.
1088. Softening Jute, &c., W. P. Butchart and J. Skinner, Dundee.—*19th March*, 1879.
1095. Gas Stoves, J. Adams, Glasgow.—*19th March*, 1879.
1105. Preventing Overwinding, J. King, Pinxton.—*20th March*, 1879.
1141. Breech-loading Fire-arms, J. Rigby, Dublin, and T. Bissell, Rotherhithe.—*21st March*, 1879.
1151. Book Covers, F. Walton, Twickenham.—*22nd March*, 1879.
1223. Hoists, D. Edwards and T. Alexander, Cardiff.—*27th March*, 1879.
1224. Buffers, D. Edwards, Cardiff.—*27th March*, 1879.
1056. Railway Switches, J. S. Williams, London.—*18th March*, 1879.
1112. Felt, W. Spence, London.—*20th March*, 1879.
1054. White Lead, J. C. Martin, Richmond.—*18th March*, 1879.
1060. Pianofortes, J. Brinsmead, London.—*18th March*, 1879.
1070. Extracting Tannin, W. A. Barlow, London.—*18th March*, 1879.
1081. Disinfectants, &c., R. V. Tuson, Camden Town.—*19th March*, 1879.
1091. Sewing Machines, C. F. Gardner, Upper Norwood.—*19th March*, 1879.
1121. Clutch Mechanism, J. C. Mewburn, London.—*20th March*, 1879.
1466. Looms, J. Rollinson and J. Senior, Dewsbury.—*15th April*, 1879.

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

1111. Lap Machines, E. Buckley, Stalybridge.—*27th March*, 1875.
1127. Printing Machines, E. Anthony, Hereford, and W. W. Taylor, Cambridge.—*27th March*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 7th April, 1882.

4939. Producing Light, A. F. St. George, London.—*11th November*, 1881.
4943. Preventing Escape of Steam, &c., G. Tall, Brixton.—*11th November*, 1881.
4962. Illustrating Objects, E. Sykes and O. G. Abbott, Huddersfield.—*12th November*, 1881.
4981. Hoppers, &c., J. Higginbottom and O. Stuart, Liverpool.—*14th November*, 1881.
4985. Teeth Brushes, E. Pierrepont, London.—*14th November*, 1881.
4986. Pickers, E. Hallas, Huddersfield.—*14th November*, 1881.
4998. Driving Bands, M. H. Smith and F. Fleming, Halifax.—*15th November*, 1881.
5003. Water-closets, H. Barron and H. Raimes, Kilburn.—*15th November*, 1881.
5016. Soaping Woven Fabrics, J. and P. Hawthorn and J. P. Liddell, New Mills.—*16th November*, 1881
5017. Fire-arm, A. Dardelle, London.—*16th November*, 1881.
5032. Working Railway Signals, S. Brear and A. Hudson, Bradford.—*17th November*, 1881.
5056. Hot-air Engines, A. E. and H. Robinson, Manchester.—*18th November*, 1881.
5131. Sewing Machines, J. Imray, London.—A communication from A. Boisard.—*24th November*, 1881
5164. Lawn-tennis Poles, E. Haskell, London.—*26th November*, 1881.
5188. Looms, J. Bullough, Accrington.—*28th November*, 1881.
5234. Fire-alarms, W. T. Braham, Manchester.—*30th November*, 1881.
5367. Covering Electrical Conductors, W. R. Lake, London.—Com. from H. Maxim.—*8th December*, 1881.
5373. Rabbit Trap, J. C. B. Fox, Brislington.—*8th December*, 1881.
5387. Steam Engines, H. B. Young, London.—*9th December*, 1881.
5444. Boots, W. R. Lake, London.—A communication from W. Comey.—*13th December*, 1881.
5471. Horses' Collars, T. Loveday, Islip.—*14th December*, 1881.
5567. Bracelets, B. W. Fase, London.—*20th December*, 1881.
5734. Electrical Resistances, G. Pfannkuche and R. E. Dunston, London.—*31st December*, 1881.
48. Folding Neckties, M. Steinbock, New York.—*4th January*, 1882.
436. Electric Telegraph Printing Apparatus, J. Imray, London.—A communication from J. M. E. Baudot.—*28th January*, 1882.
657. Anvils, E. and O. Wright, Dudley.—*10th February*, 1882.
760. Dynamo-electric Machine, C. W. Siemens, London.—Com. from E. Siemens.—*16th February*, 1882.
803. Extinguishing Fires, J. K. J. Foster, Bolton.—*18th February*, 1882.
810. Ventilating Valve, A. S. Buxton and F. O. Ross, London.—*20th February*, 1882.
843. Detaching Ships' boats, J. A. Wilkinson and N. McGounell, Folkestone.—*21st February*, 1882.
867. Carriages of Bobbin-net Machinery, H. B. Payne, Nottingham.—*22nd February*, 1882.
876. Spinning Machinery, G. Perkins, G. Wimpenny, and J. H. Evans, Manchester.—*23rd February*, 1882.
899. Cotton Opening Machines, W. R. Lake, London, —A com. from R. Kitson.—*24th February*, 1882.
905. Secondary Batteries, J. W. Swan, Newcastle-on-Tyne.—*24th February*, 1882.
968. Cutting Holes in Metal, C. Scriven, Leeds.—*28th February*, 1882.
970. Lanterns, G. Bray, Leeds.—*28th February*, 1882.
971. Ratchet Braces, C. T. Colebrook, Islington.—*28th February*, 1882.
995. Obtaining Starch from Grain, W. R. Lake, London.—A com. from W. T. Jebb.—*1st March*, 1882.
1108. Safety Pins, W. R. Lake, London.—A communication from J. Jenkins.—*7th March*, 1882.
1190. Scraping Cane, W. R. Lake, London.—A communication from F. F. Raymond.—*11th March*, 1882.
1196. Car Couplings, J. E. Carmalt, U.S.—A communication from M. R. Thurber.—*11th March*, 1881.
1224. Sewing Furniture Tufts, G. Doolittle, Bridgeport.—*14th March*, 1882.

Last day for filing opposition, 11th April, 1882.

4995. Measuring Speed, C. E. Kelway and F. Dyer, London.—*15th November*, 1881.
5023. Charging Syphons, T. G. Messenger, Loughborough.—*16th November*, 1881.
5031. Spinning Cotton, M. Dickie, jun., Stockport.—*17th November*, 1881.
5033. Artificial Marble, B. O'Neill, London.—*17th November*, 1881.
5036. Mixing Gas, J. A. B. Bennett, King's Heath, & P. B. Walker, Birmingham.—*17th November*, 1881.
5039. Disinfecting Water-closets, &c., T. Beddoe, London.—*17th November*, 1881.
5047. Smiths' Hearths, A. Wilson, Handsworth.—*17th November*, 1881.
5053. Telescopic Sights, L. K. Scott, London.—*18th November*, 1881.
5064. Fire-proof Floors, E. Homan, Turnham Green.—*19th November*, 1881.
5066. Shaping Wood, H. J. Haddan, London.—A communication from A. Wenzel.—*19th November*, 1881.
5067. Furnaces, W. S. Welton, London.—*19th November*, 1881.
5075. Sizing Machines, A. P. Dickinson and W. Rosseter, Blackburn.—*19th November*, 1881.
5081. Stereotyping Apparatus, F. Harrild, London.—*21st November*, 1881.
5093. Traverse Motions of Lathes, T. White, jun., Headingley.—*22nd November*, 1881.
5097. Folding Bedstead, A. J. Boult, London.—A com. from O. Guinchard.—*22nd November*, 1881.
5099. Automatic Attachments, W. Thompson, London.—Com. from C. McCormick.—*22nd November*, 1881.
5101. Mechanical Heels, A. Steenberg, Copenhagen.—A communication from A. H. Christensen and G. Lund.—*22nd November*, 1881.
5109. Vacuum Brake Apparatus, J. Gresham, Salford.—*23rd November*, 1881.
5112. Filter Blocks, C. D. Abel, London.—A communication from F. Kleeman.—*23rd November*, 1881.
5121. Folding Chairs, L. Field, Birmingham.—*23rd November*, 1881.
5171. Brewing Apparatus, A. Kinder, London.—*26th November*, 1881.
5250. Harrow, J. Elkington, London.—A communication from R. Cockerell.—*30th November*, 1881.
5332. Feeding Printing Machines, J. J. Allen, Halifax.—*6th December*, 1881.
5371. Furnaces, J. Bissett, Glasgow.—*8th December*, 1881.
5472. Mechanical Stoppers, N. Fritzner, Berlin.—*14th December*, 1881.
147. Cranes, F. R. Ellis, Liverpool.—*11th January*, 1882.
172. Mixing Materials, J. Jackson, Kensington.—*12th January*, 1882.
405. Dredging, C. J. Ball, London.—*26th January*, 1882.
414. Carriages, A. Cracknell, Peckham.—*27th January*, 1882.
439. Seats of Tricycles, A. Burdess, Coventry.—*28th January*, 1882.
447. Sectional Warping Machines, E. and W. A. Rothwell, Walkden.—*28th January*, 1882.
537. Burners, B. Verity, London.—*3rd February*, 1882.
683. Ball Bearings, A. Burdess, Coventry.—*11th February*, 1882.
725. Feeding Mechanism, R. B. Pope, Dumbarton.—*15th February*, 1882.
801. Wooden Packing Boxes, W. Crookes, York.—*18th February*, 1882.
802. Refrigerator, W. Morton and P. Robinson, Burton-on-Trent.—*18th February*, 1882.
828. Smelting Furnaces, W. Ferrie, Calderbank.—*21st February*, 1882.
833. Perpetual Calendars, P. M. Justice, London.—A com. from T. H. Hovenden.—*21st February*, 1882.
904. Ovens, B. Cochrane, Durham.—*24th February*, 1882.
944. Packing Receptacles, H. J. Haddan, London.—A com. from T. B. Fogarty.—*28th February*, 1882.
992. Propelling Ships, J. Cooke, Richmond.—*1st March*, 1882.
1015. Reflecting Lights, W. Brass, jun., London.—*2nd March*, 1882.
1040. Safety Reducing Valves, W. Brierley, Rochdale, and M. Mitchell, Bacup.—*4th March*, 1882.
1063. Extracting Metals, H. H. Lake, London.—A communication from N. F. Evans.—*4th March*, 1882.
1073. Steamships, J. E. Mouland, Roby.—*6th March*, 1881.
1077. Fire-blowers, J. J. Lish, Bucklersbury.—*6th March*, 1882.
1245. Creels, W. R. Lake, London.—A communication from J. O'Neill & G. Stewart.—*14th March*, 1882.
1264. Heating Zinc Furnaces, W. R. Lake, London.—A communication from La Société Oeschger Merdach and Cie.—*15th March*, 1882.
1292. Treating Alcohols, H. A. Bonneville, London.—A com. from A. Ralu, jun.—*17th March*, 1882.

Patents Sealed.

(*List of Patent Letters which passed the Great Seal on the 17th March*, 1882.)

3604. Brushes, S. Abraham, Manchester.—*19th August*, 1881.
4021. Lamps, T. Ward, Kentish Town.—*19th September*, 1881.
4031. Skein Holder, F. Mausch, Termonde, Belgium.—*19th September*, 1881.
4035. Glue, G. W. Bremner, London.—*19th September* 1881.
4031. Expression of Juice, W. Thomson and J. Milne, London, and J. B. Alliott, Nottingham.—*19th September*, 1881.
4051. Driving Mechanism for Velocipedes, E. R. Settle, Coventry.—*20th September*, 1881.
4057. Producing Electric Currents, H. E. Newton. London.—*20th September*, 1881.
4067. Receptacles for Coins, C. Horner, Halifax.—*21st September*, 1881.
4069. Signals, W. P. Thompson, London.—*21st September*, 1881.
4070. Signals, W. P. Thompson, London.—*21st September*, 1881.
4078. Alarm Signals, J. Norris, Sunningdale.—*21st September*, 1881.
4082. Steam Generators, L. Shaw and P. T. Fletcher, Manchester.—*22nd September*, 1881.
4083. Measuring Water, W. Richard, Norwood-road, Surrey.—*22nd September*, 1881.
4087. Cutting Holes in Metal Plates, J. H. Smiles, Stockton-on-Tees.—*22nd September*, 1881.
4094. Pumps, F. P. and J. E. Preston, J. T. Prestige, J. Fowler, Deptford, and E. W. de Rusett, Anerley.—*22nd September*, 1881.
4106. Bicycle Lamps, J. E. Leeson, Oldham.—*23rd September*, 1881.
4107. Dynamo-electric Machines, F. H. Fahrig, Southampton.—*23rd September*, 1881.
4114. Raising Water, W. Rainbow, London.—*23rd September*, 1881.
4207. Dynamo-electric Machines, C. A. Barlow, Manchester.—*29th September*, 1881.
4220. Metal Wheels, W. R. Lake, London.—*30th September*, 1881.
4304. Dynamo Machines, H. Aylesbury, Bristol.—*4th October*, 1881.
4319. Bicycles, J. A. Lamplugh, Manchester.—*4th October*, 1881.
4486. Obtaining Oxides, J. B. Readman, Glasgow.—*14th October*, 1881.
4540. Filter Presses, H. E. Newton, London.—*18th October*, 1881.
4640. Roasting, &c., Coffee, &c., J. Parnall, Bristol.—*22nd October*, 1881.
4718. Rivetting Machines, G. D. Edmeston, Manchester.—*28th October*, 1881.
5418. Electrical Apparatus, J. E. Liardet, Brockley, and T. Donnithorne, London.—*10th December*, 1881.
5491. Grinding Wire Cards, A. W. L. Reddell, London.—*15th December*, 1881.
5631. Secondary Batteries, J. S. Sellon, London.—*23rd December*, 1881.
5751. Operating Railway Brakes, W. R. Lake, London.—*31st December*, 1881.
39. Colouring Matters, J. A. Dixon, Glasgow.—*4th January*, 1882.

(*List of Letters Patent which passed the Great Seal on the 21st March*, 1882.)

4084. Racquets, A. Hodgkinson, Manchester.—*22nd September*, 1881.
4091. Tricycles, J. Adams, Camberwell.—*22nd September*, 1881.
4097. Making Cards, J. Sellers, Scholes.—*23rd September*, 1881.
4098. Consumption of Smoke, W. Ireland, Chester.—*23rd September*, 1881.
4111. Dressing Cases, T. H. Mann, London.—*23rd September*, 1881.
4115. Flood Valves, F. Dyer, London.—*23rd September*, 1881.
4118. Money Changing Apparatus, G. E. Absell, London.—*24th September*, 1881.
4126. Condensing Vapours, A. Chapman, Liverpool.—*24th September*, 1881.
4129. Spinning, &c., Cotton, J. Bastow, Bradford.—*24th September*, 1881.
4131. Lace, W. C. Horne, Bexley.—*24th September*, 1881.
4132. Opening Asbestos, C. J. Allport, London, and A. Hollings, Salford.—*25th September*, 1881.
4134. Adjusting Looking-glasses, E. W. Elmslie, St. Leonard's-on-Sea.—*26th September*, 1881.
4139. Coating Metals, T. S. Webb, London.—*26th September*, 1881.
4140. Spinning Mules, T. H. Blamires, Huddersfield.—*26th September*, 1881.
4141. Supplying Lamps with Oil, J. Wilby, Barnsley.—*26th September*, 1881.
4159. Bookbinding, W. Morgan-Brown, London.—*27th September*, 1881.
4160. Tunnelling, F. B. Dœring, Trefriw.—*17th September*, 1881.
4166. Barrels, W. Smedley, Burton-on-Trent.—*27th September*, 1881.
4176. Treating Clay, J. Gillespie, Garnkirk.—*28th September*, 1881.
4188. Sun-blinds, G. Hatton, Southport.—*29th September*, 1881.
4214. Treatment of Seaweed, H. E. Newton, London.—*29th September*, 1881.
4227. Insulators, J. Lyon, St. Helen's.—*30th September*, 1881.
4261. Cutting Weeds, G. Hamit, Haddenham.—*1st October*, 1881.
4267. Exhibiting Apparatus, W. R. Lake, London.—*1st October*, 1881.
4271. Electro-magnetic Apparatus, W. R. Lake, London.—*1st October*, 1881.
4275. Steam Boilers, J. L. Rastrick, London.—*3rd October*, 1881.
4277. Preparing Food, E. J. T. Digby, Hammersmith.—*3rd October*, 1881.
4345. Transhipping Coal, J. Rigg, Chester.—*6th October*, 1881.
4351. Sewing Machines, H. Simon, Manchester.—*8th October*, 1881.
4390. Trimming Boots and Shoes, W. R. Lake, London.—*8th October*, 1881.
4435. Smelting Ores, J. W. Chenhall, Morriston.—*11th October*, 1881.
4449. Brushing Surfaces, F. Stansfield, Bradford.—*12th October*, 1881.
4516. Forging Metals, E. Dearden, Darnall.—*17th October*, 1881.
4678. Heating Water, S. Leoni, London.—*26th October*, 1881.
4742. Cabinet Desks, F. H. F. Engel, Hamburg.—*29th October*, 1881.
4796. Lavatories, G. H. and S. Jennings, Stangate.—*2nd November*, 1881.
5105. Beer Barrels, W. Rose, Halesowen.—*22nd November*, 1881.
5650. Alum, P. and F. M. Spence, Manchester.—*24th December*, 1881.
5732. Towing Lighters, W. R. Lake, London.—*30th December*, 1881.
26. Stowing Ships' Anchors, S. Baxter, London.—*3rd January*, 1882.
36. Sewing Machines, W. R. Lake, London.—*3rd January*, 1882.
62. Treating Timber, S. B. Boulton, London.—*5th January*, 1882.
133. Converters, J. H. Johnson, London.—*10th January*, 1882.

314. Treatment of Animal Refuse, J. H. Johnson, London.—10th January, 1882.
226. Protecting Bottles, &c., J. M. Thorp and J. A. Belloli, San José, U.S.—17th January, 1882.

List of Specifications published during the week ending March 18th, 1882.

1637,* 4d.; 1657,* 4d.; 5135,* 4d.; 2635, 2d.; 2665, 2d.; 2819, 2d.; 2875, 2d.; 2935, 6d.; 2979, 2d.; 3059, 2d.; 3145, 1s. 2d.; 3151, 2d.; 3156, 4d.; 3225, 6d.; 3230, 10d.; 3231, 6d.; 3232, 6d.; 3235, 2d.; 3237, 1s. 2d.; 3240, 6d.; 3243, 6d.; 3267, 6d.; 3271, 4d.; 3272, 6d.; 3276, 6d.; 3280, 6d.; 3283, 8d.; 3284, 6d.; 3287, 6d.; 3301, 6d.; 3310, 6d.; 3316, 6d.; 3317, 6d.; 3320, 6d.; 3323, 6d.; 3329, 8d.; 3330, 1s.; 3332, 6d.; 3333, 8d.; 3335, 6d.; 3341, 6d.; 3344, 6d.; 3346, 6d.; 3347, 6d.; 3349, 6d.; 3353, 6d.; 3357, 6d.; 3362, 6d.; 3365, 6d.; 3367, 8d.; 3368, 6d.; 3370, 4d.; 3371, 8d.; 3372, 6d.; 3374, 6d.; 3377, 6d.; 3379, 6d.; 3381, 8d.; 3382, 6d.; 3384, 8d.; 3386, 8d.; 3389, 6d.; 3392, 4d.; 3394, 6d.; 3395, 6d.; 3400, 6d.; 3402, 6d.; 3403, 6d.; 3405, 8d.; 3406, 6d.; 3408, 6d.; 3413, 6d.; 3423, 6d.; 3424, 6d.; 3426, 6d.; 3427, 6d.; 3432, 4d.; 3434, 6d.; 3436, 6d.; 3439, 6d.; 3444, 6d.; 3451, 6d.; 3453, 6d.; 3463, 6d.; 3468, 6d.; 3474, 6d.; 3476, 6d.; 3481, 6d.; 3485, 10d.; 3496, 6d.; 3503, 6d.; 3508, 6d.; 3514, 6d.; 3516, 2d.; 3518, 2d.; 3519, 2d.; 3520, 2d.; 3521, 2d.; 3523, 6d.; 3524, 2d.; 3526, 2d.; 3527, 8d.; 3529, 2d.; 3530, 2d.; 3531, 2d.; 3535, 4d.; 3542, 2d.; 3545, 2d.; 3548, 2d.; 3549, 10d.; 3550, 2d.; 3552, 2d.; 3558, 2d.; 3562, 2d.; 3570, 4d.; 3571, 2d.; 3574, 2d.; 3575, 4d.; 3577, 2d.; 3579, 4d.; 3584, 4d.; 3585, 2d.; 3586, 2d.; 3587, 6d.; 3589, 6d.; 3592, 2d.; 3596 2d.; 3597, 2d.; 3601, 2d.; 3602, 4d.; 3603, 4d.; 3605, 2d.; 3608, 2d.; 3611, 2d.; 3612, 2d.; 3613, 2d.; 3614, 2d.; 3623, 2d.; 3624, 4d.; 3629, 2d.; 3630, 2d.; 3813, 6d.; 4352, 4d.; 5094, 6d.; 5116, 6d.; 5328, 8d.; 5346, 6d.; 5464, 6d.; 5570, 6d.; 5579, 4d.; 5584, 2d.; 5589, 4d.; 5596, 2d.

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

ABSTRACTS OF SPECIFICATIONS.

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

2635. An Improved Floating Apparatus for Generating and Conveying Electricity for the Production of the Electric Light and the Transmission of Power, *W. C. Johnson and S. E. Phillips, Charlton.—16th June,* 1881.—*(Not proceeded with.)* 2d.

This consists of a combination of boilers, engines, and electric machines on board of a suitable vessel, so that the whole plant necessary for generating the electric light can be transported from place to place, and the current led where necessary by cables.

2665. Boilers, Coppers, &c., *A. Cooper, Clerkenwell.—18th June,* 1881.—*(Provisional protection not allowed.)* 2d.

This relates to boilers and coppers, and consists in dividing them into suitable divisions, having waste, overflow, or refuse pipes, with inlet or outlet pipes, and cocks or taps, inserted so that foul or dirty water acted upon by a circulator or mixer, described in patent No. 1886, A.D. 1881, may be drawn off.

2819. Extract of Coffee, *C. Paul, Vienna.—28th June,* 1881.—*(Provisional protection not allowed.)* 2d.

This relates to the utilisation of the envelope in which the coffee beans are enclosed, and consists in roasting and grinding the same, and employing it in combination with the coffee in place of chicory.

2875. Instrument for Calculating Foreign Exchanges, *E. L. Walford, London.—1st July,* 1881.—*(Provisional protection not allowed.)* 2d.

This relates to the employment of a slide rule bearing divisions representing the currencies of different countries.

2979. Indicating Apparatus or Universal Guidorama, *B. Hunt, London.—7th July,* 1881.—*(A communication from A. Lagrange, A. Aubert, and G. Nos, Paris.—(Provisional protection not allowed.)* 2d.

So as to furnish means for providing information of different localities, a box containing the desired information in microscopic characters is placed in each thoroughfare, and is illuminated from within, a lens being employed so as to magnify the characters.

3151. Teaching Children the Alphabet, *W. C. Day, Middlesex.—19th July,* 1881.—*(Provisional protection not allowed.)* 2d.

This consists in making the learning of the alphabet attractive by necessitating the building up of each letter in two or more pieces of wood.

3156. Open Fire-grates, Stoves, &c., *T. E. Parker, London.—20th July,* 1881. 4d.

A slab of fire-brick with an opening at bottom is placed at the back of the grate and leads into a small chamber tapering to a narrow orifice into the chimney, the gaseous products passing through such orifice and being consumed in the chamber.

3225. Sawing Machines, *T. N. Robinson, Rochdale.—23rd July,* 1881.—*(A communication from W. H. Smyth, San Francisco, U.S.)* 6d.

The object is to impart a rocking motion to the saw while it is at work, in order to give it an in-

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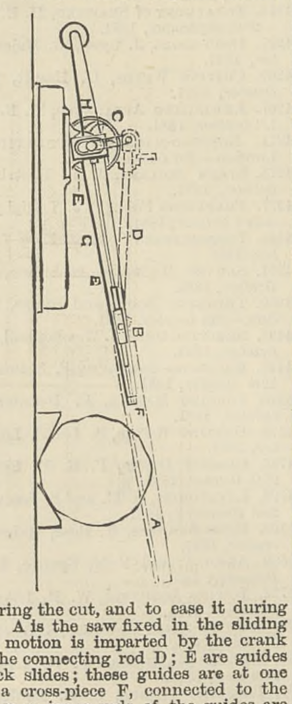

creasing action during the cut, and to ease it during the return stroke. A is the saw fixed in the sliding block B, to which motion is imparted by the crank shaft C, through the connecting rod D; E are guides on which the block slides; these guides are at one end pivotted on a cross-piece F, connected to the frame G; the other or inner ends of the guides are slotted to allow the crank shaft to pass through them; near the slot on each guide are two projecting lips or flanges, and in the space between the flanges on each guide works an excentric H; these excentrics are fixed on the crank shaft C, and are or may be adjustable, and they are set so as to raise the inner ends of the guides as the saw moves forward, thus depressing the saw gradually during the cut; the excentrics lower the inner ends of the guides and raise the saw so as to ease it during its return stroke.

3230. Plain-bottomed Paper Bags, *T. Coates, Carlisle.—23rd July,* 1881. 10d.

The machine has a number of rollers caused to revolve by gearing, and means are provided to actuate at intervals a series of levers and creasers, which operate revolving rollers in boxes containing paste, from which the creasers take away a portion of paste on one side only at each operation. On the creasers descending upon and bending the paper to form the side or bottom seam, the paste is wiped off the creasers by the paper as it closes against the former in the operation of folding.

3231. Improvements in Commutators for Dynamo or Magneto-electric Machines, &c., *E. G. Brewer, London.—23rd July,* 1881.—*(A communication from T. A. Edison, Menlo Park, U.S.)* 6d.

The object of the invention is to reduce sparking; this is done as follows:—The insulation of the commutator is widened and the conducting bars narrowed

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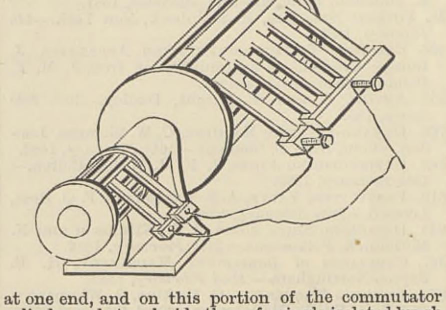


at one end, and on this portion of the commutator cylinder and at each side thereof a single isolated brush is arranged to bear, whose bearing end is noticeably behind the ends of the main brushes, as shown in the figure. This brush is connected to a series of breaking points resting on a breaking cylinder, as shown.

3232. Carbonising and Distilling Bones, &c., *W. L. Wise, Westminster.—23rd July,* 1881.—*(A communication from Messrs. Piton Frères and Co., Paris.)* 6d.

The carbonisation and distillation are effected in apparatus which has an intermittent delivery, and is so arranged that the two processes are conducted so that the substances are gradually and progressively subjected to the action of heat and to cooling.

3235. Displaying Advertisements, &c., *W. Dorset, Kingsland.—23rd July,* 1881.—*(Provisional protection not allowed.)* 2d.

In order to render advertisements or signboards more readily distinguishable, the announcement is written on glass, placed in a frame, and illuminated from the interior.

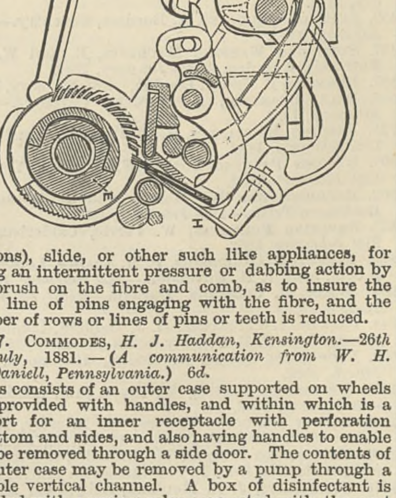
3237. Bobbin-net or Twist-lace Machines, &c., *J. R. Hancock, Nottingham.—25th July,* 1881. 1s. 2d.

This relates to a combined go-through lace machine and jacquard, the improvements being equally applicable to lever machines and curtain machines. The go-through machine consists of an inverted T-top tie bar, two end standards, and one internal top standard with brackets forming bearings for a cam shaft at front, a point bar arm axle, and a point bar knocking-out lever axle. The point bar arm lever is double-sided, and between it revolves the point bar truck and slide, which is a block adjustable in the upper end of the point bar arm. The latter at front and back are slotted from the foot to the block bearing end, the upper end allowing the point bar pressing-up cam to pass within it, the lower end leaving a pin to secure the lower front end of the knocking-out bowed link within it, or the straight link for the back point bar. The links which govern the in-and-out movements of the front and back catch bar feet are hinged on pins in the end standards. Each link carries a pin to connect it to a lever on a shaft rocking in bearings secured to a second rocking shaft supported by the intermediate and end standards. The second shaft carries a lever at each end connected to a rod secured to a disc driven by a rod. Between the governing links are levers rocking upon the axles, and with their inner ends secured to the catch bars, the ends of which are adjustable on the truck levers. The jacquard is driven either by a continuation of the driving shaft or by a separate shaft connected to it.

3243. Machines for Combing Fibres, *G. Little, Oldham.—25th July,* 1881. 6d.

In combination with the cylindrical comb E is employed a brush H operated by cam or crank (and con-

3243



nections), slide, or other such like appliances, for giving an intermittent pressure or dabbing action by the brush on the fibre and comb, as to insure the front line of pins engaging with the fibre, and the number of rows or lines of pins or teeth is reduced.

3267. Commodes, *H. J. Haddan, Kensington.—26th July,* 1881.—*(A communication from W. H. Daniell, Pennsylvania.)* 6d.

This consists of an outer case supported on wheels and provided with handles, and within which is a support for an inner receptacle with perforation at bottom and sides, and also having handles to enable it to be removed through a side door. The contents of the outer case may be removed by a pump through a suitable vertical channel. A box of disinfectant is provided with a spring valve connected with the seat frame, so as to discharge a fixed quantity of disinfectant when the lid or cover is raised and closed.

3271. Glasses or Lenses for Pavement and other Lights, *A. McLaren, London.—26th July,* 1881. 4d.

This consists in forming a lenticular or double convex lens with a plane surface for receiving light, and a plane concave combined for dispersing and diffusing light.

3272. Bicycles, *J. H. Johnson, London.—26th July,* 1881.—*(A communication from W. Rennyson, Pennsylvania.)* 6d.

The object is to prevent the rider being thrown over the handle and consists in securing the handle bar to the upper end of the steering yoke or fork, so that it can yield when pressure is exerted upon it.

3276. Adjusting the Position of Swing Looking-glasses, &c., *C. E. Bulling, London.—26th July,* 1881. 6d.

A wheel with a number of teeth or recesses is secured to the centre pivot, and over it a spring catch is fitted to the frame of the swing glass, and engages with the wheel.

3280. Films for Printing, &c., *A. M. Clark, London.—26th July,* 1881.—*(A communication from B. Day, New Jersey, U.S.)* 6d.

A film or sheet of gelatine is employed with a smooth upper surface, and lines, dots, stipples, &c., or other configuration in relief or in transfer ink or colour on its lower surface, which inked surface is to be placed on the surface upon which the drawing is to be transferred by applying an abrasive pressure on the back of the film by means of a stylus or like instrument. The invention further relates to a frame to which the printing film is attached, and which is provided with clamping devices for holding it, and which are detachably hinged to longitudinally and transversely adjustable blocks held in clamps on a vertically adjustable frame surrounding the stone or block, so that the swinging film-holding frame will rest on the block or stone.

3284. Separating Glycerine from Spent Soap, Lyes, &c., *F. J. O'Farrell, F.C.S., Dublin.—27th July,* 1881. 6d.

This consists, First, in the method of treating soap lye by fire heat or dry steam until an aqueous solution of common salt is obtained, and using this solution for the purpose of separating the glycerine from a fresh charge of soap, thus enabling the process to be repeated over and over until the maximum amount of glycerine is obtained from the minimum volume of spent lye; and Secondly, to the method of distillation in vacuo in combination with the introduction of a steam jet, so as to secure a perfectly uniform solution during distillation.

3287. Governors for Steam Engines, *F. W. Durham, New Barnet.—27th July,* 1881. 6d.

This consists in combination with a governor and subsidiary cylinder and its slide, of the differential lever N linked to the piston rod of the subsidiary

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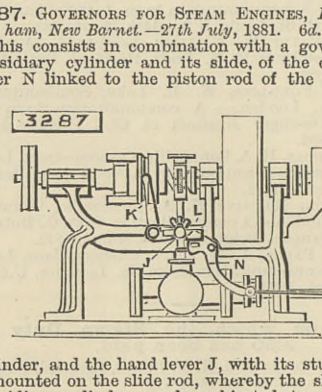
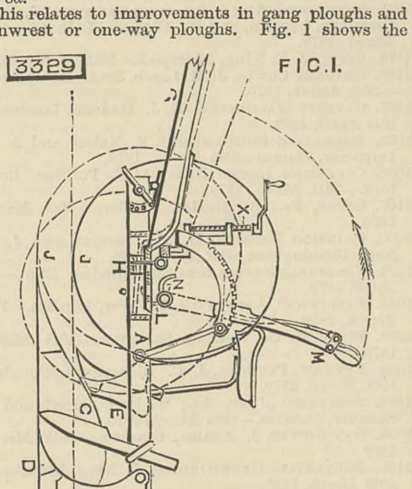


cylinder, and the hand lever J, with its studs K and L mounted on the slide rod, whereby the slide of the subsidiary cylinder can be subjected to differential action when desired.

3329. Ploughs, *J. Cooke, Lincoln.—1st August,* 1881. 8d.

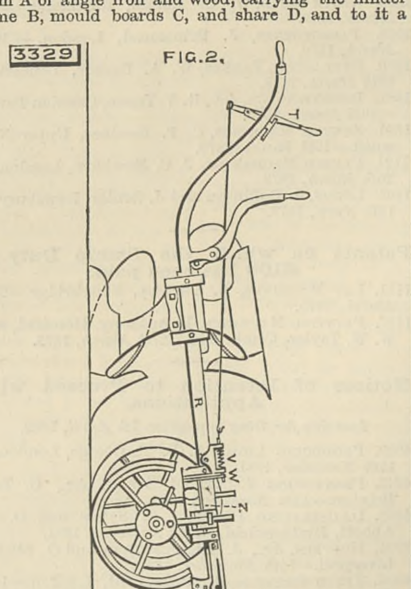
This relates to improvements in gang ploughs and turnwrest or one-way ploughs. Fig. 1 shows the

3329 FIG. I.



improvements to gang ploughs, and it consists of a beam A of angle iron and wood, carrying the hinder frame B, mould boards C, and share D, and to it a

3329 FIG. 2.



secondary adjustable beam carrying the front frame or plough body E is attached, the adjusting of such secondary beam nearer to or further from the main beam regulating the width of the furrows. The pole G is fitted at the front of the plough and between the two beams, and is carried by a pivotted bar, and so arranged as to rock loose vertically thereon, its lower end terminating in a bar held in position by an iron pocket H by means of a pin passing through holes in the pocket, so as to adjust the pole laterally. The land and furrow wheels J are fixed on sliding bars carried in bearings L, and the furrow wheel is adjustable by screw X. The lever M works in a notched quadrant, and by cam N acting on pole G raises the rear end of plough. Fig. 2 shows the improvements in turnwrest ploughs, and consists in an arrangement to enable the wheels to act alternately as land and furrow wheels, without necessitating the ploughman to stop at each end and leave the handles to adjust the wheels. Under the beam R is a swing carriage Z carrying the wheel slides, and also a circular plate W, with which a spring bolt engages, so as to lock it in the required position, such spring being withdrawn by means of lever T.

3310. Valves for Regulating and Controlling the Flow of Fluids, *A. E. Carter and D. Young, London.—28th July,* 1881. 6d.

This relates to screw-down valves, and the object is to prevent leakage, and to subject the packing to the pressure of the fluid only during the operations of opening and closing the valve, and also to enable the packing to be renewed while the valve is under pressure, and in some cases to do away with any packing.

3316. Spinning, &c., *J. J. Broadbent and E. Mitchell, Bradford.—30th July,* 1881. 6d.

This relates to cap spinning, and its object is to combine the ring and traveller with the ordinary cap, whereby the present cap frame and spindles can be utilised and a smoother and better yarn produced than by the ordinary cap. The bottom part of the cap is made of larger diameter than the body, and is formed with a flange at the extreme end of the cap, and a groove at the inside diameter between the flange and the body. Around the flange an ordinary traveller is placed, through which the yarn passes in its travel from the front rollers to the bobbin on the ordinary tube and spindle, and which is driven in the usual manner.

3317. Tricycles, *W. Jeans, Christchurch, Hants.—30th July,* 1881. 6d.

This relates to means for increasing or diminishing the power exerted upon the driving wheel at pleasure without altering the throw of the cranks worked by the rider's feet; that is to say, the driving wheel may be caused to rotate a greater or less distance at each rotation of the crank shaft, the extent of movement of the latter remaining unchanged.

3320. Fittings for the Holds of Colliers, *C. H. Mowll, Dover.—30th July,* 1881. 6d.

The object is to provide against the breaking-up and disintegration of a large percentage of coal which occurs while loading the coal into the holds of colliers, and it consists in the use of permanent shutes fitted in the holds and reaching from the hatchways to the floor of the hold.

3323. Mounting the Spindles of Spinning Machinery, *C. H. Openshaw, Bury.—30th July,* 1881. 6d.

This relates more particularly to the spindles of throstles, and consists in mounting each spindle to revolve within a tubular pillar formed with the upper bearing for the spindle, and provided at the lower end with an enlargement to contain the wharve. An opening is provided for the passage of the driving band and to allow access to the wharve. The lower end of pillar is secured to the rail, and the upper end extends nearly to the boss of the flyer. The upper bearing is a short distance from the top of pillar so as to leave a space to act as an oil cup. The footstep is formed in a plug fitted into a hole in the rail large enough to allow the wharve to pass through it.

3330. Gas Engines, &c., *E. A. Brydges, Berlin.—2nd August,* 1881.—*(A communication from M. V. Schiltz, Cologne.)* 1s.

This consists, First, in the communication of the combustion chambers with the cylinder by self-acting valves, so that the explosive mixture or the products of combustion may be emptied easily into the cylinder behind the piston and without any back pressure; Secondly, in the division of the explosive power into several separate explosions in separate compartments; Thirdly, in warming the explosion compartments and the cylinder for evaporating liquid petroleum introduced; Fourthly, the utilisation of the heat in the water of the jacket by injecting the same behind the piston, and converting it into steam; Fifthly, to a special form of rotary slide valve rotating in one direction only; Sixthly, the regulation of the speed of engine by closing the exhaust valve during the up stroke. Several other improvements are described.

3332. Road-making Engines, &c., *A. Lamberton, Coatbridge, N.B.—2nd August,* 1881. 6d.

This consists in combining a stone-breaking apparatus and a road roller in one machine, whereby as the machine travels over the ground the stones or "metal" used are broken to the proper size and distributed behind the machine, being rolled in on the return journey of the machine.

3333. Manufacture of Ice, *W. P. Thompson, Liverpool.—2nd August,* 1881.—*(A communication from F. M. McMillan, Washington, U.S.)* 8d.

This consists primarily in a pump communicating with the internal chambers of two cylinders, each provided with a central chamber and an annular surrounding chamber, the pump being arranged to deliver a body of water or other liquid from one vessel to the other alternately in opposite directions, and provided with a reversing gear controlled and operated by such liquid, so that when the liquid attains a given height in one chamber it shall cause the pump to be automatically reversed, and the liquid to be pumped to the other chamber, suitable valves and pipes being provided for the admission of gas or other fluid into the central chambers, and for its delivery into the annular surrounding chambers when compressed by the rise of the water column. The invention further consists in a peculiar construction of the cylinders, and in a novel arrangement of valves for controlling the reversing gear of the pump, and various other details of the machine.

3335. Steam Cranes, &c., *A. Barclay, Kilmarnock, N.B.—2nd August,* 1881. 6d.

The object is to enable the weight of the parts upon the carriage or top framing to counteract with the greatest effect the weight suspended from the jib, and to enable the crane to work freely under heavy strains, and it consists in constructing the top of the bogie upon which the crane works, in the case of a travelling crane, with a central pivot round which the carriage turns, being supported on wheels running on a truck on the bogie. The upright of the crane is supported and fixed to the top of the carriage, and is further supported by a strut fixed at one end to the upright, and at the other to the carriage. The jib is pivotted at the outer edge of the carriage. The working parts of the engine are mounted on the carriage, mostly on the lower part of the upright, the boiler being diametrically opposite to the upright on the platform. The invention also relates to means for adjusting the level of the bogie or carriage, in order that the crane may always stand on a level.

3341. Adjusting and Securing Door Handles, *W. Neilson, Glasgow.—2nd August,* 1881. 6d.

One end of a square spindle is fixed to one handle, and the other end is formed with ratchet-shaped grooves on one or more of its faces, with which a sliding catch piece in the other handle engages. To disengage the catch an instrument is inserted through a hole in the rose and presses on the further end of the catch, so as to raise the opposite end from the grooves in the spindle.

3344. Grinding Corn or Grain, *H. H. Lake, London.*—*2nd August, 1881.*—*(A communication from J. T., R. K., and E. H. Noye, Buffalo, U.S.)* 6d.

This relates to grinding grain by roller mills in which two or more rolls revolve against each other at different peripheral rates of speed, and it consists chiefly in the peculiar construction and arrangement of the grooves and ribs upon the rolls, also in the means for adjusting the rolls, and in a series of such rolls graded in respect to fineness or number of grooves to the inch with intermediate bolts, the several sets acting in succession of grade.

3347. Steam Boilers, *H. W. Blake, London, and J. Shepherd, Manchester.*—*2nd August, 1881.* 6d.

The object is to increase the heating surface in the flue tubes of steam boilers, and to render the parts exposed to the water less liable to choke with deposit, and also to render the flue tubes strong and flexible, so as to admit of expansion and contraction, and it consists in forming U-shaped chamber rings bent in the direction of the flue's circumference, and fixed at suitable distances in the flue, so as to form part of same.

3353. Crushing and Pulverising Machinery, *A. Lamberton, Coatbridge, N.B.*—*3rd August, 1881.* 6d.

In the upper part of a strong frame, one, two, three, or more jaws are carried on an axis, upon which they can be moved up and down as well as in and out by means of excentrics passing through bearings in the lower part of each jaw. As each movable jaw is forced inwards, it crushes the material between it and the fixed jaws, the crushed material falling down and passing between two rollers, which pulverise the same. An endwise motion is imparted to the rollers to prevent them becoming scored or grooved.

3357. Pugging Clay, &c., *C. Walton, Bournemouth.*—*3rd August, 1881.* 6d.

The clay is fed into a pugmill, in the bottom of which are outlets, through which the materials pass into exchangeable dies or moulds; while one mould is being filled the contents of the one previously filled is pressed, the pressure being applied simultaneously from above and below. After being pressed the article is raised to the top of the mould, which is placed on a sliding table and removed, the next mould being at the same time carried to the place where the pressure is applied.

3365. Capping Cans or Tins, *B. J. B. Mills, London.*—*3rd August, 1881.*—*(A communication from H. K. and F. B. Thurber and Co., New York.)* 6d.

The capping machine consists of a framework in the form of two parallel benches with a raised platform between, on which a boy who feeds to the solderer stands. On the outside edge of the benches is a series of spindles, on the lower end of each of which is a small grooved pulley, around which runs an endless chain running over a cylinder under the platform. On the upper end of each spindle a few inches above the bench is an iron bowl with grooves in it to receive two sizes of cans. Alongside the spindles and running through the benches are a corresponding number of rods having each a weight at the lower end, the upper end being curved over, so that when pushed to one side the end of the curve fits in the centre of the cap on the can in the bowl and forms a pivot for the can to rotate on.

3367. Gas Engines, *M. P. W. Boulton, Oxford.*—*3rd August, 1881.* 8d.

This relates to engines in which a mixture of air with inflammable gas or vapour is ignited behind a piston working in a cylinder, and propels the piston. One object is to introduce the inflammable charge so that it may be ignited when the piston is about to commence its stroke, or is at the dead point; another is to work so that for each ignition of the charge the piston shall not make more than one pair of strokes, *i.e.*, a forward and a return stroke. A third object is to introduce the inflammable charge so that it shall be separated from the surfaces of the piston and cylinder by air or elastic fluid, which does not undergo combustion, in order that this air or fluid may abstract the passage of heat from the ignited charge to the metal.

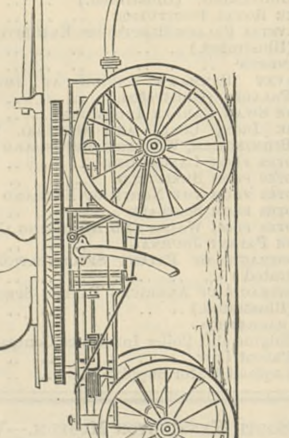
3368. Folding or Adjusting Bedstead, &c., *H. H. Lake, London.*—*3rd August, 1881.*—*(A communication from R. T. White, Boston, U.S.)* 6d.

The object is to produce a folding adjustable cot bedstead particularly adapted for hospital use, which may also serve as a stretcher.

3377. Fire Engines, *H. J. Haddan, Kensington.*—*4th August, 1881.*—*(A communication from S. B. Babcock, Geddes, U.S.)* 6d.

This consists chiefly of two or more double-acting force pumps grouped at the centre of a horizontal driving wheel, and connected with said wheel by suitable actuating mechanism, all mounted on a suitable vehicle, and having extended from the driving wheel a lever adapted for the connection thereto of the animal power required for operating the said driving wheel and pumps connected therewith.

3377



3379. Drying or Carbonising and Distilling, *E. G. Brewer, London.*—*4th August, 1881.*—*(A communication from F. Stormer, Christiania.)* 6d.

The apparatus consists of an upright retort of parallel or conical form and cylindrical or elliptical section, within which is a stirring appliance consisting of a spindle carrying conical rings with outer flanges, spaces being left between the rings. The retort is set in brickwork with flues, and the material to be dried is admitted at top and gradually drops down from ring to ring, clogging being prevented by the stirring appliance. The material leaves the retort at the bottom.

3381. Moving or Traversing and Holding Forgings or Ingots under Steam Hammers, &c., *A. Muir, Glasgow.*—*4th August, 1881.* 8d.

A strong framing is placed at opposite sides of the anvil, and in it are mounted two or more triangular, square, or equivalent carriers capable of rotation. The flat surfaces of the carriers are slightly below the level of the anvil block, but their angular edges when uppermost are above such level. The carriers are coupled together so as to rotate in unison either by tooth gearing or its equivalent, and on the axis of one carrier is mounted a ratchet wheel and pawl driven by a chain or equivalent connection with the moving parts of the hammer.

3382. Frames or Stands for Bottles, &c., *G. Green, Birmingham.*—*4th August, 1881.* 6d.

The central pillar carries a toothed pinion gearing with wheels on the axes of covers fitting over the different bottles, so that by turning the central pillar the bottles are either covered or uncovered.

3389. Wire Hair Brushes, *W. R. Lake, London.*—*4th August, 1881.*—*(A communication from J. A. Horton, Boston, U.S.)* 6d.

This relates to mechanism for holding a strip of india-rubber while a row or series of metallic pins is being simultaneously inserted into it, and for feeding the strip forward after each row is inserted, and the object is to enable the strip to be automatically grasped at its opposite edges and stretched at the point where the pins are inserted, so that it will be held sufficiently firm to enable the pins to perforate it when forced against it without displacing the strip to any material extent; a second object is to enable the strip to be automatically fed so that the pins will be inserted in groups, each group having the number of pins to form a single brush, and separated from the adjacent strips, so that the strip can be readily cut to detach the sections of material containing the groups of pins.

3392. Asbestos Packing, *C. J. Allport, London, and A. Hollings, Manchester.*—*5th August, 1881.* 4d.

A core is formed of any desired number and size of strands to make up a packing of the required dimensions, and around such core, the strands of which are parallel, a covering is woven, consisting of comparatively large diameter warp and fine woof or weft. During weaving the weft is drawn tight, by which means the core is sufficiently compacted, and the surface of the finished article is left with round projections of warp only for bearing on the rod when the packing is in position in a gland. The fine weft being at the bottom of the depressions between the projections, does not come into contact with the article packed until after excessive wear has taken place.

3395. Surgical Apparatus for Treatment of Fractures, &c., *J. C. Mewburn, London.*—*5th August, 1881.*—*(A communication from Dr. E. Bonnefoy, Paris.)* 6d.

This relates to apparatus which will allow of producing an immediate and absolute immobility of the parts, assured by perfect coaptation and complete consolidation, with capability of allowing the joints to act without affecting the place of fracture, and it consists of a frame forming a litter to receive the patient, with means for securing and adjusting the injured parts in the desired positions.

3403. Sugar, *J. Duncan, London.*—*5th August, 1881.* 6d.

This consists in the employment of chlorine for bleaching raw or coloured sugar, the small being afterwards removed by passing air through the mass, and then adding alcohol in any convenient form.

3406. Foot Skates, *J. F. Walters, Bayswater.*—*6th August, 1881.* 6d.

On a light spring steel skeleton frame is mounted a foot-board that can adjust itself by rubber cushions. The frame is attached to an axle bearing light skeleton wheels on each side of the foot-board, and at the rear of the frame a small wheel is placed.

3408. Bicycles, *G. Strickland, Malta.*—*6th August, 1881.* 6d.

This relates to means for adjusting the rake or inclination of the fork carrying the driving wheel, so as to allow for acclivities and declivities of the road, and it consists in forming the backbone in two parts, one sliding within the other, suitable means being provided to effect the sliding movement without dismounting.

3413. Lids for the Filling Holes of Oil Cans, &c., *J. Nickholds, Wolverhampton.*—*6th August, 1881.* 6d.

The lid is in the form of a segment of a sphere, and is fitted inside the can on spring arms mounted on a transverse spindle. The filling hole in the can is opened and closed by sliding the lid forwards and backwards, and if left open, when the valve for the exit of oil is opened, a projection on the valve spindle acts on the spring arms and closes the filling hole.

3423. Musical Boxes, &c., *J. G. Dudley, Carmarthen.*—*8th August, 1881.* 6d.

This relates to the application of an electric motor for driving musical boxes.

3424. Gearing and Apparatus to Increase and Differentiate the Speed of the Driving or Propelling Shaft in Engines, *G. M. Cruikshank, Glasgow.*—*8th August, 1881.*—*(A communication from A. Houstan, Bombay.)* 6d.

This consists in securing on the crank shaft one or more spur or friction wheels, which gears or gear into a corresponding wheel or wheels of the same size fixed on a hollow shaft or sleeve surrounding another or intermediate shaft, and geared therewith by feathers or their equivalents. On the intermediate shaft two spur or friction wheels of the same size and pitch as the wheel or wheels secured on the crank shaft are fixed, and these are geared with corresponding wheels also of the same size, secured on the driving or propelling shaft of the engine. The intermediate shaft is carried in brackets or bearings at each end, and is capable of being lowered and raised so as to throw the spur or friction wheel secured upon the hollow shaft into and out of gear with the corresponding wheel on the crank shaft by means of levers centred at one end on the driving or propelling shaft, the opposite ends of the levers being connected together by a crosshead or frame, which is provided with screw rod for purposes of adjustment.

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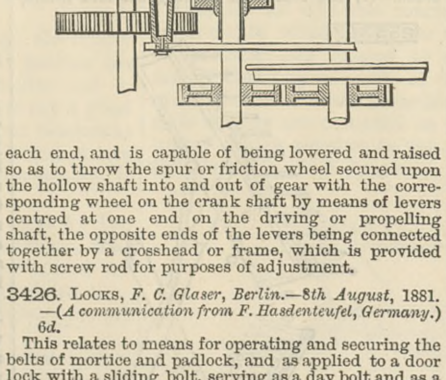

3426. Locks, *F. C. Glaser, Berlin.*—*8th August, 1881.*—*(A communication from F. Hasdenteufel, Germany.)* 6d.

This relates to means for operating and securing the belts of mortice and padlock, and as applied to a door lock with a sliding bolt, serving as a day bolt and as a night bolt, being operated from outside by a key, and from inside by a slide; it consists in forming a transverse opening in the bolt to receive the short arm of a balance lever, the longer arm of which carries a weight, and the fulcrum being so placed that the weight serves to close the bolt. The key withdraws the bolt by turning a cam so as to lift the balance lever. If the lock is to be closed from inside, a revolving cam is turned by the key and is guided over a ring concentric with the keyhole, and bears against the recessed underside of the bolt, so as to close the latter by turning the cam.

3427. Permanent Way of Railways, *F. C. Glaser, Berlin.*—*8th August, 1881.*—*(A communication from A. Haarmann, Germany.)* 6d.

The rails are secured at the desired inclination on metal sleepers of the form described in patent No. 2159, A.D. 1879, by means of tapering or sloping saddle pieces provided with clips on the outside, which enter suitable slots in the sleepers.

3432. Securing India-rubber Tires to Wheels of Bicycles, &c., *W. R. Foster and T. J. Williams, Bermondsey.*—*8th August, 1881.* 4d.

The tire is formed with V or other shaped grooves on each side, and the hollow rim of the wheel is formed with corresponding ribs or projections extending round the inner edge and taking into the grooves of the tire.

3436. Regulating Valve for Railway Brakes Worked by Fluid Pressure, *G. Westinghouse, jun., London.*—*8th August, 1881.* 6d.

This relates to a regulating valve to enable fluid under pressure to be admitted into the pipe which conveys it along the train, and also to relieve the pressure more or less in the train pipe. The valve box has two nozzles, A connected to the fluid supply, and B to the train pipe, such nozzles opening from two compartments of the valve box separated by a partition having a valve C pressed to its seat by a spring. Attached to C is a second valve D, the seat of which is a hole in the centre of piston E, which has in front of it a flexible diaphragm F secured at its outer edge between the two parts of the box. The compartment of the box on the other side of piston communicates

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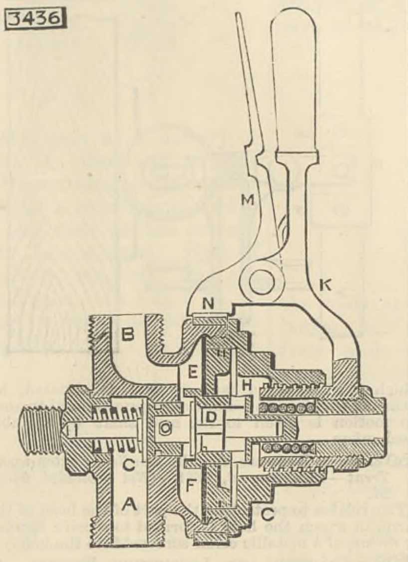

with the outer air by passages G, there being free passage to this compartment when valve D is unseated by the hole through the piston and cross holes. The stem of piston has a shoulder, between which and a plug on the lever handle K a spring H is placed, the boss of the handle having a screw thread working in an internal thread of the valve box. The handle has a spring catch lever M engaging with teeth on ring N between the two parts of valve box. When the handle is turned one way the piston E is pressed forward, the valve D seated and valve C opened, the fluid entering nozzle A, and flowing by nozzle B to the train pipe, whilst when the handle is turned in the opposite direction, thereby relieving the pressure of spring H on piston E, the fluid forces back the piston and passes past valve D through the piston and escapes by passages G, thus relieving the pressure in the train pipe.

3439. Automatic Gear for Working Pneumatic Sewerage Conduits, *C. Pieper, Berlin.*—*9th August, 1881*—*(A communication from Captain C. T. Lierner, Holland.)*—*(Complete.)* 6d.

This relates to means for removing excremental matter from towns by air pressure, and it consists in means for automatically actuating cocks which put the district reservoir in communication with the vacuum pipe, so as to produce a vacuum thereon; then to close such cock, and open the cocks which establish communication between the district reservoir and the water-closets to be emptied, and finally closing the latter cocks and opening the cocks which open communication between the district reservoir and the main reservoir of the engine-house.

3444. Detaching Horses from Carriages in case of Accident, &c., *W. Walker, Yorkshire.*—*9th August, 1881.* 6d.

This consists in attaching the shafts to the carriage frame by means of bolts, which when raised by means of levers will instantly release the same, and so detach the horses from the vehicle.

3451. Regulating the Supply of Water and other Liquids for Water-closets, &c., *E. Lee, Torquay, and A. C. Moore, Deptford.*—*9th August, 1881.* 6d.

The water is supplied by a ball cock to a tank of a capacity equal to the quantity of water to be supplied at one time, and in the bottom of the tank is fixed a vertical discharge pipe reaching up to the highest level of the water. Surrounding the pipe is an annular passage with openings at the bottom of the tank, so that water may pass up it and into the discharge pipe. A fixed cylindrical displacer surrounds the annular passage, its upper edge being attached to the edge of same and carrying an annular plate extending over its mouth and partly over the mouth of the discharge. The displacer extends some distance down the outside of the passage. A cylindrical hood is capable of being raised and lowered by the pull, and raises the amount of water required, which flowing into the annular passage and so into the discharge pipe, then passes to the water-closet basin.

3453. Engine for Obtaining Motive Power, *H. A. Bonneville, Paris.*—*9th August, 1881.*—*(A communication from F. Roland, France.)* 6d.

This relates to an engine in which the motive fluid employed is sulphuret of carbon, and ether, separately or mixed together, or with water in suitable proportions, or all gases capable of being liquefied or bodies capable of passing from the liquid to the gaseous state or *vice versa*.

3463. Chain for Protecting Submarine Telegraphs, &c., *F. R. Lucas, London.*—*10th August, 1881.* 6d.

This consists in placing the cable through the links of a double chain, which form a sort of cage so as to thoroughly protect the cable from dragging and chafing on the bottom of the ocean.

3468. Spring Saddle Bars, *G. Curtis, London.*—*10th August, 1881.* 6d.

The object is to effect the instantaneous release of a rider in event of being thrown from a horse, and also to give additional strength to the saddle tree, and it consists in pivotting to the saddle bar a lever arm with a vertical and horizontal joint, which catches into a shorter curved arm governed by an internal spring in the saddle bar.

3474. Self-inking Pad for Endorsing Stamps, *S. Reid, Newcastle-on-Tyne.*—*11th August, 1881.* 6d.

A trough or box is divided into an upper and a lower compartment by a perforated metallic plate, the upper one containing the pad and the lower one forming a reservoir for the ink. By turning the pad downwards it will become saturated with ink, the excess running back into the reservoir when the pad is placed upwards again.

3476. Cutting, Chopping, or Rending Wood, *C. F. Parsons, London.*—*11th August, 1881.* 6d.

A strong frame carries a chopping blade or guillotone knife driven by a crank, and the wood already cut into blocks is placed in a trough leading to the blade and is forced forward either by hand or mechanically. In front of the blade is a guide to regulate the thickness of the slice to be cut and for holding the wood well up to the blade, such guide being fitted with a spring arrangement to allow the slice cut off to fall into a tube which leads it between a pair of rollers, one plain and the other fitted with a number of circular knives, which again act on the wood and reduce it to pieces of the required size and form.

3481. Rotary Pumps, *C. Comstock, New Canada, Conn., U.S.*—*11th August, 1881.* 6d.

This consists, First, in the construction of the levers Q R, and parts connected with them, and their combination with a heart-shaped cam or slot (or cams or slots) in which the rollers on the short arms of the said levers work; Secondly, in making the valves or radially sliding plates with converging sides, so that in use they wear themselves into shape and thus avoid leakage; Thirdly, in the combination with the valves, and with the fixed division between the ingress and egress passages of the pump, of elastic metallic packings.

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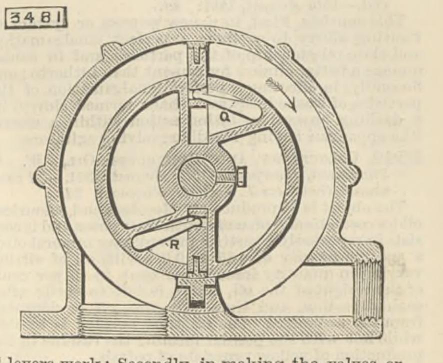

3496. Umbrellas, *A. MacMillan, London.*—*12th August, 1881.* 6d.

This relates to means for retaining the umbrella in its open position without the usual catch and spring at the top end of stick, and for retaining it in its closed position without the catch and spring at the handle end of stick, and it consists in making the "gat" on the rib longer than usual, and slightly turning the two sides of one end of the "gat," so as to make two ears on which the stretcher presses.

3503. Spinning and Doubling Cotton, *J. Seed, Preston.*—*12th August, 1881.*—*(Partly a communication from T. Seed, Narva, Russia.)* 6d.

This relates to "ring throstle" and other continuous spinning and doubling machines to which the ring and traveller are applicable, and consists, First, in an improvement to assist the winding on of the yarn or thread, more particularly on the bare spindle or on a tube, the external diameter of which is the same size as the ordinary spindle, and at the nose of cops or on bobbins or spools of smaller diameter than hitherto, which also regulates the tension of the yarn or thread, so that immediately it has any tendency to become too tight it causes the traveller to rotate more quickly, thereby avoiding breakage and enabling much finer yarn to be spun. The Second part consists in causing the ring itself to rotate and apply a brake acting directly on the traveller, so as to effect the same object.

3508. Steadying Floating Bodies or Vessels, *J. F. C. Farquhar, London.*—*12th August, 1881.* 6d.

So as to steady floating bodies or vessels, a series of horizontal plates is fixed below the bottom of the vessel, out of reach of the action of the ways, and at a distance apart one over the other, so that the water may pass freely between them.

3514. Utilisation of Petroleum, &c., in Furnaces, *W. R. Lake, London.*—*12th August, 1881.*—*(A communication from H. T. Litchfield and D. Renshaw, Mass., U.S.)* 6d.

This relates to means for burning hydrocarbon fluids to eliminate from them the greatest amount possible of heat, and deliver the resulting gases along or across the furnace, and it consists in mixing the fluids with steam or air, and forcing it through a rotating perforated pipe into a combustion chamber, where it is ignited and used separately or in connection with an ordinary furnace.

3527. Gas Engines, *T. H. Lucas, Birmingham.*—*13th August, 1881.* 8d.

This consists in the combination with the ordinary or motor piston of the gas engine of a supplementary piston constituting as it were a movable bottom or end to the cylinder, the said supplementary piston having a variable or irregular motion given to it for the purposes of expelling the exploded gases from and for drawing into the cylinder the fresh charge of the gaseous mixture, and in conjunction with the principal or motor piston for compressing the said gaseous mixture, the drawing in, compression, and ignition of the gaseous mixture, and the expulsion of the spent gases being effected in one cylinder, and at each rotation of the principal shafts of the engine, or in double-acting engines at each end of the stroke of the principal or motor piston.

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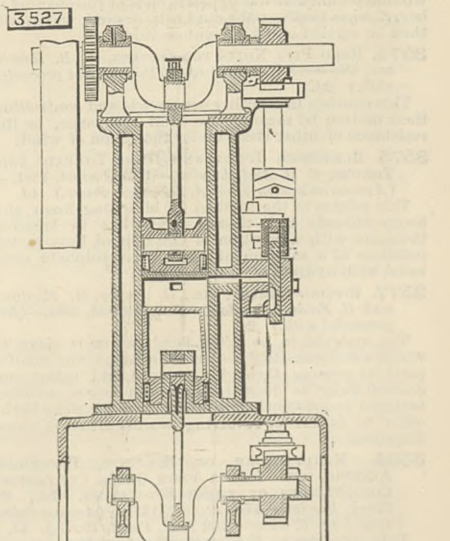

3529. Fabrics with Velvet or Pile Surfaces, *W. R. Lake, London.*—*13th August, 1881.*—*(A communication from M. Antoinette, H. Gorges, E. Legé, and L. H. Goizet, Paris.)*—*(Not proceeded with.)* 2d.

The velvet surfaces, according to this invention, are produced by means of a sewing machine by making loose stitches which project in loops from the fabric to which the material to form the pile is sewn; the stitches so formed are afterwards submitted to a shearing device, which cuts the raised loops.

3530. CARTRIDGES FOR MINING ORDNANCE, &c., *W. Hogarth, Southport.*—15*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the formation of an air space passing right through the centre of the cartridge open to every surrounding part, yet filled with oxygen up to the moment of firing, so as to more effectually consume the powder in the cartridge. The air space consists of a bottle, filled with air and closed, and which the concussion of ignition causes to break and liberate the air.

3531. BRAKES FOR RAILWAYS, &c., *A. Balme, Leeds.*—15*th August*, 1881. (*Not proceeded with.*) 2*d.*

The brake blocks at opposite sides of a wheel axis are carried by a pendant lever formed with a skid to act on the rail, when the two levers are caused to approach each other by a toggle lever arrangement.

3535. PORTLAND CEMENT, &c., *I. C. Johnson, Gravesend.*—15*th August*, 1881. 4*d.*

This consists, First, in a new process or system of treating slurry to produce a perfect amalgamation and close relationship of the particles, and in consequence a better clinker for cement than hitherto; and Secondly, in effecting a perfect amalgamation of the particles of washed clay and chalk termed slurry, by a dashing onward agitating action within a churn-like apparatus having rapidly revolving agitators.

3542. COLOURLESS AND ODOURLESS OIL, *W. P. Thompson, Liverpool.*—16*th August*, 1881.—(*A communication from J. Gottlieb, Vienna.*) 2*d.*

The object is to produce an odourless and colourless oil for cosmetic and pharmaceutical purposes, and it consists in repeatedly digesting any ordinary mineral oil of a specific gravity of 0·85 to 0·95, with oil of vitriol, varying in quantity from 10 per cent. to 40 per cent. of the weight of the oil, which is left to settle after each digestion, and then skimmed off or decanted from the sediment. The oil thus purified is treated while hot with the powder forming the residue in the production of yellow prussiate of potash.

3545. DECOY FISH FOR ANGLING, *G. W. von Nawrocki, Berlin.*—16*th August*, 1881.—(*A communication from C. Schondelmaier, Germany.*—(*Not proceeded with.*) 2*d.*

A case in the form of a fish contains mechanism which causes a number of fish-hooks to spring out of the body as soon as the fish bites at it.

3548. MECHANICALLY COLLECTING LETTERS FROM POST-OFFICES, &c., *F. C. Winby, Westminster.*—16*th August*, 1881.—(*Not proceeded with.*) 2*d.*

A pipe is laid below the pillar post or letter boxes, and in it a series of trucks is caused to travel in succession at intervals of a few minutes or less.

3549. ROLLS, *T. Brown, Walsall.*—16*th August*, 1881. 10*d.*

This relates to rolls for rolling metals, and consists, First, in forming rolls for rolling rails with grooves so shaped that when the acting grooves of the top and bottom rolls become worn, it is only necessary to put the top roll bottom and the bottom roll top to bring the unused grooves into use. The reversed top and bottom rolls are used in conjunction with a spare middle roll. Secondly, to chilled rolls used for rolling sheet metals, and consists in casting them with an axial hole of large diameter passing from end to end, the object being to prevent fracture from the unequal expansion of the outer and inner portions through heating. So as to cause them to cool slowly after use, gas or other flames are caused to play on the outside of the rolls.

3550. LUBRICATING BEARINGS, *H. Reisert, Cologne.*—16*th August*, 1881.—(*Not proceeded with.*) 2*d.*

A cylinder is fitted with a piston, and contains a semi-liquid or viscous lubricant, upon the surface of which the piston is caused to press by a spring, and so force the lubricant through a hole in the cylinder to the bearing.

3552. STEAM BOILERS, *J. R. Oldham, Sunderland.*—16*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a peculiar form and arrangement of combustion chambers, and a peculiar arrangement of tubes in connection with them, the object being to form a boiler in which the products of combustion are led downwards and through return tubes at the bottom and centre of the boiler, so as to heat the water at the coldest and lowest part.

3558. FOLDING CHAIRS, *H. Austin, London.*—16*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates, First, to means for adjusting the angle of the backs of folding chairs and other articles; and Secondly, to the manner of fixing rockers to such chairs, so that they may fold up with it.

3562. TENNIS, CRICKET, AND OTHER PLAYING BALLS, *A. J. Altman, London.*—16*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in forming the balls from pieces of cork cut to the necessary shapes and united together by a solution impervious to the action of moisture.

3571. DREDGING OUT CHANNELS, OR REMOVING SAND OR MUD BANKS IN TIDAL WATERS OR RIVERS, *T. Burroughs, Liverpool.*—17*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in dragging chains along between two windlasses anchored at opposite ends of the channel to be cut, so as to stir up the mud, silt, or sand, which will then be carried off by current or tide.

3574. REED PIPE NOTES FOR ORGANS, *J. B. Hamilton, Greenwich.*—17*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in reacting upon reeds and controlling their motion by means of a wind resistance, or the resistance of other reeds under the action of wind.

3575. BLEACHING LINEN AND HEMP THREADS AND TISSUES, *C. D. Abel, London.*—17*th August*, 1881.—(*A communication from A. Delabore, Paris.*) 4*d.*

This relates to the method of bleaching linen and hemp threads and tissues, consisting in treating the same with a solution of chloride of lime in the presence of a solution of aluminum sulphate saturated with hydrate of alumina.

3577. SIFTING CEMENT, &c., *G. Butler, G. Scudder, and H. Fabian, London.*—17*th August*, 1881.—(*Not proceeded with.*) 2*d.*

The material to be sifted is placed on a sieve to which a reciprocating motion is imparted, the smaller portions passing through the sieve and being conducted away as desired, while the larger unsifted material is conveyed from one end of the sieve to the other by means of revolving worms situated above the sieve.

3584. MANUFACTURE OF SULPHUR, PHOSPHOR, ARSENIC, AND IODINE FROM GASES CONTAINING COMBINATIONS OF THESE SUBSTANCES, &c., *W. Clark, London.*—17*th August*, 1881.—(*A communication from C. Girard and J. A. Pabst, Paris.*) 4*d.*

This consists in the employment of the crystals formed in the lead chambers used in the manufacture of sulphuric acid for decomposing combinations of hydrogen with the metalloids, as well as noxious and odorant gases.

3585. WORKING UP BUTTER, *R. W. Whinnerah, near Salisbury.*—17*th August*, 1881.—(*A communication from R. Whinnerah, Leadville, U.S.*)—(*Not proceeded with.*) 2*d.*

The apparatus consists of a sloping funnel-shaped trough with raised sides and mounted on feet, and at the lower end of which is pivotted a hand lever forming a presser fluted on one side to convey away moisture.

3586. SOLDERING TOOLS, *C. Toope, Stepney.*—17*th August*, 1881.—(*A communication from W. Braidwood, New York.*)—(*Not proceeded with.*) 2*d.*

This consists in a reversible soldering tool, the tip of which may be brought into any position desired by any variety of work.

3587. BICYCLES, &c., *A. W. Robinson, Birmingham.*—17*th August*, 1881. 6*d.*

This relates, First, to a steering check spring to keep the steering shaft of the velocipede in the position necessary for travelling in a straight line, so that the hands of the rider may be free except when desired to travel in a curved line; and Secondly, to the contruction of seats for tricycles.

3589. MOUNTING ROTATING SHAFTS IN THEIR BEARINGS, *J. Tangye, Birmingham.*—17*th August*, 1881. 6*d.*

This consists in dispensing with the collars ordinarily fixed on the shaft on each side of the bearing, and fixing two collars B C on the shaft A on same side of the bearing at a short distance apart, between

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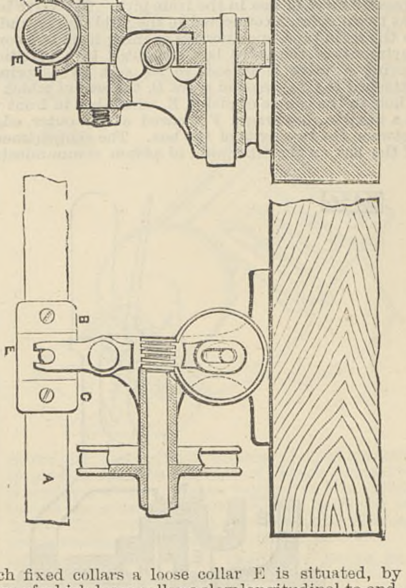


which fixed collars a loose collar E is situated, by means of which loose collar a slow longitudinal to-and-fro motion is given to the said shaft by suitable mechanism.

3592. BEER BARRELS, &c., *W. Smedley, Burton-upon-Trent.*—18*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to protecting the part of the head of the barrel in which the hole is formed to receive the tap by means of a metallic collar screwed into the hole.

3596. TRACTION AND LOCOMOTIVE ENGINES, *H. Tasker, near Andover.*—18*th August*, 1881.—(*Not proceeded with.*) 2*d.*

The upper part of the chimney of the engine can be turned in any desired direction, so as to escape the direct current of wind which may be blowing, and also to direct the sparks and smoke away from any objects in its vicinity.

3597. PRINTING MACHINERY, *R. C. Annand, Peterhead.*—18*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a machine by which printed copies of a sheet on one or both sides may be obtained by using the type in the flat, and also printing the sheet from the web, and cutting it up afterwards into the required size. The machine has four platens arranged one above the other, and guided and held in position by vertical guides, the top and bottom ones being fixed, and the middle ones capable of moving vertically up and down.

3601. SUPPORTING, FIXING, AND ADJUSTING SWING LOOKING-GLASSES AND OTHER SWINGING ARTICLES, *C. D. Martin, Holborn.*—18*th August*, 1881.—(*Not proceeded with.*) 2*d.*

A spring lever fixed to the frame has at its middle and on its inner face a bearing block with a concave seat to bear against the spherical end of the supporting axis of the swing looking-glass when caused to advance by means of a thumb-screw.

3602. TREATMENT OF FRUITS, *A. J. M. Bolnachi, West Dulwich.*—18*th August*, 1881. 2*d.*

This consists in the manufacture of compounds consisting of ceratonia siliqua, or the date fruit, the seeds vicia sativa, or dholl, and coffee or cocoa.

3603. COLOURING MATTERS FOR DYEING AND PRINTING, *J. H. Johnson, London.*—18*th August*, 1881.—(*A communication from the Badische Anilin und Soda Fabrik, Germany.*) 4*d.*

This relates to the conversion of alizarine blue into a compound soluble in water for the purposes of dyeing and printing by the employment of bisulphites of the alkalies.

3605. BLACK INK OR DYE, *H. S. L. Gurney, Warrington.*—19*th August*, 1881. 2*d.*

This consists, First, in substituting for the ordinary oak-gall solution waste tan liquors rich in gallic acid; Secondly, instead of using sulphate of iron, iron filings or iron in a finely comminuted condition is employed.

3608. PERAMBULATORS, *J. T. Shaw and H. D. Meredith, Manchester.*—19*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to perambulators with a seat at each end, and consists in mounting the hood so that it can be reversed and made to cover either seat, also in making the front end of the body capable of being folded down inside the other end when desired to make the perambulator single only.

3611. SORTING AND LOADING COAL, *T. Hancock, Stafford.*—19*th August*, 1881.—(*Not proceeded with.*) 2*d.*

An endless platform moves along the centre of a stage, and conveys the coal to shoots from which it falls into wagons.

3612. WEAVING, *P. Dunkerley, Manchester.*—19*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates principally to weaving belting for driving machinery, and consists in the employment of four shoots and six sets of warps, the tension on the latter being always equal, so that the second warp beam is abolished, and only one employed.

3613. ORNAMENTED SOAP, &c., *J. A. Graham, Putney.*—19*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates especially to a die consisting of an outer tube of the form to be given to the soap, and containing inner tubes of any desired form, soaps of different colours being forced through the different tubes and made to unite where they issue from the die.

3614. LIFTS, &c., *H. J. Haddan, Kensington.*—19*th August*, 1881.—(*A communication from C. Lievens, Brussels.*)—(*Not proceeded with.*) 2*d.*

The cage runs on two vertical iron rails by means of friction rollers, and brakes are so arranged that a rupture of the cable from which the cage is suspended sets the brakes automatically in action.

3623. BICYCLES AND TRICYCLES, *C. Toope, Stepney.*—19*th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in lessening the jolting when passing over uneven surfaces, and consists in interposing coiled springs between the fork and the socket of the back, and also between the lower ends of the fork and the bearings of the driving wheel.

3624. CONTROLLING AND ARRESTING THE INCURSIONS OF LOCUSTS, &c., *W. Clark, London.*—19*th August*, 1881.—(*A communication from A. Durand and C. Havard, Paris.*) 4*d.*

This consists, First, in the employment of barriers of thin smooth sheet metal plates arranged in converging lines, in combination with pits also furnished with barriers; and, Secondly, in treating the mass of insects collected in such pits by a metallic salt, and the subsequent use of apparatus for disengaging ammonia by the action of a base, and transforming the mmonia into sulphate.

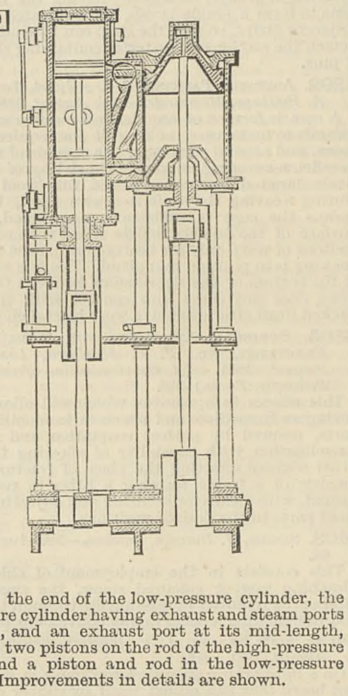
3813. FORMING THE JOINTS OF TIN OR SHEET METAL VESSELS, *M. Benson, London.*—2*nd September*, 1881.—(*A communication from A. H. Fanchers, Brooklyn, U.S.*)—(*Complete.*) 6*d.*

This relates to apparatus for forming double seams in sheet metal by first forming a joint or seam of circular or semicircular cross section, and then flattening such joint to a flattened configuration, thereby pressing the interlocked edges into close contact with each other.

5570. COMPOUND ENGINES, *A. M. Clark, London.*—20*th December*, 1881.—(*A communication from G. B. Massey, New York.*)—(*Complete.*) 6*d.*

This consists in compound engines, of the combination of two contiguous cylinders in direct connection

5570



by ports at the end of the low-pressure cylinder, the high-pressure cylinder having exhaust and steam ports at its ends, and an exhaust port at its mid-length, there being two pistons on the rod of the high-pressure cylinder, and a piston and rod in the low-pressure cylinder. Improvements in details are shown.

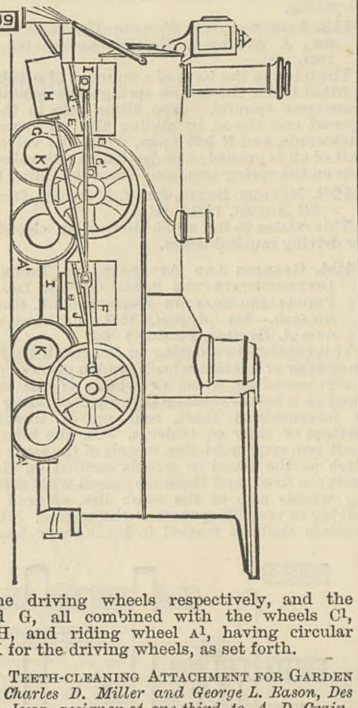
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

253,289. LOCOMOTIVE, *Benjamin F. Hudson, Bear Creek, Tex.*—*Filed November* 28*th*, 1881.

Claim.—The frame B, having inclined guides J J^1, and the reciprocating carriages I I^1, connected by the pitman E, the arms D F, connecting the carriages

253.289



I I^1 to the driving wheels respectively, and the piston rod G, all combined with the wheels C^1, cylinder H, and riding wheel A^1, having circular bearings K for the driving wheels, as set forth.

253,307. TEETH-CLEANING ATTACHMENT FOR GARDEN RAKE, *Charles D. Miller and George L. Eason, Des Noines, Iowa, assignor of one-third to A. D. Crain, same place.*—*Filed October* 10*th*, 1881.

Claim.—(1) The combined clearing bar and frame,

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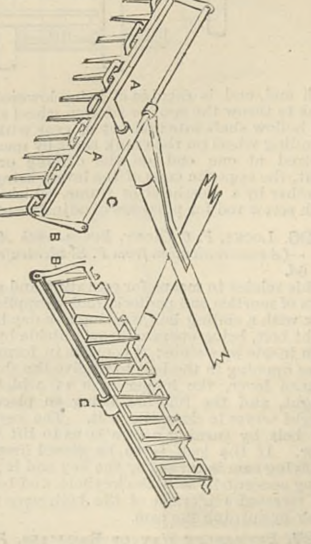

consisting of the bent wire or rod A A, adapted to be intertwined between rake teeth, and the frame B B C and the spring G, adapted to be fastened to a rake head, substantially as shown and described, for the purposes specified. (2) The attachment for cleaning rakes, composed of the combined clearing bar and frame A B C and the spring G, adapted to be fastened to a rake handle, substantially as set forth, to operate in the manner described, for the purposes specified. (3) A combined clearing bar and frame adapted to surround, extend between, or intertwine the teeth of a rake, a spring extending from said frame and adapted to be fastened to a rake handle, arranged and combined relatively to each other, and a rake, substantially as shown and described, to operate in the manner set forth, for the purpose specified.

353,339. FERTILISER DISTRIBUTER FOR GRAIN DRILLS, *George D. Baker, Lovettsville, assignor of one half to George Wire, Londoun County.*—*Filed September* 17*th*, 1881.

Claim.—(1) The rollers R having concave peripheral faces, in combination with the guano box A, having the openings A in the lower rear corner, said rollers being mounted on a shaft outside the said corner, and extending flush with or a little beyond the inner line of the box, substantially as set forth. (2) The combination of the slide C, links, and operating lever D, shaft D_1, hand lever D^2, and spring, forcing one end of the lever D^2 outward, with the ratchet E^1 mounted outside of the lever D^2, the latter being adapted to be released from the ratchet by pressing down the spring end of it, as set forth. (3) The dial E, formed into the journal-box E, and having the ratchet E^1 formed on the underside of an elevated portion, in

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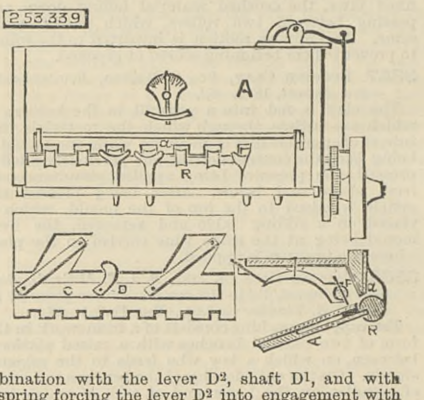

combination with the lever D^2, shaft D^1, and with the spring forcing the lever D^2 into engagement with the ratchet, as set forth. (4) The guano box described, cut away in the back to receive the slide and its operating links, and having a sloping bottom formed on the wood, and a feather-edge at the point where the rollers revolve, and having the lining F covering the entire interior of the box, lying over the slide and attachments, and also having the openings in the rear corner provided with the metal boxes A^2, forming with the lining F a complete metal cover for the port A^1, substantially as set forth.

CONTENTS.

THE ENGINEER, March 24th, 1882.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending March 18th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9583; mercantile marine, building materials, and other collections, 4215. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 5 p.m., Museum, 1517; mercantile marine, building materials, and other collections, 750. Total, 16,067. Average of corresponding week in former years, 15,707. Total from the opening of the Museum, 20,795,649.

EPPS'S COCOA.—GRATEFUL AND COMFORTING.—"By a thorough knowledge of the natural laws which govern the operations of digestion and nutrition, and by a careful application of the fine properties of well-selected Cocoa, Mr. Epps has provided our breakfast tables with a delicately flavoured beverage which may save us many heavy doctors' bills. It is by the judicious use of such articles of diet that a constitution may be gradually built up until strong enough to resist every tendency to disease. Hundreds of subtle maladies are floating around us ready to attack wherever there is a weak point. We may escape many a fatal shaft by keeping ourselves well fortified with pure blood and a properly nourished frame."—*Civil Service Gazette.*—Made simply with boiling water or milk. Sold only in packets labelled—"JAMES EPPS AND CO., Homœopathic Chemists, London."—Also makers of Epps's Chocolate Essence for afternoon use.—[ADVT.]