THE ELECTRICAL TRANSMISSION OF POWER.

By Professor Oliver J. Lodge.

No. IV.

Theory of two series dynamo machines connected by a uniformly leaking line wire, summarised.—Some rather long expressions are perpetually occurring in the discussion of a leaking wire, whose value it is easy to calculate when the wire and machines are given, and which it will be convenient to devise abbreviations for.

One is the expression—

$$\cosh \sqrt{\frac{R}{S}} + \frac{\rho_1}{\sqrt{RS}} \sinh \sqrt{\frac{R}{S}}.$$

This we already have shortened to $c + \rho_1 s$; but we will now denote it by a single symbol, say M_1; and, since in all ordinary cases of transmission the insulation resistance S of the line will be considerably greater than its conduction resistance R, the approximations suggested in the last article, namely,

$$\cosh \sqrt{\frac{R}{S}} = 1 + \frac{R}{2s}, \text{ and } \sinh \sqrt{\frac{R}{S}} = \sqrt{\frac{R}{S}},$$

may be used without compunction. I shall therefore write—

$$M_1 = 1 + \frac{\frac{1}{2}R + \rho_1}{S} \quad . \quad . \quad . \quad (\alpha)$$

Similarly

$$M_2 = c + \rho_2 s = \cosh \sqrt{\frac{R}{S}} + \frac{\rho_2}{\sqrt{(RS)}} \sinh \sqrt{\frac{R}{S}}$$

$$\simeq 1 + \frac{\frac{1}{2}R + \rho_2}{S}. \quad . \quad . \quad . \quad . \quad (\beta)$$

Remember that ρ_1 and ρ_2 are the resistances in ohms of the wire on the two dynamo machines; field magnet and armature together.

Another expression which occurred frequently was the denominator $(RS + \rho_1\rho_2)s + (\rho_1 + \rho_2)c$, and this I shall now call D, and will here write down its complete and its approximate values—

$$D = \frac{RS + \rho_1\rho_2}{\sqrt{RS}} \sinh \sqrt{\frac{R}{S}} + (\rho_1 + \rho_2) \cosh \sqrt{\frac{R}{S}}$$

$$\simeq R + \rho_1 + \rho_2 + \frac{\rho_1\rho_2 + \frac{1}{2}R(\rho_1 + \rho_2)}{S}. \quad . \quad . \quad (\gamma)$$

In the strength of all this I will now repeat the important expressions obtained last time in the very simple forms they now assume.

The current at the sending end of the line,

$$C_1 = \frac{M_2 E_1 - E_2}{D} \quad . \quad . \quad . \quad . \quad (29)$$

The current at the receiving end,

$$C_2 = \frac{E_1 - M_1 E_2}{D} \quad . \quad . \quad . \quad . \quad (30)$$

The power obtained from the receiving machine,

$$p_2 = \frac{E_1 E_2 - M_1 E_2^2}{D} \quad . \quad . \quad . \quad . \quad (31)$$

And the efficiency of the whole arrangement,

$$F = \frac{E_2}{E_1} \cdot \frac{E_1 - M_1 E_2}{M_2 E_1 - E_2} \quad . \quad . \quad . \quad (28)$$

Practical problems.—I will now attack a few simple problems of practical value, writing the solutions in their brief forms, but remembering that the numerical value of M_1 M_2, and D for given machines can be obtained at once by means of the equations labelled (α) (β) and (γ). There is nothing variable or accidental about these quantities, they are simply functions of the resistance of the wire which is wound on the machines, and of that which forms the line.

Notice also that the numerical values of M_1 and M_2 will never be much greater than unity, and that the better the line is insulated the more nearly will they be 1.

The numerical value of D on the other hand is always a little greater than the total resistance of the circuit in ohms; but, for the case when the wire is perfectly insulated, D simply is the total resistance of the circuit.

In discussing the following problems it may be remembered that we have already several times seen that, in general, the higher the electro-motive force and the weaker the current that can be used, the better for economy. There are various causes which make it difficult to work with electro-motive forces above a certain amount, and hence in some of the problems—1 and 2—I take the highest electro-motive force employed as a specified quantity, and ask what is the best that can be done with it.

In other cases, however, I start with the assumption that a given power is required at the receiving end, and ask what is the least value of the electro-motive force which will give it me under specified conditions—this is done in probs. 3, 5, and 6; understanding that a higher electro-motive force will usually give it me more easily, and with a balance to spare for practical emergencies. The only exception to this occurs when the loss by leakage more than balances the gain due to high electro-motive force; and it is important to determine this point, and to settle what is the maximum electro-motive force that can be used with advantage on a given line. Problem 7.

Problem 1.—With a given line wire and machines, and a given electro-motive force at the sending station, what is the absolutely greatest power which can be obtained at the other end? What will be the opposition electro-motive force of the receiving machine when it is giving this maximum power? And at what efficiency is the system then working?

Answer.—By differentiating (31) it is plain that p_2 is a maximum

$$\text{when } E_2 = \frac{E_1}{2M_1} \quad . \quad . \quad . \quad . \quad (33)$$

The maximum value of the power obtained being then

$$\frac{E_1^2}{4M_1 D} \quad . \quad . \quad . \quad . \quad . \quad (34)$$

while the electrical efficiency, or the ratio of the net power applied at one end to the gross power obtained at the other, is by (28)

$$\frac{1}{4M_1 M_2 - 2} \quad . \quad . \quad . \quad . \quad (35)$$

which is necessarily rather less than 50 per cent. always; and, if the insulation is bad, may be very much less.

Problem 2.—With a given line wire and machines, and a given sending electro-motive force, as before, what is the highest power that can be obtained at the receiving end consistently with a specified efficiency? And what is the electro-motive force of the receiving machine when it is exerting this power with the given efficiency?

Answer.—Since F cannot now be chosen to make p_2 a maximum, but is laid down beforehand, we must take the general relation between E_2 and E_1, instead of the simple one (33); we deduce it from (28), viz.:

$$\frac{E_2}{E_1} = \frac{1 + F - \sqrt{\{(1+F)^2 - 4FM_1M_2\}}}{2M_1} \quad . \quad . \quad (36)$$

And substituting this in (31) we find the power transmitted under the given conditions to be—

$$p_2 = \frac{E_1^2 F}{2M_1 D} \left\{ 2M_1M_2 - (1+F) + \sqrt{(1+F)^2 - 4M_1M_2F} \right\} \quad . \quad . \quad (37)$$

We observe that unless $(1+F)^2$ is greater than $4M_1M_2F$ the above answer has no meaning; *i.e.*, unless this condition is satisfied it is absolutely impossible under any circumstances to obtain the specified efficiency with the given line wire and machines. The highest attainable efficiency is, in fact, given by putting $(1+F)_2 = 4M_1M_2F$, and it is—

$$2M_1M_2 - 1 - 2\sqrt{M_1M_2}\sqrt{M_1M_2 - 1} \quad (41)$$

and the power transmitted with this maximum efficiency is by substitution—

$$\frac{E_1^2 M_2}{D} \sqrt{\left(\frac{M_1M_2 - 1}{M_1M_2}\right)} \left\{ 2M_1M_2 - 1 - 2\sqrt{M_1M_2}\sqrt{M_1M_2 - 1} \right\} \quad . \quad . \quad (42)$$

Problem 3.—Required a certain amount of power to be transmitted with a given line wire and machines, what is the very least sufficient electro-motive force in the sending dynamo machine? Also, what is the opposition electro-motive force of the receiving dynamo at the same time?

Answer.—Simply by (34);

$$\text{the very least } E_1 = 2\sqrt{(M_1 D p_2)}; \quad (38)$$

but the efficiency with this electro-motive force will be only that given by (35), viz.:

$$\frac{1}{4M_1M_2 - 2}.$$

If a specified efficiency F is aimed at, a higher electro-motive force must be used, namely, that indicated in (37); but we will leave this to be considered in Problem 6.

The corresponding values of E_2 can be written down from (33), viz.:

$$E_2 = \sqrt{\left(\frac{D p_2}{M_1}\right)}. \quad . \quad . \quad (39)$$

Problem 4.—With a given line wire and machine as before, what is the very highest efficiency which can be aimed at? What is the ratio of the electro-motive forces of the two machines that will give this highest efficiency? And what is the power then actually transmitted for a specified value of the sending, or of the receiving, electro-motive force?

Answer.—Differentiating (28), the value of $\frac{E_2}{E_1}$ which will make F a maximum is found to be

$$\frac{E_2}{E_1} = M_2 - \sqrt{\left(M_2^2 - \frac{M_2}{M_1}\right)}, \quad . \quad (40)$$

or, what is the same thing,

$$\frac{E_1}{E_2} = M_1 + \sqrt{\left(M_1^2 - \frac{M_1}{M_2}\right)}.$$

Putting these into (28), which with discretion is very easy to do, we get the highest possible efficiency.

$$\text{Highest } F = 2M_1M_2 - 1 - 2\sqrt{\{M_1M_2(M_1M_2 - 1)\}} \quad (41)$$

And finally putting this efficiency into (37) or, what comes to the same thing, combining (40) and (31), we find the power transmitted to be

$$\frac{E_1^2 M_2 F}{D} \sqrt{\left(\frac{M_1M_2 - 1}{M_1M_2}\right)} \quad . \quad . \quad (42)$$

Which agrees with what we found at the end of Problem 2.

If E_2 is given instead of E_1, the power that can be transmitted with the highest efficiency is

$$p_2 = \frac{E_2^2}{D}\left(\frac{E_1}{E_2} - M_1\right)$$

$$= \frac{E_2^2 M_1}{D} \sqrt{\left(\frac{M_1M_2 - 1}{M_1M_2}\right)} \quad . \quad . \quad . \quad (43)$$

The expression for the highest possible efficiency (41) is rather an interesting one. It shows that this highest efficiency depends greatly on the insulation of the line, becoming unity if the line is perfectly insulated, falling down to ·536 if the insulation resistance is only ten times the metallic resistance of the circuit, and to ·172 if the insulation and conduction resistances are equal, but not reaching *o* till the line is absolutely uninsulated.

This result is rather curious if we compare it with the case of a perfectly insulated wire; for in that case the highest possible efficiency was simply 1, but no power could then be transmitted—see Art. 2. With a leaky wire, on the other hand, the highest efficiency (41) is less than unity; but if it be attained some power can be transmitted, viz. the amount given by (42). Of course this does not mean anything so absurd as that a leaky line is better than a perfectly insulated one. The efficiency which is the highest possible in a leaky line is not the highest possible in a perfectly insulated one.

Problem 5.—Required a certain power to be transmitted with a given line wire and machines, what is the highest efficiency which can be aimed at? and what are the necessary electro-motive forces to give this highest efficiency?

This problem differs from the preceding in having p_2 specified beforehand. To answer it, first combine (28) with (31), so as to get

$$F = \frac{p_2 D}{M_2 E_1^2 - E_1 E_2}. \quad . \quad (44)$$

Then differentiate this and (31), remembering that p_2 is fixed, and one gets for the necessary electro-motive forces, to make the efficiency a maximum, and yet to transmit the specified power,

$$E_1 = \sqrt{(p D M_1)} \cdot \left\{ \left(\frac{M_1M_2}{M_1M_2 - 1}\right)^{\frac{1}{4}} + \left(\frac{M_1M_2 - 1}{M_1M_2}\right)^{\frac{1}{4}} \right\} \quad (45)$$

$$E_2 = \sqrt{\left(\frac{p D}{M_1}\right)} \cdot \left(\frac{M_1M_2}{M_1M_2 - 1}\right)^{\frac{1}{4}}. \quad . \quad . \quad . \quad . \quad . \quad (46)$$

And substituting these values in (43), one gets the maximum efficiency under the circumstances, namely,

$$\frac{1}{2M_1M_2 + 2\sqrt{\{M_1M_2(M_1M_2 - 1)\}} - 1},$$

which is precisely the same as (41).

Equations (45) and (46) are, in fact, really the same as (42) and (43) respectively.

Problem 6.—It is required to transmit a certain power with a specified efficiency by means of a given line wire and machines, at what electro-motive forces must the two machines be run?

Answer.—This problem differs from Problem 3 in having the efficiency laid down beforehand, and we must use the general relations (36) and (37), or what comes to the same thing, we must simply combine (28) and (31), solving them for E_1 and E_2. We thus get

$$E_1^2 = \frac{2 p D M_1}{F\{2M_1M_2 - (1+F) + \sqrt{((1+F)^2 - 4M_1M_2F)}\}} \quad (47)$$

which is the same as (37)

$$\text{and } E_2^2 = \frac{2 p D M_2 F}{1 + F - 2M_1M_2F + \sqrt{((1+F)^2 - 4M_1M_2F)}} \quad (48)$$

Problem 7.—With a given line wire and machine, what are the highest electro-motive forces that can advantageously be employed in order to transmit a specified power?

Answer.—This is already answered by equations (45) and (46) of Problem 5. When E_1 has reached the value (45), and E_2 the value of (46), no further increase in the speed of either machine gives any advantage, but rather the contrary.

It is plain that the most advantageous electro-motive forces vary with the square root of the power to be transmitted.

Numerical illustrations.—For the purpose of illustrating some of these results we may apply them to a special case or two. First, say, a telegraph wire like that of Despretz.

Example 1.—Let $\rho_1 = \rho_2 = 500$ ohms.

Let R = 1000 and S = 16,000 ohms.,

and let it be required to transmit nearly a horse-power, or let $p_2 = 625$ Watts. [This would not give above half a horse on the brake probably.]

Then, by (α) (β) and (γ) we calculate.

$$M_1 = M_2 = 1 + \tfrac{1}{16}$$

$$M_1 M_2 = 1 + \tfrac{1}{8}$$

and D = 2047

Wherefore, the answers to problems 5 or 7 come out

most advantageous $E_1 = 108\sqrt{p_2} = 2700$ volts

most advantageous $E_2 = 76\sqrt{p_2} = 1900$ volts

and the highest efficiency possible = 50 per cent.

The answer to Problem 3 is—

the least sufficient $E_1 = 2330$ volts

$E_2 = 1095$ volts

and the efficiency corresponding, 40 per cent.

Example 2.—With the same line wire and machines let the sending electro-motive force be 2700 volts.

The answers to Problem 1 are—

$E_2 = 1270$ volts.

$p_2 = 838$ Watts

F = 40 per cent.

This is about the Despretz case as worked out near the end of the last article with the above value for S.

In Example 1, if S had been 100,000, instead of only 16,000, the highest possible efficiency would have been much greater, viz., 75·4 per cent.; and the electro-motive forces to give it would have been $138\sqrt{p}$ and $120\sqrt{p}$ respectively.

Example 3.—Take a shorter and thicker line.

Let R = 10 and S = 1000 ohms

and let $\rho_1 = \rho_2 = 45$.

Then $M_1 = M_2 = 1{\cdot}05$

$M_1 M_2 = 1{\cdot}1$

and D = 102·5.

The highest possible efficiency is 53·6 per cent. by (41)

The most advantageous $E_1 = 25{\cdot}2\sqrt{p_2}$ by (45) or (42)

and the corresponding $E_2 = 17{\cdot}7\sqrt{p_2}$ by (46) or (43).

So to transmit 625 watts at the highest efficiency requires E_1 to be 630 volts and E_2 to be 442 volts. No greater electro-motive force is advantageous with this line and machines, and the highest efficiency is strikingly low.

To mend it we must either increase the leak resistance S, or diminish the machine resistance ρ.

Example 4.—Let R = 10 S = 10,000

and $\rho_1 = \rho_2 = 45$,

then $M_1 = M_2 = 1{\cdot}005$

$M_1 M_2 = 1{\cdot}01$

D = 100·25.

The highest efficiency is now 80 per cent.,

the most advantageous $E_1 = 35\sqrt{p_2}$,

the corresponding $E_2 = 31{\cdot}5\sqrt{p_2}$.

Example 5.—Let R = 10 S = 1000

and $\rho_1 = \rho_2 = 5$,

then $M_1 M_2 = 1{\cdot}02$

D = 20·075.

The best $E_1 = 13{\cdot}8\sqrt{p_2}$; $E_2 = 12\sqrt{p_2}$,

and the highest efficiency is 75·4 per cent.

Example 6.—Let R = 10 S = 10,000,

$\rho_1 = \rho_2 = 5$,

so that $M_1 M_2 = 1{\cdot}002$ and D = 20.

Then the best $E_1 = 22{\cdot}2\sqrt{p_2}$, $E_2 = 21{\cdot}2\sqrt{p_2}$,

and the highest efficiency is 94 per cent.

Example 7.—As the last example we may take the case of two similar machines coupled up directly with no length of line wire at all; so that R = *o*, S = ∞, $M_1 = M_2 = 1$,

and $\rho_1 = \rho_2 = \frac{1}{2} D = \rho$ say; then the answers to Problem 5 are merely the stale information that the best E's are infinite, and the attainable efficiency is 1. But to Problem 6 we get the answers—

$$E_1^2 = \frac{2\rho p}{F(1-F)}$$

and

$$E_2^2 = \frac{2\rho p F}{1-F}$$

which agree with the answer to the similar problem in the middle column of Article II.

INTERNATIONAL EXHIBITION AT NICE.

At the Vienna exhibition of 1873, and again at that of Paris in 1878, it was generally predicted that international exhibitions had had their day, and that the public and—what is probably more important—the exhibitors, were tired of them. Many English manufacturers declared that the enormous expense to which they were put, if they wished their productions to be adequately represented, brought them no corresponding benefit; and that from henceforth they would be contented with the laurels they had gained in previous competitions, and not endeavour to add to them.

But still the long series of international exhibitions has by no means come to an end. That of Philadelphia, in 1876, and more recently the exhibitions of Melbourne, Sydney, and Brussels, have all been successful; at any rate they have given satisfaction to their promoters. And now another city is about to be added to the list. Nice—*Nizza la bella*—has issued an invitation to all nations to take part in an exhibition which will be opened on the 15th of November next, and she is making rapid preparations for the reception of her expected guests.

To many of our readers who only know Nice as the abode of pleasure, the idea of an International Exhibition, held in a French provincial town, some hundreds of miles from the capital, will seem absurd; and yet those who are well acquainted with the locality will see that there are few places where the elements of success are greater. The rapidity with which Nice is developing is unexampled in France, perhaps in Europe. The number of residents has doubled during the last ten years, and it is expected that at the present rate of increase it will, in five years' time, exceed 100,000, a population which is not possessed by twelve French towns at the present moment. But it is to the visitors that she attracts that Nice owes her reputation. We cannot in this article enlarge on the wonderful climate, and the other inducements which bring, every winter, to this favoured spot, 40,000 to 50,000 people from all parts of Europe. Suffice it to say that they come. Not only royal personages, and distinguished members of the political world, but the heads of industrial houses, and the leading scientific men of all nations may be recognised in the crowd on the *Promenade des Anglais* on any afternoon at this time of year. And besides those who are able to pass the winter there, the visitors who remain for a week or two on their way to or from Italy are many thousands; we cannot be sure of the exact number, but the arrivals at Nice railway station during the winter months of 1881-82 were more than 1,200,000!

It is, however, not to visitors alone that an Exhibition must look for success, nor is their point of view the one which more particularly concerns our readers. They will chiefly be interested to hear what inducements are held out to British exhibitors. Before commenting on the circular issued by the Commission of Administration, we will call attention to the geographical position of Nice. Situated midway between Marseilles and Genoa, she is in many respects superior to either; and there is no doubt that when the railways which are to connect her with the interior are completed she will divert a certain amount of their trade, both import and export. At present the only line of railway passing through Nice is the Paris, Lyons, and Mediterranean, which skirts the coast; but as goods can be delivered by sea, an English or Belgian has frequently less to pay for transport than a French manufacturer. The chief competitors we shall have to meet will be the Italians. Genoa, Savona, and Leghorn are all industrial towns, and there are many manufacturers in them who are doing a good trade on the Riviera, and who will muster in strong force at Nice, from which they are only separated by a short sea journey, although they have not cared to send their goods to the Exhibitions of Paris or Vienna. Nice, though the capital of the department of the *Alpes Maritimes*, and the source from which a very large district draws its supplies, is not a manufacturing town, nor is there an engineering factory of any importance along the whole of the French Riviera. The little machinery that is used comes from a great distance; but as a general rule the inhabitants of the department have not found out that they need any. The agricultural implements would be considered primitive even in the centre of Spain; saw-mills are only put up where there is a fall of water, and when this from any cause fails, they are abandoned; whilst joiners take a week to turn out what English wood-working machines would enable them to do in half a day. The country flows with oil and wine, yet a modern press is never seen; and of the many tons of perfumery annually exported from Grasse, probably not one is sent off in machine-made casks.

The site of the Exhibition is within 300 yards of the Nice station, to which it will be connected by a branch line. The grounds extend over twenty acres, but it is not yet decided how much of this will be covered with buildings. The charge for space is to be as follows:—(1) Main building, horizontal space, 2s. to 4s. per superficial foot; Main building, wall space, 1s. 2d. to 2s. per superficial foot. (2) Annexes, horizontal, or wall space, 9d. to 1s. 6d. per superficial foot. (3) Open air, 4d. to 9d. per superficial foot. Forms of application for admission are to be obtained from "M. le Commissaire Général de l'Exposition, Nice," to whom all inquiries are to be addressed. For English exhibitors these applications may be sent in up to the 1st of June, and the goods must be delivered in Nice not later than the 15th of October.

The circular announces that at least fifty of the leading representatives of science, industry, and commerce, of France and other countries, will form the jury; and that diplomas of honour, gold, silver, and bronze medals, and honourable mentions, will be awarded. It also states that motive power will be provided gratuitously to all exhibitors who apply for it; whilst those who require water, gas, steam, or electricity, will be supplied with them at cost price.

We regret to see that the commissioners make no mention of the admission of foreign goods free of duty or in bond. The French custom's tariff is in many instances so high that foreigners will be afraid of exhibiting goods for which they may find no sale at the conclusion of the Exhibition, unless they are assured that the duty will be returned to them. Another fault we have to find is the clause which prohibits the sketching of any exhibited object. It is quite right to prevent the improper reproduction of works of art, but this clause, too strictly enforced by ignorant policemen, was often a source of annoyance at other Exhibitions; and not only prevented visitors from benefiting by the exhibits, but even rendered it extremely difficult for the press to give an accurate account of them.

W. W.

Nice.

WHITWOOD SEWERAGE WORKS.

In our last issue we stated that we should publish additional engravings illustrating these works, and also give our description of them in the present impression.

Whitwood is situated in the West Riding of the County of York, and immediately adjoining the confluence of the rivers Aire and Calder. The portion of the district of Whitwood adjoining the rivers, and known as Whitwood Mere, lies very low, and much difficulty has been experienced in draining this portion of the township. Some time ago the Local Authority consulted Mr. John Richardson, M. Inst. C.E., as to the best means of draining their district, and he afterwards submitted a scheme of sewerage which met with their approval and has since been carried out.

The scheme was divided into three drainage areas, two of which get rid of the sewage by gravitation, and such sewage is conveyed on to irrigation grounds, and after purification the effluent water is passed into the adjoining watercourses, and ultimately into the river Calder; but, as before stated, the portion of the district called Whitwood Mere is so low that it was found impossible to dispose of the sewage except by pumping; it was therefore determined to put down a pumping station at the lowest level, with sewage tanks capable of holding 250,000 gallons, and to lift the sewage on to the irrigation grounds before referred to. These works have now been constructed, and the ground forming the site of the pumping station raised, so as to be above the highest floods, and it is thus accessible at all times. Much difficulty was experienced in securing a safe foundation for the sewage tanks and chimney, as well as for the engine and boiler-houses.

The engines and pumping machinery were designed and constructed by Mr. J. Horne, of Castleford, from specifications furnished by Mr. Richardson. The engines consist of a pair of direct-acting horizontal high-pressure condensing engines, so constructed that they can be worked either singly or coupled together. The cylinders are 12½in. diameter, 24in. stroke, jacketted and clothed with hair felt, lagged with mahogany and bound with brass bands, and they are fitted with variable expansion valves. The piston rods, valve rods, and pump rods are of cast steel, working through solid brass glands, the crank and crank-shaft are of wrought iron and the fly-wheels are turned on the rims. The engines are regulated by a pair of high speed governors to run 18 strokes per minute. The condensers fetch their water from a well outside the building, 12ft. deep, and they maintain a vacuum of 27in. The air pumps are double-acting, 4½in. in diameter and 24in. stroke.

The sewage pumps are 14in. diameter, 24in. stroke, and double acting, fitted with valves of a large area and of easy access, so arranged that any of the valves may be examined while the engines are running. These pumps deliver on to the sewage farm at an elevation of 68ft., and through 2300 yards of 12in. main, 30,000 gallons per hour, and this quantity could be doubled if required. We shall illustrate these pumps next week. Our engravings this week illustrate the engines in detail. Figs. 1 and 2 are an elevation and plan of the engine, showing the valve gear in section. Figs. 3, 4, 5, 6, and 7 show the bed-plate of one engine, and Figs. 8, 9, 10, 11, 12, and 13 illustrate the construction of the air pump and condenser.

The whole of the working parts are above the engine-house floor, which is 5ft. above the ground-level. The floor is carried on cast iron girders. All steam and waste-water pipes are under the floor, and are provided with cast iron chequered access plates.

The steam is supplied by two Cornish boilers 5ft. 6in. in diameter and 20ft. long with 3ft. flue, and tested to 120 lb. per square inch, the working pressure being about 50 lb. The feed-water for the boilers is taken from the hot wells by a single-acting pump while the engines are working. An arrangement is provided by which the gases generated in the sewage tanks are passed through boiler flues to the chimney.

The engines and pumps have been in operation for four months, and work with perfect smoothness and entirely free from any jar from the pumps.

The whole of the works have been carried out under the directions of Mr. Richardson at a cost of £15,000, and a rate of 1s. 4d. in the pound on the present rateable value of the district will repay principal and interest in thirty years.

THE INSTITUTION OF CIVIL ENGINEERS.

COVERED SERVICE RESERVOIRS.

At the meeting on the 20th of February, Mr. Brunlees, President, in the chair, the paper read was on "Covered Service Reservoirs," by Mr. William Morris, M. Inst. C.E. (of Deptford).

The author alluded to the fact that covered reservoirs were used by the Romans, and other ancient people, for keeping water cool and pure for potable purposes, and showed that their use was by no means a recent refinement, although they had only lately been introduced in modern waterworks. It did not appear, from official returns, that covered reservoirs were used in London in 1850, when filtration had only been partially introduced. But it soon became evident that covered reservoirs were necessary for the storage of filtered water, and accordingly it was enacted by the Metropolis Water Act, 1852, which required all water—except water pumped from wells—to be filtered, that all reservoirs for filtered water within five miles of St. Paul's Cathedral should be covered. This enactment was more particularly intended to preserve the water from contact with the smoke of London; but the objection to uncovered reservoirs was by no means confined to the neighbourhood of large towns, as owing to the rapid growth of vegetable and animal life in service reservoirs, the improvement from the filtration of the water was rapidly lost, especially during the summer. As examples, the author referred to the uncovered reservoirs constructed at the cost of the Admiralty in Greenwich Park and on Woolwich Common, for the protection, in case of fire, of the Greenwich Hospital, Royal Dockyard, and other Government establishments, which were partially used by the Kent Waterworks for the supply of their district. The author then proceeded to describe the covered reservoirs at Plumstead and at Shooter's-hill, purchased by the Kent Company. These were covered by brick arches, springing from cast iron girders. Then followed descriptions of different works, including the Chislehurst reservoir, which was built of brick, covered with arches supported by cast iron girders, and rendered internally with cement. The circular reservoir, purchased from the Dartford Local Board of Health, was covered with brick arches supported on nine wrought-iron joists radiating from the centre, where they were supported by a cast iron column. The circular reservoir in Greenwich Park consisted of brick arches, resting on concentric rings of rolled wrought iron girders, supported by piers. The filter-beds at Deptford were converted into covered reservoirs, consequent on the Kent Company abandoning the supply from the river Ravensbourne in favour of spring water from the chalk, in which case the old filtering material was utilised in the construction of the concrete vaulting. The covering of a small reservoir at Plumstead with Bunnett's flooring was described, and the construction of a covered reservoir on Woolwich-common in lieu of the old one referred to, when relinquished by Government. This was an oblong reservoir, 200ft. long by 100ft. wide; the walls were of concrete, faced with brick; the covering arches were of brick, springing from rolled joists supported on brick piers. The above works were designed by the author's father, the late Mr. W. R. Morris, M. Inst. C.E.

The author then described the New Cross Reservoir, built under his direction in 1874, which was similar to that on Woolwich Common, except that the roof consisted of brick arches springing from the piers instead of rolled joists. He then gave a full description of a reservoir recently constructed by him at Farnborough, Kent, in which the outer walls were reduced to a minimum, by supporting the covering arches till their springing was level with the centre from which they were struck. This system was adopted for the end as well as for the side walls. An account was given of a slip which occurred during the construction of the reservoir, and of the means taken for making the work secure.

The East London Waterworks Company had at Hornsey Wood a fine brick reservoir, which was capable of containing 5,000,000 gallons of water. The same company had at Haggar-lane a reservoir capable of containing 1,500,000 gallons. This also was built of brick; the vaulting was supported by longitudinal walls, stiffened by transverse walls, so that the reservoir was divided into forty-nine sections, the walls of which were pierced with circular openings. The Kilburn Reservoir, capable of containing 6,000,000 gallons, was a fine brick structure, with vaulted roof, supported on cruciform piers; the outer walls were supported by buttresses against the pressure of the external earth. The Hampton Reservoir, capable of containing 2,750,000 gallons, was constructed entirely of concrete. This reservoir was built in clean sharp gravel, and the excavated ballast was admirably adapted for the concrete. The arches sprung from wrought iron joists. The Burton-on-Trent Reservoir, built for the South Staffordshire Waterworks, had a capacity of 4,000,000 gallons; it was rectangular on plan, and was covered with brick arches springing from cast iron girders, supported on cast iron columns; the walls were of concrete, faced with Staffordshire bricks.

The author then referred to several service reservoirs, of which he had the opportunity of learning some particulars during a recent tour. The Charlottenburg Reservoir of the Berlin Waterworks, with a capacity of 5,000,000 gallons, was built of brick, with walls sufficiently thick to resist the internal pressure of the water; the soil was fine loose sand, on which bitumenised paper was spread before laying down the concrete foundations. The Berlin filter-beds were covered with Bohemian vaulting, the foundation of which rested on gravel puddle. The reservoir at Breslau, capable of containing 900,000 gallons, was supported on a tower 130ft. high, and the tower contained the pumping engines. The author then described one of the Vienna reservoirs, and furnished some notes on the aqueduct which supplied that city. The waterworks of the city of Munich, which were in course of construction at the time of his visit, comprised a reservoir having a capacity of 8,800,000 gallons; the walls and floor were of concrete, the vaulting was semicircular, built with one ring of brick. The author gave a sketch of the Frankfort Reservoir and some notes as to the water supply of the city. The reservoir and works of the Darmstadt Waterworks were noticed; the reservoir was of brick, built above ground; it was capable of containing 900,000 gallons; the water was pumped from six tube wells, sunk in the sandy plain between the Odenwald mountains and the Rhine at Griesheim, about five miles from the city. The reservoir at Cologne, which consisted of a cast iron tank, with a capacity of 800,000 gallons, was erected on a tower 100ft. high; the water supplied to the city was pumped from wells on the banks of the Rhine; but the spring-water was quite distinct from the Rhine water. The Dresden Reservoir was capable of holding 4,600,000 gallons of water. The Hanover Reservoir, with a capacity of 2,400,000 gallons, was of brick. It stood 30ft. above the ground-line, and the outside walls supported the full pressure of the water without the assistance of any embankment.

After some remarks on the marked preference of Germans for spring water as compared with lake water or river water, the author concluded the paper with a sketch of his idea of a model service reservoir. This was so arranged that the earth dug from the excavation was all utilised in forming the necessary embankment. The floor and the side walls were of concrete, the piers, arches, and vaulting of brick. The vaulting was similar to that of the Farnborough Reservoir; but the ends of the vault were brought down with a curve of 12ft. 6in. radius, till they rested on correspondingly curved bays in the concrete end walls. By this construction the thrust of the roof would be carried down to an abutment reaching against undisturbed ground, and the pressure of the water on the reservoir would not only be supported by the abutment, but be also counterbalanced by the weight of made-earth facing the embankment, which rested on the exterior arches of the reservoir, in addition to the pressure of the earth which would have to resist internal pressure if the walls were vertical. The author held that the whole of the interior surface should be rendered in cement mortar.

Liverpool Engineering Society.—The fourth meeting of the session was held on Wednesday, the 28th February, at the Royal Institution, Colquitt-street, Mr. F. Bramall in the chair, when a paper entitled "The Pittsburgh, McKeesport, and Youghiogheny Railroad," was read by Mr. M. E. Yeatman, M.A., Cantab., late assistant engineer. The extent of the line is fifty-six miles south-east from Pittsburgh, Pa., into the Connellsville coalfield. The method of procedure in an American railroad comprises charter of incorporation, survey or "preliminary line," levels, slope, and topography, "location," contract let in this case at prices per cube yard before completing the location, scale of prices for "grading," masonry, timber, and ironwork. The line was separated into divisions and sections, with a staff of divisional engineers taking cross sections for monthly estimates. The author then described the special features of the line, the alternative route between Pittsburgh and McKeesport, the covered way provided at the American Ironworks, the pile trestle work, the bridges, the Monongahela Viaduct and the Youghiogheny Bridge, and concluding with a description of the permanent way and a comparison of English and American railways. .....

with white metal was adopted. The plan is to "burn" them to the original length, thus leaving a considerable space to be filled with white metal, rebit in the rods, and then to bore out the white metal to the required size, leaving about $\frac{1}{64}$in. draw for wear. This plan has answered most admirably, as rods have rarely even to be taken down for closing until the engine is returned to the workshops for general repairs, which on an average is from sixteen to eighteen months for goods engines. Passenger engines remain out much longer. The wear in all cases is very trifling indeed. Thus, practically, a new set of brasses is produced at quite a fraction of the cost of the original ones, while the very material advantage of wearing much longer without closing is secured.

I will here leave, without remark, these figures to readers of THE ENGINEER in general, but to locomotive engineers in particular, to judge for themselves of the degree of success which has attended my efforts in the conducting of a railway brass foundry on the principles as herein advocated, with a view to true efficiency, economical maintenance and working of a railway company's engines. For these results I claim no special credit other than having availed myself of opportunities when presented, which enabled me to exercise a careful and constant watching, noting and studying of the working and results of the wear and tear of bearings, &c., of each class of engines, as well as peculiarities of individual engines for which I had to provide. This can only be accomplished by acquiring a practical knowledge of forces of the several thrusts and the distribution of weights upon axles by never resting satisfied with results, however satisfactory they may appear to be from time to time, but ever exercising a persevering desire to further reduce the cost of working and maintenance of the great mechanical civiliser—the locomotive engine.

In conclusion, I should say that my locomotive superintendent was a gentleman who possessed not only considerable abilities as a locomotive engineer, but one whose mind was always actuated in all his professional transactions and official duties by good foresight and common sense. From him I received every encouragement and assistance in pursuing my investigations and inquiries for results, and also for my general course of action in working the brass-foundry. To him, therefore, is due, and must be given, a very considerable amount of credit for results as herein enumerated. In all respect I would here venture to invite some one of the locomotive superintendents on large systems to reorganise his brass-foundry on the lines and principles which I have here endeavoured to set forth, and if so I do assure him that ere long he will have arrived at such a reduced cost of maintenance as will more than satisfy him for any trouble or expense incurred in carrying out the necessary alterations.

March 5th. FOUNDRYMAN.

[Our correspondent's letter deserves careful perusal. It certainly supplies some figures not generally accessible and extremely suggestive; as, for example, those concerning the durability of white metal liners. We may add that we are in possession of the name of the railway referred to, and the position held in the works of the company by our correspondent is sufficient to guarantee the accuracy of his statements.—ED. E.]

Analysis of Expenditure of Brass Slide Valves, Coupling Rod Brasses, Axle Brasses, and White Metal Excentric Strap Liners, from 1st January, 1873, to 31st March, 1879.

GOODS ENGINES.

Engine No.	Date of receipt from makers.	Slide valves. Date of first supply.	Number.	Date of second supply.	Number.	Date of third supply.	Number.	Total pairs.	Coupling rod brasses. Date of first supply.	Number in pairs.	Date of second supply.	Number in pairs.	Date of third supply.	Number in pairs.	Date of fourth supply.	Number in pairs.	Total sets.	Odd pairs.	Axle brasses. Date of first supply.	Number.	Date of second supply.	Number.	Date of third supply.	Number.	Date of fourth supply.	Number.	Date of fifth supply.	Number.	Total supply.	White metal excentric liners. Previous supply.	Last supply.
1	June, 1872	Nov. 13, 1874	2	July 4, 1876	2	Nov. 14, 1878	2	3	Sept. 16, 1873	6	July 4, 1876	6	—	—	—	—	2	—	Sept. 16, 1873	2	May 21, 1874	1	Nov. 15, 1874	2	July 4, 1876	2	Nov. 14, 1878	6	13	—	Furnished when new
4	June, 1872	Oct. 14, 1873	2	Dec. 15, 1875	2	May 29, 1878	1	2½	Oct. 14, 1873	6	Nov. 28, 1875	2	Mar. 29, 1879	6	—	—	2	2	Sept. 18, 1874	4	Mar. 29, 1879	6	—	—	—	—	—	—	10	—	Ditto
6	July, 1873	Aug. 21, 1875	2	—	—	—	—	1	Jan. 13, 1877	6	—	—	—	—	—	—	1	—	Aug. 21, 1875	4	Jan. 13, 1877	6	—	—	—	—	—	—	10	—	Ditto
10	Aug., 1873	Aug. 5, 1876	2	—	—	—	—	1	Jan. 30, 1875	6	—	—	—	—	—	—	1	—	June 30, 1875	2	Oct. 4, 1878	6	—	—	—	—	—	—	8	—	Ditto
11	Dec., 1861	Oct. 29, 1874	2	—	—	—	—	1	May 3, 1873	3	Oct. 29, 1874	3	May 2, 1876	6	Feb. 29, 1879	6	3	—	Dec. 30, 1873	2	Dec. 27, 1874	2	May 2, 1876	2	Feb. 20, 1879	2	—	—	8	—	Feb. 20, 1866
12	Dec., 1861	Dec. 30, 1873	1	April 13, 1876	2	—	—	1½	April 13, 1876	6	—	—	—	—	—	—	1	—	April 13, 1876	2	Nov. 15, 1878	4	—	—	—	—	—	—	6	—	June 4, 1866
13	Feb., 1875	July 14, 1877	2	—	—	—	—	1	July 14, 1877	6	—	—	—	—	—	—	1	—	—	—	July 14, 1877	6	—	—	—	—	—	—	6	—	Furnished when new
14	Mar., 1878	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*Brass when new	—
15	Feb., 1878	Feb. 25, 1879	2	—	—	—	—	1	Feb. 25, 1879	2	—	—	—	—	—	—	—	2	Feb. 25, 1879	1	—	—	—	—	—	—	—	—	1	Ditto	—
19	Nov., 1862	Oct. 21, 1875	1	Feb. 16, 1878	2	—	—	1½	July 14, 1875	6	Feb. 16, 1878	6	—	—	—	—	2	—	July 14, 1875	2	Feb. 7, 1878	2	—	—	—	—	—	—	4	Sometime previous to 1866	Feb. 1, 1868
26	Feb., 1863	June 26, 1875	2	Oct. 18, 1876	2	Aug. 3, 1877	1	2½	Aug. 18, 1876	6	Aug. 31, 1878	6	—	—	—	—	2	—	June 26, 1875	2	Oct. 18, 1876	6	—	—	—	—	—	—	8	Ditto	Dec. 30, 1368
27	Feb., 1863	May 24, 1877	1	—	—	—	—	0½	April 4, 1873	6	May 24, 1877	6	—	—	—	—	2	—	April 4, 1873	2	July 30, 1874	1	May 24, 1877	2	—	—	—	—	5	Ditto	July 23, 1866
34	May, 1863	Jan. 25, 1875	2	—	—	—	—	1	Aug. 19, 1876	6	—	—	—	—	—	—	1	—	Feb. 21, 1874	6	Aug. 19, 1876	6	May 11, 1877	1	—	—	—	—	13	Ditto	Aug. 19, 1876
35	May, 1863	Jan. 18, 1875	2	—	—	—	—	1	Jan. 18, 1875	6	May 25, 1876	6	July 19, 1878	6	—	—	3	—	Jan. 18, 1875	2	Sept. 28, 1877	4	July 19, 1878	2	—	—	—	—	8	Ditto	Dec. 21, 1867
39	June, 1863	July 17, 1873	2	Oct. 25, 1875	2	—	—	2	July 11, 1873	6	Oct. 25, 1875	6	—	—	—	—	2	—	June 3, 1874	2	—	—	—	—	—	—	—	—	2	Dec. 17, 1870	Oct. 25, 1875
40	June, 1863	Sept. 6, 1874	2	—	—	—	—	1	April 25, 1875	6	Aug. 29, 1876	6	—	—	—	—	2	—	Sept. 6, 1874	2	Mar. 25, 1875	4	Aug. 29, 1876	6	—	—	—	—	12	Sept. 12, 1867	Aug. 29, 1876
45	Aug., 1864	Oct. 2, 1874	2	Jan. 6, 1879	2	—	—	2	Oct. 2, 1874	6	May 2, 1878	2	—	—	—	—	1	2	May 15, 1873	2	Oct. 31, 1876	6	—	—	—	—	—	—	8	April 14, 1866	Oct. 9, 1874
46	Aug., 1864	Jan. 5, 1875	2	July 16, 1877	2	—	—	2	July 16, 1877	6	—	—	—	—	—	—	1	—	Oct. 2, 1873	2	—	—	—	—	—	—	—	—	2	April 23, 1868	July 16, 1877
51	April, 1865	June 5, 1876	2	—	—	—	—	1	Oct. 9, 1878	6	—	—	—	—	—	—	1	—	June 5, 1876	2	—	—	—	—	—	—	—	—	2	Supposed brass when new	May 5, 1866
52	May, 1865	May 21, 1874	2	May 8, 1877	1	Mar. 19, 1878	1	2	May 8, 1877	6	—	—	—	—	—	—	1	—	May 21, 1874	4	May 8, 1877	6	—	—	—	—	—	—	10	Ditto	May 31, 1866
			35		17		5	28½		107		49		18		6	30	3		45		66		15		4		6	136		

With nineteen working engines, these figures represent an average wear of one pair of slide valves for every four years.

The average wear, as per these figures, is about one set every four years, consisting of six, as for six-wheel coupled engines.

According to these figures the average for eighteen engines is about one set, consisting of six brasses, for every five years.

* No. 14. Brass liners removed 17th May, 1882; white metal substituted. No. 15. Ditto, 22nd July, 1880.

Analysis of the Expenditure of Brass Slide Valves, Coupling Rod Brasses, Axle Brasses, and White Metal Excentric Strap Liners, from 1st January, 1873, to 31st March, 1879.

PASSENGER ENGINES.

Engine No.	Date of receipt from makers.	Slide valves. Date of first supply.	Number.	Date of second supply.	Number.	Total in pairs.	Coupling rod brasses. Date of first supply.	Number in pairs.	Date of second supply.	Number in pairs.	Total in sets.	Axle brasses. Date of first supply.	Number.	Date of second supply.	Number.	Date of third supply.	Number.	Total number of brasses.	White metal excentric strap liners. Engines now in shops, with date of entry.	Previous supply.	Last supply.
16	Aug., 1878	nil	—	—	—	—	nil	—	—	—	—	nil	—	—	—	—	—	—	Nov. 8, 1878*	Furnished when new	
17	Aug., 1878	nil	—	—	—	—	nil	—	—	—	—	nil	—	—	—	—	—	—	†	Ditto	
28	Mar., 1863	Aug. 22, 1877	2	—	—	1	Jan. 20, 1873	4	Aug. 27, 1875	4	2	Jan. 20, 1873	6	Aug. 27, 1875	6	Aug. 19, 1878	2	14	—	Supposed to be brass when new	Dec. 21, 1866
29	Mar., 1863	Aug. 15, 1874	2	—	—	1	Aug. 15, 1874	4	Sept. 30, 1876	4	2	Aug. 15, 1874	4	July 20, 1875	4	Sept. 30, 1876	2	10	—	Ditto	June 5, 1866
30	Mar., 1863	May 10, 1875	2	—	—	1	May 10, 1875	4	June 14, 1878	4	2	Dec. 19, 1873	4	Mar. 10, 1875	4	June 14, 1878	2	10	—	Sometime previous to 1866	May 14, 1872
31	Mar., 1863	Jan. 18, 1877	2	—	—	1	Jan. 18, 1877	4	—	—	1	Aug. 21, 1873	4	Feb. 21, 1879	4	—	—	8	—	Ditto	May 24, 1867
41	Mar., 1864	Dec. 9, 1874	2	—	—	1	Nov. 30, 1876	4	—	—	1	Nov. 30, 1876	6	—	—	—	—	6	Feb. 21, 1879	Ditto	Jan. 20, 1868
42	Mar., 1864	Dec. 12, 1873	2	Feb. 2, 1878	1	1½	Dec. 12, 1873	4	Feb. 2, 1878	4	2	Dec. 12, 1873	4	Sept. 11, 1875	4	Feb. 2, 1878	4	12	—	Ditto	July 3, 1868
43	Mar., 1864	Mar. 18, 1875	1	—	—	0½	Mar. 18, 1875	4	May 18, 1878	4	2	July 19, 1876	2	May 13, 1878	6	—	—	8	—	Ditto	Mar. 19, 1868
44	Mar., 1864	May 3, 1877	2	—	—	1	May 3, 1877	4	—	—	1	Oct. 19, 1875	6	May 3, 1877	4	—	—	10	May 24, 1878	Ditto	Nov. 12, 1867
53	Oct., 1865	May 7, 1874	2	Jan. 10, 1877	—	1½	Jan. 10, 1877	4	—	—	1	May 7, 1874	4	Jan. 10, 1877	4	Nov. 21, 1878	2	10	—	Ditto	Dec. 11, 1869
54	Oct., 1865	Feb. 6, 1874	2	Feb. 6, 1879	2	2	Feb. 6, 1874	4	Jan. 19, 1876	4	2	Jan. 19, 1876	2	Feb. 6, 1879	4	—	—	6	—	Ditto	July 30, 1867
55	Dec., 1865	April 5, 1877	2	—	—	1	April 5, 1877	4	—	—	1	Feb. 18, 1874	4	—	—	—	—	4	Sept. 19, 1878	Ditto	April 14, 1869
56	Dec., 1865	Sept. 28, 1878	2	—	—	1	Feb. 19, 1876	4	—	—	1	Feb. 19, 1876	6	Sept. 20, 1878	4	—	—	10	—	Ditto	Aug. 17, 1868
						13½		48		24	18		52		44		12	108			

Representing an average wear of one pair of slide valves every 5½ years.

Judging from notes taken from time to time, the average wear of passenger engine valves has been found to be considerably below $\frac{1}{4}$in. per working year; and when averaged with goods engines, it is somewhat below $\frac{1}{4}$in. per working year.

All the above-named dates have reference to time of leaving works after having undergone general repairs.

Representing an average of one set of coupling rod brasses every four years.

Representing an average wear of one set (six brasses) of axle brasses every four years.

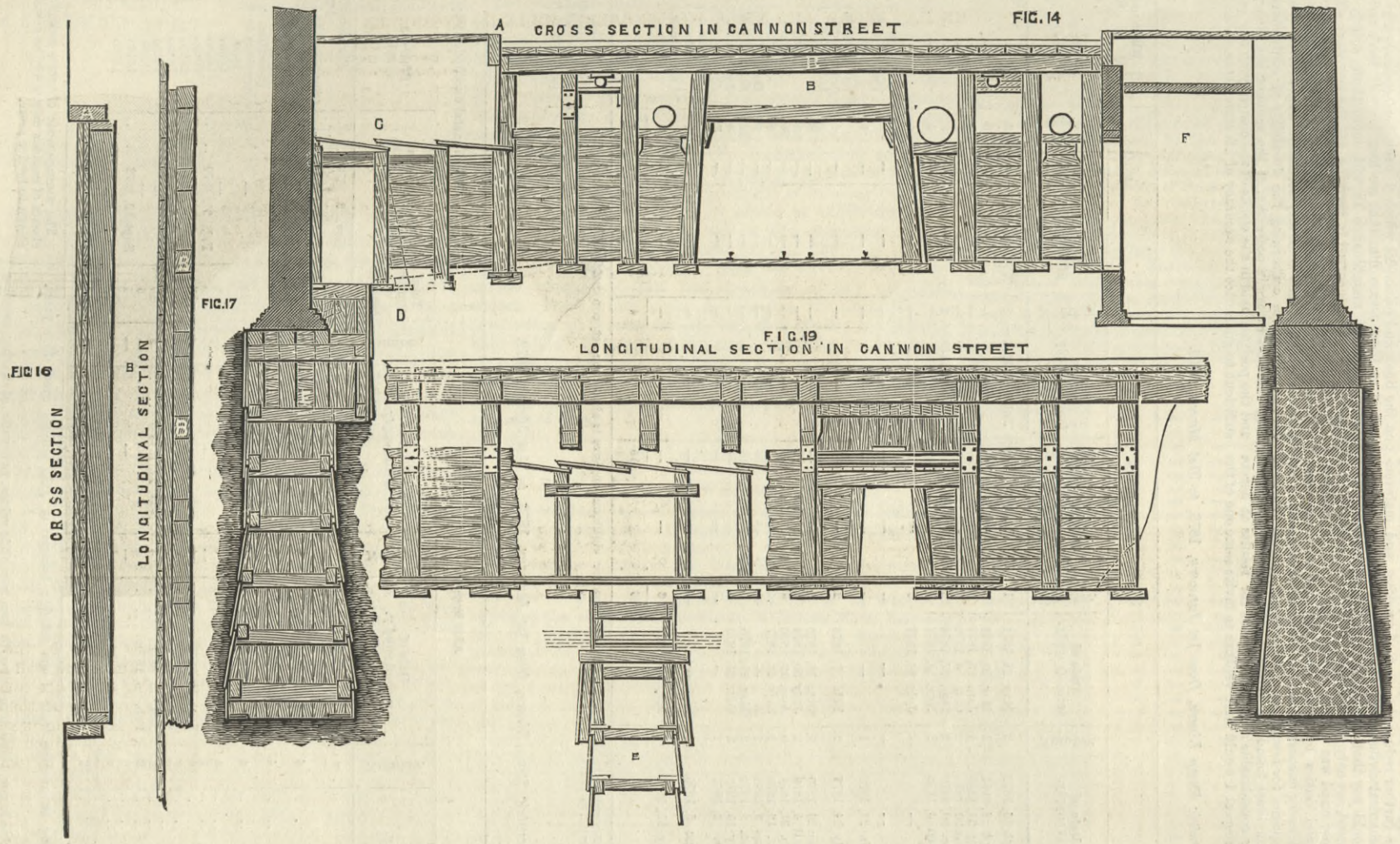
* This engine is now being supplied with two new slide valves, two pairs of driving coupling rod brasses, one driving axle brass, one small end connecting rod brass, and one tender axle brass. Has received slight repairs on two previous occasions.

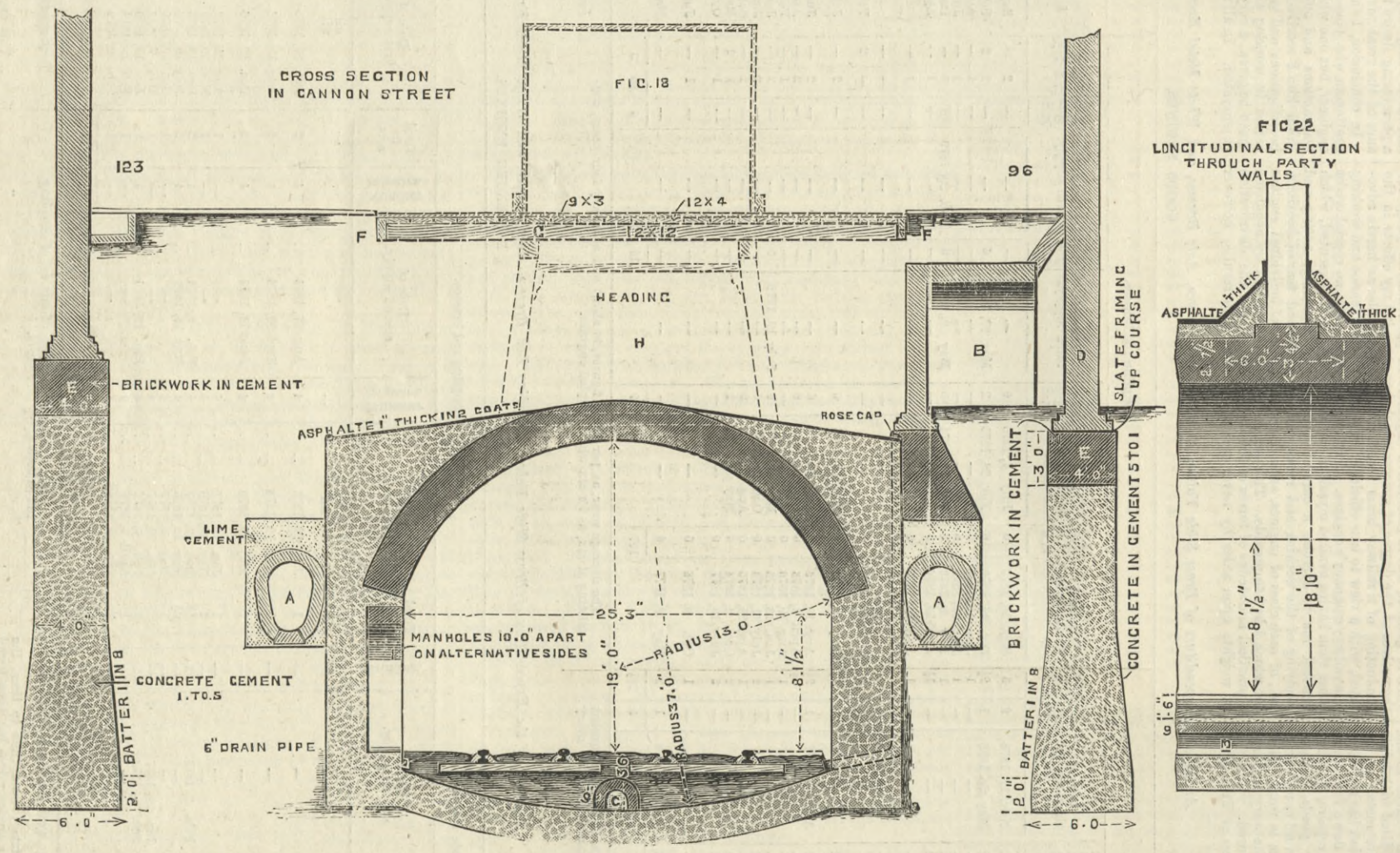
† This engine has undergone slight repairs twice.

The average wear of white metal liners for both classes of engines may safely be assumed to be from eleven to twelve years.

THE INNER CIRCLE COMPLETION RAILWAY.—MANSION HOUSE TO TOWER HILL SECTION.

SIR JOHN HAWKSHAW AND MR. J. WOLFE BARRY, MM.I.C.E., ENGINEERS.





THE INNER CIRCLE COMPLETION RAILWAY.

No. II.

In our impression of the 2nd inst. we gave some account of that part of the Inner Circle Completion link, and commenced a description of some of the work on that part which runs from Mansion House Station of the District Railway to Tower Hill, and which is being constructed by the joint committee of the Metropolitan and of the District Railway Companies.

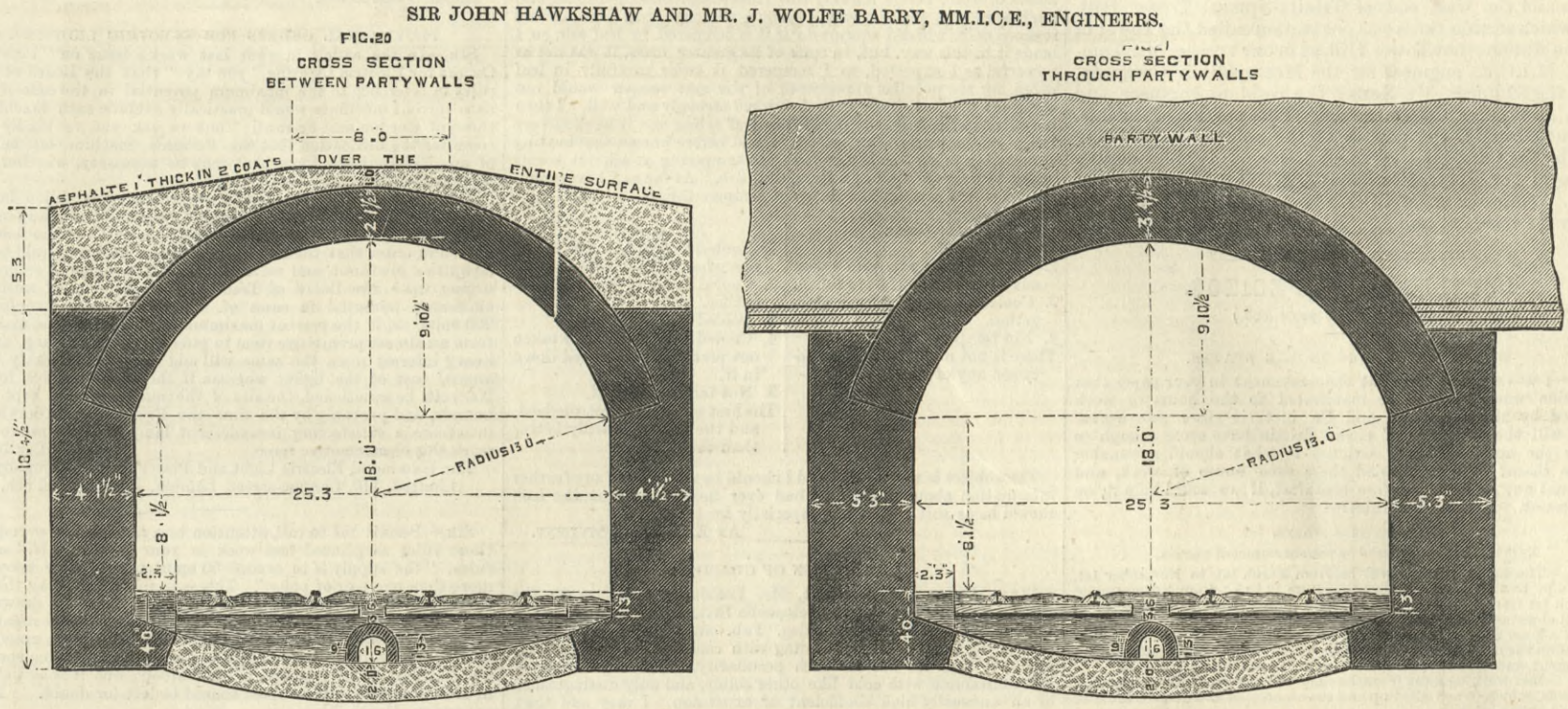
Passing from the Mansion House by a 10-chain curve and under Queen-street, the line next runs under Cloak-lane, along the south side of which the houses are all being removed, including the Cutlers' Hall—at F on map—while those on the north side are underpinned, and supported on a concrete wall. The Cutlers' Hall will have to be rebuilt by the joint committee. Near this the line crosses the site of the Wall brook, which was long since diverted, and the gravelly clay under what was its bed, at about 35ft. below the surface, was found to be very wet, but there was but a very small quantity of free water.

At this part the line runs under the graveyard of St. John the Baptist. Here the contents of a large number of coffins have been put into large boxes and placed in a specially constructed arched vault, will now be sealed up. When making the excavation along under Cloak-lane a considerable number of Roman pottery remains were found at about 18ft. below the surface. A curious old pocket comb was found at about the same level, the comb and its case being of ivory or bone, now of a dark brown-green colour. What seems to have been a gold pin, about 6in. in length, was found under St. John the Baptist churchyard, at a depth of about 25ft. and underneath some pieces of Roman pottery. Many other things have been found at similar distances below the surface, and it seems as if London had continued to flourish under ancient rules and management, it would be only a question of time for its site to have become a considerable hill.

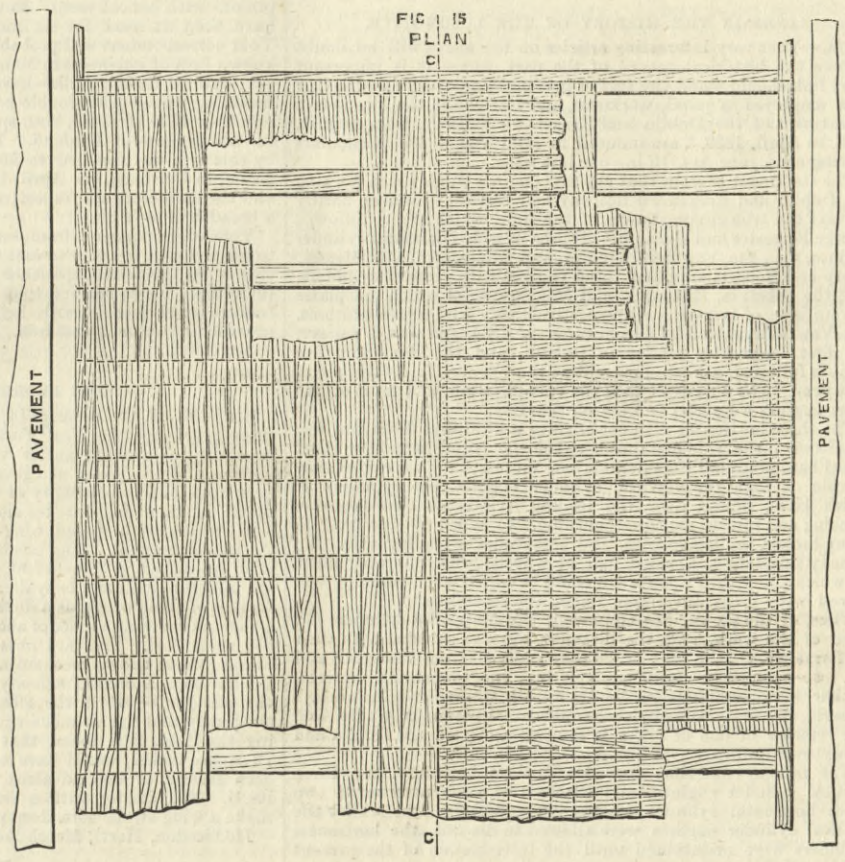
In crossing over the upper part of Dowgate-hill costly sewers and sewer diversions and alterations had to be effected. A 6ft. barrel main has been constructed of gault bricks and blue brick inverts. Into this two 4ft. cast iron sewers under the line deliver, the sewage from Hampstead being brought down here, and with that from Dowgate discharged into the low level sewer in Cannon-street, which acts as a storm overflow into the Thames. In front of Cannon-street South-Eastern station will be the new Cannon-street station, about 1000ft. from the Mansion House station. The position of the entrances will be in Cannon-street and Dowgate-hill. The construction of the station will make it necessary to carry a part of the forecourt of the South-Eastern station and part of the street and pavement on girders. In front of this station may now be seen the hoarding which covers the entrance to the Cannon-street cutting and heading. From St. Swithin's-lane to the statue of King William the line runs under the centre of Cannon-street, and the houses on either side have had to be underpinned and supported on struts and needles during the construction of the concrete walls which have been built under them, in some cases under cellars two stories below ground. The heading and the sewers along this street are now considerably advanced. Our illustrations on page 188 show two views in this heading taken from the same spot, but in different directions. The one—Fig. 12—shows the cutting as made close under the houses after the underpinning is done, for the side sewers by which the main sewer

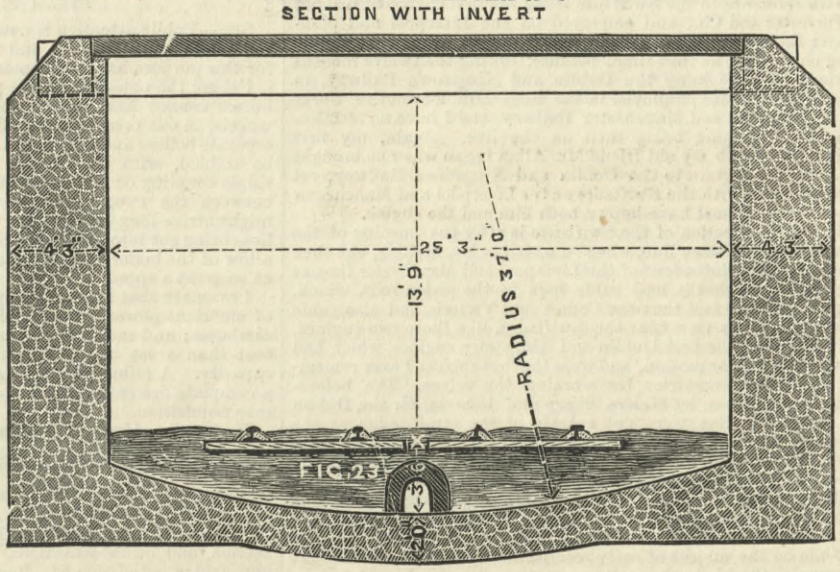
THE INNER CIRCLE COMPLETION RAILWAY.—MANSION HOUSE TO TOWER HILL SECTION.

SIR JOHN HAWKSHAW AND MR. J. WOLFE BARRY, MM.I.C.E., ENGINEERS.



along Cannon-street will be replaced, while the other—Fig. 13—is a view of the central heading with the tunnel arch below. To make these intelligible we must here describe Fig. 14, which is a section across the street, showing the timbering used and the method by which the whole of the buildings along both sides of Cannon-street, from the South-Eastern Station to King William's statue, have safely had their foundations dug from beneath them. On the left-hand side of the figure is seen the wall completed under a house, the wall consisting of concrete capped with about 3ft. of brickwork. On the other side is seen the house wall with the timbering as constructed or inserted under short lengths of the wall to be supported. By means of this engraving the method of procedure may be explained. Firstly, the longitudinal deals A—shown in section along by the gutters—are put in, then the whole baulks B are sunk across the roadway. Upon these are laid 9in. by 4in. deals longitudinally, crossed by 12in. by 3in. deals. The roadway of wood is thus made as shown in the plan and sections, Figs. 15, 16, 17. When this roadway is made excavation is commenced at a shaft some ten feet deep, as shown in dotted lines in Fig. 18. A heading is then made, as shown in Fig. 14, the bottom of which is about the level of the crown of the tunnel, the wood road flooring being supported by timbers as shown. When this is done, or as it proceeds, side drifts are made, so as to get at the side walls of the houses, some of which have cellars under the pavement, as shown at B, Fig. 18, or at Fig. 14, and some have not, as shown in the same figures, but on the opposite sides. At C, Fig. 14, it will be seen that a side drift is made to the main wall of the house. These drifts are run within a few feet of each other, the roof being supported by timberings, as shown also at Fig. 19, which is a section along the main heading. Excavations from 4ft. to 5ft. wide are then made, as shown at D., Fig. 14, close to the house wall footings, but of sufficient depth below them to enable men to proceed by cutting away a width of from 4ft. to 5ft. of the concrete below the house wall footings, and then descending to the level of the bottom of the tunnel side walls in the manner shown at E—Figs. 14 and 19. These excavations are then filled with concrete with the exception of the upper 3ft., which is of brickwork in cement, made good to the house wall footings with slates and cement. When these columnar walls are finished, the earth between them is excavated, and the concrete underpinning wall made complete by filling the spaces. If it had not been necessary to construct the two sewers A A—Fig. 14—to take the place of a large central sewer, it would have been possible to construct the tunnel without underpinning these walls, but it would then have been necessary to make the tunnel stronger, while the buildings would not have been so free from the settlements which would in all probability take place if the tunnel were so constructed. When cellars have to be supported as at F—Fig. 14—and B—Fig. 18—they are carried for the time on 12in. balk needles passed through holes through the outer walls, resting on timbers on the floor of the side drift, and in some cases on the main wall to be supported. The positions of a large gas main, a smaller main, and a water main, are shown at Fig. 18. When the sewers A are completed, walls are carried up over them to support the cellar walls, the needles carrying the cellar walls being, in the meantime, supported on portions of the tunnel side wall and the house wall. After the underpinning walls are completed the heading H is increased in size, to allow of the formation of the tunnel, the sides and invert being in concrete five to one, as well as that above the arch, which is afterwards covered with 1in. of asphalte, put on in two coats. In some parts this underpinning of Cannon-street has been a very difficult work, as, for instance, where it became necessary at the corner of Nicholas-lane to pin up a heavy towered corner of a house with two cellars below ground surface, the height about the corner being great, while the slightest deflection or settlement would have caused destruction or very serious damage to a costly structure. In some cases it has been necessary to have a very thick wall of brickwork in cement, and in these cases, as shown in Fig. 20, and again where party-walls cross the tunnel, both the brick arch and the side walls are increased in thickness, as shown at Figs. 21 and 22. To secure efficient drainage from the top of the tunnel, pipes with rose-capped tops are built in, as shown in Fig. 18.





From the end of Cannon-street the line runs under the King William statue, and by Pudding-lane, by a twelve-chain curve, and thence down Eastcheap and Great Tower-streets. The whole of the houses on the north side of the streets have to be taken down, as these streets are to be increased to 60ft. in width, making a fine thoroughfare in a very busy place, and between the Tower Hill station and the station which will be built at the top of the site of the block of buildings now existing between Fish-street-hill and King William-street. It is towards the construction of this street that the Corporation have, after so much delay, offered to contribute about one-half the cost of purchasing and removing the buildings, or £500,000. Between Fish-street-hill and Pudding-lane is the St. Leonard's Churchyard, which has been dug out and the bones removed. Here the cutting will remain permanently open, and will have the form shown at Fig. 23. At the north-east corner of Fishstreet-hill the removal of houses on the south of Eastcheap commences, and continues to Idol-lane, where the widening crosses over to and commences on the north side. A little east of this 125ft. of the tunnel is completed, and the surface ready for the rebuilding of houses. At Water-lane, as at Bush-lane, the main sewer had to be lowered, that of Water-lane being carried under the line with an oval sewer 4ft. 6in. by 2ft. 9in. in gault bricks and cement and stoneware inverts. Thus, Seething-lane is reached, where work is commenced, and where the station on the west side of Trinity-square will be constructed.

In passing under the King William statue, the statue will have to be supported and the foundations cut away. For this purpose a strong wood collar made of balks and bolts will be fixed under the upper part of the column on which the statue rests. Under this a number of raking struts will be fixed, the struts being fixed to longitudinal balks, and all bolted together. With this done, the statue cannot fall if any mishap did take place with the lower part of the pedestal, which might easily be, for it rests upon a bed of material supposed to be concrete, but which is really only road metal discoloured with lime or cement. It is quite easily friable. In making the arch under this it is proposed to cut a piece out through the centre of the statue's foundation, and build a brick arch of this width resting on the side walls of the tunnel. When this is built in and the upper part made good with the bottom of the statue pedestal, then the two sides will be removed and the arch increased in width on each side of that built.

Along the whole of Cannon-street, it may be pointed out, there is now an excellent opportunity for making a subway for gas and other mains and electric conductors very cheaply. The heading above the tunnel is excavated, and will, if not so utilised, be filled up.

One or two slight errors appeared in our last impression which we correct here. The Act was obtained in 1879, and was called the "City Lines and Extensions," Sir John Hawkshaw and Mr. J. Wolf Barry being the engineers. The Bill was obtained in the joint names of the Metropolitan and District Railways. By an arrangement

between the two companies the Metropolitan Railway Company made that portion lying between the Aldgate station and the west end of Trinity-square, Tower Hill, upon which section there was one station called the Tower of London station; not Tower Hill, as in our article, Mr. Tomlinson, M.I.C.E., engineer for the Metropolitan Company, being the engineer, Mr. Seaton the resident engineer, and Mr. T. A. Walker, the contractor. This portion of the line, constructed under the powers of the same Act, is being made by the joint lines of the District and Metropolitan Railways, Sir John Hawkshaw, F.R.S., M.I.C.E., and Mr. J. Wolfe Barry, M.I.C.E., being the engineers, Mr. Seaton the resident, and Mr. T. A. Walker the contractor.

LETTERS TO THE EDITOR.

(*Continued from page* 183.)

WAGES AND HOURS IN THE STATES.

Sir,—I was rather amused at the statement in your paper that opposition was likely to be manifested to the hours of work proposed by Messrs. Sterne and Co. in their gas-engine works. When will the workmen of Great Britain have sense enough to confine the action of their societies to what should reasonably concern them? We have tried these same hours of work, and would not now turn out before breakfast, if we could help it, on any account. Here are our rules:—

SILVER IRON WORKS.

Regulations to be observed by persons employed therein.

No. 1.—The hours of work will be, from March 1st to November 1st, from 7 a.m to 6 p.m., with dinner time from 12 to 1; from November 1st to March 1st from 7.30 a.m. to 6 p.m., with dinner time from 12.30 to 1; but will close on Saturdays at 4 p.m.

No. 2.—Each man working in the shops will charge his time daily, as directed on the cards furnished, have them approved by the foreman of his department, and deposit them every evening in the place provided.

No. 3.—Men working away from the shop will be furnished with weekly time cards, which, when filled up and countersigned as directed, must be delivered at the office.

No. 4.—In the matter of wages the proprietors will be considered to have made their own arrangements with each man individually, and no regulations of any society will be regarded in the management of the business.

No. 5.—The wages for each month will be paid on the 15th of the month following, and the proprietors will not be responsible to any person for the payment before that time.

No. 6.—Payments will be made in cash as far as practicable; but, when it is necessary in taking work to accept other kinds of pay, all persons working here will be expected to take such share thereof as may be offered.

No. 7.—Boys are expected to be treated by the men in such a manner as to gain their respect, and they are expected to treat the men with that deference and respect to which, by their age and position, they are entitled; and on no account will any insolent language or behaviour be tolerated.

No. 8.—Every man must clean down his bench or lathe and put all the tools used by him away in their places at night before leaving; and, when a lathe or other tool is not constantly in use, the one using it last during the day is to clean it at night.

No. 9.—The standard rules and gauges furnished by the shop are the only ones allowed to be used in the final fitting of work, and it is expected that every one on taking a piece of material or unfinished work, will see that it will fill all requirements before commencing to work at it.

No. 10.—All work is to be made absolutely according to the drawings or instructions furnished; and if any mistake or breakage occurs, the person making the same will be charged with the amount required to make it right, including casting or forging, if such be necessary.

No. 11.—No tools are to be altered without the permission of the superintendent, under any circumstances whatever.

No. 12.—Anyone breaking or damaging tools, unless clearly unavoidable, will be charged with the amount of such damage.

No. 13.—No smoking allowed at any time in or about the premises, nor will any liquor be allowed therein except when required in case of sickness.

No. 14—Anyone fighting, or using profane or obscene language will be immediately dismissed.

Anyone accepting work in this establishment will be considered as fully assenting to the above in the letter and spirit thereof.

Wm. J. Silver,
Superintendent.

No.

SILVER IRON WORKS.

Outdoor Time Card for .....No.....
Working on.....
At .....
For the week ending.....188

This card must be filled up by the person whose name it bears, and properly countersigned as below.

All writing to be in ink, and no erasures.

Sunday ...., ...
Monday ...., ...
Tuesday ...., ...
Wednesday..... ....., ...
Thursday ...., ...
Friday ...., ...
Saturday..... ....., ...
Total Hours,

Signed by
.....in charge for Silver Ironworks.
.....in charge for
....

Let an English workman work in the Eastern States and travel on West to the Pacific and the mining regions, working wherever he can, and he would no more be trammelled by a society than he would willingly become a subject of the Czar of Russia. Take my advice, gentlemen, and try the new *régime*. If you don't like it leave it, but no strikes or hindrance to others; and I dare risk that eventually there will be found a superior class of men working in that shop, especially if they will cut loose from such societies, and each one get all the pay and position that his abilities will entitle him to obtain. I was interested in the great strikes of the Amalgamated Engineers, &c., and then came to the conclusion that a man in such a society was a good deal nearer a serf than the average Englishman would like to acknowledge. Fancy another workman dictating to me how much wages I should get and how long I should work, it would be a new feature to us here, and not a very acceptable one. Wm. J. Silver.

Silver Ironworks, Salt Lake City, U.S.,
February 5th.

CORES AND ARMATURES FOR ELECTRO-MAGNETS.

Sir,—Would any of your readers who are electricians kindly give me some information as to the effect of tempering the metal of the cores and armatures of electro-magnets? My experience tends to show that the temper of the armature is very important, while that of the core of the electro-magnet, provided it be of good soft iron, matters little; exactly the reverse of what I had expected. I have on several occasions tempered one of a pair of similar cores after they came from the smith by heating to a medium red, and then burying in leaf ashes, also by heating and cooling in the air; if left in the ashes till quite cool I do not find any improvement, if taken out in a few minutes, while still too hot to touch, and cooled down in the air, it is a little better; when heated and cooled in the air altogether, it seems a little better still, but all these differences are very slight, and may be accidental.

With armatures the case seems different. I have been working with a small lever drawn over by an electro-magnet, said lever being cut out of common sheet iron about $\frac{1}{16}$in. thick, with the end folded down on itself to increase the mass of the armature opposite the electro-magnet, but the temper of the metal was so poor that it would hardly bend more than 90 deg. cold, so by successive heatings, bending it over a little each time, I at last hammered it down flat—I will call it No. 1; it worked weakly and seemed deficient in mass, so I made another, No. 2, folded so as to get three thicknesses of iron; before making this I had learnt that by heating and burying in salt, the iron would become so tough that I could fold it down cold, which I cannot do if it is tempered in leaf ash, so I made it in this way, but, in spite of its greater mass, it was not as powerful as I expected, so I tempered it twice carefully in leaf ashes, for the peculiar appearance of the salt temper would not come out the first time; it then worked strongly and well. I then took No. 1 armature, tempered it in leaf ashes, and it worked very fairly—much better than before. I had before known that heating and cooling in air was better than not tempering at all. It seems better to heat the iron in a slow, dull fire. As far as I have gone, then, I would arrange the different tempers thus:—

For Cores.	*For Armatures.*
1. Cooled in air.	1. Cooled in leaf ash and taken out when still too hot to touch.
2. Cooled in leaf ash, and taken out when still too hot to touch.	2. Cooled down in leaf ash altogether.
3. Cooled down in leaf ash altogether.	3. Cooled in air.
4. Not tempered at all.	4. Cooled in salt, whether taken out pretty hot or cooled down in it.
There is not much difference between any of these.	5. Not tempered at all.
	The first two seem much the best, and the third decidedly better than the last two.

The subject is new to me, and I should be very glad of any further information about it, for all I had ever heard was that the iron should be as soft as possible, especially for cores.

An Electrical Student.

THE MOTION OF GLACIERS.

Sir,—If your correspondent, Mr. Lockhart, will turn to the article on ice in the new "Encyclopædia Britannica," he will see that although water between 39 deg. Fah. and 32 deg. Fah. does reverse the usual order, expanding with cold and contracting with heat, yet that ice has no such peculiarity, expanding with heat and contracting with cold like other solids, and only distinguished by an unusually high coefficient of expansion. I may add that, since my paper was published, my attention has been called to the measurements of the great Jacob's haven glacier in Greenland by Prof. Holland. This glacier, though in so high a latitude and lying at a very slight angle, moves more rapidly than any glacier yet measured, a fact very difficult to explain on the theory of simple gravitation. Walter R. Browne.

Feb. 27th.

LINKS IN THE HISTORY OF THE LOCOMOTIVE.

Sir,—Your very interesting articles on the above will no doubt become the historical record of the past, hence it is important every link should stand the test of personal knowledge; and having been employed as pupil, workman, and foreman in the locomotive department of the Dublin and Kingstown Railway, from August, 1834, to April, 1839, I am induced to send you a few particulars bearing upon your Art. 13 in your last issue.

The statement therein that the first engines employed in working the Dublin and Kingstown Railway had vertical cylinders, hardly conveys the true circumstances of the time, which are as follows: George Forrester and Co. supplied three outside horizontal cylinder engines, viz., the Vauxhall, Dublin, and Kingstown, and Messrs. Sharp and Roberts supplied three engines with vertical cylinders, viz., the Hibernia, Britannia, and Manchester, of which the plates in your issue of last week are respectively very good representations. The Vauxhall arrived in the autumn of 1834, and was, I believe, the first locomotive landed in Ireland, and the remaining five engines followed, all being present at the opening in December of that year. The Vauxhall took the opening train, and most of the other engines were also at work on that day.

The three horizontal cylinder engines were always the favourites, as, although the wide distance between the cylinders and the short wheel base produced considerable side motion, they were more easy to ride on than the vertical cylinder engines, the cylinders of which being placed over the leading axle caused an excessive pitching and rolling motion—churning, we called it—resulting in many broken leading springs, and sometimes a leading axle. To remedy this defect, a third pair of wheels, with an arrangement by which the weight upon them could be varied when running, was placed with great advantage under the foot-plate.

Thus, of the six engines employed, the horizontal cylinders did most of the work, and the directors were so satisfied with their performance, that in 1835 or '36 they ordered from Forrester and Co. two—not three—tank engines, viz., the Comet and Victoria, similar in general design, but with six wheels, which were, I believe, the first tank engines employed on passenger traffic, and the remains of one of them is now at work on the Dublin and Kingstown Railway.

The railway was thus opened with three horizontal and three vertical cylinder engines, and within two years afterwards two more horizontal cylinder engines were added; and whilst the vertical cylinder engines were allowed to die out, the horizontal cylinders were maintained until the introduction of the present inside cylinder engines.

With reference to the Swiftsure being the first engine turned out by Forrester and Co., and employed on the Liverpool and Manchester Railway in 1834, I have strong doubts about that engine being on the line at that time, because, during the twelve months previous to my joining the Dublin and Kingstown Railway, in August, 1834, I was employed in the Edge Hill locomotive works of the Liverpool and Manchester Railway, and I have no recollection of the engine being then on the line. Again, my first acquaintance with my old friend Mr. Allan began when he brought the Forrester engines to the Dublin and Kingstown Railway, yet if he had been with the Swiftsure on the Liverpool and Manchester lines in 1834, I must have known both him and the engine.

My first recollection of the Swiftsure is after the opening of the Dublin and Kingstown line, when on a visit to Mr. Melling, the then locomotive superintendent of the Liverpool and Manchester line, at Edge Hill, and that it had guide bars to the piston-rods, which, coupled with the fact that the Comet and Victoria had also guide bars, confirms my view that the Swiftsure, like those two engines, was made after the first Dublin and Kingstown engines, which had the vibrating pillar motion, and were the first engines I ever remember with four excentrics for working the valves. The before-mentioned engines, by Messrs. Sharp and Roberts, for the Dublin and Kingstown line, were not exactly of the same design as the Experiment, inasmuch as though both had vertical cylinders, those of the Experiment were placed between the leading and driving wheels, and the bell cranks were pivotted in front of the cylinders, whilst, as is seen in your plate, the Dublin and Kingstown engine cylinders were placed over the leading axle and the bell cranks pivotted in their rear.

While on the subject of early recollections, permit me to correct an error in Clark's work on "Locomotives," p. 10, Fig. 11, where "Forrester's locomotive, 1834," is represented as like those of the Dublin and Kingstown Railway. A comparison of the plate in your last issue with Fig. 11 in Clark's work shows a wide difference. The axle guards and frame of the latter are bolted together and the excentric rods are vertical, whereas in the Dublin and Kingstown engines the axle guards and frames were solid and the excentric rods were horizontal. The design of the wrought iron frame of the Dublin and Kingstown engines was so superior to the compositions of wood and iron by Stephenson and others that I would willingly, if I could, furnish you with the name of the designer. Probably Mr. Allan can do this, and also say if he had anything to do with the introduction of four excentrics to the same engines.

My recollection of the vertical excentric rods of Fig. 11 is that they were first applied to an engine by Forrester and Co. for the Grand Junction Railway a few years after 1834. Thos. Hunt.

London, March 3rd.

PROVISIONAL ORDERS FOR ELECTRIC LIGHTING.

Sir,—In the article in your last week's issue on "Provisional Orders for Electric Lighting," you say "that the Board of Trade rules in reference to the maximum potential in the case of alternate current machines would practically exclude such machines as those of Gordon and Ferranti;" but we ask you to kindly make room for the intimation that the Ferranti machine can be made of any electromotive force that may be necessary, whether it be 50, 200, or 2000 volts.

The writer of the article has however naturally fallen into the error from the fact that the machines which the company are now producing are of 150 and 200 volts; but this tension has been chosen in order that the important items of mains should be kept down to a low limit, and we are at present engaged in respectfully urging upon the Board of Trade the advisability of raising the maximum potential in cases of alternate current machines to 200 volts, as, if the present maximum is adhered to, the mains will form an almost prohibitive item in public electric lighting, and the heavy interest upon the same will add very considerably to the annual cost of the light; whereas if the electromotive force of 200 volts be sanctioned, the size of the mains can be kept within bounds, and probably by the time the Provisional Orders are put into force a satisfactory incandescent lamp will be produced to work this electromotive force. R. Hammond.

The Hammond Electric Light and Power Supply Company,
Limited, 110, Cannon-street, London, E.C., March 6th.

Sir,—Permit me to call attention to a remarkable oversight in these rules as printed last week in your pages. "If," say the rules, "the supply is to exceed 50 ampères it is to be taken from more than one pair of poles." This is as much as to say that "If the supply of water exceeds 500 gallons, it must be drawn from more than one tap." The error is that no time is mentioned. What are meant are coulombs, the coulomb being an ampère per second. It is quite true that when ampères are being spoken of by electricians, the coulomb is understood; but it is as well that in Acts of Parliament no room should be left for doubt. Lux.

London, March 7th.

WHEELS WITH HELICAL TEETH.

Sir,—In the report of your "Own Correspondent" on the trades of the Staffordshire district, I notice that he mentions as a novelty in engineering practice the fact that Messrs. Thomas Perry and Sons, engineers, of Bilston, "have succeeded in casting wheels and pinions with helical teeth" in iron, and that a pair of such wheels have been at work for six months at an ironworks in Cheshire. Your correspondent will probably be surprised to learn that a well-known firm of engineers in Manchester—Messrs. P. R. Jackson and Co., Salford Rolling Mills—have for nearly three years been manufacturing wheels with double helical teeth in cast iron, and have now over 1300 of these, both spur and bevel, successfully working in various parts of England. The first pair of these wheels made by this firm was supplied to Messrs. Schulz, Knauelt, and Co., of Essen, in Germany, in April, 1880. They have a pitch of $7\frac{7}{32}$in., and the diameters are respectively 10ft. $1\frac{7}{8}$in. and 3ft. $5\frac{15}{16}$in., with a breadth of over 2ft.

Your correspondent, from some remarks he makes, would seem to infer that it is easier to cast these wheels in steel than in iron; this is not the usual experience of firms who have gone into steel-founding. I may remark that the above-named firm also manufacture steel wheels with helical teeth; these were, however preceded by those in cast iron. Helix.

March 5th.

THE PROBLEM OF FLIGHT.

Sir,—Mr. C. G. Loeder, of 14, Eleventh-street, New York, recently interviewed by the *New York Mail and Express*, declared his capability of making an air vessel, to carry a large number of persons and provisions, and gave at the same time some da a which bear upon the impossibility of birds sustaining themselves by the power of their wing-strokes alone:—"Of the weight of the duck, 4 lb., which with spread wings displaces 200 cubic inches, only $\frac{14}{100}$ oz. is buoyed. The condor, weighing 50 lb. and displacing with spread wings 8 cubic feet, is buoyed only 10 oz. These birds are unable to gain any buoyancy from a displacement of air by the strokes of their wings, as a duck would have to make and keep up a vacuum covering a space of about 52 cubic feet; a condor a space of 650 cubic feet. The bird obtains a far greater effect than is produced by any known mechanical device. A plunger moved against the air with a certain velocity results in a reacting effect against the plunger equal to the effect produced on the plunger if it be stationary and the air move against it with like velocity. Applying the data, it is found that the duck, with a wing surface of 72 square inches, would have to make a wing stroke of 50ft. deep each second, or its equivalent in short strokes, merely to sustain itself. The condor, with a wing surface of 8 square feet, must make a wing stroke 45ft. deep per second for a like result."

Hoddesdon, Herts, March 3rd. Reginald Bolton.

STEAM FIRE ENGINES.

Sir,—Public attention is now being drawn to the subject of the control of conflagrations, and the need of more pumping power for this purpose has been demonstrated.

I think the objection on the part of fire engine makers, that two horses cannot haul more machinery than is now got upon four wheels, in our present steam machines, may be met by the use of separate boilers and engines; in which case the power might readily be trebled, with the number of horses only doubled; and as a single coupling on a flexible steam hose would make the connection between the two, on meeting at the scene of action, the boiler might arrive long enough after the engine to allow of all the water-hose being got into position. This point is of importance, as it would allow of the boiler being of greater weight, not having to be hauled at so great a speed.

I estimate that a steam pump only, on a carriage, can be made of sufficient power to require the steam of two boilers on separate carriages; and such a plant would be of far less complication and cost than a set of complete fire engines, as now made, equal in capacity. A failure of a tube could not then, as now, incapacitate a complete fire engine, for a spare boiler could be readily brought into requisition. Reginald Bolton.

Hoddesdon, Herts, March 2nd.

South Kensington Museum.—Visitors during the week ending March 3rd, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 13,331; mercantile marine, Indian section, and other collections, 4331. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 5 p.m., Museum, 1828; mercantile marine, Indian section, and other collections, 259. Total, 19,749. Average of corresponding week in former years, 14,048. Total from the opening of the Museum, 21,747,342.

Death of a Railway Contractor.—We regret to have to record the death, at an advanced age, at his residence, Redland, Bristol, of Mr. Rowland Brotherhood, well known in the west and southern districts of England in connection with several large railway contracts, and with important and extensive iron and wagon works at Chippenham. Mr. Brotherhood, we might state, among other large undertakings, constructed the Bristol and South Wales Union Railway and piers. Some of the best and finest iron bridges ever turned out for India have been made at Mr. Brotherhood's Chippenham works. He leaves a widow, ten sons, and three daughters.

RAILWAY MATTERS.

FROM next May there will be a "lightning train" between Paris and Vienna, the transit occupying 27 hours, and the journey from Paris to Constantinople will be reduced from 111 to 78 hours.

THE goods traffic of the St. Gothard Railway is increasing so rapidly that, although winter is not yet past, the company find it necessary to run several supplementary trains. The increase has occurred chiefly in unmanufactured iron and coal, which are being sent in large quantities from Germany, for consumption in Northern Italy.

TWO new railways, destined, the one to supply the southern and the other the eastern suburbs of Glasgow, will be constructed with all possible speed, the necessary arrangements having been completed for the purpose. A third railway, a great part of which will be underground, which is to connect the city with its western suburbs, will also be constructed as soon as possible.

AT a recent meeting of the Paris Society of Civil Engineers, M. Mallet communicated a note by M. Borodine as to comparative trials on the South-Western Railway of Russia, between ordinary passenger locomotives and one of the same type transformed into a compound engine. The results go to show that the latter is capable of effecting a saving of at least 20 per cent. of fuel.

THE Select Committee of Standing Orders of the House of Commons have had under consideration the South Staffordshire Tramways Bill, owing to its having failed to comply with the rules of Parliament before the Examiner. The committee have decided to recommend the House to allow the Bill to proceed, but have made it a condition that tramway No. 1 shall be struck out.

THE death is announced of Mr. George Wythes, of Bickley Hall, Kent, and of Copt Hall, Essex. He was born in June, 1811, and died on Saturday, the 3rd of March, in the 72nd year of his age. Mr. Wythes was engaged in railway contracts with the late Mr. Brassey and other men equally known to fame in the world of engineers. He was soon recognised as an expert of no ordinary kind, and one of his successful efforts was the construction of a portion of the Great Indian Peninsular Railway. He was in partnership with Messrs. Jackson and Brassey and others in several railways, and various contracts of great public benefit.

MESSRS. R. STEPHENSON AND CO., of Newcastle-on-Tyne, have just turned out the largest locomotive ever built in that town. It is for the London and South-Western Railway Company, and is built to the design of Mr. Wm. Adams, superintendent to the company. It is a tank locomotive, for suburban railway traffic; it has four wheels, 5ft. 7in. diameter, coupled; a four-wheeled bogie in front, and a pair of trailing wheels, fitted with radial boxes behind. The total weight of the engine is about fifty-five tons. Messrs. Stephenson and Co. have on order for the same company other sixteen engines of the same type, and thirteen express engines.

THE *National Car Builder* estimates the yearly consumption of sleepers for new roads in the United States, and for replacing worn-out ties on old tracks, roughly at 30 millions, assuming the average life of the ties now in use to be about seven years. The annual increase in track mileage, if it is to continue at a rate approximating that of the past year, with a corresponding increase in the great volume of traffic points to a continuous yearly increase in the consumption of timber for ties for an indefinite period in the future—a home consumption strictly, and not including timber exported for like uses on the roads of foreign countries. How to meet this prospective demand with the annual increase in track mileage without causing such an excessive drought on the forests gives the problem of future supply a greater importance every year. Perhaps Americans may find the solution of the difficulty in iron permanent way, which cannot, however, fail to be very expensive under existing tariff regulations.

IN view of the formation of a new free port opposite Hamburg, joining the Zollverein, a railway under the Elb, uniting the two, has been projected by Engineer G. Westendarp. Starting from the Hamburg Exchange, it will descend a sharp gradient and cross the river by a tunnel 1300 metres—1422 yards—long; emerging by a gradient 280 metres—306 yards—long; at a point about 600 metres, 656 yards from the bank it will rise to a high level, and thus continue until it reaches the new maritime works. As the line will be completely isolated from the ordinary traffic, the trains are to have a speed of 30 kilometres—nearly nineteen miles—an hour, so that the run will be accomplished in thirteen minutes. The tunnel is to be 9 metres—29ft. 6in.—wide, by 7½ metres, 24ft. 7in.—high in the clear, protected by a wrought iron shield, on account of the slight thickness left between the crown and the river bed. Above the two lines of way, with the gas and water pipes, and telegraphs, and telephone wires, there will be a roadway and footways. The time required for the execution of the work is estimated at five and a-half years, the cost at £1,300,000.

MAJOR MARINDIN has reported to the Board of Trade the result of his inquiry into the causes of an accident which occurred on November 27th last, at Inverythan, between Fyvie and Auchterless stations, on the Macduff and Turriff section of the Great North of Scotland Railway. In this case, as a train from Macduff to Inveramsay, consisting of engine and tender, five loaded goods wagons, brake van, two third-class and one first-class carriages, and a third-class brake carriage, was passing over a bridge carrying the railway across the turnpike road from Inverary to Turriff, the superstructure of the bridge gave way. Four passengers were killed upon the spot, and one passenger was so badly injured that he died half-an-hour after he had been released from the wreck. Fourteen other passengers and the assistant guard, who was in the front brake van, were injured, and the injuries of four of these passengers and of the assistant guard are returned as being severe. Three of the goods wagons, the brake van, and the two leading passenger vehicles were destroyed, while the other two goods wagons and the first-class carriage were considerably damaged. The engine got safely across the bridge. The immediate cause of the accident was the fracture of a cast iron girder, and Major Marindin recommends that a special examination, accompanied by actual test, should by made of all bridges having cast iron girders with spans of over 25ft., by experienced engineers, and that any which show the smallest sign of weakness, or which have not an ample margin of theoretical strength, should be at once replaced by wrought iron girders.

M. POISOT lately communicated to the *Société de l'Industrie Minérale de Saint Etienne* some useful information as to the means for preventing the slipping of locomotive wheels in the Mazenay mines, no more fuel being now employed for hauling out 100 tons than the eighty formerly. He observes that the ventilation is effected by diffusion, and there is constantly in the rolley way a tolerably thick smoke, which with condensed steam from the engine and the dampness of the workings causes the rails to be slippery. The consequence is that every time they tried to ascend the gradient of 1 in 66 with a full train, they could only get up half of it, about 180 metres—590ft.—without the wheels beginning to spin; and during the rest of the rise, notwithstanding the use of fine and dry sand, this difficulty frequently began again, so that they lost pressure to such an extent that they were obliged to stop to make steam. This difficulty caused great consumption of fuel, excessive wear of the working parts of the engine, and a rapid destruction of the rails. About two months ago the joint of one of the cylinder cocks leaked, and a jet of steam escaping from it was directed on to the rail, when the train took the gradient without the engine once slipping. For two days they worked without making the repair, and the locomotive drew all the trains without the slightest stoppage. In consequence of this experience they altered the cylinder cocks so as to make them discharge directly on to the rails, and when they get to the gradient the cocks are slightly opened, so that they ascend it without difficulty. Arrangements for washing rails with a jet of water are very old, having been used on some of the French lines fifteen or sixteen years ago. The use of steam for the purpose is a simpler modification of an old idea.

NOTES AND MEMORANDA.

THE gross tonnage of steel ships built last year is over fourteen per cent. of the total iron and steel gross tonnage for the year. In 1881 it was eleven per cent.

THE facetious Mark Twain says there is something very fascinating about science—it gives you such wholesale returns of conjecture for such trifling investments of fact.

DR. GILL, at the Cape of Good Hope, succeeded in photographing the comet's tail and with it fifty stars that were seen through the tail. The plate was exposed 140 minutes, and was kept up to the motion of the earth by clockwork.

H. HERTZ has made some investigations of the evaporation of liquids, especially mercury, in a vacuum. The chief interest of his results is connected with the pressure of the vapour at the ordinary temperature of the air. According to his experiments, the pressure amounts to less than a thousandth of a millimetre—one twenty-five thousandth of an inch. The insignificance of this pressure, rather than any special peculiarity of the quicksilver itself, must be the reason for the imperceptible influence which the quicksilver vapour in Geissler tubes produces upon the discharges.

HORN is made to imitate tortoise-shell in the following manner: Make a paste with two parts of quicklime, one of litharge, and a little soap-maker's lye, or solution of caustic potash; apply it skilfully on a thin plate of horn in a way that will best imitate the natural spots of the tortoise-shell, leaving the light parts untouched; let this paste dry on, then brush it off, and the horn will be permanently stained. The effect is much improved by laying beneath it, when used, a piece of brass leaf. This staining may be varied at pleasure by substituting other coloured substances for the litharge.

ASBESTOS rope is described amongst other articles in a new catalogue published by the United Asbestos Company. The strength seems to be about one-fourth that of ordinary hemp rope of the same diameter. Rope 1·5in. diameter has a breaking strength of one ton, and 20ft. of it weighs 13¼ lb. The breaking strength of the rope 0·6875in. diameter—$\frac{11}{16}$—is 0·2 tons, or 4 cwt., a 20ft. length weighing 3½ lb. The rope is made especially for fire escapes' purposes, for theatres, fire brigades, and for ready means of escape from houses and public buildings, the advantage being that the rope will not break and drop its burden if a flame bears upon it. It is made like ordinary rope, but spun from Italian Asbestos thread.

AN American engineer, who, being engaged in the construction of a railway in China, has had unusually favourable opportunities of examining the famous Great Wall, built to obstruct the incursions of the Tartars, gives the following account of this wonderful work:—"The wall is 1728 miles long, 18ft. wide, and 15ft. thick at the top. The foundation throughout is of solid granite, the remainder of compact masonry. At intervals of between 200 and 300 yards towers rise up 25ft. to 40ft. high, and 24ft. in diameter. On the top of the wall, and on both sides of it, are masonry parapets, to enable the defenders to pass unseen from one tower to another. The wall itself is carried from point to point in a perfectly straight line, across valleys and plains and over hills, without the slightest regard to the configuration of the ground, sometimes plunging down into abysses 1000ft. deep. Brooks and rivers are bridged over by the wall, while on both banks of larger streams strong flanking towers are placed."

A DURABLE and inexpensive method of employing papier-maché as a substitute for mattings, carpets, oil-cloths, and other floor coverings has been introduced, says the *Providence* (U.S.) *Journal*, the simplicity of the process being also an additional advantage in its favour. After the floor has been thoroughly cleaned, the holes and cracks are then filled with paper putty, made by soaking newspaper in a paste made of wheat flour, water, and ground alum—that is, to one pound of such flour is added three quarts of water and a tablespoonful of ground alum, these being thoroughly mixed and boiled. With this paste the floor is uniformly coated, and upon this a thickness of Manila or hardware paper is placed, or, if two layers are desired, a second covering of paste is spread on the first layer of Manila paper, and then the second thickness of paper is put on, and the whole allowed to become perfectly dry. On this being accomplished another surface of paste is added, succeeded by a layer of wall paper of any style or pattern desired. On the work becoming entirely dry, it is covered with two or more coats of sizing, made by dissolving half a pound of white glue in two quarts of hot water, and when this has dried, a coat of "hard oil finish varnish," nothing more being required after the latter has had time to become thoroughly dry in every part.

THE *Eisen Zeitung* has published the following estimate of the cost per actual hour and horse-power of the various descriptions of motive force:—(1) Small steam engines, about 1¾d.; (2) hot air engines, about 3⅜d.; (3) Otto's new gas motor, about 3d.; (4) water motors with artificial high-pressure water conduits, about 11½d.; (5) horse work, about 5⅜d.; (6) wheel-turning, eight men being reckoned as equal to one horse, about 2s.; (7) large and well-constructed steam engines of at least 50-horse power, using for the indicated unity of work and time about 4⅜ lb. of coal, about 1d. It is remarked that the cost of large steam engines is proved to be surprisingly low, and the inference is drawn that if electric transmission of force to places where it is required in limited quantity becomes a generally accomplished fact, the power divided and laid on from steam engines of great power will come far cheaper to the person employing it than the lowest-priced independent motor. Even allowing for the ascertained loss of half the original force when electric transmission is employed, the cost would only represent 2d. per hour and horse-power. The *Eisen Zeitung* seems to reckon the coal at about £2 per ton. A large gas engine has been erected at Deutz, near Cologne, and the suggestion already made by Sir F. J. Bramwell, that at some future time gas engines of large dimensions and fed by special means of supply may be able to overtake the larger steam engines in effectiveness, is repeated.

IN a lecture delivered by Captain Abney last year, and now published by the Royal Institution, the lecturer described a process of photography through ebonite by means of the dark rays. He said:—"Some eight years ago I tried my hand at the matter, and after several years of experimenting it was my good fortune to find a compound which was chemically acted upon by the dark radiations. Silver bromide was selected as the salt to work upon. The aim was to prepare an emulsion of bromide of silver in collodion—an emulsion being silver bromide in a fine state of division suspended in collodion—which should transmit green-blue light. Dr. Huggins proposed to me that I should try the permeability of the ebonite by the dark rays; and this was done, with the result that the spectrum was taken through it, showing an impression on the green bromide of the dark rays. An image of the incandescent carbon points of the electric light are now formed on a piece of ebonite, and behind it is a glass plate covered with the bromide; an exposure of twenty seconds will suffice to impress the image of the points by their dark rays. The image was developed and subsequently shown. It will be seen that the bromide in this state is somewhat sluggish to respond to the vibrations of the dark rays. I will now make an experiment to show how different is the behaviour of the orange bromide. Behind this rotating disc, which is made up of alternate transparent and opaque sectors, is a plate prepared with the orange bromide. A spark $\frac{1}{5}$ of an inch in length from a battery of Leyden jars is sufficient to impress a sharp image of the sectors on the plate though they are rapidly rotating. The exposure was made to the spark whilst the disc was rotating, and developed before the audience, and subsequently the photograph was shown. The exposure is estimated by Cazin as $\frac{4}{1000000}$ of a second. It would require twenty such sparks to impress the red end of the spectrum on a pure bromide plate."

MISCELLANEA.

THE members of the Gas Institute are to hold their annual meetings this year at Sheffield.

IN America gas was made and used as early as 1813, by David Melville, at the Bath House, Newport.

THE Fives-Lille Company has turned out for the French Government a 50-ton gun with nearly 3 cwt. shell, capable of piercing 6in. armour plates at a seven mile range.

A MEETING was held at Bradford on Tuesday for the purpose of considering a proposal to amalgamate the scientific, art, and literary societies of the town. The proposal was favourably received.

WHAT is claimed to be the largest output from a single furnace ever produced in the Shropshire district has just been attained by the Coalbrookdale Iron Company. From its Castle furnace it has run 357 tons in a week.

THE Pelsall Hall Colliery, Pelsall, owned by Mr. T. Starkey, has this week been sealed down in order to extinguish a fire which broke out in the workings on Sunday last. The origin is believed to be spontaneous combustion at a point where the pit had been rendered unusually dry by pipes which conveyed steam from the surface to an underground engine.

MESSRS. DAVEY, PAXMAN, AND CO. have been selected by the executive committee of the Great International Fisheries Exhibition to supply the engine and boiler power for driving the electric lights throughout the building. The firm are preparing for the purpose over 600 indicated horse-power of engines with the necessary boiler power. There will be four engines, one of which will indicate about 350-horse power.

THE South-West Lancashire Coalowners' Association, at their monthly meeting, held in Manchester on Tuesday, decided to lodge a petition against the Ship Canal Bill. The step, however, is not being taken in any spirit of hostility to the project, but mainly with the view of placing the association in a position to protect the interests of property owners, and to watch the Bill with reference to the rates of charges and the arrangements for the transit of coal and other minerals.

NEXT month a somewhat extensive ironworks will be publicly offered for sale. It includes a plant of three blast furnaces at Deepfields, known as the "Deepfields Furnaces," together with their surrounding machinery and appliances; and also the Deepfields Sheet Ironworks adjoining, now in the occupation of Mr. George Tinn. The plant at the sheet works includes 20in. forge and plate mill trains, and 18in. sheet mill train, and sixteen puddling, heating, and annealing furnaces. The sale takes place under the will of the late Mr. Samuel Pemberton.

THE promenade pier at Withernsea, about twenty miles from Hull, designed and constructed by Mr. Thos. Cargill, M.I.C.E., and described and illustrated in our pages, January 25th, 1878, was almost entirely swept away in a gale on Tuesday. The pier, which originally cost £14,000, was opened to the public in 1878. In 1880 a disabled vessel drove through its centre, carrying away about 150ft. The gap was filled in with timber, and now all beyond that point, consisting of half the pier and a spacious saloon, has been destroyed. The coast is one of the worst on which a pier could be constructed.

THE Rev. Mr. Gilbert, during an address at Christ Church the other night, remarks the Otago *Times*, while speaking of the telephone, asked his audience if they would be astonished if he were to tell them that it was now proved to be possible to convey, by means of electricity, vibrations of light—to not only speak with your distant friend, but actually to see him. The electroscope—the name of the instrument which enabled us to do this—was the very latest scientific discovery, and to Dr. Gnidrah, of Victoria, belonged the proud distinction. The trial of this wonderful instrument took place at Melbourne on the 31st October last, in the presence of some forty scientific and public men, and was a great success. "Sitting in a dark room, they saw projected on a large disc of white burnished metal the race course at Flemington, with its myriad hosts of active beings. Each minute detail stood out with perfect fidelity to the original, and as they looked at the wonderful picture through binocular glasses, it was difficult to imagine that they were not actually on the course itself, and moving among those whose actions they could so completely scan." We do not expect our readers to believe this, for we do not believe it ourselves. But he would be a rash man who asserted that such a statement could never be true.

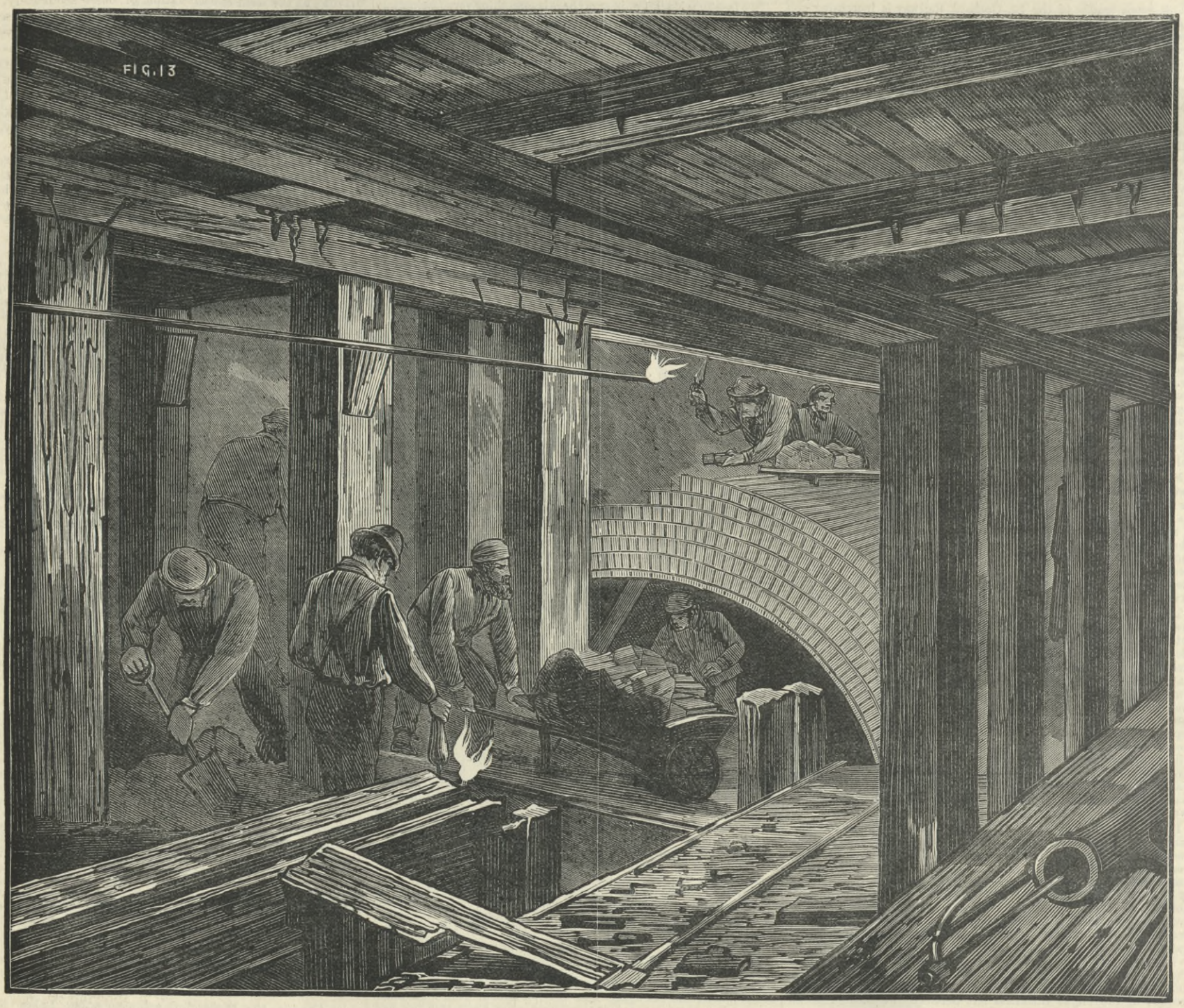
IN Canada, the Welland Canal, connecting Lakes Erie and Ontario, has been open to traffic for some time, and steamers of very considerable tonnage now pass from one lake to the other. However, this canal is but one section of a gigantic waterway which is intended to place the Great North-West in direct communication with Europe. Great efforts are now being made to deepen and re-construct the various canals that now lead between Kingston and Montreal, and when a sufficient depth has been attained—uniform with that in the Welland channel—it will become possible for grain vessels to load in Manitoba and unship in Liverpool or London. Although this project attracts little attention here, it cannot fail to prove of immense consequence to the well-being of our colony and ourselves. Not the least advantage, says the *Nautical Magazine*, will consist in our consuming more Canadian and less American corn, and in the cheapening of our food supply, which must inevitably follow from this increased competition. In the second place, the Canadian route may appropriate to itself some proportion of the rich trade centreing in "Porkonopolis." According to a calculation that has been made, the distance between Chicago and Montreal by the Welland Canal system is 150 miles less than from Chicago to New York, by way of Buffalo and the Erie Canal. This fact, if true, should not be lost sight of, and alone might justify the enormous expense which Canada is now incurring in connection with this scheme.

A COMMITTEE has been holding daily sessions to consider projects and receive suggestions relating to an increase in the water supply of New York. It is admitted that the need of such an increase is urgent. The largest capacity of the present Croton aqueduct is 100,000,000 gallons a day, and this at a pressure that seriously imperils the integrity of the structure. The engineers in charge agree that the aqueduct ought not to be made to carry more than 72,000,000 gallons a day. The present storage capacity is about 9,000,000,000 gallons. The Bronx River aqueduct, to be completed next year, will increase the supply about 20,000,000 gallons a day. A large proportion of the present supply is wasted. Mr. John C. Campbell, formerly chief engineer of the Croton aqueduct, estimates the waste at "about 50 per cent. of the entire amount of the water furnished by the aqueduct;" this partly through the carelessness of consumers, but largely through leakage from the water mains. The Department of Public Works is in favour of building a dam at Quaker Bridge, six miles below the Croton dam, to retain the water which now flows over the latter in seasons of abundance, with a new aqueduct to deliver the water thus saved. The supply of the Croton watershed, it is claimed, is sufficient for a population of 5,000,000. Other plans for the better husbanding of the waters of the Croton region contemplate the damming of the east branch of the Croton, by which means, it is claimed, additional storage can be provided for 4,000,000,000 gallons. The amount of water flowing from the Croton watershed varies from 250,000,000 to 600,000 gallons a day. To lessen the demand for Croton water, it is proposed to supplement the fresh water supply with salt water drawn from the adjacent rivers, for the use of the fire department for flushing the streets and water-closets, for water power, and so on. This is to be done either by direct pumping under the Holly system or by a reservoir system. One engineer proposes a huge water tower in the middle part of the city below Central Park, the tower to be 100ft. in diameter and 350ft. high above tide water. On the top of this tower he would place a reservoir holding 2,000,000 gallons, to be pumped up from the river

THE INNER CIRCLE COMPLETION RAILWAY.—TUNNEL UNDER CANNON STREET.

SIR JOHN HAWKSHAW AND MR. J. WOLFE BARRY, MM.I.C.E., ENGINEERS.

(*For description see page* 184.)



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W. H. T.—*We fail to see that the publication of your letter would advance knowledge. There is nothing in Mr. Lancaster's paper bearing on perpetual motion. Exactly the same thing may be said of a cutter sailing close-hauled within four or five points of the wind as you have said of Mr. Lancaster's models. The difference between the model and the yacht is that the latter is held up to the wind by the water, but the model bird wants the equivalent of the water. The things lacking now are experiment and observations on the lines indicated by Mr. Lancaster.*

HAWES' PATENT STEAM-TRAP.

(To the Editor of The Engineer.)

SIR,—I shall be obliged to any reader who will give me the name of a maker of Hawes' patent steam-trap? W. H.
Birmingham, March 3rd.

ENGLISH SALT MINES.

(To the Editor of The Engineer.)

SIR,—I shall be much obliged to any of your readers who will give me information on the manner of exploitation of salt mines adopted in England, the transformation of salt from its derivative materials, the amount of consumption in England, the amount of exportation, and the prices obtained. S. W.
Bucharest, March 3rd.

THE YORK BUILDING COMPANY.

(To the Editor of The Engineer.)

SIR,—Can any reader give me some information regarding the above Iron Company? They are known to have brought iron ores to near Loch Etive, Argyleshire, and smelted them by the aid of the native woods about the year 1720. What I wish to know is the date of leaving, and how far north they got. ANTIQUARY.
Crewe, March 3rd.

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Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. George Leopold Riche; all other letters to be addressed to the Editor of THE ENGINEER, 163, *Strand.*

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, March 13th, at 8 p.m.: Ordinary meeting. Papers to be discussed, "The Productive Power and Efficiency of Machine Tools and other Labour-saving Appliances Worked by Hydraulic Pressure," by Mr. Ralph Hart Tweddell, M. Inst. C.E. "Stamping and Welding under the Steam Hammer," by Mr. Alexander McDonnell, M. Inst. C.E. Thursday, March 15th, at 8 p.m.: Special meeting. Third lecture "On the Application of Electricity"—"The Electrical Transmission and Storage of Power," by Dr. C. William Siemens, F.R.S., M. Inst. C.E.

CHEMICAL SOCIETY.—Thursday, March 15th, at 8 p.m.: Paper to be read, "On Some Condensation Products of Aldehydes with Aceto-acetic Ether and with Substituted Aceto-acetic Ethers," by Mr. F. E. Matthews

THE ENGINEER.

MARCH 9, 1883.

THE VENTILATION OF THE METROPOLITAN DISTRICT RAILWAY.

A GREAT deal has been said recently concerning the construction of certain shafts in Queen Victoria-street and on the Embankment, intended to ventilate a section of the Metropolitan District Railway. The opposition to the construction of these shafts is, we are glad to see, taking form and increasing in strength. Thus, for example, a deputation from the Westminster District Board of Works waited on Tuesday on Mr. W. H. Smith and Lord Algernon Percy to urge them to take steps to prevent the railway company from carrying out their purpose. The deputation urged that there were three reasons which clearly justified the District Board in making an earnest protest against the company placing ventilating shafts in the public streets. First, it should have kept the land it once possessed, upon which the ventilating shafts might have been placed. That land it had sold to the Westminster Aquarium Company and to the St. Stephen's Club. Secondly, the inhabitants of Westminster had not been in any way considered by the company; and thirdly, the space occupied by the ventilators would to a great extent impede the traffic. It was contrary to justice and equity that it should sell its land—the purchase-money for which went to its shareholders—and then take possession of the public streets for ventilating its line. The interests of the residents had not been at all considered, and they would suffer greatly from the poisonous smoke which would come out of the shaft, and he believed that Westminster Abbey would be injured, as one of the ventilators was to be placed nearly opposite the north entrance to the Abbey. Again, the subject was brought up at a meeting of the City Commission of Sewers on Tuesday. Colonel Haywood, the engineer, replying to questions, said the railway company originally proposed to construct four ventilators in Queen Victoria-street, each 42ft. long and 8ft. 6in. wide. The arbitrator—Captain Galton—had decided on the construction of one aperture 50ft. long by 6ft. 6in. wide, to be covered by an iron and slate structure 8ft. high. No doubt this would cause a great obstruction to the traffic in a street where every inch of space was needed. The arbitrator had also granted the company power to construct a second ventilator in Queen Victoria-street. The arbitration, he added, had been expensive, but the results, such as they were, had been in favour of the citizens. The Commission, in the end, resolved to bring the matter before Mr. Chamberlain, the President of the Board of Trade. It is, we think, quite unnecessary to urge on our readers that the proposed ventilators would be an intolerable nuisance. It will be more to the purpose if we explain the true position of affairs, and show that the railway company has really no ground whatever for proposing to ventilate the tunnel in the way indicated.

That part of the line which most stands in need of ventilation is the section between Charing Cross and the Mansion House, and we shall deal with it first. It is a mistake to suppose that the company wants to make the air in this section better for the sake of its passengers; as a matter of fact the air is not so bad in this section as it is in many other places on the line. That is to say, it is not so highly charged with carbonic oxide and acid, and sulphurous acid gas. What the company wants to get rid of is steam, with which the tunnel—especially between the Temple and the Mansion House—becomes so charged that it is impossible for the drivers to see the signals until they are within a couple of yards of them. We state this as the result of observations personally made, not from the carriages, but from the foot-plate of an engine. There ought to be no steam in the tunnel of the Metropolitan Railway, and there would be none if the company provided proper means of condensing the exhaust steam of the engines. For this purpose nothing more is required than a sufficient supply of cold water in the engine tanks. The drivers fill their tanks with cold water at the City terminus, and they have to run with this supply to Earl's Court and other places and back again. The result is that while the engines going out of the City give off no steam in the tunnel between the Temple and the Mansion House, the engines of the up trains, as we may term them, carry boiling water in their tanks, which is, of course, incapable of condensing steam, and the effect is that although the condensing exhaust valves are kept open, the steam simply passes through the tanks and escapes through the pipes on top of them provided for the purpose. It may be worth while to explain that the condensing arrangements are very simple. At each side of the engine is placed a large tank, the exhaust from the cylinders is led through two pipes, one at each side, to the space above the water in the tanks, the ends of the pipes being turned down so as to direct the steam down on the surface of the water; and this suffices to condense it. The engines carry enough water for complete condensation for a run of about three miles, and no more. Whenever an opening exists in the tunnel the steam is turned up the chimney, in order to economise the cold of the water as much as possible, and to blow up the fire. The Metropolitan engines making the round trip, as we may call it, from Moorgate-street, have lost all power of condensation long before they reach the section under Queen Victoria-street. For some time past the company has been aware that its trains are worked with considerable risk; because the drivers, as we have said, can as a rule see no signals until they are close upon them. The speed being slow, and the trains kept under proper control by continuous brakes, no accidents have happened. All the same, the risk is there, and the company, very rightly, wish to get rid of it. It will be understood from what we have said that the proposed ventilating shafts will give forth a great deal of steam; and the dwellers in Queen Victoria-street will find, all too late, that they will have far worse troubles to contend against than invisible foul-smelling gases.

Of course the proper remedy does not lie in discharging steam and bad air into the centre of a great public thoroughfare, but in preventing the accumulation of either in the tunnel. One way of doing this, in part, at least, lies in using more cold water. It is quite possible to do this in many cases, and with many trains. The difficulty lies in dealing with the engines which make the round trip. They cannot stop midway to change the water in their tanks under present arrangements; nor can they carry enough to condense all the steam made. But by dealing with all the trains that can be dealt with, emptying and refilling the tanks when practicable, something—nay, even a good deal—might be gained. Moreover, if it once became imperative that there should be no steam in a tunnel, there are expedients which could be adopted to secure that object. For example, a modification of Ramsbottom's water troughs might very easily be fitted in the tunnel, by the aid of which the water could be renewed; but it is, of course, obvious that anything of the kind would cost more money than the making of holes in the Thames Embankment and Queen Victoria-street.

It is well known that not only the City section of the Metropolitan District Railway, but the whole metropolitan underground system, needs ventilation, or, more accurately, purification of its atmosphere. The railway companies concerned have never taken any energetic steps to secure the much-needed improvement. They have always contented themselves with making openings in the top or sides of the tunnel whenever or wherever they got the chance. Nothing can be more unscientific. The first thing wanted is a radical change in the whole rolling stock of the lines. The engines and coaches are far too heavy for their work, and as a consequence burn too much fuel, and thereby augment at once the volume of the products of combustion sent into the tunnels and of the steam sent into the tanks. The engines weigh, full, 43 tons each, and burn about 32 lb. of Welsh coal per mile. Of course it will be said that lighter engines could not be got to do the work; but, as a matter of fact, Mr. Stroudley's "Terriers" on the South London line draw at least the same number of passengers as the Metropolitan engines, and weigh but 25 tons, and burn but 17 lb. to 19 lb. of coal per mile. As far back as Feb. 28th, 1873, we called attention to the facts of the case, and showed then that the total weight of a train on the Metropolitan Railway was made up of four 16-ton coaches, weighing 80 tons, and one 43-ton engine, total 123 tons. On the District line the trains consist of eight coaches, weighing about 70 tons, and a 43-ton engine, total 113 tons. The Great Western Railway Company runs trains over the District line, the engine, weighing 33 tons and the eight coaches 50 tons, total 83 tons. Mr. Stroudley's engines run nine coaches, weighing 60 tons, the total weight being 85 tons. The Metropolitan trains full seat about 350 passengers, the Great Western trains about 280, and Mr. Stroudley's about 400. It would be quite possible to make engines of the "Terrier" type which would carry water enough to condense right through the round trip. But these engines could not be used with the present extravagantly heavy Metropolitan carriages. But even with the existing stock the railway companies do not do all that might be done to keep the tunnels pure. When the line was first opened, nothing but the very best coke, practically free from sulphur, was used as fuel; but Welsh coal costs less than coke, and it is now used and has been used instead of coke for several years—and such coal is not as smokeless as coke. Long since it was suggested in the pages of this journal that the air might be practically kept clear of sulphur by the use of quicklime, carried on the roof of a carriage in each train—one pound of lime sufficing to deal with the products of combustion of a pound of coke. The carriage of the lime would, of course, entail some trouble, just as the carriage of gas does; but the expense would be almost *nil*, the lime retaining its market value after being used. But the railway company took no steps to adopt the scheme or even to give it a fair trial. But the simplest possible way of disposing of the whole difficulty lies in the use of exhaust fans. For example, there is not anywhere in the City or near it a section of tunnel of considerable length. The longest tunnel on the District Railway is that between Westminster Bridge and St. James's Park stations, a distance of 221 yards, or one-eighth of a mile. To change the air completely in this at such a rate that it would be practically pure enough for all purposes, a velocity of a little over one mile an hour would suffice, and this would demand less than 1-horse power actual work done. The difficulty lies in applying the fan so as to ensure the whole of the air passing through it; but this could be readily overcome. A great deal has been done to purify the air in the Metropolitan Railway tunnels, especially between Gower-street and King's Cross, by the aid of screens in a way already described in our pages by Mr. Tomlinson with very limited means, and we venture to think that if he was given money and power enough he would very soon effect radical changes for the better.

We have, we believe, said enough to show that if the Metropolitan District Railway Company would do what it ought to do, no necessity would exist for making openings in City thoroughfares. The whole scheme is nothing more than a rough-and-ready way out of a difficulty of the company's own making. Several years ago, when the railway was being constructed, we stated in this journal that it was proposed to make large sections of the line along the Thames Embankment in open cutting. The statement was made the subject of a question in Parliament, and its accuracy was denied. Nevertheless, it was not made rashly nor without good reason. The line was not made in open cutting, however—that is to say, there are lengths of it not greater than one-eighth of a mile long covered in. If at the time we wrote it had been hinted that four ventilating shafts, each 42ft. long and 8ft. 6in. wide, would be made in the centre of a great street, what a storm of virtuous indignation would have been called up. Is it certain now that the proposed ventilators mean finality? We think not, and no exertion should be spared to prevent their construction. If it could be shown that their presence was essential to the utility of the railway, or the comfort of its passengers, and that there was no way of doing without them, then there would be something, nay, a good deal, to urge in favour of the railway company. But, as we have said, this is not the case. Whatever may be said to enshroud the subject in a mist of words, and conceal the true issues, the reason for the Queen Victoria-street ventilators is that the locomotives do not effectually condense their steam, and that this steam prevents the engine drivers from seeing the signals. We have explained that this results partly from the use of engines and trains far too heavy for their work; partly from the economical notions of the company concerning water. Neither is a sufficient excuse for calling a great public nuisance into existence. That what we have said will be disputed by the company is quite possible. Anything may be expected from persons who can seriously propose to hide the ventilators on the Thames Embankment with trellis-work, festooned with ivy! If the atmosphere of the tunnel is so pure that ivy would

grow round the mouths of the ventilating shafts, then the necessity for the shafts would not exist.

THE UNITED STATES TARIFF.

The news which was telegraphed a few days ago from Washington of the final passing of the amended Tariff Bill, though incomplete till a full report arrives, is yet significant enough in its main features; and some brief account of the matter, so far as is at present possible, may be interesting to our readers. The Protectionists have won an undoubted victory, not perhaps immediately apparent if judged only by the alterations in the rates, but evident enough if the spirit which has guided the change and the practical result be taken into account together. To understand the question, it is necessary to glance back at the agitation of the last few months; and to take notice of the different political parties who have moved in the affair. In the Congress whose tenure of office expired last Saturday, the Republicans, elected with a special mandate to uphold the high tariff system, were in a majority. In the Senate, on the other hand, parties were almost exactly balanced; and although not so pointedly elected on the tariff question, leaned to free trade. Strangely enough, the ordinary action of parties has been to some extent reversed. The enormous revenue of the last few years, and the undue haste with which the public debt was being paid off, rendered some reduction of duties inevitable; and the Republicans seeing their power slipping from them—for in the Congress already elected for the session commencing next December there will be a Democratic majority—resolved, in order to settle the question for some time, to promote a moderate tariff reform, lest a worse evil should befal them if they left the question for a hostile Congress to deal with. The low tariff men, on the other hand, preferred to endure the existing condition of things a while longer, till they could inaugurate a Radical reform. Public opinion was, however, too strong to brook further delay and roving commissioners were appointed to collect evidence and prepare a scheme of tariff reform for adoption by both branches of the Legislature. Evidence of any kind which bore at all on the subject was taken from both sides; and strong efforts were made by the high tariff advocates to maintain and even increase the existing rates on the articles in which they were interested. The advantages of lower duties were not ignored, for every one wanted to reduce the rates on what he bought and to increase those on what he sold. The principle which was supposed to guide the commissioners, or, at any rate, the principle which was loudly proclaimed as forming the basis of public opinion, was the reduction of taxes on raw material, the graduating of rates upwards as labour had been bestowed on the partly finished article, so that in this way the highest rates should be levied on the finished goods which afford no employment to American labour, and finally the adjustment of the many discrepancies in classification which hampered trade and complicated the proper collection of duties. This theory has been very imperfectly followed; it has, indeed, to some extent been reversed, and generally it may be said that the protectionists, knowing exactly what they want, and bringing strong influence to bear, have succeeded in neutralising every apparent concession. The duty on steel rails has been reduced from 28 dols. to 17 dols., but while this serves as a sop to public opinion, which had been aggravated by the notoriously high profits of the rail makers, it will probably not increase the purchase of rails from this country by a single ton. The Bessemer steel works and rail mills have been so largely extended in the United States, that they are now far more than equal to the home demand; and till they are fully occupied orders will not be sent abroad, for even the reduced duty renders imported English rails at their present low prices dearer than home-made rails. So far as can be judged by the telegraphic summary just received, the American rail-makers have some cause of grievance, for though the duty on pig iron has been slightly reduced, this will, in regard to the Bessemer pig they make, lower the value of their blast furnaces; and the duty on iron ore, which, according to the accepted theory, ought as raw material to be relieved, has been raised. The old duty was 20 per cent. *ad valorem*, and as the price of ore at the European shipping ports ranged from 8s. to 15s. per ton, the tax varied from 1s. 8d. to 3s. per ton, or an average of about 55c. The Tariff Commissioners, after hearing evidence from all sides, reported in favour of a fixed duty of 50c., or about 2s. per ton, the cost of sea freight, of course, serving as additional protection to the American mine-owner, and the matter was considered settled. But at the last moment the protectionists, urged on by the lobbyist influence of the mine-owners, seeing that they had a controlling majority, and reluctant to concede what in the more judicial atmosphere of a committee inquiry they had deemed a wise compromise, threatened to throw out the whole Bill if higher rates were not imposed, and within forty-eight hours of the end of the session the Act was passed with a fixed duty of 75c. The exact effect of this remains to be seen, but it will probably shut out the cheaper ores on which the tax has been nearly doubled.

The general effect of the new law may be summarised as follows:—Much internal taxation has been remitted by alterations in the stamp and other duties; and very large reductions have been made in the duties on imported sugar, the Protectionists having struggled to reduce in this way the excessive revenue of the country, so as to leave less cause for touching the import duties on manufactured goods. In regard to the latter, the reductions have been as far as possible made where the existing tariff was unnecessarily high for the purpose—as in the case of steel rails—while, on the other hand, the rates have been raised in many cases, and the classification of the tariff-book amended, to close some of the few loop-holes through which English goods gained admittance to the country. The removal of certain anomalies which caused disputes and litigation between importers and revenue officers will undoubtedly be a boon to both. Englishmen who are accustomed to carry on their business as they please without official interference, can hardly realise how trade is impeded by the declarations, permits, fees, and delays which the American Custom-house system involves. But while it will be seen from what we have said that the American policy is still sternly protective, signs are not wanting of agitation in another direction. It is difficult to alter a complicated tariff without hurting some existing interests, and discontent so caused is the first condition of reform. American manufacturers in several branches of the iron and steel trades complain that the reductions of the new tariff will ruin them; and just as when protective taxes are first imposed, those who pay them cry for corresponding protection for their own manufactures, so when reductions commence, those who suffer on what they sell cry loudly for reductions on what they buy, and in this way the working of a protective system becomes apparent. Meanwhile the working man is likely to be discontented. He does not share in the profit which the taxes give to his employer, for his wages are determined mainly by the number of workmen available, and the real protection which he might logically claim, namely, an import tax on immigrants is denied him.

There are several aspects of the new law which demand attention, and to these we shall probably have occasion to refer when the details of the amended tariff become better known. In regard to partly manufactured goods like iron nail-rods or steel blooms and billets, the effect of the new legislation cannot be exactly foreseen; and outside all these considerations which directly affect English and American mauufacturers is one equally important to the American farmer, namely, the effect on Atlantic freights eastward, which a further diminution in exports from this side will cause.

COOLIE IMMIGRATION.

The public works of our West Indian Colonies are largely dependent upon an external supply of labour for their execution, and this has always been restricted to the balance remaining unemployed after the demands of the planters for their estates have been satisfied. Recent reports received indicate that the main source from which supplies of coolies have hitherto been drawn is becoming exhausted; and our colonies in the Caribbean Sea are likely, at a critical period, when the extension of roads and other works is loudly called for, to be deprived of all chance of carrying them out. We have looked in vain for any record of action being taken to meet this apparently unforeseen contingency. Year after year the great province of Bengal has sent forth the thousands of its surplus population to labour under a period of indentureship on the sugar estates of British Guiana and the coffee plantations and pimento gardens of Jamaica, and but few indications have been noticed of any probability of this exodus failing until within the last few months, when letters were received from the immigration agent in Calcutta to the effect that they found it to be impossible to enlist the number of coolies indented for for the current season. It would seem as if the planters of the West Indian Colonies have too confidently relied upon the hitherto annually recurring scarcity in certain districts of Bengal which has driven thousands of their inhabitants forth to seek a livelihood in foreign lands. The irrigation works which have been steadily carried out throughout the whole of India under British rule are, however, beginning to tell, and our fellow subjects there are gradually ceasing to be so dependent for their means of subsistence upon the uncertain periodic rainfalls. Hence, increasing prosperity in the East is now likely to injuriously affect that of the West Indies.

Such a cause of diminution in the labour supply is certain to become more and more operative as time goes on; and the difficulty only now beginning to be felt will soon become of a vital character. It is necessary, therefore, that other sources from which the local deficiency of labour can be made up be sought for, or the struggle of our planters to maintain the severe competition to which they are now subjected will be fearfully increased, and may lead to a failure, having the most serious consequences. As regards the Island of Ceylon, which also draws the whole of its estate labour and the larger proportion of that required for public works from India, its contiguity to that continent prevents any chance of its sharing the possible fate of its sister colonies in the Atlantic; but even there, the improved condition of the ryot under British rule in the Madras Presidency has necessitated largely increased rates being paid to induce the coolie to leave his home to cross the narrow strip of sea intervening and labour among the mountains of Ceylon for a few months. It is only by the most fostering care bestowed upon him throughout his journey to and fro, high rates of pay and kindly treatment on the estates, and to the certainty of his return with what is to him an untold wealth in rupees, that his strong conservatism can be overcome. If such inducements are now required for a few months of absence, how can the West Indian planter expect much longer to tempt the Bengali to cross that great ocean of which he has such a dread, and to expatriate himself for a term of seven years from those family attachments so strongly developed throughout all the native races in India. *Ce n'est que le premier pas qui côute*, and instances are numerous of Indian coolies who have served one seven years' term of foreign labour, and who have, under the terms of their engagement, been sent back to the land of their birth, voluntarily returning to work out a further similar term. But it is precisely that *premier pas* which is the obstacle to overcome which is now found to be well nigh impossible, and that is creating those difficulties to which we are here giving consideration. The state of the negro population of the West Indian colonies is singular, and its characteristics vary much in the different islands. But recently, comparatively speaking, emerged from slavery, the new generation look down on field labour as having been the attribute of the degraded condition of its fathers. Used to having his material wants supplied with the same regularity and absence of need for forethought as with domestic animals, the enfranchised negro really "takes no thought for the morrow." The climate in which he lives creates but few artificial wants, and the stimulus for regular labour is therefore absent. But it is singular that this is not the case with the negroes of Barbados. In that fertile little island, and from the time of the emancipation, the "Badian nigger" of Captain Marryatt has looked upon himself as a gentleman among his black *confrères* of adjacent islands, and as being bound to comport himself as such. The consequence is that he will labour to supply the means for supporting his assumed status in the social scale, and the result has followed that coolie immigration into that island is unnecessary and scarcely ever heard of. But the case of Barbados is a solitary exception among the colonial group. In all the other British settlements imported labour is a vital need, and unless some new steps, at present even unconsidered, are shortly taken, the look-out for continued prosperity in them will be an exceedingly poor one.

As we have said, the question of public works is largely affected by the anticipated failure of imported labour. In each colony railways are in progress, and their development, and that of other means of communication, must be pushed on to offer our planters advantages which alone can enable them to compete with the products of slave-labour in the South American States. It may be said that the Brazils is no longer a slave-holding country. Granted that *nominally* it has ceased to be so; but recent information given to us assures us that the "apprentice" still works there under the lash of the overseer, and that the sale of negroes under official sanction is practised at the present time. Unless our humanitarians can call the attention of the Emperor of Brazil to what is going on in the backwoods of his vast empire, the blood of the slave will still be freely shed in the competition with the free labour of our colonies; and if these last are deprived of the means of meeting that competition by hindrance to their public works, they must fail in the fight.

It behoves the governors of those colonies, therefore—and we would call Lord Derby's attention most strongly to the fact—to look about them and see how this deficiency of labour is to be supplemented. At first sight China seems to offer an almost inexhaustible field, but wherever its people have been imported in large numbers, prejudice—in many cases most unreasoning—has been established against them. The South Sea Islands are often mentioned as likely to afford labour in sufficient quantities; but they are now proving a failure as regards Fiji, and the planters there are becoming competitors with the West Indian colonies in the Bengal market. Sooner or later the plan just initiated by Mr. Kortwright, late Governor of British Guiana, may prove the only resource. As he has done, make it worth the immigrant coolie's while, by free grants of land, to *settle* in the colony. His habits of industry will in time permeate even the crass obstinacy of the negro, or the latter will die out, and we shall witness once again "the survival of the fittest."

Having thus treated of the several points connected with the question of coolie emigration, it may be desirable to notice briefly a few circumstances recently brought into prominence with reference to the subject. For years past we have heard complaints of the system under which labourers resident in the New Hebrides, and adjacent islands in the South Pacific, have been kidnapped and taken to serve the planters of Fiji, Queensland, and elsewhere. Not long since a deputation representative of various missionary societies waited upon the Earl of Derby for the purpose of bringing this matter to his notice, and to urge that steps be taken to place the traffic under proper control. As Lord Derby then pointed out, this question is far from free from difficult complications, as any step of our Government might be jealously construed by the French, who have considerable interests in the South Pacific. Again, did we seek to establish an English protectorate—which, after all, would be the surest way of stopping the evils complained of—we should be accused by foreign nations generally, as well as by a large section of our own people at home, of that "earth hunger" which is said to be our common characteristic. The evils, which are by no means one-sided only, evidently require some drastic mode of treatment if a very valuable source of labour supply is not eventually to be wholly closed to our colonists.

A further instance of the difficulties connected with the important matter with which we have been dealing is afforded by the recent importation of Singhalese labours from Ceylon into Queensland. Some 500 men and women of this nationality recently arrived in the latter colony, where they were received with much antagonism by the white working-men. Now these coolies were shipped from Ceylon under the careful supervision of H.M. Government in that island; and from the various statements appearing in the *Ceylon Observer* it is evident that every possible precaution was taken by the authorities, both that the coolies understood the agreement they entered into, and that due and proper provision was made for their comfort. Yet we find that the Aborigines Protection Society has taken occasion to declaim as to tyrannous treatment, because a few rebellious individuals among these Singhalese were punished by English law—as would have been any Englishman—for the infringement of their agreement, the provisions of which had been most fully explained to them. It is a mistake for a society to interfere "both in and out of season." Such a course brings its often beneficial proceedings into contempt, and altogether nullifies the usefulness of the society. We believe from our own practical experience that it is the general rule that, if for their own sakes only, our English planters treat their coloured labourers with kindness and consideration, any attempts to cast obloquy upon them is a most ill-advised proceeding, tending to destroy the useful position occupied by our colonies towards Great Britain, which has been largely created by means of coolie immigration into them; and it may be fairly stated in conclusion that the benefit has been in nearly all cases thoroughly reciprocal.

AN ELECTRIC FIRE ALARM.

Fires in hotels and other large buildings on either side of the Atlantic have lately excited a feeling of apprehension in the

public mind, which gives particular importance to every effective method for minimising danger of this description. An instance of a very successful application of electricity for this purpose occurs in the case of the well-known Langham Hotel, in Portland-place, at the west end of London. This colossal establishment, consisting of basement, mezzonine, ground floor, *entresol*, and six upper floors, comprising in all more than 500 apartments, would seem by its very construction to offer the greatest defence against fire and the best possible means of escape. All the stairs are of stone, all the corridors are paved with the same material, all the walls are of brick, and there is not a particle of lath or plaster in the place. The wine cellar and spirit stores are under the quadrangle, so as not to threaten the security of the main structure. There are six points of exit, and some of the stairs are external. Water is pumped from a chalk well, 400ft. deep, to a tank at the top of the building, which is in communication with numerous hydrants, which are also supplied with water from the mains of the water company. There are likewise forty-four hand pumps on the several floors, and forty "fire stations," with all the appliances necessary for making use of the hydrants, including a plentiful allowance of hose and buckets, some of the latter being left filled with water. Fire-escapes are also provided, and the servants of the establishment, male and female, to the extent of more than 300, are subject to frequent drill as to the mode of using these contrivances, either to rescue other persons, or for the purpose of being rescued. There are always two firemen on duty ready to attend to the signal which shows that their services are required; and this brings us to a consideration of the plan which has been patented by Mr. Gordon, the manager of the hotel, whereby a system of electric circuits is employed to secure the ready presence of the firemen when wanted. It is not every hotel manager who can be expected to earn a good dividend for the proprietors or shareholders, and at the same time to possess scientific qualifications sufficient to produce patent apparatus conducive to the comfort and security of the visitors who patronise the establishment. Such, however, appears to be the fortunate state of affairs at the Langham Hotel, and a personal inspection of the arrangements has impressed us with a sense of the ability with which Mr. Gordon has fulfilled his task. Supposing a visitor to the hotel to become conscious that a fire was breaking out on the premises, he would only have to step into the corridor on whatever floor he might be, and he would find near at hand a push piece, or circuit closer. By pressing the handle he would immediately set bells ringing on every floor throughout the building, so as to attract the attention of one or both the firemen. On hearing one of these bells the fireman would run to inspect an indicator—of which there is one on each floor—a glance at which would show him the exact spot from whence the alarm proceeded. On the day of our visit the alarm was given on the third floor, and it happened that the signal was accepted by a fireman in the basement—itself a remote spot; but in three-quarters of a minute he made his appearance where the push piece had been driven in. We were assured that the time consumed in this instance was exceptionally long, and that it very rarely amounted to 35 seconds. Supposing a fire to break out, a bucket of water could be seized in an instant, to be followed by the hand-pump or hydrant as circumstances might demand. From basement to summit these various appliances exist, and on the whole it must be said that protection against fire is as complete as can well be imagined. A fireproof building, with an abundant and constant supply of water under pressure, and with provision for fetching skilled aid at a moment's notice, would seem to offer every reasonable guarantee for safety, so that no dread of fire need harass the occupants of the hotel either by night or day.

PROJECTED CANALS IN GERMANY.

A PROJECT was before the Russian Chamber of Deputies in its last Session, which was not disposed of, and which has now come before that body in a more extended form. The scheme in question is the canal from Dortmund to the Lower Ems, which will run for a distance of 130 miles, and will cost about 2¼ millions sterling. The *Deutsche Bauzeitung* comments upon the increased attention which is now being given in Germany to canal construction upon a large scale. The alterations of dimensions consequent upon the proposal to make the canal available for sea-going ships form a distinctive feature of the modified project. It is remarked that the Government has not displayed a favourable tendency towards the new form of the proposal, this opposition arising both from economical and technical grounds. The junction of the Spree with the Havel is a question which has long occupied a certain amount of attention in Berlin technical circles. Various circumstances have, however, contributed to delay the project being carried out, amongst other reasons, the cost of the war having tended to delay various public works, involving the expenditure of large sums of money. There are now, however, two plans under consideration. Messrs. Von Hohmann and Von Lancizolle have recommended the canal starting at Potsdam, below the Glienick Bridge, over the Havel, and falling into the Upper Spree beyond Berlin, passing through Steglitz and the Teltow district. The object of this plan is the connection of the Upper Spree with the Elbe, without the new canal touching Berlin. Another project is that of Major Wagner, who recommends that a canal should be constructed from the Lower Spree at Charlottenburg, and should reach the Havel through the Gunnewald district and lakes at Wannsee. The *Thonindustrie Zeitung*, in publishing a summary of the two projects, remarks that at the present moment the communication between the two rivers would be more productive of advantage to the public at large if the latter scheme were to be adopted. The authorities of Berlin have, of late, been paying much attention to the development of the water communication in connection with the Prussian capital, and it is considered that Major Wagner's project is more adapted than the competing scheme for meeting the practical necessities involved in the question at issue.

LITERATURE.

Report of the Proceedings of the Sixteenth Annual Convention of the Master Car-builders' Association. New York: M'Ilroy. 1882.

THIS report, which appears as a small 8vo. volume of 250 pages, is a favourable specimen of the kind of work which is being done by what may be called the specialist societies of the United States—societies which have their parallel on the Continent, especially in Germany, but which are practically unknown in England. We have, of course, technical societies in plenty—some, like the Institution of Civil Engineers or Society of Arts, which cover a very wide ground; others, like the Iron and Steel Institute or the Society of Telegraph Engineers, which cultivate only a restricted field. Even with the latter, however, the restriction, at any rate as regards membership, is rather nominal than real. The Iron and Steel Institute, for example, would welcome into their ranks any one who is eligible for the corporate membership of the Institution of Civil Engineers, besides very many who are not. Whatever their aims or restrictions, however, the course of action of such societies is similar. They meet at regular intervals throughout a session of some eight months—say once a week, or once a fortnight. At these meetings such papers as have been offered by members or others, and approved by the governing body, are read and discussed, and the record is subsequently published for the benefit of the society and of the public. Such papers are necessarily of a sporadic and various character, dealing mainly with whatever may be the "burning questions" of the day in that particular department of knowledge; and the discussions are apt to be desultory and disappointing. No attempt is made—with few exceptions—to take up and work out any particular question; to ascertain exhaustively what is the experience of the most prominent members on that particular subject, and to record this, with their opinions on its past history and future progress. It is known, in fact, that such experience and opinions will in most cases be given grudgingly, if given at all; and that it would probably be impossible to collect such a body of information as would fairly represent the facts of the case. As a matter of fact, it is not attempted; the weekly or fortnightly meeting, with a good paper on some subject or other, and if possible a good discussion to follow, is all that a member looks for as the ultimate object of such an association.

This sort of thing does not suit our brethren in America. In the first place—confining ourselves to engineering societies—the country is so vast that it is impossible to collect the engineers of any one class together for weekly or fortnightly meetings. Hence the form naturally assumed is that of an "Annual Convention," which is held at some important centre, and to which an engineer, even from a distance, finds it quite worth while to give up a week. Then, when the Convention has met, the intensely practical turn of mind characteristic of the American engineer indisposes him to listen to papers on subjects with which he has no direct concern. In England a mechanical engineer sits contentedly through a paper on blast furnaces, and a civil engineer listens amicably to a discussion on the difference between English and American practice in locomotive boilers. He feels that he is picking up some knowledge on an interesting subject, which is at least akin to his own business; and that it is impossible to say when such knowledge may turn out of practical value to him. We by no means wish to imply that he is not quite right in his view; but at least it is not that of an American. Long before the paper was over, the latter would "calculate that he had something better to do with his time"—something, namely, which he could see a more immediate prospect of turning into hard cash. This feeling naturally tends to split up societies into small groups, each working a very limited field, in which all of its members are directly interested. In England, even on the Continent, no one would dream of proposing one society for locomotive superintendents and another for carriage superintendents; but in the United States we find the Master Mechanics' Association and the Master Car-builders' Association both in full vigour. Now, it is obvious that, the ground being thus subdivided, each plot can furnish a sufficiency of intellectual food for those concerned in it only by being most diligently cultivated. Add to this that an American engineer believes in theory, believes in practice, believes most of all in going ahead. When a subject is started, he wants to know what everybody thinks about it, and what everybody has been doing with it hitherto, in order that he may strike out something which shall outshine them all. Hence the regular course of things in an American technical society is as follows:—Somebody starts a subject; he suggests, we will say, that it would be well to know something about the best forms of continuous brake for goods trains. In England this would only mean that the secretary would endeavour to get somebody, probably an inventor of goods train brakes, to read a paper upon them, and that paper, if obtained and read, would receive a certain very limited amount of discussion. In America it means something quite different. The society forthwith appoints a committee to deal with the question. This committee sends round to every inventor of such brakes, and to every railway engineer who is known to have tried them, a schedule of questions to elicit his experience and his opinions. These not only send these round, but—*mirabile dictu*—they get answers to them, at least in the majority of cases. Their answers form the basis of a report, which is laid before the society at its next convention. It is needless to state that a number of opinions, obtained independently from different persons, will be found to present very marked discrepancies and even contradictions. Those who have thus put forward opposing views are pretty well bound to maintain them. A good discussion by really capable men—the most difficult thing to ensure in such meetings—is thus provided for, and the subject either gets thrashed out completely on the spot, or is referred back to the committee for further inquiries, further experiments, if need be, and for a second report to be presented and considered at the next convention.

It is difficult to resist the conclusion that much good must result from such thorough and painstaking investigation of a subject. Why such a thing does not exist in England, and whether it could be introduced, are questions we shall not attempt to enter upon here. Anyone, however, who wishes to judge for himself as to the manner in which such inquiries are conducted may be recommended to glance through the volume before us. The convention of the Master Car-builders' Association was held at Philadelphia on the 13th to 15th June, 1882, under the presidency of Mr. Leander Garey. The president's address, which was very short, pointed to three questions as specially requiring the attention of the association, viz., the automatic coupling of cars; the exact gauge to which wheels should be set with reference to lateral play between flange and rail; and the repairs to loaded cars while in transit. Reports were then read and discussed on the following subjects:—Train brakes for freight cars; accidents to train men; standard draw bars and draw springs; carrying capacity of freight cars; materials for car construction; amendment of the constitution of the society; brake heads and shoes; a standard wheel gauge; repairs to cars in transit; the Tallman brake; automatic draw bars for freight cars; standard screw threads for cars; and, on a joint meeting with the Master Mechanics' Association. Some of these reports contained little or nothing beyond the fact that the committee was pursuing its investigations; others gave most valuable information on the topics concerned, and led to long and animated discussions.

We will take one of these discussions as a specimen, because it relates to a subject very recently discussed in these columns, namely, the proper form to be given to the tread of railway wheels. In that discussion it was noted as very remarkable that the question whether a wheel tread should be conical or flat was not yet settled in England; inasmuch as at least one eminent authority considered the practice of coning to be a mistake. It appears that the same difference of opinion exists in America, but in a much more marked degree. That the question, after forty years of railway working, should yet remain to be fought out is itself a powerful argument for the existence of such bodies as the Car-builders' Association. It arose at the present meeting indirectly, in the course of a discussion as to wheel gauge. Mr. Davenport observed that a railway master car-builder had maintained to him, as the result of many tests, that a wheel straight on the tread, or cylindrical, will run more evenly and more steadily, and go round a curve as easily, as a coned wheel. On the last point, which is, of course, the special point of discussion, he made the following very pertinent remark: "Does it not make a difference whether you are pulling a car round a curve or pushing it round a curve? If you are pushing, then, of course, the inclination of the car is to go off on a tangent, and hug the outer rail. Then, of course, the cone would be a help. But if you are pulling the car, then you are forcing it toward the inner rail, and the momentum of the train is carrying it toward the outer rail. But in freight trains, which of course is the principal thing, the draught of the train is all the time tending to force the wheel against the inner rail."

It would certainly seem at first sight that there is much force in this. The subject has always been treated, we believe, as if the vehicle were running round the curve by its own momentum, independent of any pull in front. This is true, of course, of the engine, and so far the arguments in favour of coning would apply; but it is not true of the vehicles which it is dragging round the curve after it. These have a forward pull upon them which acts at a tangent to the curve, and does actually tend to lead them round it. But a moment's reflection shows that this is not, even yet, the whole of the story. The vehicle has also a backward pull upon it, due to the remainder of the train, and this pull tends to twist it in the opposite direction, or to throw it off the curve. If the two pulls were equal, as well as symmetrical, the vehicle would thus be in the same condition as if it were free, and the arguments for coning would still hold. But they are not equal, the forward pull being of course the greater, by just the amount of the resistance to traction due to the wagon itself. Hence there will be a resultant movement, tending to make the vehicle follow the curve; in other words, to keep the inner leading wheel close to the inner rail. How far this will succeed in actually turning the vehicle in the required direction, and so preventing the flange of the outer leading wheel from bearing against the outer rail, must be determined by observation; but if it does so to any considerable extent, then the advantage of coning, as enabling the outer wheel, which has furthest to go, to run on the larger circle, is so far rendered nugatory.

The discussion of the point at Philadelphia revealed an extraordinary variety of opinion. It was asserted by one or two speakers that on a curve the flange of the outer leading wheel was always hard against the rail, and the rapid wear of the inside of the rail-head was quoted as a conclusive proof. To this it was replied that the argument as to the cars did not, of course, affect the engine; in fact, the engine is forced against the outer rail not only by its own momentum, but by the twisting action of the pull on its draw bar, and has probably a greater grinding effect than all the carriages put together. Again, the question was said to have been asked, "How long does the coning last?" and it was admitted that it was completely worn off long before the wheel came back for re-turning. It appeared further that the Lehigh Valley Railway had been testing unconed wheels for a year, on a very crooked road, with great success; that on the New York Central an engine had been turned from a hard-running into an easy-running one by taking off the cone; and that another railway had been using unconed wheels on its locomotives for ten years. Therefore even for engines there is some ground for thinking, as one speaker expressed it, "that the coning of wheels is an old fogey idea, and ought to be done away with." Eventually a committee was appointed to examine into the question. Doubtless they will present a valuable, probably a conclusive, report to the Convention of 1883; and within ten years after the question has thus been disposed of, it is not, perhaps, too much to hope that English engineers may generally wake up to the fact of its existence.

BOOKS RECEIVED.

Plumbing: A Text-book to the Practice of the Art or Craft of the Plumber, with Supplementary Chapters on House Drainage. By W. P. Buchan. Fourth edition. London: Crosby Lockwood and Co. Weale's series.

A Rudimentary Treatise on Clocks and Watches and Bells. By Sir E. Beckett. Seventh edition. London: Crosby Lockwood and Co. 1883. Weale's series.

Rudimentary Treatise on Wells and Well Sinking. By J. G. Swindell and G. R. Burnell. New edition. London: Crosby Lockwood and Co. Weale's series.

The Art of Mechanical Digging. By Frank Proctor. Stevenage.

The Philosophy of Advertising and Newspaper Register, 1883. By H. Sell. London: H. Sell.

DETAILS OF PUMPING ENGINES, WHITWOOD SEWERAGE WORKS.

MR. JOSHUA HORNE, ENGINEER, CASTLEFORD.

(*For description see page* 180.)

FIG. 1

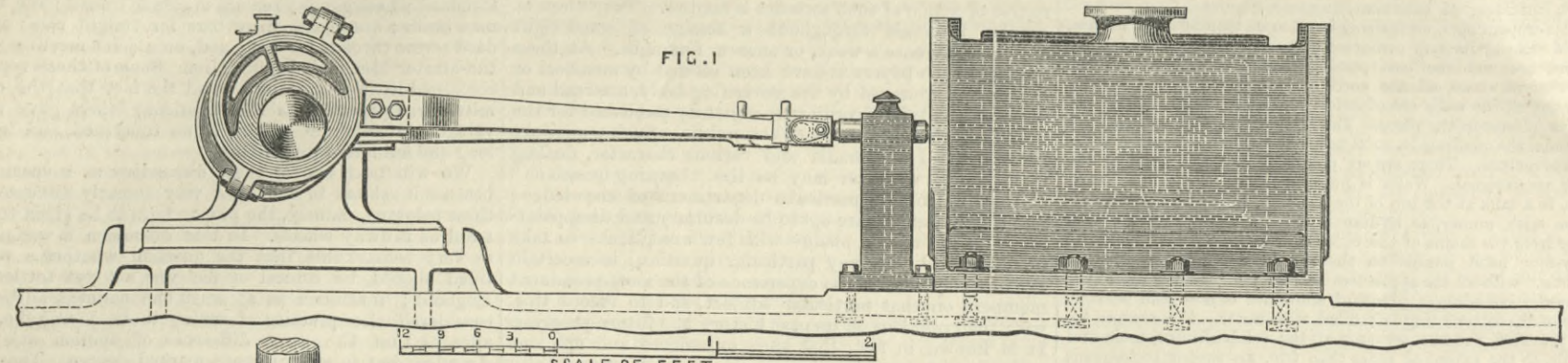


FIG. 2

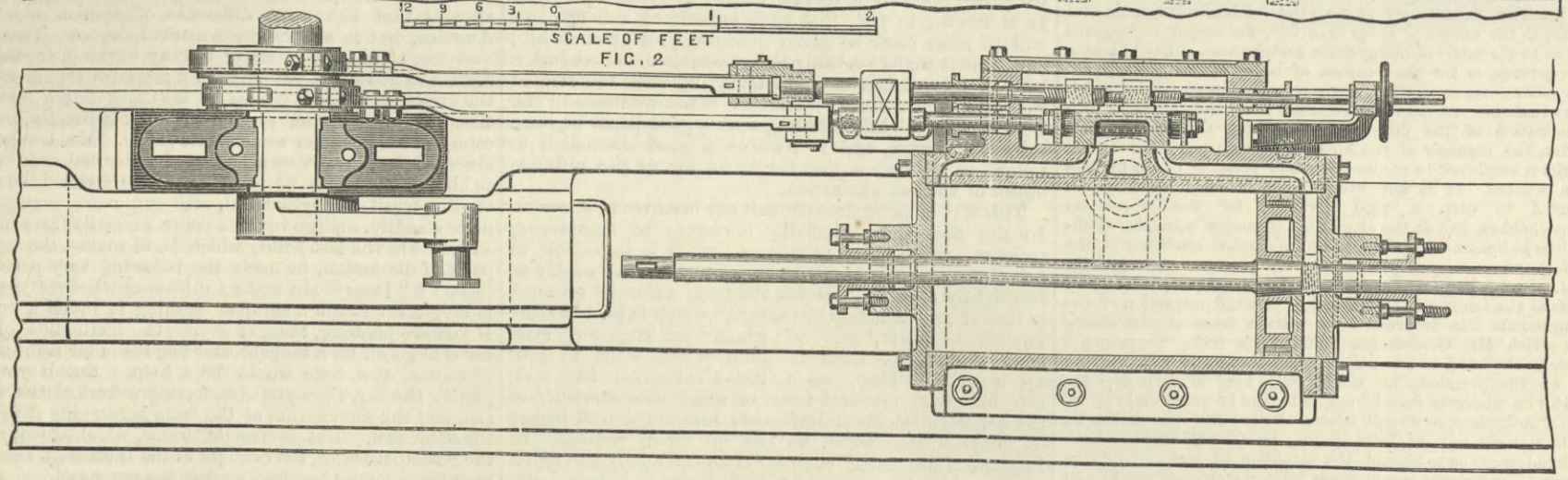
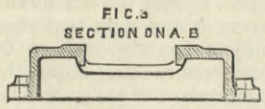
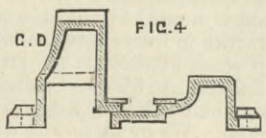


FIG. 3
SECTION ON A B



SECTION ON C.D FIG. 4



SECTION ON E.F
FIG. 5

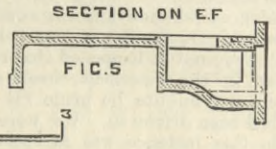
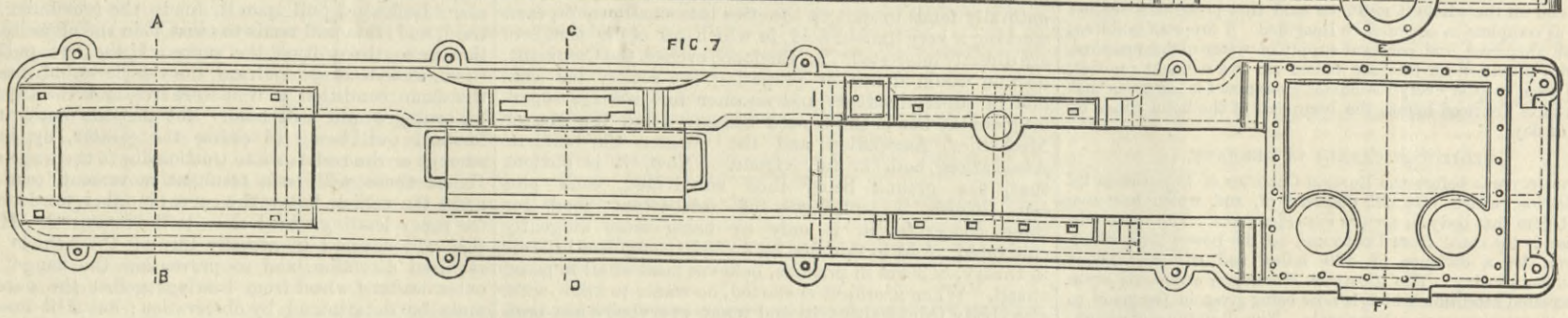


FIG. 6

FIG. 7



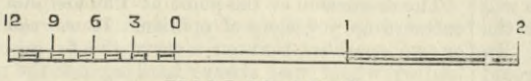


FIG. 10.

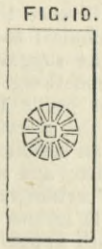


FIG. 11.

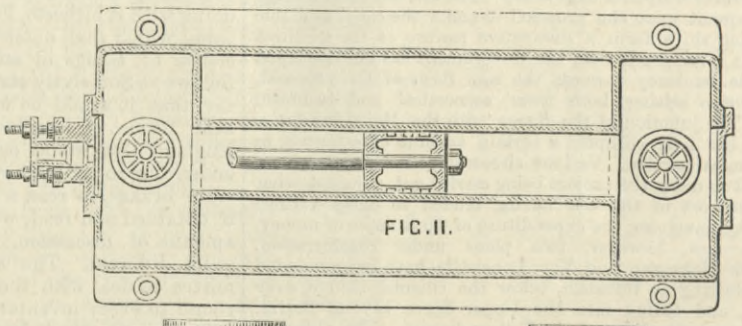


FIG. 8

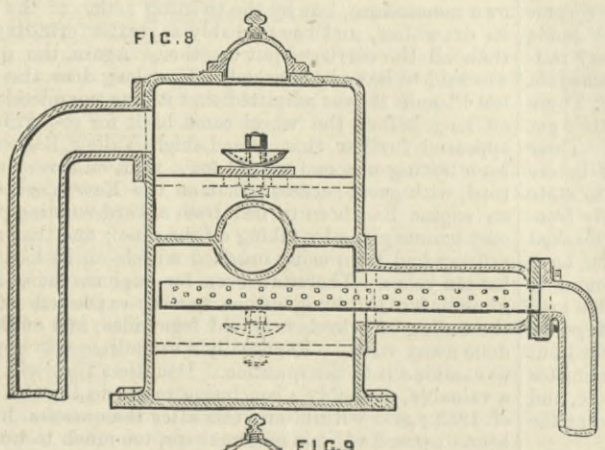


FIG. 12.

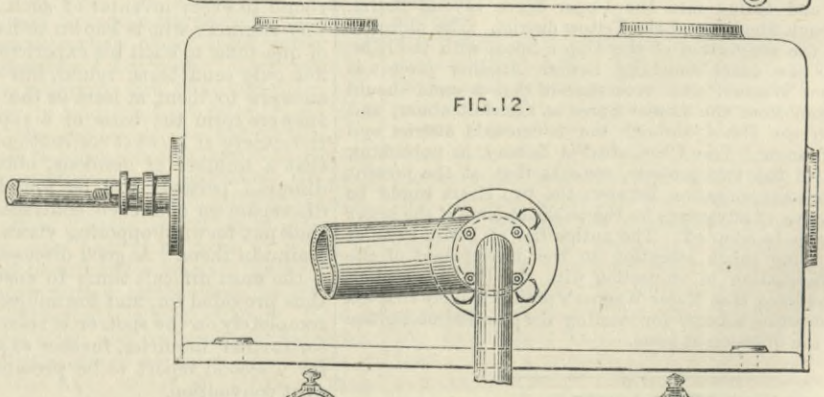


FIG. 9

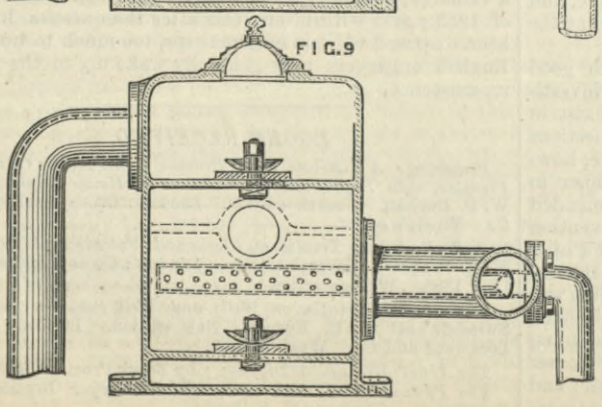
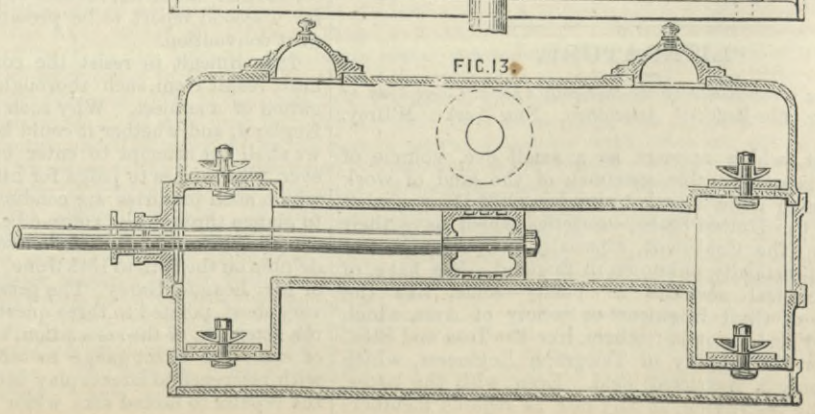


FIG. 13.



THE SOCIETY OF ENGINEERS.

A NEW SYSTEM OF TREATING FŒCAL MATTER.

AT the ordinary meeting of the Society of Engineers held on March 5th, Mr. Jabez Church, president, in the chair, a paper was read by Mr. Harry Olrick on the above subject, of which the following is an abstract. The almost universal system of water home sewage adopted when a city is near a river has given rise to a very grave inquiry as to whether this should not give place to some other method of disposal and utilisation, which will not pollute the rivers. The pail system, apart from a sentimental view of the case, seems to work well in such towns as Manchester, Birmingham, Warrington, Rochdale, and others, the Board of Health of Manchester claiming that since the adoption of this system the cases of zymotic diseases have greatly decreased. They, like numerous other towns, are making manure out of fœcal matter, besides treating and utilising the other large amount of refuse, and although doing a considerable amount of work which does not produce revenue, they are not only self-sustaining, but work at a profit. The new system which the author calls particular attention to has been worked out by Baron de Podewils, of Munich, and is claimed to be an improvement on other systems, from the facts that the operations of the factory are comparatively automatic, that no unpleasant odour can arise, since the operations are all performed in closed vessels, that by a system of quadruple evaporation the fuel necessary is reduced to a minimum, and the resultant manure is of high quality, and is sold at from £9 to £10 per ton. A factory has been erected by the Baron at Augsburg, in Bavaria, which is designed to deal with the excrement of about 17,000 inhabitants, or about 7000 cubic metres per annum. The fœcal matters are deposited in air-tight tanks, the gases generated being drawn under the steam boiler and burned. From these tanks the matter is drawn into a mixer provided with revolving arms, where a proportion of sulphuric acid is added; the effect of this is to generate carbonic acid, and other gases which are conveyed away to be burnt. From the mixer the fœcal matter is forced into a fumigating pan; this pan is provided with hollow revolving arms which curve down to the bottom of the pan. Part of the products of combustion from the steam boiler are blown through the fœcal matter by way of the hollow arms, and pass away, together with the gases generated, through an exhauster to the furnace of the boiler. From the fumigator a *monte-jus* forces the matter into a series of four evaporators, the vapours of one serving to evaporate the moisture from the next at a lower temperature and below atmospheric pressure, thus saving 75 per cent. of the fuel ordinarily required to produce the same result. These evaporators have a temperature varying from 140 deg. to 248 deg. Fah. From the evaporators the *monte-jus* forces the by this time pasty mass into a tank provided with a bucket wheel. This tank is placed above the final drying machine, which accomplishes the most difficult part of the whole process, viz., evaporating the remainder of the 95 per cent. of moisture originally contained in the fœcal matter, when it has reached a peculiarly tenacious and sticky stage. This machine consists of steam jacketted ring-shaped plates, on which the pulp is thinly spread by means of a rotating spout attached to a revolving hollow spindle, which conveys the pulp from the overhead tank fed by the bucket wheel. After this layer has remained on the plates a few minutes it is scraped off by knives, also attached to the revolving spindle, and drops into a shute, from whence it passes, by means of an elevator, into a disintegrator. This is the end of the process, a manure being produced in the shape of powder containing less than 9 per cent. of moisture, 8 to 10 per cent. of nitrogen, 3 to 4 per cent. of alkalies, and 3 to 4 per cent. of phosphoric acid, and consequently worth now as much as imported guano. This factory has been in operation nearly three years, and although labouring under the disadvantage of having to use coal as fuel at 23s. per ton, the proprietor has been able to make 20 per cent. dividends. Another factory has been erected at Stuttgart with equally good results. At Augsburg a pail system is in use. At Stuttgart the cesspool is general. The author calculates that with a population such as England possesses manure weighing 600,000 tons, and of a low estimated value of £4,000,000, is annually allowed to poison the air and water, instead of being permitted to return to the soil as Nature intended.

TENDERS.

NEW BREWERY, BURTON-ON-TRENT.

FOR extension of plant at the new brewery, Burton-on-Trent, for the trustees of the late Mr. P. Walker. Messrs. Scamell and Colyer, 18, Great George-street, Westminster, S.W.

	£	s.	d.
CONTRACT No. 4.—MACHINERY, &c.			
G. Waller and Co.—accepted	1052	0	0
CONTRACT No. 8.—COPPERWORK AND PIPES.			
Bindley and Briggs—accepted	550	0	0
CONTRACT No. 10.—BACKWOR			
R. Carty and Co.—accepted	300	0	0

A MACHINE FOR PICKING COTTON. — A recent special report issued by the Department of Agriculture at Washington contains a reference to a cotton-picking machine, the invention of Mr. D. B. Hazleton, of Charleston, who seems to have solved the problem of picking cotton by machinery. The implement somewhat resembles a long wagon on two wheels, from whose naves motion is conveyed by a chain band, horses or mules furnishing the motive power. The pickers are toothed steel discs revolving between two wooden discs. The latter prevent unopened bolls, foliage, &c., from entanglement, while the fibres of the blossom, drooping even but slightly between, are caught, drawn entirely in, and taken cleanly from the boll by the teeth of the swiftly turning metal. A revolving brush removes from the teeth the fibres, which fall upon an endless apron, and are conveyed to the body of the machine. As the machine moves forward a V-shaped device conveys the plants to the pickers. The shaft on which the latter revolves is inclined in such a way that the blossoms at any distance from the ground are reached. Motion is also conveyed to brushes on the front of the implement, by which sand and dust are removed from the plant.

AN ELECTROMOTIVE TORCH.—Dr. Brard, of La Rochelle, some time since announced his discovery of a method of preparing blocks of combustible matter, capable of being used as fuel, which at the same time developed a current of electricity. See engravings in *Scientific American*, October 28th, 1882. Proceeding on the same lines, Dr. Brard has succeeded in making a kind of torch which yields a current of electricity in burning. He makes, first of all, an inflammable wick of coal dust and molasses moulded into a rod. A thin sheet of asbestos is then wrapped round this wick, and the whole is dipped into fused nitrate of potash until a good thickness of the material adheres. When the wick of the torch thus made is ignited, a current of electricity may be detected in a circuit of wire connecting the coal paste and the nitrate of potash. It does not appear that such a torch is at all a good one for giving light, and, indeed, the contrary might be inferred from the materials used in its construction. Neither does it develope a useful current of electricity, for the electro-motive force produced is insignificant, Still the discovery is regarded as important, because it proves the possibility of electro-generative fuels. It also affords a starting point for the imagination of sanguine individuals, who have already begun to speculate on the time when the fireplaces of living rooms will be made available for supplying electricity—not only for ringing bells, but also for charging accumulators, and thus giving light also. It is reported that Dr. Brard has this latter object in view.

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

(*From our own Correspondent.*)

TO-DAY—Thursday—in Birmingham, and in Wolverhampton on Wednesday, the tone of the market was improved. Most quotations were stronger. Some makers of singles sought, upon the previous minimum, a rise of 5s. per ton in that class of sheets, making the quotations of such firms £8 per ton. The rise was not easy to secure, for doubles were still to be had at prices which from £8 10s., and occasionally £8 15s., descended to £8 5s.; while trebles were procurable at from £9 5s. to £9 10s. per ton.

The demand for bars is steady; marked sorts are £8 2s. 6d., to £7 10s.; medium sorts at £7 10s. to £6 10s.; and common sorts were a minimum of about £5 17s. 6d.

Nos. 4, 5, and 6, rolled wire rods were quoted £7 at Liverpool for fencing purposes as an average; and for drawn rods of the same sizes, £8 10s. to £9 per ton was named.

The average price asked this afternoon for hoops was £6 15s. to £7.

The pig iron market is a little strengthened by the better prices that are being obtained this week in Scotland and Cleveland, and the local demand also is rather better. Derbyshire, Wiltshire, and Northampton sorts were to-day in abundant offer; the two first at from 47s. to 50s., according to quality, and the latter at a minimum of 46s. 3d., which is an advance on the week of 1s. 3d. per ton. The Clay Cross and the Westbury brands of Derbyshire were quoted at 48s. 6d. delivered.

Hematites sold rather better, and the Tredegar brand was in under supply due to special circumstances. Blaina hematites were quoted 62s. 6d., but the price could not be realised; Tredegar hematites were strong at 65s.; while for Barrow hematites 67s. 6d. was asked, but without success.

Native pigs were, if anything, a little stronger. Quotations, however, remain unaltered on the basis of 65s. for all-mine, and 42s. 6d. to 40s. for common sorts. The Willingsworth brand was quoted 45s.

The number of furnaces blowing shows but very little fluctuation, and there are now in operation about forty-eight.

Coke and ironstone is offered in large quantities, but sales are not numerous. Prices favour buyers, though open market quotations are unaltered. Good forge coal is selling at 7s. per ton at the pits, and good mill coal at 8s.

At a meeting of the Mines Drainage Commissioners in Wolverhampton on Wednesday, the chairman reported that on the 25th March, a powerful pumping engine would be set to work at Stow Heath, and that in about three months' time the unwatering of the Bilston district would be actively commenced.

The adoption of machinery in the place of manual labour in the cultivating and edge tool industry, and the increased employment of steel, is resulting in the production of tools in this district much superior to those formerly turned out in a like quality, design, and finish. The American axes, hatchets, matchets, and other tools are being imitated with much exactness, and tests to which I have this week seen certain of the new productions in this line submitted side by side with the American articles, prove the quality of the native axes to be equal to the American. Adzes, picks, and hoes also show great advances. The Colonies, South America, and India are the chief markets for these goods.

The Admiralty are inquiring for large supplies of hardwares of various descriptions, tenders for which are to be in at specified dates between the 14th and 22nd inst. The following branches are expected to benefit:—Weighing machines, stoves, lathes, chain rigging, hinges, iron plate workers' ware, black ironmongery, tin and japanned ware, locks and lock furniture, wire, nails, and screws.

The annual Conference of the Midland Counties Federation of Miners has been held at Hanley, North Staffordshire, this week. There were delegates present from South Staffordshire, Worcestershire, Salop, Forest of Dean, Derbyshire, and North Staffordshire, representing, it was asserted, in the aggregate 64,000 men. It was reported that the Federation had successfully resisted a general notice for a reduction of 10 per cent., with the exception of the Forest of Dean district, where the struggle was now going on. The Conference resolved to support the Forest of Dean men if the employers do not agree to a settlement by arbitration or conciliation.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—A change, which shows some indication of a more healthy condition of trade, has come over the iron market during the past week, and the long continued depression has at length given way to a better and more hopeful feeling. Last week I intimated that as pretty keen buyers were giving out orders at about 1s. per ton under what makers had been asking, this might be taken as an indication that the market had touched its lowest point, and there now seems to be a pretty general belief that not much advantage can be gained by any longer holding back orders. There has been more inquiry in the market, and offers for tolerably large quantities have been made by buyers at prices they were not disposed to give a week or so back. Makers, on the other hand, have not been slow to take advantage of the altered feeling in the market, and previously low sellers are not now willing to book further orders at the prices they have recently been taking. At present the improvement in the market seems to be mostly confined to pig iron. So far as finished iron is concerned the most that can be said is that prices have not given way any further, and that at the minimum quotations makers are not anxious to commit themselves to any very large sales.

At the Manchester 'Change meeting on Tuesday, although the weight of business actually done was not large, a more animated tone prevailed in the market. Lancashire makers of pig iron reported moderate sales on the basis of their minimum quoted rates of 46s. 6d., less 2½ for forge and foundry delivered equal to Manchester, with offers for fairly large quantities at a little under this figure. In district brands tolerably large orders for Lincolnshire forge iron could have been secured at 45s. 4d., less 2½ delivered equal to Manchester, but the makers who have recently been taking this figure were asking an advance of 1s. per ton, and there was no disposition to entertain offers at anything below 45s. 4d. less 2½. For foundry qualities quotations averaged about 46s. 10d., less 2½ delivered, and at this figure a few sales were being made. For Derbyshire brands makers' prices nominally remain at about 48s. to 49s., less 2½ delivered, but there does not appear to be any business doing. Sellers of Middlesbrough iron were on Tuesday asking an allowance of 1s. per ton upon the prices ruling last week, but this had the effect of checking further business in north country iron, which the low rates previously ruling were tending to stimulate in this district.

Consumers of hematite who are known to have fairly large orders to place out, and who have been offering at a few shillings under quoted rates, do not as yet come into the market; but there has been increased business done in parcels of moderate weight, and prices remain at about 63s. to 64s., less 2½ for good foundry qualities delivered equal to Manchester.

For finished iron the orders giving out continue very small, and although some of the makers are fairly off for work for the present, generally order books are very bare, and some of the forges are only kept partially employed. Prices, however, are maintained at £6 5s. as the minimum quotations for bars delivered into the Manchester district.

With regard to the engineering trades, I have nothing new to report. There is still plenty of work in hand generally, but I hear complaints that new orders are not very numerous so far as general engineering work is concerned.

An exhibition devoted to appliances directly connected with lighting or heating by electricity or gas, and general exhibits of a *bonâ fide* engineering character, was opened in the St. James's Hall, Manchester, on Saturday. The whole arrangements are, however, at present in so backward a state that any general description is impossible. The only section at all approaching completeness is that devoted to gas engines, and as this will probably form one of the most important features of the exhibition, some reference to it will be of interest. Manchester and the district may now be considered the most important centre in the kingdom for the manufacture of gas engines, and although all the local makers have not as yet put in an appearance, no less than seven different types of gas engine are shown. Messrs. Crossley Bros.' Otto silent engine, and Messrs. J. E. H. Andrew and Co.'s Bisschop engine, which are shown, are already well known, and the Haigh and Nuttall engine, shown by W. B. Haigh, Oldham; the Turner engine, shown by Thos. Bradford and Co., Salford; the Wordsworth engine, shown by John Wolstenholme, of Radcliffe, have all been at previous exhibitions, so that detailed reference to these is not necessary. There are, however, a couple of new engines which have not before been exhibited. Messrs. Ashbury and Summer, of Manchester, exhibit a newly-designed engine styled the "Manchester," which is very compact in construction, special care having been taken to dispense as much as possible with moving parts requiring lubrication, and as the use of bevel wheels is discarded, the engine is practically noiseless when at work. One special advantage, however, which is claimed for the engine is that it stands alone in being reversible in its action. Messrs. Pickard, Goodbead, and Barker, of Manchester, also exhibit for the first time a new engine, styled the "Whittaker," which is certainly for the power developed the lightest engine in construction I have yet seen, and a special feature is introduced by an arrangement of wheel valves for regulating the intake of gas. At a later stage of the exhibition I understand that additional interest will be imparted to this section by the introduction of the latest developments in gas engines specially designed for driving in connection with the electric light. Manufacturers are now specially directing their attention to securing increased steadiness, and with this object in view engines are being constructed with double cylinders in which an impulse is taken at every revolution, and examples of this type of engine are to be exhibited.

As an illustration of how essential a perfect driving power—if such is attainable—is to the success of the present system of electric lighting, I may mention that the chief difficulty in carrying out the most important attempt yet made at electric lighting in Manchester has been with the engines. The Royal Exchange has for some time past been lighted with electricity, the arrangements for which I have previously described. A short time back the whole of the lights suddenly went out, and the explanation was the engines had got overheated. One day this week I noticed that gas, which had been wisely kept on as a precaution against accident, was burning in place of the electric lights, and the explanation again was something wrong with the engines. The extensive restaurants underneath the Exchange have also for some time been lighted by electricity, and here I found this week that gas had again been temporarily installed. It was the engines again; a gas engine which had been used for driving being taken out to be replaced by a steam engine.

Now that the Ship Canal Bill, or a portion of it, has been allowed to pass the Standing Orders, the waning interest in the scheme has been revived. There, however, appears to be a certain amount of misconception with regard to the position in which the promoters are now placed. It is evidently thought in many quarters that because the committee have struck out the clause with reference to the tidal portion of the scheme, a very serious obstacles lies for the present in the way of completing the project. Practically the promoters are, with regard to this portion of their scheme, in the hands of the Conservators of the river Mersey, who have already powers for the improvement of this portion of the navigation. The Conservators are the First Lord of the Admiralty, the President of the Board of Trade, and the Chancellor of the Duchy of Lancaster, the acting Conservator being Admiral T. Spratt, C.B. The promoters, I understand, have never wished to over-ride in any way the authority of the Conservators, nor do they anticipate that they will have any difficulty in working satisfactorily with them. The Conservators are, of course, to an extent trustees of the whole of the interests involved in the Navigation, but from their position they are not likely to take any prejudiced position with regard to the proposed ship canal, providing it can be clearly shown that existing navigation interests will not be injured. The ship canal promoters, I have been given to understand, are thoroughly satisfied with their present position, and are not at all averse to work under the authority of the Mersey Conservators.

The coal trade continues generally in a satisfactory position. The demand is still taking away present supplies, and the pits are kept working on an average about five days a week. In some of the very inferior classes of coal there is a little giving way, but prices generally are steady at late rates, with an upward tendency in the better qualities of slack. Prices at the pit mouth are as under:—Best coal, 9s. 6d. to 10s.; seconds, 7s. 6d. to 8s.; common house coal, 6s. 6d. to 7s.; steam and forge coal, 5s. 6d. to 6s. 3d.; burgy, 5s. to 5s. 3d.; good slack, 4s. 3d. to 3s. 6d. per ton.

Shipping has been very quiet owing to a scarcity of vessels, and to clear away stocks thrown on their hands, sellers have been willing to take low prices.

The miners' conference concluded its labours last week, practically leaving the question of the restriction of the output as they found it, and they will no doubt find that as the summer advances the question of reducing the get will be settled without any interference on their part being requisite.

The eighteenth annual report issued by Bolckow, Vaughan, and Co., shows that although low prices have had to be contended with in nearly every department, the amount of profit available for distribution amounts to £307,035. The disposal of this is recommended as follows:—Interest on debentures and preference shares, £42,934; dividend of 7½ per cent. on ordinary shares, £187,923; to write off capital, £40,000; and to carry forward, £36,178. The stocks held are valued at £647,852, and £126,675 has been spent during the year on capital account, chiefly in extensive alterations of furnaces. Mr. W. M'Laren Keighley, M.P., and Mr. Henry Lee, M.P., are recommended as additional directors.

Barrow.—The demand for all classes of hematite pig iron is, I am informed, very quiet, but although business on the week has been small, the steady tone noted last week is maintained, and I notice indications that there will soon be an increase in the demand and also in the sales. There has been for some weeks past an inclination to reduce the output at the works, but the favourable signs I have noted have had the effect of checking that to some extent. This course will not be necessary for the present at least, as not only is the shipping trade in the spring expected to bring new contracts, but I am informed that new orders for steel to a large extent have recently been given, and the likelihood exists of others following on both home, colonial, and Indian account.

Prices are steady, and mixed qualities of Bessemer are quoted at 52s. per ton at works. Steel also remains at steady values, £5 to £5 5s. being the quotation for best qualities per ton net, prompt delivery. A great quantity is now being booked for forward delivery. Iron shipbuilders, I am told, are expecting several new orders, and the business doing by them at present is fairly good. There is a steady demand for iron ore at 10s. to 12s. 6d. per ton at works. The coal and coke trades are steady, with a tendency in the direction of cheaper prices.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE Cleveland pig iron trade has at last shown signs of improvement. At the market held at Middlesbrough on Tuesday the feeling was firmer and more cheerful than it has been for a long time. A considerable amount of business was transacted at prices about 6d. per ton higher than those quoted on the previous Tues-

day. Buyers were offering at 40s. 3d. per ton freely for No. 3 g.m.b., but few makers would take less than 40s. 6d., whilst others were quoting 41s. It is now generally believed that better prices will soon be obtainable. The shipments have increased considerably during the last few days, and there is every likelihood that the demand will be good for some time to come, both for export and for home consumption.

A petition was in course of signature during market hours, asking the directors of the Middlesbrough Exchange Company to fix the time for opening the market at twelve o'clock, and for closing at ten o'clock. It was suggested that the doors should be closed at noon, and that no one thereafter should be allowed to enter except on payment of a fine.

Holders of warrants were less eager to sell, and demanded the same price for them as were current for makers' iron, viz., 40s. 6d. per ton f.o.b.

The stock of Cleveland pig iron in Connal and Co.'s Middlesbrough store on Monday night was 842 tons less than a week previous.

The demand for manufactured iron has improved somewhat during the last few days, and a good many orders have been placed; but prices cannot be said to have improved. Ship-plates are still to be had at £6 to £6 5s. per ton; angles at £5 2s. 6d. to £5 7s. 6d.; and common bars at £5 10s. to £5 15s., all f.o.t. at makers' works, less 2½ per cent.

The quantity of pig iron shipped from the Tees during February was 53,828 tons, and of manufactured iron and steel, 26,123 tons. In January, 56,841 tons of pig iron, and 21,376 tons of finished iron and steel were exported. In February, 1882, the quantities were, pig iron, 66,893 tons, and manufactured iron and steel, 29,542 tons. During last month the bulk of the pig iron was sent to the following ports, viz.:—Scotland, 16,470 tons; Wales, 4775 tons; France, 10,072 tons; Spain and Portugal, 3259 tons; Germany, 4570 tons; Belgium, 4234 tons; and Holland, 2550 tons. The shipments for this month are proceeding at a rate varying from 2000 to 5000 tons per day.

The Cleveland ironmasters' returns for February show that there are 119 blast furnaces at work, eighty-six making Cleveland iron, and thirty-three hematite and basic iron. There were eighty-five furnaces producing Cleveland iron in January, and thirty-six making hematite. There are, therefore, two furnaces less at work than at the beginning of January. The output of Cleveland iron for the whole district was 143,867 tons, being a decrease of 12,426 on the previous month. The make of hematite and basic iron was 68,623 tons, or less than January by 7413 tons. The total make of iron of all kinds was 212,490 tons. Makers' stocks at the end of the month were 189,737 tons, giving an increase of 20,522 tons since January 31st. Makers' stores were 25,662 tons, or a reduction of 831 tons. The quantity of iron in warrant stores was 92,346 tons, or less than at the end of January by 4948 tons. The net increase in stocks was therefore 14,743 tons. A much larger increase was anticipated, and there is no doubt but that market values will feel the effect.

The partnership lately existing between Messrs. John Gjers, John Mills, Eliezer Biggins Emerson, and Thomas Hill Dodson, deceased, carrying on business as ironmasters at the Ayresome Ironworks, Middlesbrough, and as mineowners at the Spa Ironstone Mines at Guisbrough, under the style of Gjers, Mills and Co., has been dissolved so far as regards Thos. H. Dobson, deceased, and his representatives. The business will be carried on as before by the other three partners, the style of the firm remaining the same.

A number of influential gentlemen met at Middlesbrough, on Monday last, to consider a proposal to form a company for purchasing and working the extensive chemical works belonging to Dr. Saddler, of Middlesbrough. The latter gentleman has been established as a chemical manufacturer about twelve years. His principal products have been dyes made from gas tar; and he is generally thought to have been very successful. Recently he purchased the works before carried on by Messrs. William Jones and Co., where glauber and Epsom salts were made on a large scale. Dr. Saddler has also works at Carlton, near Stockton. It is the purpose of the new company to enter into the manufacture of Turkey red, of which there is said to be a large consumption at lucrative prices. Dr. Saddler was Mayor of Middlesbrough one year, and twice successfully contested the borough in the Conservative interest.

On Monday next there will be a meeting of the Board of Arbitration at Darlington to discuss the wages question. The employers demand a return to "Dale's sliding scale," which will involve an immediate reduction of 2½ per cent. The operatives virtually decline the proposal. They say that instead of reducing wages, the employers ought to put up selling prices. To facilitate this they are prepared to enter into a policy of restriction. They accuse manufacturers of reckless competition, needless underselling, and so forth, and intend to show them how to manage their business more wisely. What the result will be none can foresee.

THE SHEFFIELD DISTRICT

(From Our Own Correspondent.)

The notices given by Messrs. Charles Cammell and Co., Limited, to their workmen expired on Saturday. The "last blow" and the rolling of the last rail took place on the afternoon of that day, the latter operation being witnessed by Mr. Alexander Wilson, assistant managing director; Mr. Oates, engineer; Mr. J. Duffield, manager, and other gentlemen. The "last blow" took place within a few days of ten years from the time of the "first blow." In celebration of the closing of the works, the company entertained twelve hundred persons—workmen, with their wives and sweethearts—to a tea, interspersed with neat little speeches, and winding up with a dance. Several workmen remain to assist in the removal of the plant and machinery to Workington. This work, it is expected, will be completed by the end of May. The exodus from Dronfield has been going on for a considerable time. While the works were in operation at Dronfield, the output of steel rails was sometimes equal to 3000 tons a week. The cause of the removal, as has been already stated in The Engineer, is the impossibility of competing with firms situated on the coast, on account of the cost of conveying the raw material to the works, and the finished products to the port of delivery.

The executive of the Yorkshire Miners' Association have resolved to issue 30,000 ballot papers to union and non-union miners throughout Yorkshire, in order to test their individual opinions relative to the carrying out of the Manchester Conference resolutions of working five days per week—eight hours from bank to bank. The papers are to be returned by the 26th inst.

The sharp snap of cold weather which began on the 5th, and was intensified on the 6th and 7th, gave coalowners promise of a change in the weather. It frequently happens that a genial February is succeeded by a cold fortnight in March, causing a fillip to be given to the house-coal trade. Whether the present cold weather will continue long enough to move the house-coal pits to something like activity remains to be seen. Nothing could be more acceptable to the coalowners, but the general public might not look at the question quite in that way. At present quotations at the pits are:—Hand-picked Silkstone brands, 15s. per ton; Silkstone brands, 12s. 11d.; Silkstone, screened, 12s. 1d.; second ditto, 10s. 10d.; Silkstone nuts, 8s. 9d.

An important change for the better is reported by the Bilbao Iron Ore Company, Limited. The Company's shipments for 1882 were 630,172 tons, compared with 441,906 tons in 1881, a gain of 188,266 tons. The exports from the Bilbao river reached a total for the year of 3,637,176 tons, showing an increase of nearly 50 per cent. over the exports of 1881, and evidencing an important growth in the consumption of these ores.

There is some talk of a new process of making steel, by which surprising results are said to be attainable. If half I hear be true, the discovery is an amazing one; but at present too little is known to write definitely about it. The idea has already been brought before several leading manufacturers with a view to the formation of a company. Its success would, it is stated, affect not only the steel trade, but all the railway material into the manufacture of which steel enters.

The Sheffield Gas Company purpose, after the 31st inst., to reduce gas to ordinary consumers from 2s. 4d. to 2s. 2d. per thousand feet, and to large consumers to 1s. 10d. and 2s. per thousand feet, according to the quantity consumed.

Arrangements are being made here for the visit of the Gas Institute to Sheffield. A meeting was held on Tuesday, with the Mayor in the chair, and an influential local committee was formed.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow pig iron market has been characterised by considerable animation this week. There has been much more inclination on the part of the public to engage in pig iron speculation than for a long time past, this being due partly to the cheapness of money, and partly to the general prevalence of a belief that warrants were so low in value that to purchase in present circumstances would undoubtedly turn out a safe and profitable investment. Accordingly the warrant market has been quite busy, and quotations have shown a considerable increase. As for the legitimate business in pig iron, there does not seem to be much change. The home demand continues steady, and the shipments abroad are not unsatisfactory, there being especially very good deliveries for the United States. Stocks in the Glasgow warrant stores continue steadily to diminish, the past week's reduction being about 1700 tons. On the other hand, the opinion is pretty strongly entertained that a number of makers of pig iron must be adding considerably to their stock, as the production shows a margin beyond all reasonable estimates of consumption. The prices of makers' iron are at the same time quite firm, and No. 3 Gartsherrie has been advanced 1s. per ton.

Business was done in the warrant market on Friday forenoon at from 47s. 6½d. to 47s. 9½d. cash, and 47s. 9½d. to 47s. 11½d. one month; the afternoon quotations being 47s. 7d. to 47s. 6½d., and again 47s. 7d. cash, and 47s. 10d. one month. The market was strong on Monday with transactions in the forenoon at 47s. 8d. to 48s. cash, and 47s. 11d. to 48s. 2½d. one month. In the afternoon business was done from 47s. 11d. cash, to 47s. 10d. cash, and 48s. 2d. to 48s. one month. Tuesday's market was strong, with business up 48s. 2½d. cash, and 48s. 4½d. one month.

The quotations of makers' iron are:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 62s. 6d.; No. 3, 54s. 6d.; Coltness, 65s. 6d. and 56s. 6d.; Langloan, 65s. and 55s. 6d.; Summerlee, 62s. and 52s.; Chapelhall, 61s. 6d. and 52s.; Calder, 62s. 6d. and 51s.; Carnbroe, 56s. and 50s.; Clyde, 52s. 6d. and 50s. 6d.; Monkland, 49s. 6d. and 47s. 6d.; Quarter, 49s. and 47s.; Govan, at Broomielaw, 49s. 6d. and 47s. 6d.; Shotts, at Leith, 65s. and 56s. 6d.; Carron, at Grangemouth, 53s. (specially selected, 57s. 6d.) and 52s.; Kinneil, at Bo'ness, 48s. 6d. and 47s. 6d.; Glengarnock, at Ardrossan, 55s. 6d. and 49s. 6d.; Eglinton, 50s. and 47s. 6d.; and Dalmellington, 50s. and 49s. 6d.

The engineering trades of Glasgow and district are very busy. There is a very active inquiry for different kinds of machinery, the makers of sugar crushing plant being scarcely able to overtake the orders with which they are favoured. All kinds of shipbuilding irons are very animated, while the malleable iron department generally is full of work. For the most part manufacturers have been working for moderate prices, which is not bad policy, seeing that the value of material is low, labour moderate—except in a few extreme cases—and that business is stimulated by the easy prices which are charged.

Among the past week's shipments of iron manufactures from the Clyde was £1500 worth of machinery, £4488 sewing machines, and £5777 steel manufactures.

The coal trade has been very active in the West during the week. There have been cases here and there where orders were kept back for a day or two in the expectation that there might probably be a reduction of prices, but the volume of business has still been very good, particularly in connection with the shipping trade of Lancashire. There is still only a moderate demand in Fife. During the month of February the total quantity of coals shipped at Burntisland was 27,876 tons, as compared with 29,908 tons in the corresponding month of last year. Only a moderate business was done at Leith, while the shipments at Grangemouth were very small. It is reasonable to expect, however, that the trade on the east coast will soon begin to improve. The Fife and Clackmannan coalmasters have reduced their prices about 3d. per ton, and they have also reduced the miners' wages, but as yet their business does not seem to have been much benefitted by the expedients.

A meeting of the executive board of the Fife and Clackmannan Miners' Association has been deliberating on the proposal to restrict the working hours, and it has been resolved to issue ballot papers to all the miners in the two counties in order to ascertain their opinion before any action for restriction is adopted.

The works connected with the new slip dock and esplanade at Ayr are now completed. They will be of great advantage to the town, the trade of which has of late years been rapidly developing. Mr. John Strain, C.E., Glasgow, was the engineer, and Mr. James Young, of Edinburgh, the contractor.

As the result of a conference held a few days ago in Glasgow, between representatives of employers and workmen, the operative shipwrights of Glasgow have had their wages increased ¼d. per hour, with the promise of another ¼d. on the 1st of June.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Good and steady progress is reported from Harris's Deep Navigation Colliery, where there has been a long struggle against "falls," and the output is now steadily rising.

I have been watching the course of things at this pit with interest, as it is the nearest to the centre of the South Wales coal basin, the centre being at Llancaiach village, and all the large collieries of the future in the vicinity will have the same difficulties to contend against, and the same peculiar problems to solve. Some mining engineers insist that "openings" should not be made so far from the bottom, as in the cave at the Deep Navigation, which is nearly half a-mile deep. Bedlinog, another of the new collieries, is still struggling against broken ground, but the output is improving.

It is pleasant to turn from incidents of great difficulty and stubborn obstacle to such a colliery as that of Clydach Vale, Rhondda Valley, the property of Messrs. Thomas and Riches. This is now regarded as the cream of the valley. The colliery is literally more like a quarry than an ordinary working, and the huge face of the coal is as hard as limestone. Top is excellent, ventilation all that could be desired, and the output enormous. I have been at some pains to collect a few facts illustrative of this fine colliery, and find that in the week ended March 3rd the quantity of large coal worked was 6506 tons; small, 1355; total, 7862 tons, giving for the last month a grand total of 31,836 tons. During the time there has been no hitch, no stop, and the great output has been accomplished without accident. Much credit is due to the manager, Mr. Hayhurst, one of the veteran mining engineers of Wales.

Generally the coal trade is in a very satisfactory position, both as regards quantity and price. The export of the week from the Welsh ports has been 220,000 tons, and the block on lines and at docks only prevented by great resolution and activity.

The Barry Scheme is still to the front. Efforts are being made by friends of the high contending parties to bring about a compromise, and some hopes are held out that such a result is probable. Sir E. J. Reed, M.P. for Cardiff, suggests that the Taff Company should reduce its coal rate to ⅝d. per ton, instead of ¾d., and that the coal rate to Cardiff should be the same as to Penarth per ton per mile. Further, that the extra 1d. per ton authorised by the Bute Bill of last year be reduced to ½d., and that the rates to the Bute Docks, Cardiff, shall be the same per ton per mile as to Penarth. Mr. W. Lewis, on the part of the Marquis of Bute, has replied in a conciliatory tone, and, I repeat, there are some hopes of a settlement.

In the face of gossip as to the speedy exhaustion of the best coal, I have pleasure in reporting several important "finds." After getting through forty-two yards of fault, the management at the Coedcae have hit upon a fine bed of 3ft., which will double the output, and is computed to last twenty years. The Coedcae collieries now turn out 2000 tons a day, and are fast proving a fine investment.

In the Monmouthshire district the Mynyddislwyn seam has been struck by Messrs. Griffiths and Co., near the old Waterloo colliery, and it is tolerably certain that there is a large unworked area in the district.

Mr. Davey, late manager of Briton Ferry, has bought the whole of the stock, &c., at these works, and one of the blast furnaces will soon be in action. This comes in opportunely. I wish I could give other good news affecting the tin-plate districts, but, unfortunately, the trade is at a low ebb, and if there is not a speedy change, more disasters may be expected. Business is very difficult of arrangement now that "paper" from almost every quarter is regarded with suspicion.

There is not much to report about in connection with the iron and steel trades. Old contracts not yet completed keep up a fair appearance, but the trade is slack, and prospects rather dull. I hear of one Italian order for rails having been secured for Swansea.

The strike amongst the Dean Forest miners is now almost inevitable, and has been rendered so by the injudicious offer of aid, instead of conciliation and arbitration, from outside parties.

I am glad to note that the Welsh colliers are working with singular unanimity, and are starting reading-rooms in various districts.

Pitwood keeps firm, and is in good demand. Iron ore dull, and prices falling.

Great Western Colliery directors report favourably of their Coppée coke ovens, and will declare a dividend of 10s. per share.

Newport is full of vigorous business. I hear adverse rumours about the fate of the Cardiff and Monmouthshire Valley's line, against which all the Tredegar influence is certain.

Inundations in Italy.—The Italian Chamber of Deputies has lately agreed to a proposal by which the Government is authorised to spend £400,000 as a single extraordinary outlay for the restoration of the damage to watercourses, roads, &c., which was occasioned by the inundations of last autumn. A further sum of £60,000 is placed at the disposal of the military authorities for the purpose of making good the injury done to defensive works, &c. Finally, a sum of £260,000 is allotted to the Minister of the Interior for distribution in such a manner as may be deemed most suitable for the support and assistance of the sufferers by the inundations.

Colonial Contracts.—Last November we published two articles on colonial contracts. The following article, taken from *The West Australian* of Friday, January 12th, will serve to show what Australians think of the matter:—"Bearing upon our railway contracts and the method of obtaining railway material, two papers have appeared in issues of The Engineer of a late date, which are of great interest. The first deals with the Crown Agency, and, on the whole, the reader is led to the conclusion that, what must be considered a very high authority, considers the Crown Agents preferable to special agents for the purchase of materials required for public works. The Engineer speaks of the Crown Agents as an admirable organisation, available at most moderate expense, owing to the charges made being divided proportionately over the many dependencies for which it acts. It states also, what our readers will recollect was not generally understood until lately, when certain questions were asked in the House of Commons and a rather startling City leader commenting upon the answers to those questions appeared in the *Times*—that though the Crown Agents are an adjunct to the Colonial Office, have a corner of the Downing-street building set apart for them, and are promoted and recognised by the Government, they are independent of English control. The Engineer holds that one of the chief recommendations of the Crown Agents is that they are honest, and, apparently, from the explanations and examples subsequently given, it considers that strict honesty in private agencies can be very seldom secured. Not a vestige of corruption has ever been brought home to the Crown Agents, whatever little jobs may have occurred in connection with their work having been confined to very minor personages engaged in it. Having thus highly eulogised the Crown Agents, The Engineer proceeds to find an explanation of the fact that nearly every colony, so soon as it emancipates itself from Downing-street control, or adopts representative Government, becomes desirous to use other agencies for the purchase of materials for public works. This it seeks first to explain on grounds apart from the question directly at issue—on the ground of a restless desire of independence, or of an idea that by combining the purchase of materials with emigration business placed in the hands of private agents, economy would be secured. But subsequently The Engineer arrives at what probably are the real reasons which cause a desire for emancipation from the Crown Agents. In the first place there are, it says, continual disputes and misunderstandings between the Downing-street office and the officials in the colonies with which they are dealing, the Crown Agents being of opinion that the colonists are stupid and do not know what is good for them, while the colonists are exasperated by the red tape, the mistakes and the delay of the people at home. Taking the best professional advice, the Crown Agents endeavour to send out good, strong material, typical of English manufacture, but it is often old-fashioned and sometimes 'ludicrously inappropriate.' The *Times* lately stated that the difference between English and American manufacturers was that the latter endeavoured by every possible means to suit themselves to the circumstances and local wants of their customers, whereas the former, though turning out far better work, continued in the old groove and treated suggestions for the modification of their old style of article with contempt—this being the secret of the advantage which the Americans are steadily gaining in our colonial markets. The Crown Agents, according to The Engineer, have upheld this conservative action, and hence a great deal of the discredit which they have brought upon themselves in new countries where old ways are not necessarily regarded with reverence. Then, again, the Crown Agents, like all Government organisations, are dilatory, while sometimes their machinery breaks down as completely as the commissariat in the Crimean war. Thus The Engineer relates how, in South Africa, rolling stock and locomotives were withheld till the service of the railways broke down and then were sent out in quantities exceeding the demand. Expensive carriages and wagons were sent out with some of the parts missing, or of a kind unsuited to the railway, requiring expensive alterations, while locomotives were dispatched of wrong types and shipped to ports where there were no cranes that could land them. But, nevertheless, The Engineer seems to be of opinion that what colonies using the Crown Agents may lose through their mistakes and their red tapeism, they gain in other ways—in the confidence which may be placed in their incorruptible rectitude and in the excellence of the material which, as a rule, they supply, and it goes on to draw a most alarming picture of the wheels within wheels of corruption incident to the private agency business in connection with railway material contracts—a picture which certainly is calculated to make the reader doubt whether these private agencies are so advantageous to a colony as they are so frequently represented to be. However, these are only the opinions of The Engineer. But, then, The Engineer is a great authority."

3360. REVERSIBLE FOG AND DANGER SIGNALS, *J. H. Sullivan, Walworth.*—15*th July*, 1882.—(*Not proceeded with.*) 4*d.*

This consists of a lever connected to the signal and serving to actuate the whistle of passing trains.

3361. METALLIC GLAZING BAR AND FITTINGS, FOR GLAZING WITHOUT PUTTY OR PAINT, *T. Hughes, Market Drayton.*—15*th July*, 1882. 6*d.*

The bar consists of a tube with a slot cut the whole of its length to receive the edge of the glass. Two of such tubes are secured together with the slots outwards, and the edges of the glass are held in the slots partly by the spring of the tubes and partly by T-shaped wedges pushed into the ends of the bars.

3363. HOOD JOINTS OF PERAMBULATORS, &c., *C. E. Gibson, Birmingham.*—15*th July*, 1882. 6*d.*

The joint consists of two solid bars connected together by means of a coupling or channel piece open at one side and at the ends, the rods being connected thereto by pivots. The outer ends of both rods are pierced through with the stem of the ornamental cap.

3364. ARTIFICIAL HIPS, BODIES, OR STANDS FOR SUPPORTING DRESSES, &c., *A. W. and G. B. Childs, Clerkenwell.*—15*th July*, 1882. 6*d.*

This relates to means for adjusting the extent and the angle with which the back part of the dress stands out.

3365. ANTISEPTIC COMPOUND, *H. J. Haddan, Kensington.*—15*th July*, 1882.—(*A communication from C. Aschman, Belgium.*)—(*Not proceeded with.*) 2*d.*

This relates to a compound for preserving provisions, beverages, and other fermentable organic substances, and consists of borax and glucose sugar heated with a little water, and boracic acid added in certain proportions.

3366. SMOKE-FLUES AND SMOKE-CHAMBERS OF METALLURGICAL WORKS, *H. J. Haddan, Kensington.*—15*th July*, 1882.—(*A communication from the Meckernicher Bergwerks-Actien-Verein, Prussia.*)—(*Void.*) 2*d.*

The object is to increase the quantity of volatile products condensed during their passage through the smoke-flues, and it consists in providing the flues with partitions laid across the flue and extending alternately from the top downwards, and from the bottom upwards.

3368. APPARATUS FOR FACILITATING THE SLICING OF BREAD, *J. Erskine, Newton Stewart, N.B.*—15*th July*, 1882. 6*d.*

The loaf is placed on a base board and pushed forward between two side uprights, at a short distance from the ends of which a stop piece is adjustably fixed. The knife is pressed down on to the part of the bread projecting beyond the ends of the uprights, and the slices thus cut off in quick succession.

3371. PULLEYS FOR WINDOW BLIND ROLLERS, &c., *H. A. Williams, Lincoln.*—15*th July*, 1882.—(*Void.*) 2*d.*

The object is to enable window blind rollers to be more readily fitted in position and removed without disturbing the blind cord, and it consists in securing the pulley to the bracket and providing suitable means for readily connecting and disconnecting the roller.

3373. SAWING METALS, *J. H. Johnson, London.*—15*th July*, 1882.—(*A communication from H. Tuyssuzian, Paris.*) 6*d.*

This relates to apparatus whereby it is possible to cut fretwork or open-work in sheets of metal. When using reciprocating saws they are operated by oscillating levers, to which motion is imparted by cranks, as described in patent No. 2365, A.D. 1866, but in place of oscillating upon centres at the sides of the supports the levers work in hollows or recesses in the body of the supports. The teeth of the saw are set or inclined laterally to the right and left alternately, so as to cut with a certain clearance, and thus enable the saw to follow all the curves or angles of the design.

3372 LAWN TENNIS RACQUETS, *A. J. Altman, London.*—15*th July*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to prevent lawn tennis racquets breaking off at the neck, and consists in lining the racquet frame with cane or india-rubber.

3374. WIRE NETTING FOR FENCING, &c., *D. Peres, London.*—15*th July*, 1882.—(*A communication from T. Hentze, Germany.*) 6*d.*

The netting is made up of wire links or pieces, each consisting of two arms with a loop at their junctions and an elongated eye at each end. The netting is built up by passing the eye of one link through that of another, and then bringing the central loop of one into position so that it rests in the eye of the other.

3381. APPARATUS FOR EXTRACTING SHUTTLES FROM SEWING MACHINES, *W. H. Beck, London.*—17*th July*, 1882.—(*A communication from D. P. Contamine, Paris.*)—(*Not proceeded with.*) 2*d.*

Under the needle-plate is fixed a foot or carriage adapted to carry the axis of an oscillating bell-crank lever, one of which, by its weight, holds the other arm in a horizontal position, the latter arm working in a mortice in the needle-plate and presenting its end perpendicularly to the shuttle. By oscillating the pendant arm of the lever, the other arm raises the shuttle so that it can be grasped by the fingers.

3387. FILING SAW BLADES, *L. A. Groth, London.*—17*th July*, 1882.—(*A communication from J. P. Hausen, Denmark.*) 6*d.*

The file is attached to a reciprocating carrier and moves across the path of the saw, which is held securely in a vice or guide, and which as the file returns is lowered and fed forward a tooth.

3388. ATTACHMENTS FOR BOOTS AND SHOES, *G. Rate and T. Chattaway, Leicester.*—17*th July*, 1882. 2*d.*

This relates to the attachment of ridge-shaped pieces stamped out of solid leather and secured to the soles of boots by means of nails and rivets, so as to protect the same.

3390. CANDLE HOLDERS, *C. Keibel, Germany.*—17*th July*, 1882. 6*d.*

The object is to securely hold candles of varying diameters in the same holder, and it consists of a sleeve tube or socket in which a female thread is formed, and the sides of which present sharp edges to the candle, so as to cut into the same as it is screwed in.

3391. WIRE, *T. Morgan, London.*—17*th July*, 1882.—(*A communication from E. J. Levavasseur, Paris.*) 6*d.*

This relates to an arrangement of rotating ingot mould, so as to enable metal to be run out directly in the form of wire of the required diameter.

3395. OLEAGINOUS COMPOUND FOR USE IN THE MANUFACTURE OF ROPE, &c., *H. H. Lake, London.*—17*th July*, 1882.—(*A communication from H. F. Evans, New York.*)—(*Not proceeded with.*) 2*d.*

This relates to a compound to be used instead of oil for treating the materials from which rope is to be made, and it consists of a mixture of a mineral oil known as "amber oil," and fish or whale oil.

3396. MACHINERY FOR PRINTING IN COLOURS, *J. Davies, Hatcham; T. A. Middleton, Staines; and W. G. White, Deptford.*—17*th July*, 1882. 10*d.*

This relates to improvements on patent No. 3047, A.D. 1879, in which the designs are made of colouring matter mixed with a composition, and cut to the required form, and it consists in improved means for holding the design composition in place in order to print from it. The slabs of composition are caused to adhere to metal surfaces. In a rotary printing machine adapted to print from this composition, a series of pressing rollers are provided, and are gradually advanced as thecomposition decreases in use.

3403. STEAM JET APPARATUS, *E. de Pass, London.*—18*th July*, 1882.—(*A communication from E. Körting, Hanover.*)—(*Not proceeded with.*) 2*d.*

This relates to means for preventing both noise and vibration in the steam jet apparatus.

3404. APPLIANCES FOR HOLDING AND GRINDING TOOLS FOR CUTTING METAL, *R. Rawlinson, Salford.*—18*th July*, 1882. 6*d.*

To hold tools for turning and cutting metals, a belt with a wedge or conical-shaped head, or a head curved on one side to fit the tool, is employed. In a holder, in which the angle of the tool is adjustable, being held in a stud bolt or swivel piece, a wedge bolt is used to hold the tool, so that it can be removed without disturbing the angular adjustment. For grinding tools, they are carried on the upper end of a swivel lever fitted with a sliding tool carriage for traversing the tool across the grinder.

3405. EYELETTED HEALDS, *W. R. Harris and J. G. Cooper, Manchester.*—18*th July*, 1882. 6*d.*

This relates, First, to improvements on patent No. 590, A.D. 1869, and consists in a machine for forming the punched and softened blanks into a double-flanged form, similar to a grooved pulley, by means of suitable dies. The eyelets are then softened and silvered, and afterwards made oval in a machine having dies which slide towards each other. The Second part of the invention relates to a machine for fixing the eyelets in the yarn, whereby an extra twist is imparted to the yarn before closing the eyelet.

3406. SECURING THE HANDLES OF TABLE CUTLERY, &c., *H. Bottom and C. Rose, Sheffield.*—18*th July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to making the tang in the form of a pair of forceps, and to the employment of a pin.

3409. PLATES FOR SECONDARY BATTERIES, *W. Taylor, Tottenham, and F. King, New Cross.*—18*th July*, 1882. 2*d.*

The inventors make their plates by coiling special forms of tapes of lead, which are cut out from the solid by a lathe or other machine, in such a manner that the surface of the tape that does not come in contact with the cutting tool will have given to it a roughened or cellulated surface raised by the angle at which the cutting tool is worked.

3412. EMBALMING AND COOLING BOARDS OR RESTS FOR CORPSES, *P. M. Justice, London.*—18*th July*, 1882.—(*A communication from N. T. Shaw, Columbus, U.S.*)—(*Not proceeded with.*) 2*d.*

The object is to render embalming and cooling boards substantial, light, and neat, with provision against accidental crushing or falling under the weight of the body, and in shifting the position of the board when required.

3413. PILLARS OF METALLIC BEDSTEADS, *T. Jefferies, Birmingham.*—18*th July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to constructing the pillars of metallic bedsteads by combining or grouping together two or more tubes, and connecting the said tubes together and converting them into a bedstead pillar.

3422. PURSES, *G. Macaulay-Cruikshank, Glasgow*—19*th July*, 1882.—(*A communication from F. W. Schwarz, Germany.*—(*Not proceeded with.*) 2*d.*

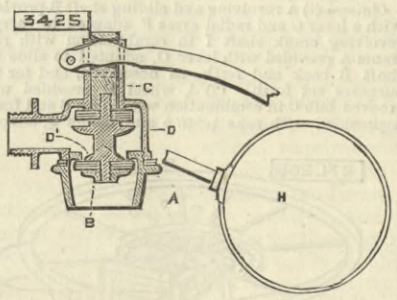
The object is to form purses from one piece of leather, and without a seam, the purse being at the same time furnished with a cover lock.

3423. WIRE FENCES, *G. E. Vaughan, London.*—19*th July*, 1882.—(*A communication from C. E. Lesur, Paris.*—(*Not proceeded with.*) 2*d.*

The frame consists of a series of triangles embedded in the earth to form the basis of each supporting post. One branch of each triangle is prolonged so as to overhang the enclosure at an angle of 45 deg. The inner face of these overhanging bars have holes to carry horizontal wires.

3425. BALL VALVES, *H. A. Cutler, Upton.*—19*th July*, 1882. 6*d.*

The valve spindle carries at one end a valve B of any convenient shape, and at the other end a plunger or cylinder C of a diameter slightly exceeding the effective or acting diameter of the valve. The valve case D has two openings situated in the same axial line, one of which openings D^1 serves for the outlet of fluid, and is controlled by the valve B, which is so actuated that it closes in opposition to the pressure of fluid.



The other opening serves for the passage of the plunger or cylinder C, whose lower end is subject to the pressure of the fluid within the valve case. India-rubber facings are provided. The valve is opened and closed by the ball H, which rises and falls with the fluid in the cistern or tank.

3429. CONVEYING RAILS AND BARS AS THEY COME FROM A ROLLING MILL ON TO A BED, &c., *A. Wilson, near Sheffield.*—19*th July*, 1882.—(*Not proceeded with.*) 2*d.*

The carriages to move rails sideways from the straightening plates to the "hot beds," where they remain to cool, are moved to and fro by chains actuated by winding drums placed at the outer ends of the hot beds, one set being made to wind on chain whilst the other set are unwinding.

3431. SAFETY LOCKS, *H. Thisquen, St. Petersburg.*—19*th July*, 1882.—(*Not proceeded with.*) 4*d.*

This relates to safety locks, in which a combination of figures or letters indicates the position of the parts.

3433. OPERATING MICROPHONES, *P. M. Justice, Southampton-buildings.*—19*th July*, 1882.—(*A communication from F. van Rysselberghe, Schaerbeek Belgium.*) 2*d.*

This relates to the employment of a secondary battery or a thermo-electric pile with a microphone to increase the intensity of the variations of the inducting current of the induction coil used therewith, so as to counteract the variations produced by the fluctuations in the resistances of microphonic contacts.

3436. ENGINE-POWER METERS, *C. V. Boys, near Oakham, Rutlandshire.*—19*th July*, 1882. 6*d.*

This relates to improvements on patent No. 2449, A.D. 1881, in which a cylinder reciprocating with the strokes of the piston has pressed against its surface a disc swivelled to a more or less oblique attitude by an arm worked by flexible diaphragms subject to the steam pressure, whereby the cylinder is caused to turn more or less round always in one direction, so that its amount of revolution is a measure of the engine-power, and the object is to separate the more delicate part of the instrument from the parts in which the steam acts. The cylinder is vertical, and carries a piston attached to a helical spring. Above the cylinder, and separated from it by an open framing, is the integrating apparatus.

3437. COCKS AND VALVES, *R. Ashton, Clapton.*—19*th July*, 1882. 4*d.*

This relates to diaphragm cocks or valves, and is applicable to ball valves bib valves, and other valves, and it consists in forming a through aperture in the diaphragm and placing the inlet and outlet orifices at opposite sides of the diaphragm, the diaphragm itself being adapted to close against a seat around one of the orifices.

3438. CONNECTING SWITCHES TO THE RAILS OF RAILWAYS, *J. Pickering, London.*—19*th July*, 1882. 6*d.*

The object is to provide a coupling which will allow of the free movement of the switch rail, and yet maintain a firm connection with it and the back rail, and it consists essentially in the use of a hinged clip or coupling.

3442. GAS ENGINES, *A. C. Wells and R. Wallwork, Manchester.*—20*th July*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to enable the light to be readily turned up to the full extent, or down as low as desired, independently of the ordinary tap, and according to one arrangement, one of the joints of gas brackets is made so that when in one position the gas will be full on, but when turned it will be shut off to a greater or lesser extent. Modifications are described.

3444. ARTIFICIAL STONE, *E. L. Ransome, San Francisco.*—20*th July*, 1882. 6*d.*

This consists partly in a pavement consisting of arched concrete pieces formed to fill in between and cover over the braces or supports, each piece filling the space between two supports, and covering about one-half of the supports.

3447. VALVES OF HYDRAULIC RAMS, *J. Blake, Accrington.*—20*th July*, 1882. 4*d.*

This relates particularly to the employment of a waste valve for hydraulic rams, consisting of a disc or washer of india-rubber or leather rising and falling on an adjustable spindle.

3448. DOUBLE INCLINED PLANE SPLINT, *A. Wormull, Surrey.*—20*th July*, 1882.—(*Not proceeded with.*) 2*d.*

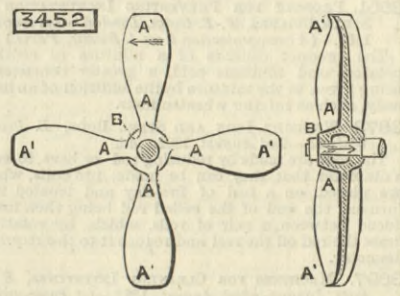
This relates to a double inclined plane splint that is also applicable as a leg splint or fracture box, and is perfectly portable, the parts being so formed that they will fold up in a small compass without being detached from each other.

3449. GAS MOTOR ENGINES, *H. P. Holt and F. W. Crossley, Manchester.*—20*th July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a construction and arrangement of gas motor engine and method of working it, that during each revolution of the crank shaft products of combustion are discharged from the cylinder, and a partial vacuum being therein, a charge of combustible gaseous mixture is admitted, and which is compressed along with the residuary products in the cylinder and then ignited, and propels the piston.

3452 SCREW PROPELLERS, *R. Duncan, Glasgow.*—20*th July*, 1882. 6*d.*

In the drawings the propeller blades A are made approximately straight from the root or boss B to near the point where they are formed with a rapid curve A^1. This curve may be uniform, that is, part of a circle, or it may be approximately so, with the



radius of the curve diminishing as it approaches the extreme point of the blade. The arrows show the direction of rotation of the propeller, and of the forward motion of the vessel to which it is fitted. Modifications are shown.

3453. AN IMPROVED BEVERAGE, *J. Lane, Liverpool.*—20*th July*, 1882. 2*d.*

Rice is boiled with unfermented wort prepared from malt, and when smooth, sugar and water, in which saffron, annatto, or other colouring matter has been infused, and milk is added. The mixture is reheated without being allowed to boil, and a suitable flavouring is added.

3457 FINDING DISTANT POINTS, &c., WITH THE TELESCOPE, *A. J. Boult, London.*—20*th July*, 1882.—(*A communication from J. Wenzel, Strasburg.*)—(*Not proceeded with.*) 2*d.*

One form of apparatus for this consists of an upright cylinder with a base having set screws for adjustment. On the lower part a broad ring can rotate, a knob being provided to rotate the same. Opposite the knob a pin projects and carries a graduated segment and a ring to receive a telescope. When the telescope is rotated in a vertical plane, a suitable index shows the extent on the segment, while the segment itself serves as an index to show the extent of motion round the cylinder on a scale marked on the latter.

3459. CHECKING CORDS OF BLINDS, &c., *A. and T. H. Dix, Rock Ferry, Chester.*—20*th July*, 1882. 6*d.*

This consists of a pivotted cam, which can be pressed back by the cord so as not to interfere with it when held a little out of the perpendicular, but which, by its own weight and the friction of the cord, flies into place and jambs the cord when the latter is let go and allowed to hang vertically with the weights of the blind tending to draw it upward.

3460. CRANK SHAFTS FOR SCREW STEAMERS, *D. Purves, Lower Clapton.*—20*th July*, 1882. 6*d.*

The object is to enable crank shafts to yield a little, so as to accommodate themselves to any untrueness in their bearings, and it consists in making them in pieces put together so as to allow of the required small yielding without producing fracture.

3462. CULTIVATORS FOR TILLING, *A. Simpson, Elgin, N.B.*—21*st July*, 1882.—(*Not proceeded with.*) 2*d.*

An iron frame is mounted on wheels, one of which is adjustable to regulate the depth of cut. The breasts, sheaths, and prongs employed are of special form, the upper prong being movable and adjustable in a slide at the back of the sheaths.

3463. CORSETS, &c., *R. Hunting, London.*—21*st July*, 1882.—(*A communication from J. G. Avery, Massachusetts, U.S.*) 6*d.*

This consists in the use of close coils composed of two or more wires for stiffeners for corsets and other purposes.

3464. SECONDARY BATTERIES, &c., *J. H. Johnson, Lincoln's-inn-fields*—21*st July*, 1882.—(*A communication from J. H. Sutton, Ballarat, Victoria.*)—(*Not proceeded with.*) 2*d.*

This relates to the formation of secondary battery plates by means of porous plates of carbon, the plates being composed of pulverised carbon moulded with a glutinous substance, from which the volatile portions are driven off by heat, and to other improvements.

3466. APPARATUS FOR GENERATING ELECTRIC CURRENTS, &c., *C. A. Carus-Wilson, Grenville-place.*—21*st July*, 1882.—(*Not proceeded with.*) 2d.

This relates to a new form of electric generators and motors.

3467. ACOUSTIC AND STENTOROPHONIC INSTRUMENTS, *F. Wirth, Frankfort-on-the-Maine, Germany.*—21*st July*, 1882.—(*A communication from A. Rettig, Saarbruck, Germany.*) 6*d.*

This relates to a speaking tube constructed as follows:—A paraboloid, *i.e.*, a curved surface produced by the rotation of a parabola around its axis, of considerable axial length, and having its focus near the apex, is cut perpendicularly to the axis of rotation so that the focus is situated between the apex and the plane of section. With this paraboloid is connected a smaller one, cut in a similar way and having also a small focal length, in such a manner that the foci of the two coincide, and their axes form one straight line. The two are connected by a short tube. The small one forms the mouthpiece and thellarge one the speaking tube.

3468. FASTENERS FOR BOOTS, GLOVES, &c., *J. N. Aronson, London.*—21*st July*, 1882. 6*d.*

An arm is pivotted to a base-plate secured to one side of the opening to be closed, and after being passed through a hole formed in the opposite side, the arm is turned so as to bring its free end under a suitable catch or locking device.

3469. SADDLE-BAR, *M. Macleod, Teignmouth.*—21*st July*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to free the stirrup leather when the rider is displaced from the saddle, and it consists in supporting the horizontal bar from which the leather depends in the lower-hooked end of a vertical link, so that an upward or outward strain on the bar will release it from the hook and so free the leather.

3473. APPARATUS FOR GENERATING, UTILISING, AND REGULATING ELECTRIC CURRENTS, *A. Reckenzaun, Leytonstone.*—21*st July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a dynamo machine which may be generator or motor. It has stationary magnets, a revolving armature, and an automatic arrangement for varying the strength of the magnetic fields. It also relates to an arc lamp.

3475. BRAKE GEAR FOR RAILWAY WAGONS, *J. M. Haime, Cardiff.*—21*st July*, 1882.—(*Not proceeded with.*) 2*d.*

The brake blocks are pivotted to hangers slung from the side of the wagon and forced apart by adjustable push-rods or levers, actuated through a hanging rod pivotted to a short crank or lever by means of a long hand or foot lever.

3476. CHAMBERS AND RECEPTACLES FOR ELECTRICAL APPARATUS, *W. A. Barlow, London.*—21*st July*, 1882.—(*A communication from L. Encausse, Paris.*) 2*d.*

This relates to the lining of battery jars, &c., with a layer of compressed carbon.

3480. UNHAIRING HIDES OR SKINS, *J. H. Johnson, London.*—21*st July*, 1882.—(*A communication from B. Etcheverry, Paris.*)—(*Not proceeded with.*) 2*d.*

This consists essentially in submitting the hides to the action of water heated to about 80 deg. C. instead of employing lime.

3482. LOCKS, *J. H. Black, Surrey.*—21*st July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a lock in which the locking mechanism is contained within the knob, whereby the construction of the lock is simplified, the ordinary key bolt dispensed with, the dimensions of the lock reduced, and the keyhole in the door abolished.

3483. AERATED BEVERAGE, *J. and R. J. Alabaster, Kingsland-road, and J. E. Simms, Clapton.*—21*st July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the manufacture of a beverage known as "lemon squash" so that it can be supplied in bottles ready for use.

3485. APPARATUS FOR TELEGRAPHING TO AND FROM A RAILWAY TRAIN IN MOTION, *W. B. Healey, Westminster.*—22*nd July*, 1882.—(*A communication from W. L. Hunt, New York.*) 6*d.*

To carry this invention out, a line of wire is laid alongside the rails and disconnected at intervals. The disconnected ends are connected with key blocks placed on the ties, and so forming a complete circuit over the whole length of line. The key blocks are provided on their exposed surfaces with two metallic rollers, which, in their normal position, form part of the circuit of the whole line, but if either of the rollers is depressed the line is disconnected and its circuit broken. On the train are two shoes or keyboards placed one at each end of a car, and suspended therefrom at such a level as just to come into contact with and depress the rollers when the train passes over them. On these shoes are copper or metal strips which touch the rollers as the train is running, and to one of these shoes is attached a wire which is connected with a telegraphic instrument in the car, and from the latter with the shoe at the other end of the car. On a shoe touching and depressing one of the rollers the circuit is made through the instrument or through the other shoe and then along the line.

3487. MAINTAINING A CONSTANT DRAUGHT IN CHIMNEYS, &c., *E. Edwards, London.*—22*nd July*, 1882.—(*A communication from A. Marques, Bordeaux.*) 6*d.*

A central pipe with a conical lower end is supported by a pipe fitting into the top of the chimney. Round the conical end are fitted a number of smaller conical pipes, whose upper ends enter the former at different heights. The whole apparatus is surrounded by an external case, with openings at bottom for air to pass into the small conical tubes.

3488. COUPLINGS FOR HOSE, &c., *J. H. Heathman, Long Acre.*—22*nd July*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to form the different parts of a hose coupling so that they will be compact, light, strong, and efficient for providing a ready means of connecting and disconnecting two lengths of hose, and it consists in the combination of a ring with lugs, claws, grooves and tapered portions, so formed that two similar rings may be interlocked with each other without the use of screw threads, springs, hinges, or bolts.

3493. RENDERING TEXTILE FABRICS WATERPROOF FOR COVERINGS, SHEETINGS, &c., *C. Court, Rotherhithe.*—22*nd July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a composition for cementing textile fabrics together so as to render them waterproof, and it consists of india-rubber and gutta percha, to which camphine and white naphtha are added, and the whole stirred until the former are dissolved, when a certain quantity of chloride of lime is added.

3496. SUSPENSION FOR CARRIAGES, WAGONS, &c., *E. M. Desprez, Paris.*—22*nd July*, 1882. 6*d.*

This consists in supporting the body of the vehicle by means of a frame formed with holes, so as to pass over vertical bolts secured to the under frame, spiral springs being arranged round the bolts both below and above the frame of the body, those above being retained by nuts screwed on to the ends of the bolts.

3497. TREATMENT OF SEWAGE AND OTHER REFUSE ANIMAL MATTER, &c., *T. H. Cobley, Dunstable.*—22*nd July*, 1882. 4*d.*

This relates to the treatment of sewage and other refuse animal matter with a mixture of soluble chlorides, such as chlorides of aluminium, calcium, iron and manganese in varying proportions, or that mixture absorbed in and combined with carbonaceous matter.

3501. WOOL CARDING ENGINES, *E. G. Brewer, London.*—22*nd July*, 1882.—(*A communication from C. Rudiger, Germany.*) 6*d.*

This invention differs from ordinary wool carding engines mainly that in each of the main carding cylinders which are provided with workers or working rollers works by itself and conveys the material on further, so that no part of the same comes back. Two or more immediately contiguous cylinders are used, each being separately provided with two or more workers and corresponding strippers, all arranged in such manner that by the different surface speeds the first carding cylinder gives off the material directly to the next cylinder or cylinders, that the material by the different speeds of the workers is gradually treated, and that a partial return of the material to a carding cylinder which it has already passed is impossible.

3504. MACHINE FOR GENERATING ELECTRICITY, *A. D'Oreli, Greenwich.*—24*th July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a dynamo machine having a disc armature pierced with holes corresponding to two series of fixed bobbins composed of magnets wound with copper wire.

3503. HAMMOCKS, *R. H. Holman and W. Carlton, Grantham.*—22*nd July*, 1882.—(*Not proceeded with.*) 2*d.*

The hammock is of sailcloth, and it is contracted opposite the head by folding the side edges inwards

upon themselves one or more times, and secured, so as to leave the folded parts free to rise and gradually approach one another over the body and legs of the occupant, while the head is left free. Stretcher bars stiffen the hammock transversely.

3514. COUPLINGS FOR PIPES, *M. H. Simpson, Lancaster.*—*25th July*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to form couplings for connecting pipes to convey fluids under pressure, so that the action of connecting the pipes opens a valve, whilst such valve is closed in disconnecting the pipes, and the loss of fluid thus prevented.

3515. APPARATUS FOR DISTRIBUTING AND DIFFUSING POWERFUL LIGHTS, *A. P. Trotter, Cambridge.*—*25th July*, 1882.—(*Not proceeded with.*) 2*d.*

The object of this invention is to soften and distribute the powerful light from arc or other lamps without great loss. The inventor employs a glass lantern in the shape of an inverted cone, the light being situated near the centre of its base. The exterior surface of the cone is circularly grooved, so as to present a series of steps, each of which has its surface so curved that the rays of light passing through it are distributed by refraction uniformly over the desired area. Above the cone a reflector is provided.

3516. GALVANIC BATTERIES, *J. R. Rogers, Upper Holloway.*—*31st July*, 1882. 4*d.*

This relates to the use of oxide of copper with a mixture of plumbago and peroxide of manganese in combination with copper or carbon and zinc as electrodes.

3518. SPRING SLIDES FOR SECURING PAPER IN MACHINE PRINTING, *M. Millington, Nottingham, and R. Burton, Clerkenwell.*—*25th July*, 1882.—(*Not proceeded with.*) 2*d.*

This consists of two bottom lay-to's, each composed of a grooved block with plate springs opposite one another, or one clip spring holding down with the groove a sliding arm carrying beneath the projecting end thereof a circular lay-to block. Beneath the block is a clip to fasten the lay-to to the platen iron, so that it may be moved along the same. A side lay-to of similar construction is also provided.

3521. ATTACHING HANDLES TO VESSELS OF GLASS, &c., *H. J. Haddan, Kensington.*—*25th July*, 1882.—(*A communication from A. Ezepelka and E. Fritsch, Vienna.*)—(*Not proceeded with.*) 2*d.*

The handle is made separate from the vessel, to which it is secured by wires, rings, or hoops passing round the vessel, and to which the handle is secured in any suitable manner.

3522. PRODUCING METALLIC WOLFRAM, OR ALLOYS, OR CARBURATES OF WOLFRAM, *C. J. L. Leffler, Sheffield.*—*25th July*, 1882. 2*d.*

This consists in producing metallic wolfram or alloys, or carburates of wolfram, in combination or not with other metals, by placing alternate layers of wolfram ore, or oxides, or salts of wolfram and charcoal or other carbonaceous matter, with or without the addition of fluxes or other ores or oxides of metals, in a furnace constructed so that no air or oxidising gases can obtain ingress to the materials.

3524. PACKING FOR PISTON RODS, &c., *W. R. Lake, London.*—*25th July*, 1882.—(*A communication from E. Degrave, Paris.*)—(*Not proceeded with.*) 2*d.*

The packing consists of a case made of asbestos, cotton, flax, or other suitable material, and filled with a paste of graphite, paraffine, or other lubricant.

3525. PENHOLDERS, *J. A. Pickering, Russell-square.*—*25th July*, 1882.—(*Not proceeded with.*) 2*d.*

An elastic or rigid tongue of metal is mounted on the penholder, so that it may be slid along, so as to regulate the distance between the point of the nib and that of the tongue, whereby the degree of hardness of the pen can be regulated at will, while at the same time the space between the pen and the tongue will be filled with ink when dipped into the ink-pot, so that the ink will not require renewing so frequently.

3529. FIRE-ESCAPES, *F. Hoe, Burton-on-Trent.*—*25th July*, 1882.—(*Not proceeded with.*) 2*d.*

The escape consists of telescopic tubes capable of opening out under a pressure of water.

3530. SELF-BINDERS FOR PAPERS, *C. R. Basevi, Holborn Viaduct.*—*25th July*, 1882.—(*Not proceeded with*) 2*d.*

This relates to a portfolio or self-adjusting binder, consisting of two boards connected by a flexible back, and to the edge of one of which cords are secured and carry needles, so that they may be readily passed through the papers to be bound, after which they are attached to elastic straps or springs secured to the edge of the other board.

3531. COMMUNICATING IN RAILWAY TRAINS, *F. Hoe, Burton-on-Trent.*—*25th July*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to enable passengers to send written messages to the guard, or to enable the guard and engine-driver to communicate. The message is written on paper, and placed in a tube, through which a current of air passes and conveys the paper to the guard's van.

3535. SEWING NEEDLES, *J. Hewitson and W. J. Napier, Liverpool.*—*25th July*, 1882.—(*Not proceeded with*) 2*d.*

The eyes are made long, and an oblique slit is made for the thread on one side, sloping inward to near the end of the eye nearest the point. If desired the unslit side of the needle may be strengthened, so as to prevent the needle bending.

3541. PRODUCTION OF METHYLQUINOLINE FROM ORTHO-NITRO-BENZYLIDENACETONE, *J. Erskine, Glasgow.*—*26th July*, 1882.—(*A communication from the Farbwerke vorm: Meister Lucius and Bruning, Germany.*) 2*d.*

This relates to means for the production of methylquinoline by treating ortho-nitro-benzylidenacetone with reducing agents.

3543. WHEELS FOR GRINDING, GLAZING, AND POLISHING, *J. Robinson, Manchester.*—*26th July*, 1882. 2*d.*

The inner part of the wheel is made of iron, and is covered with india-rubber combined with 33 per cent. of lime and 17 per cent. sulphur. A second covering of india-rubber and 15 per cent. litharge and 5 per cent. sulphur is then applied, and to it the emery is applied in the usual manner.

3544. ELECTRIC REGULATOR AND METER, *W. Laing, Paris and London.*—*26th July*, 1882. 6*d.*

This relates to an apparatus similar to an electric bell, except that the bell is replaced by metallic contact pieces. It is intended to be placed in a shunt from an arc lamp, and so regulated that when the arc gets too long the armature of the apparatus will be attracted, and the feed mechanism of the lamp actuated. It is proposed to be used as a meter in combination with a galvanometer.

3551. PUMPS FOR RAREFYING AND COMPRESSING AIR, &c., *W. R. Lake, London.*—*26th July*, 1882.—(*A. communication from A. Burckhardt and F. J. Weiss, Switzerland.*) 6*d.*

The object is to reduce the prejudicial effect of the space between the piston and the end of the cylinder in air and other pumps. The pump is so formed that the spaces on each side of the piston are connected immediately the piston has completed its stroke and after the valves in the inlet and outlet passages have been closed. The piston is mounted loosely on the piston-rod, and so that it can slide between two fixed discs, whereby the channels connecting the two sides of the piston are opened during the intervals between the strokes of the piston.

3558. VELOCIPEDES, *J. S. Orton, Birmingham.*—*27th July*, 1882.—(*Not proceeded with.*) 4*d.*

This relates, First, to constructing bicycles so that the seat is always in line with the track of the driving wheel, and consists in attaching it to that part of the bicycle head which is rigid with the fork; Secondly, to means for conveying or transmitting motion from pedals to cranks at a distance from each other by an arrangement of levers and links producing an action similar to that of the pantograph; Thirdly, to so arranging the cranks that they may revolve upon the same axis as the two driving wheels, and at the same time allow of automatic differential balance motion being transmitted from either wheel to the other; Fourthly, to the mode by which two equal sized wheels may be made fast or loose on the shaft on which they revolve; and Fifthly, to a mode of throwing a clutch in and out of action.

3560. LIQUID METERS, *H. J. Haddan, Kensington.*—*27th July*, 1882.—(*A communication from T. L. Calkins, Newark, U.S.*)—(*Not proceeded with.*) 2*d.*

This consists in making liquid meters with two sets of valves which are thrown in opposite directions by a spring actuated lever, and retained when thrown. A locking lever retains the valves in position while the position of the tripping levers is changed.

3561. DRAWING THE TINES OF FORKS, *J. Imray, London.*—*27th July*, 1882.—(*A communication from P. E. Bird and H. W. Wass, Philadelphia, U.S.*)—(*Not proceeded with.*) 2*d.*

The metal to form the tine of a fork is drawn through a die divided lengthwise, and of such shape that the two parts of the die being caused to slide longitudinally in opposite directions, the hole of the die becomes less and less, and the tine is drawn to the desired taper. Other dies clear off the heads of the tines, removing any lumps of metal.

3574. GOVERNORS FOR STEAM ENGINES, &c., *W. R. Lake, London.*—*27th July*, 1882.—(*A communication from J. Judson, Rochester, New York.*)—(*Complete.*) 6*d.*

The invention consists partly in the combination in a governor of springs connecting the governor balls and a spring tension device connected with the valve rod by a lever. It also consists in the peculiar construction of the piston.

3642 SCULLING BOATS, *T. J. Edwards, Southwark.*—*1st August*, 1882. 6*d.*

The object is to enable the sculler to sit with his face directed to the direction of motion. Stanchions are fixed on each side of the boat immediately before the forward reach of the sculler, and others at a point behind the rearward part of the body of the sculler, the two being joined by a rail on which slides a small rowlock carrying the handle ends of the sculls, which latter cross each other inside the boat, their blade ends passing between the top rails and the gunwales of the boat. A brace is attached to the sculls and passed over the back of the sculler.

3651. PRODUCT FOR PREVENTING INCRUSTATION IN STEAM BOILERS, *W. E. Gedge, London.*—*1st August*, 1882.—(*A communication from J. Boissie, Paris.*) 2*d.*

The product consists of a mixture of crushed potatoes and muriatic acid, a greater consistency being given to the mixture by the addition of an inert body, such as inferior wheaten flour.

3673. WROUGHT IRON AND STEEL RODS, *E. Deeley, Walsall.*—*2nd August*, 1882. 4*d.*

The rods are made by reducing rod or bars to such a diameter that they can be made into coils, which are placed on a reel of fire-clay and treated in a furnace, the end of the coiled rod being then introduced between a pair of rolls, which, by rotating, draw the rod off the reel and reduce it to the required diameter.

3697. MACHINES FOR CLEANING INTESTINES, *E. de Pass, London.*—*3rd August*, 1882.—(*A communication from S. Oppenheimer, New York.*) 6*d.*

This relates to machines for cleaning intestines for making sausage "cases," &c., and consists of a pair of double scrapers arranged in relation to a revolving cylinder which may be adjusted so as to clean the entrails. It also prevents the coiling up of the tissue around the scrapers.

3724. MANUFACTURE OF SULPHO-ACIDS AND COLOURING MATTERS THEREFROM, *F. Wirth, Frankfort-on-the-Main.*—*4th August*, 1882.—(*A communication from the Farbfabrick vormals Brönner, Frankfort-on-the-Main.*) 4*d.*

This consists, First, in the conversion of the naphthosulpho-acids into the corresponding naphthylamine sulpho-acids by the action of ammonia acids; Secondly, the production of azo colouring matters from the diazo compounds of the naphthylamine sulpho-acids so obtained combined with the phenoles, oxyphenoles, or their ether and sulpho-acids; Thirdly, the production of the amido-azo compounds of the naphthylamine sulpho-acids obtained as described.

3783. ASPHALTE APPARATUS, *B. D. Healey, Brighouse.*—*9th August*, 1882. 6*d.*

This relates to an apparatus for melting and mixing bituminous compounds and like substances, of the combination of a pan and a surrounding brick-lined case, and one or more stirrers arranged within and near the lower part of said pan, so as to act both to mix the contents and to keep the bottom clear of deposit of the material under treatment.

4986 MANUFACTURE OF IRON IN BLAST FURNACES, *C. Cochrane, Stourbridge*—*19th October*, 1882. 4*d.*

This consists in the method of working a blast furnace so as to diminish the amount of carbonic acid gas evolved at the red-hot zone, by employing a furnace of such large dimensions relatively to the ore treated as to effect the reduction of the ore before it reaches the red hot zone, and by using in combination with such furnace caustic lime as a flux instead of limestone.

5217. MACHINES FOR SPLITTING WILLOW WITHES OR RATAN, *J. G. Johnson, London.*—*1st November*, 1882.—(*A communication from C. Pieper, Berlin.*)—(*Complete.*) 6*d.*

The operation in the machine is carried out by pressing the withe against a suitable moving surface, such as the periphery of a rotating disc, and by causing it to be carried along thereby under or over a cutter opposed to the direction of its motion, and which in penetrating to a certain adjustable depth into the withe or ratan, severs therefrom one or more strips as required.

5279. CLOCKS FOR SIGNALLING BY ELECTRICITY, *W. R. Lake, London.*—*4th November*, 1882.—(*A communication from the Standard Time Company, New Haven, Conn., U.S.*) 6*d.*

The object of this invention is to rectify the difficulties experienced in electric clocks, owing to the variableness of the time at which the electric circuit is closed or broken by one hand making contact with a metal contact piece. The inventors propose to overcome the difficulty by so arranging the surface of the contact piece in its relation to the contact-making hand, that contact between them will be sudden and instantaneous, and the escape of the hand from the contact-piece also sudden and instantaneous; and by making the surface of the contact piece adjustable as to its extent.

5280. SIGNALLING BY ELECTRICITY THROUGH THE MEDIUM OF GAS, *W. R. Lake, London.*—*4th November*, 1882.—(*A communication from the Standard Time Co., of New Haven, Connecticut, U.S.*) 6*d.*

According to this invention, the gas in the mains and branches of an ordinary gas supply system is utilised to transmit signals. Two gasholders are provided, in one of which gas is stored at a greater pressure than the other, which latter supplies the pipes with their ordinary supply for public use. At certain times, when a signal is required to be sent, the gas from the high-pressure holder is let into the pipes, and acts on one end of a U-shaped tube containing mercury, forcing the mercury up—say the left-hand tube—until it closes an electric circuit and gives the required signal.

5320. REELING OF SILK, COTTON, OR OTHER THREAD, *W. R. Lake, London.*—*7th November*, 1882.—(*A communication from J. M. Grant, Hartford, U.S.*)—(*Complete.*) 4*d.*

This relates to a novel manner of winding silk or other threads upon the reels in a reeling machine preparatory to their being dyed, and of tying and looping or lacing the skeins formed to prevent their becoming entangled and displaced in the dyeing process. The thread is wound in the form of a wide band in which the thread crosses from side to side as it is wound. When the required quantity is wound the band is laced before being removed from the reel in one or more places, so as to divide it into a number of parts and hold it in its flat condition.

5340. RECIPROCATING CYLINDER PRINTING PRESSES, *S. Pitt, Surrey.*—*8th November*, 1882.—(*A communication from W. G. Walker, Madison, U.S.*)—(*Complete.*) 6*d.*

The press is similar in general character to existing reciprocating cylinder presses, inasmuch that the rotating cylinder, to which the paper is fed, is caused to reciprocate on a main frame, over an adjustable type bed, which is raised and lowered at the proper times to make the impressions, and then to get out of the way for the return of the cylinder, but in the new press improved means are provided for gripping the paper, guiding and securing the cylinder during reciprocation, raising and lowering the type bed, securing the blanket to the cylinder, inking, holding the paper on the cylinder, and delivering the printed sheets, whereby tapes and flyers are dispensed with.

5407. FILTERS, *J. Wetter, New Wandsworth.*—*13th November*, 1882—(*A communication from J. Grant, Boston, U.S.*) 4*d.*

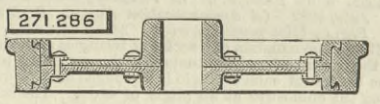
The invention is described as applied to filters consisting of a spherical case, with a screw nozzle at top, to connect to a water pipe, and a delivery pipe at bottom, such pipe enclosing a globular shell containing the filtering material, and having passages on opposite sides for the water to enter the shell, pass through the filtering material, and then out of the shell. The shell is mounted on an axle with a handle, so that it may readily be reversed for cleaning the filtering material. A gasket of flexible material is provided, with a part shaped to fit the upper surface of the shell, and an annular flange extending from one edge, to be inserted between the two portions of the case when fastened together in the usual way by screw threads thereon.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazttee.

271,286. CAR WHEEL, *Samuel T. Wellman, Cleveland, Ohio.*—*Filed April 20th*, 1882.

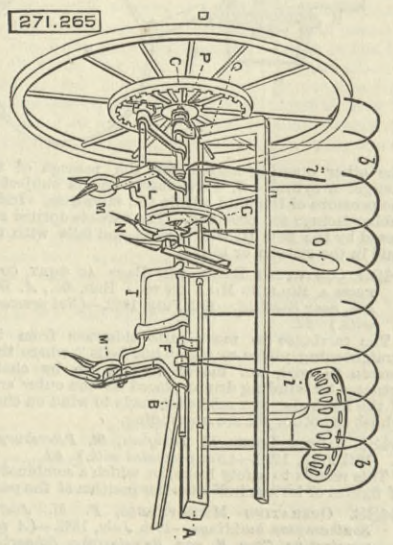
Claim.—(1) A car wheel consisting of a solid hard steel tire or tread and body and hub portions, composed of soft cast steel sections, the adjacent faces or sides of which are seated against each other and secured near the hub and tire by rivets, the said tire being adapted to receive the outer edges of the body and hub sections and to be locked to them when they are brought together, substantially as set forth. (2)



A car wheel consisting of hard steel tire or tread having annular grooves formed in its opposite sides, and body and hub portions composed of soft cast steel sections, the adjacent faces or sides of which are seated against each other, the outer edges of the body sections being provided with inwardly-projecting flanges that enter the grooves in the tires, and rivets extending through the body sections and located inside the tire and other rivets located near the hub, substantially as set forth.

271,265. COMBINED RAKE AND TEDDER, *Albert B. Pixley, Royalton Vt.*—*Filed October 18th*, 1880.

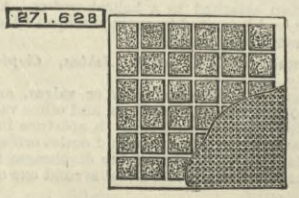
Claim.—(1) A revolving and sliding shaft B provided with a lever G and radial arms F adapted to carry a revolving crank shaft I in combination with rake frame A provided with lever O, adapted to slide the shaft B back and forth, as described, and for the purposes set forth. (2) A wheel D provided with grooved hub C in combination with axle B and frame A provided with rake teeth *b* and flange Q, adapted



to fit into the groove P of said hub, as described, and for the purposes set forth. (3) A circular spring M, supported at its ends on the arm L, in combination with tedder-fork N, attached to and supported by the spring at a point between the ends of the spring, as described, and for the purposes set forth. (4) The hay-stop *i*, adapted to turn with revolving shaft B, in combination with frame A, provided with rake teeth *b*, as described, and for the purposes set forth.

271,628. SECONDARY BATTERY, *Alfred Haid, Rahway, N.J.*—*Filed September 13th*, 1882.

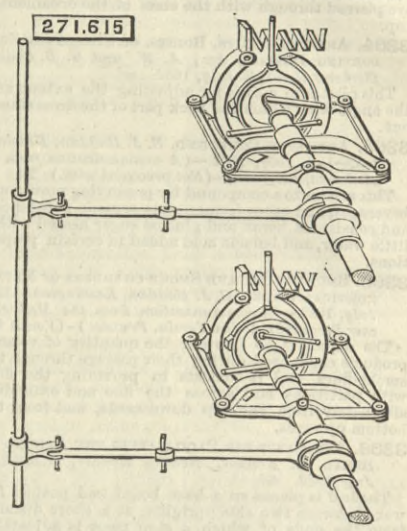
Claim.—(1) In a secondary electric battery, the frames for holding the active material, made of iron covered with tin or lead, and having apertures in which such active material is placed, substantially as set forth. (2) In a secondary electric battery, the alternate plates or frames, filled respectively, before charging, with spongy Prussian blue and oxide of lead, substantially as set forth. (3) In a secondary



electric battery the combination, with the lead-covered or tin-covered iron frames having apertures for containing the active material, of a suitable covering for retaining such material in place, substantially as set forth. (4) In a secondary electric battery the combination, with a lead-covered or tin-covered iron frames having apertures for containing the active material, of screens or coverings of woven bamboo, placed one on each side of the frame, substantially as set forth (5) In a secondary electric battery a filling, composed, before charging, of spongy Prussian blue, substantially as set forth.

271,615. GOVERNOR FOR DYNAMO-ELECTRIC MACHINES, *Thomas A. Edison, Menlo Park, N.J.*—*Filed November 9th*, 1882.

Claim.—(1) The combination, with two or more separate engines, having automatic cut-off mechanisms composed of loose excentrics and wheel governors adjusting such excentrics, of a sliding sleeve feathered on the shaft of each engine, means connecting such sleeve to the governor weights so as to be moved thereby, and means connecting the sliding sleeves of all the engines together, substantially as set forth. (2) The combination, with two or more separate engines having automatic cut-off mechanisms composed of loose excentrics, and wheel governors adjusting such excentrics, of a sliding sleeve feathered on the shaft of



each engine, means for connecting such sleeve to the governor weights so as to be moved thereby, a pivotted lever engaging a collar on such sleeve, and means connecting the levers of all the engines together, substantially as set forth. (3) The combination, with two or more separate engines having automatic cut-off mechanisms composed of loose excentrics and wheel governors adjusting such excentrics, of a sliding sleeve feathered on the shaft of each engine, bell cranks connecting the sleeve and governor weights, a pivotted lever engaging a collar on the sleeve, and a shaft connecting the levers of all the engines together, substantially as set forth.

WE learn that Mr. James Cleminson, M. Inst. C.E., has been invested with the Grand Cross of the Order of Bolivar.

AT a general meeting of the King's College Engineering Society, held on Tuesday last, the 6th inst., Mr. W. Farquhar read a paper on "Waterwheels and Turbines." On Tuesday next the terminal business meeting will be held.

RECENTLY, in Congress, Senator Vance, of North Carolina, read from a report of the late Professor Kerr, geologist of that State, an estimate of the unused water power of the North Carolina rivers. The main streams have an aggregate length of 3300 miles, with an average fall of 10ft. to the mile, giving a horse-power of 3,300,000. The numerous tributaries are not included in this estimate. The wasted water power of the State rivals the estimated engine power—stationary and locomotive—of Great Britain.

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