ELECTRICAL TRANSMISSION OF POWER.

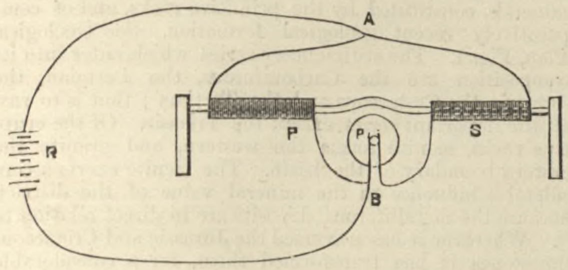
By Professor Oliver J. Lodge.

No. VII.

Behaviour of a compound wound dynamo driven by a battery.—Continuing the subject of the last article, we proceed to consider a compound wound motor driven by a storage or other battery. Compound wound motors can be arranged to run at a constant speed, and will therefore be frequently used.

Let E be the electro-motive force of the battery and R its resistance.

Let e be the back electro-motive force of the machine, and ρ its series resistance, and let its shunt resistance be s, the shunt portion being attached to the terminals of the machine the same as those to which the battery is attached, A B.



Let P be the power of the battery and p the useful power, $\frac{p}{P} = f$ being the efficiency.

Let C be the current supplied by the battery and C^1 the current flowing round armature and series magnet (so that $C - C^1$ is the current round shunt magnet).

Then, the electro-motive force between the terminals

A B is $E - R C$

and also $e + \rho C^1$

and also $s (C - C^1)$.

The total power $P = E C$

and the useful power $p = e C^1$

so the efficiency is $f = \frac{e C^1}{E C}$.

These are the fundamental formulæ from which all the rest follow.

For instance, these—

$$C^1 = C - \frac{E - R C}{s}$$

Back electro-motive force $e = E - R C - \rho \left(C - \frac{E - R C}{s} \right)$

Useful power

$$p = \left\{ E - R C - \rho \left(C - \frac{E - R C}{s} \right) \right\} \left\{ C - \frac{E - R C}{s} \right\}$$

Waste power

$$= R C^2 + \frac{(E - R C)^2}{s} + \rho \left\{ C - \frac{E - R C}{s} \right\}^2$$

Looking at the expression for p, or for waste, we observe that, for economy, it is necessary to keep R and ρ as small as possible and s as large as possible, consistently with a proper excitation of the magnets. Also that the larger E is the better, and the smaller the current with which one is enabled to work.

Problem 1.—With a given battery a certain power is required with a specified efficiency (E, R, p, f given). What current must be used? And what relation must exist between the shunt and direct resistance of the wire on the machine?

Answer to the first question—

$$C = \frac{p}{f E}.$$

Answer to the second question—

This may be expressed in two forms, either ρ in terms of s, or s in terms of ρ, viz., either,

$$\rho = \frac{(E - R C) s}{(s + R) C - E} - \frac{p s^2}{[(s + R) C - E]^2}$$

or,

$$s = \frac{2 \rho (E - R C)}{\sqrt{(E - R C)^2 - 4 p \rho} - (E - R C) + 2 \rho C}$$

The latter refuses to give a sensible value for s unless ρ is less than $\frac{E}{C} - \frac{p}{C^2} - R$. This expression, therefore, fixes the upper limit of ρ, and it can only have this value if s be ∞. Remember, then, that in order to satisfy the given conditions ρ must be less than $\frac{E C - p}{C^2} - R$.

Numerical example of Problem 1.—Given fifty boxes (E = 100, R = ·2), and aim at 5-horse power, with efficiency 75 per cent. $\left(\begin{matrix} p = 3730 \\ f = \frac{3}{4} \end{matrix} \right)$.

Then the current

$$= \frac{3730}{75} = 50 \text{ ampères.}$$

The maximum value for ρ is $\frac{5000 - 3730}{2500} - ·2 = ·3$.

Let the armature be ·15 ohm, and the thick field magnet wire ·038 ohm; so that ρ = ·188, what must s be?

Answer—

$$s = \frac{180 \times ·188}{\sqrt{8100 - 14920 \times ·188} - 90 + 18·8} = \frac{33·9}{\sqrt{5800} - 71·2} = 6·8.$$

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But suppose, through heating, &c., ρ ran up to ·2 ohm; what must s be?

$$s = \frac{36}{71·526 - 70} = 23·5 \text{ ohms:}$$

and as a big s is an advantage, it is safer to have s = 20 or 30 ohms.

Problem 2.—With a given battery and machine (E R ρ s p given), a certain power is desired. What current must be used? and what efficiency can be attained?

Answer to the first question:—Writing b for $\frac{\rho s}{\rho + s}$

$$C = \frac{E (s + b + 2 R) - \sqrt{E^2 (s - b)^2 - 4 p s^2 \frac{(s + R)(b + R)}{s + \rho}}}{2 (s + R)(b + R)}$$

Answer to the second question—

$$f = \frac{p}{E C}$$

The shortest expression for C is got by writing k for $\frac{(s + R)(s + \rho)}{s^2} - 1$

then $C = \frac{E (1 + 2 k) - \sqrt{E^2 - 4 p k (s + R)}}{2 k (s + R)}$ is the necessary current.

Numerical example—

Given E = 100, R = ·2, ρ = ·2, s = 23·5, p = 3730; so that k = ·017, the current is $C = \frac{103·4 - \sqrt{10,000 - 6000}}{·81} = \frac{40·2}{·81} = 49·7$ ampères, and the efficiency is $\frac{3730}{4970} = 75$ per cent.

Second example.—Given E = 100, R = ·35, ρ = ·15, s = 20, p = 3730,

so that b = ·1495, or $k = \frac{1}{40}$, then

$$C = \frac{2085 - \sqrt{3,940,000 - 3,000,000}}{20·35} = \frac{1115·5}{20·35} = 54·5 \text{ ampères,}$$

and efficiency $= \frac{3730}{5450} = 68·3$ per cent.

The least possible value of E, which will suffice to give a specified power p with a given machine, is—

least $E = 2 \sqrt{p k (s + R)}$. Or as $k \doteq \frac{R + \rho}{s}$

least $E \doteq 2 \sqrt{p \frac{(\rho + R)(s + R)}{s}} = 71·8$ volts in above first case. If the cells fell to this electro-motive force, the maximum current would be required to do the work, namely, $\frac{E (s + R + b + R)}{2 (s + R)(b + R)}$, or $\doteq \frac{E}{2 (\rho + R)} = 125$ ampères, and the efficiency would be $\frac{3730}{12500} = 30$ per cent.

Problem 3.—With a given battery and machine, the condition for maximum useful power is—

$$C = \frac{E (1 + 2 k)}{2 k (s + R)},$$

the maximum power is $\frac{E^2}{4 k (s + R)}$,

and the efficiency is $\frac{1}{2 (1 + 2 k)} \doteq \frac{s}{2 (s + \rho + 2 R)}$.

Problem 4.—Given a battery and a machine, what is the maximum efficiency at which they can be worked? What power can be got with this maximum efficiency? And what strength of current will give it?

Answer—The general expression for the efficiency is:—

$$f = \left\{ \left(1 + \frac{R}{s} \right) \frac{C}{E} - \frac{1}{s} \right\} \left\{ \left(1 + \frac{\rho}{s} \right) \frac{E}{C} - \left(R + \rho + \frac{R \rho}{s} \right) \right\}$$

This is a maximum when $C = E \sqrt{\frac{s + \rho}{(s + R)(R s + \rho s + R \rho)}}$

$$\doteq \frac{E}{\sqrt{s (R + \rho)}}$$

its maximum value being

$$F = 1 - 2 \sqrt{\frac{R + \rho}{s} + \left(\frac{R + \rho}{s} \right)^2} + 2 \frac{R + \rho}{s}$$

and the power thus most economically obtained is

$$p = F E C = E^2 \left(\frac{1}{\sqrt{s (R + \rho)}} - \frac{2}{s} \left(1 - \sqrt{\frac{R + \rho}{s}} \right) \right)$$

For instance	If E = 100	
	The best current is	and the power in Watts is
If R = ·2, ρ = ·2, and s = 20, the max. F = 75·4 per cent.	35·4	2683
If R = ·17, ρ = ·19, and s = 20, the max. F = 76·8 ,,	37·3	2864
If R = ·3, ρ = ·15, and s = 20, the max. F = 70·4 ,,	33·3	2483
If R = ·2, ρ = ·2, and s = 40, the max. F = 80·2 ,,	25½	2100
If R = ·3, ρ = ·3, and s = 60, the max. F = 80·2 ,,	16⅔	1366

Table showing Maximum Efficiency, and Current and Power corresponding, for a given Machine and Battery.

R.	ρ.	s.	F max. efficiency,	If E=100.		If E=200.		If E=125.	
				C.	p.	C.	p.	C.	p.
·2	·2	20	75·4	35·4	2683	70·8	10732	44	4024
·17	·19	20	76·8	37·3	2864	74·6	11456	46	4296
·3	·15	20	70·4	33·3	2483	66·6	9932		3725
·2	·2	40	80·2	25·5	2100	51	8400		3150
·3	·3	60	80·2	16·7	1366	33·4	5464		
·4	·4	40	75·4	17·7	1341	35·4	5364		
·4	·4	100	82·3	11·18	936	22·36	3744		
·16	·2	25	78·9					42	4000

Problem 5.—Required a certain power from a given machine.

What is the least number of cells that will give it?

Answer—

If e is the electro-motive force, and r the resistance of each cell, then the least number is

$$\text{least } N = \frac{(s + 2 \rho) 2 p r s}{e^2 s^2 - 2 p r^2 (\rho + 2 s)} \left\{ 1 + \sqrt{1 + \frac{\rho [e^2 s^2 - 4 p r^2 (\rho + s)]}{p r^2 (s + 2 \rho)^2}} \right\}$$

the efficiency will then, however, be less than 50 per cent.

Problem 6.—Required a certain power with a specified efficiency from a given machine.

What is the right number of cells to give it?

Answer is contained in—

$$f s^2 = \left\{ (s + R) \frac{p}{f E^2} - 1 \right\} \left\{ (s + \rho) \frac{f E^2}{p} - (R s + \rho s + R \rho) \right\}$$

writing $R = N r$ and $E = N e$;

but I have not worked it out for the general case, because it leads to an equation of the fourth degree, which is most easily solved numerically.

IRON AND STEEL WORKS, RESCHITZA, HUNGARY.

No. I.

Those who remember the Cwm Afon Works of the Governor and Company of Copper Miners in England, before their dismemberment, where the finished engine was made from iron puddled from pig, that was smelted from ore raised on the spot, by means of coal also extracted from the territory, can form some idea of the completeness of resource existing in the domain of the K.K. — Kaiserliche Königliche — Priviligirte Oesterreichische Staats-Eisenbahn Gesellschaft, situated in the old province of Banát, at the extreme south of Hungary, and thrown open to the members of the Iron and Steel Institute after their meeting at Vienna. But, whereas the Welsh works covered only a single valley, the domain of the Franco-Austrian Association is as large as an average French department or English county, and is even larger than the Grand Duchy of Luxemburg. The company was formed in 1855 by the Crédit Lyonnais of France, who received from the Austrian Government, in exchange for funds that were greatly needed at the time, the Banát domain in Hungary, the Kladno collieries in Bohemia, and the concession of 1164 kiloms.—723 miles—of railway. At the same period it acquired the railway, 45 kiloms.—28 miles—long, between Vienna and Raab, together with large locomotive works at Vienna. The administrative council holds its sittings in Paris; but the general direction, under M. Leopold Bresson, is at Vienna, while the various collieries, iron mines, and works are placed in the charge of individual managers on the spot. The capital of the company is 400,000,000f.—£16,000,000—while the value of the domain amounts to 40,000,000fl.—£3,200,000. The number of persons employed is about 78,000, not including the railway employés. It must certainly be conceded that the foreign company has energetically worked its acquired territory, thus giving an impetus to trade, in a manner that would scarcely have been accomplished without its assistance. By means of the more recently constructed branch from Temesvár to Orsova and Verciorova, which there joins the Roumanian State line, and their Bessemer rails of excellent quality, the company is fast carrying Western civilisation into the heart of the East, and supplying materials to the newly-formed principalities on the Danube that will enable them the sooner to develope their natural resources.

Means of communication.—The company's Banát domain, a geological map of which is given on Fig. 1, page 24, lies entirely in the *comitat* of Krassó in the South of Hungary. It extends from slightly above Bogsán on the north to Moldova on the Danube in the south. It is 91 kiloms.—56½ miles—long from north to south, the greatest width being 46 kiloms.—28½ miles. It is traversed from east to west by three rivers, the most important of which, the Berzava, is dammed at Franzdorf, so as to drive the blowing engines of the Bogsán blast furnaces. Its waters are also utilised for periodically floating down the timber obtained from the forest-clad hill-sides to the charcoal station near Reschitza, the works of which it supplies with water. The company has made 100 kiloms.—62 miles—of roads, in addition to maintaining another 150 kiloms., which serve for the transport of their products. Besides the Vienna and Raab Railway already mentioned, which is now extended to Neu Szöny, there is a network in Bohemia, put in direct communication with Vienna and with the Prussian system, and also the line connecting the Austrian and Hungarian capitals, formerly the Austrian State Railway, from which the company derives its title. Eastwards their railway system is also extended to Szegedin and Temesvár, the second and third towns in importance of Hungary. At Temesvár the line divides, one portion going to Orsova, above mentioned, and the other to Baziás, both on the Danube. In connection with this latter portion, a branch line leads from Jassénova to Anina-Steierdorf, where there are the most valuable coal seams—of the lias formation—in the whole of Hungary, and also works that turn out 12,000 tons of an iron vieing with that of Lowmoor and Bowling. Samples of this iron are taken daily at each stage of the manufacture; and it is no exaggeration to say that the puddle bars show a fracture equal to that of ordinary brands of finished iron. This mountain line is of the normal gauge, notwithstanding the long and sharp gradients, in some cases 1 in 50 with double curves of 60 klafter—5½ chains—radius occurring at the same time. It passes Oravitza, where there are petroleum works, the central laboratory, and a collection of all the minerals found on the domain. The other branch leaves Voitek junction for the rich iron ore deposits at Moravitza, which will be described below.

From Bogsán a line having a gauge of only 95 centimetres—not 2ft. 8in.—on account of the difficulties of construction, leads to the Reschitza district—see the geological map, Fig. 2, page 25—terminating at the Székül Colliery, while a branch puts Reschitza also into communication with the Domán Colliery. This brings up the total length of small gauge lines to 92 kiloms.—57 miles—while there are, in addition, about 28 kiloms.—17 miles—of surface and 126 kiloms.—78 miles—of underground tramways in and about the mines and collieries. The length of normal gauge railway now owned and worked by the company is 2118½ kiloms., or over 1316 miles.

Forests and charcoal.—Agriculture is not in a very forward state; but the iron plough has now entirely superseded the wooden instrument that was exclusively used before the advent of the company. The soil in the valleys is especially suitable for the cultivation of cereals, maize being the chief crop. Hemp is grown in places, the product being spun and woven in the Wallachian or Roumanian households. The vine is becoming more and more cultivated, a really good wine being produced in the south. The hills are generally covered with forests, the oak predominating up to the height of 500 metres above the sea level; but beyond this line the beech, which yields charcoal, is in the ascendant. Contrary to what has happened in most districts where the iron production is dependent on the forests, the company, which owns the forests as well as the manorial rights, and whose production of charcoal iron exceeds 15,000 tons a year, at once took measures to economise this important item of its fuel

flushes generally begin in March, when the logs, which have been laid on the banks of the river, are drawn along by the current for a distance of from 2 to 30 kilometres, accomplishing the greater distance in 6 hours. In this way, from 800 to 8000 steres—1046 to 10,464 cubic yards—of timber are accumulated at the first station, 37 kilometres—23 miles—below the dam, constructed of wooden palisades, the spaces between which can be increased or diminished at pleasure. The logs that are here arrested are led by a lateral canal to the first charcoal station, capable of stacking 4400 steres—5755 cubic yards—of timber with twenty-six piles on fire at the same time. There is also a

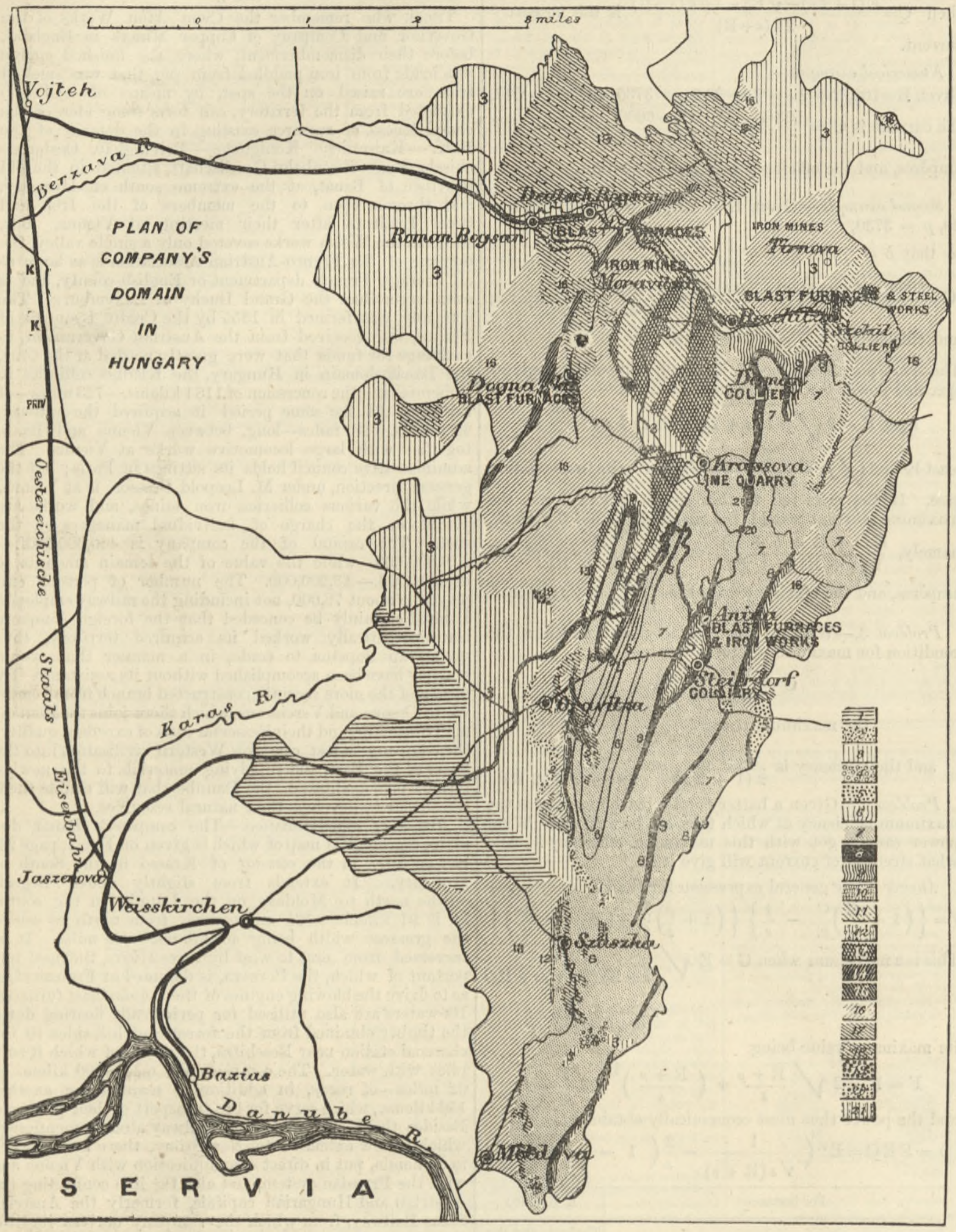


Fig. 1.—GEOLOGICAL PLAN OF DOMAIN IN HUNGARY OF THE K. K. PRIV. OESTER. ST. EISENBAHN GESELLCHAFT.

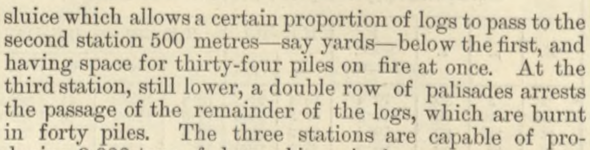
REFERENCE—

DILUVIAN	1. Loam, clay, and gravels.
TERTIARY FORMATION	2. Gravels and conglomerates. 3. Sand, clay, and sandstone.
CRETACEOUS FORMATION	4. Breccia. 5. Sandstones and marls (upper cretaceous). 6. Marls, 7. Limestones (middle and lower cretaceous).
JURASSIC FORMATION	8. Schistose limestones and marls.
LIAS FORMATION	9. Sandstone, argillaceous shales and marls. 10. Metamorphic sandstone,
DIAS FORMATION	11. New red sandstone. 12. Metamorphic sandstone.
COAL MEASURES	13. Argillaceous sandstones and shales. 14. Crystalline limestone. 15. Silicious limestone.
CRYSTALLISED ROCKS	16. Gneiss and Mica-schist.
IGNEOUS ROCKS	17. Granite, 18. Sienite. 19. Serpentine. 20. Porphyry and diorite. 21. Gangues.

supply. In accordance with a cadastre, definitely revised in 1874, they divided the forest land into five classes or periods. Estimating the quantity of timber in each class, and knowing the requirements of the furnaces, they have worked the growth of beech trees in periods of 80 or 100 years. Thus, while taking each year the quantity of timber required to produce the quantum of charcoal, the forest supervisors arrange for the reproduction of an equal quantity for the future.

Those trees that are far removed from a stream are felled, cut up and turned into charcoal on the spot, during the summer months, the charcoal being conveyed to the furnace in the best manner possible. But, in the case of all timber that can by any means be got down to a stream, a regular system is pursued. It is felled in winter, drifted down by the torrents which swell the streams in the spring of the year, carried on to the charcoal stations, as will shortly be described, stacked to dry during the summer and autumn, and burnt into charcoal the following winter. The principal charcoal stations are on the river Berzava, near Reschitza, in which district alone there are no less than 27,000 hectares—66,720 acres—of forest land for supplying timber and charcoal. At about 8½ kilometres from the source of this river, a timber dam was constructed in 1865, 11·4 metres—38ft.—high by 25 m.—82ft.—wide, capable of retaining a volume of 115,900 cubic metres or about 25,500,000 gallons of water. The sluice which allows a certain proportion of logs to pass to the second station 500 metres—say yards—below the first, and having space for thirty-four piles on fire at once. At the third station, still lower, a double row of palisades arrests the passage of the remainder of the logs, which are burnt in forty piles. The three stations are capable of producing 9,000 tons of charcoal in a single season. Formerly, none but the smaller branches were used; but it has since been found that the larger wood is also suitable for making charcoal fit for use in the blast furnace.

The Hungarian method of burning is adopted, in



CHARCOAL BURNING IN HUNGARY

which conical piles, called "pits" in the North of England, of 130 to 220 cubic yards content are formed, as shown in the annexed sketch. The logs are piled up regularly round a core of small wood, the larger at the bottom and the smaller at the top. They are covered with straw and fine earth, which is used over and over again. Vent-holes are made for admitting air; but they are carefully watched so as to admit only so much as will just support combustion. Unfortunately, in this primitive method all the gases pass off absolutely to waste. The pile, originally of the form shown at 1, successively assumes that of 2 and 3, when the operation, which lasts from twelve to thirteen days, is finished. The absolute calorific power of the charcoal produced is on an average 6602·8; and the pyrometrical calorific power 4386, the resistance to direct pressure being 25 kilogs. per square centimetre, or 355½ lb. per square inch. Analyses made by the chief chemist, Herr Anton Maderspach, show the following to be its mean composition:—Carbon, 79·98; hydrogen, 2·14; oxygen, 13·11; water, 2·92; ash, 1·85. From 4 to 5 cubic metres—141 to 176½ cubic feet—are required to produce a ton of pig iron.

Minerals.—The boundaries of the company's domain have evidently been determined by the valuable basin, containing several deposits of coal, iron ore, and other minerals, constituted by the primitive rocks, and of comparatively recent geological formation. See Geological Plan, Fig. 1. The sedimentary series which enter into its composition are the Carboniferous, the Permian, the Jurassic, the Cretaceous and the Tertiary; that is to say, all the important series except the Triassic. Of the eruptive rocks, sienite forms the western, and granite the eastern boundary of the basin. The sienite exerts a considerable influence on the mineral value of the district, because the metalliferous deposits are in direct relation to it. Wherever it has traversed the Jurassic and Cretaceous limestones it has transformed them, for a considerable thickness, into crystalline limestone, and sometimes even into a true marble; while the eruption of the porphyry has coked the coal in contact with it for a thickness of half a metre. It is in contact with the limestone and the sienite that are found the magnetic iron ore, and also the red and brown hematites which are worked up at Reschitza and Anina, as well as the copper, lead, and zinc ores, and those of gold and silver. The shales of the primary formation contain a highly manganiferous brown hematite, iron pyrites, sulphate of antimony, and galena. Large quantities of iron pyrites are worked at Moldova, where they are used for the manufacture of sulphuric acid. Copper and silver were raised here by the Romans; and 18 tons of the former metal were produced as late as 1854, but the mines are now no longer worked. Gold is worked to a small extent at Oravitza; and the silver found in conjunction with the lead and zinc smelted at Dognacska is sent to Moldova to be reduced.

The Carboniferous formation, which is here the most ancient of the sedimentary rocks, is met with chiefly in the valley of the Berzava, near Reschitza. The lower series of this formation consists of conglomerate and coarse-grained sandstone, which form the unproductive portion; while these strata, on account of the entire absence of the carboniferous limestone, are immediately overlain by the productive portion, consisting of fine-grained sandstone and argillaceous shales. While the outcrop is unworkable owing to its want of continuity, there are at Székul, near Reschitza, four workable seams, varying in thickness from four metres to half a metre, which supply the Reschitza works with a considerable portion of their fuel. There exist in the Permian group, at Reschitza and other points, concretions of brown hematite, the working of which has not proved remunerative; the fire-clay used at Reschitza and Anina is, however, obtained from this formation. Were the works dependent for their coal on the Carboniferous series alone, they would come badly off; but, as if to make up for a deficiency in these measures, the lias coal of the Jura series is present to a large extent. The most valuable deposit of this nature in the whole of Hungary is that forming an elliptical outcrop between Anina and Steierdorf, the measures having been thrown up by an eruption of the igneous rocks, and thus presenting themselves in the form of an inverted basin. The best of this coal is sold, chiefly to the Government, the inferior only being used at the Anina works. Lias coal is also present at Domán, in the neighbourhood of Reschitza, and contributes to the fuel supply of the iron and steel works.

Above the lias coal of the Jura formation occur the blackish argillaceous shales, very rich in bitumen, which yield on distillation 5 and sometimes 8 per cent. of raw mineral oil. Until recently this substance was treated at the Oravitza works for the production of petroleum and paraffin; but now raw oil can be obtained from the wells in Roumania more cheaply than by working the shales. Between the lias coal and the bituminous shale there is a stratum about 34 metres thick of "blackband" or argillaceous carbonate of iron, which contains sufficient carbon to support combustion during the process of roasting, when once the oven is fairly heated. The effect of the roasting is to raise the percentage of iron from 30 to 42 per cent. for a given weight of stone. The average composition of these blackbands, which form a notable portion of the charge in the Anina blast furnaces, is as follows:—Carbonate of iron, 76; carbonate of lime, 1; carbon and bitumen, 6·5; silicate of alumina—insoluble in acids—16·5.

The Tertiary formation yields lignite at several points, but either not in sufficient quantity, or mixed with too many impurities to warrant its being worked. In the diluvium are found nodules of magnetic iron and also of a pure and rich oligist or oolitic iron ore, the weight of which varies from a few ounces to five tons. While at Tilfa Zapulai the ore is nearly exhausted, the rich Amelia mine, which is worked open-cast, contains about 50,000 tons of valuable mineral.

Collieries.—Besides the charcoal yielded by the beech forests, the Reschitza works are, it has been seen, dependent for their fuel supply on the coal measures proper worked at Székul and the lias coal raised at Domán. Both these collieries, shown on the general plan, Fig. 1, above, and plan of the Reschitza district, Fig. 2, are near the Reschitza works, and connected with them by small-gauge lines worked by locomotives. The rich coal from the former and the poor coal from the latter are mixed in about equal portions at the screening station, and washed when the amount of impurity exceeds a certain proportion, so as to render them fit for making coke. This is effected in three rows of Belgian ovens containing twenty each. The charge is drawn, or rather pushed out, by a ram with rack worked by a combined portable and locomotive engine. The annual production

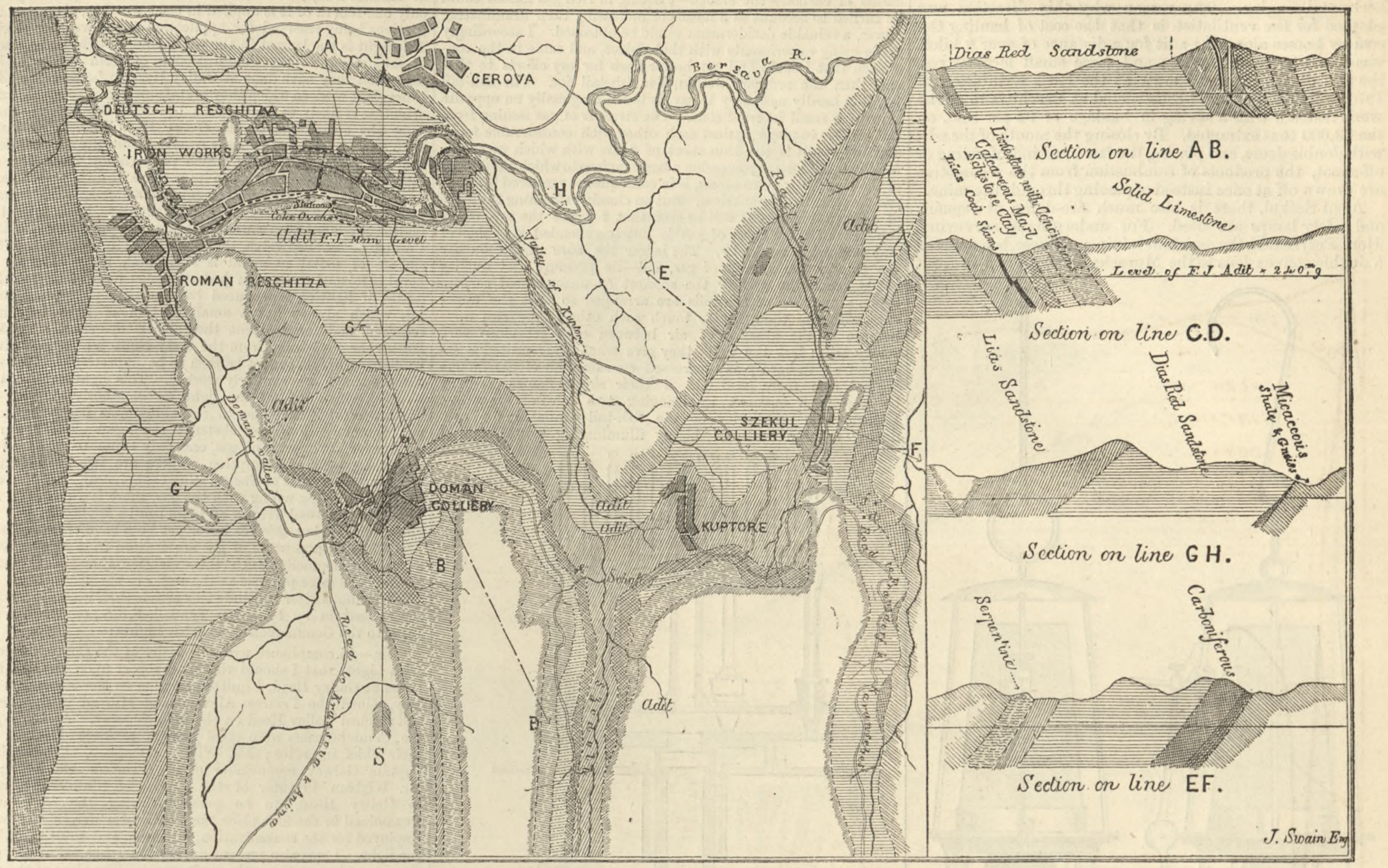


Fig. 2.—GEOLOGICAL PLAN AND SECTIONS OF RESCHITZA DISTRICT.

a	Szécsén shaft	Winding	324·9	399·5	Depth to the level of Franz Joszef adit, 147m.
b	Almásy shaft	Ventilation	109·2	366·9	Serves also to take down wood for timbering.
c	Alfred shaft	Winding	243·3	468·9	Depth to level of adit, 32m.
d	Versuch shaft	Exploration	170·4	545·5	Serves also for winding.
e	Georg shaft	Exploration	204·6	387·5	Abandoned.
f	Wetter schacht	Ventilation	27·6	512·0	Serves to extract the air from the Szekul Colliery.

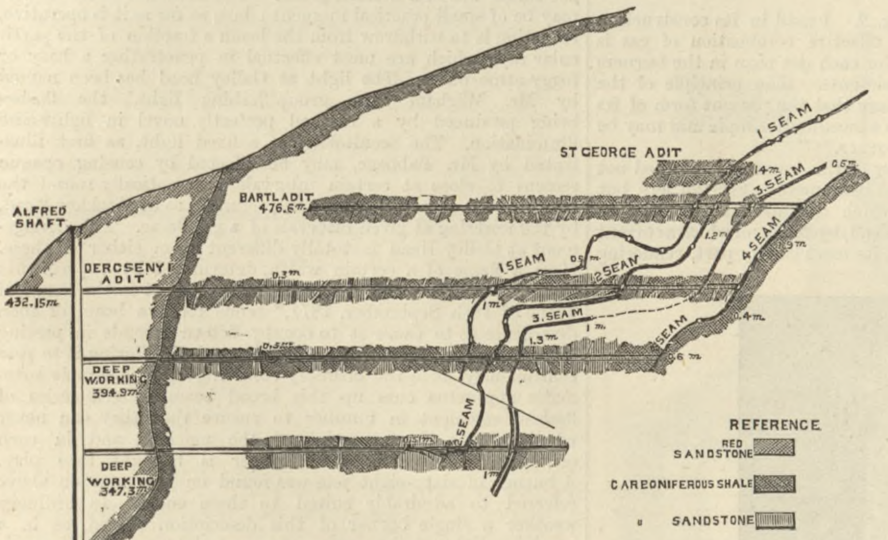


Fig. 3.—VERTICAL SECTION OF SZEKUL COLLIERY.

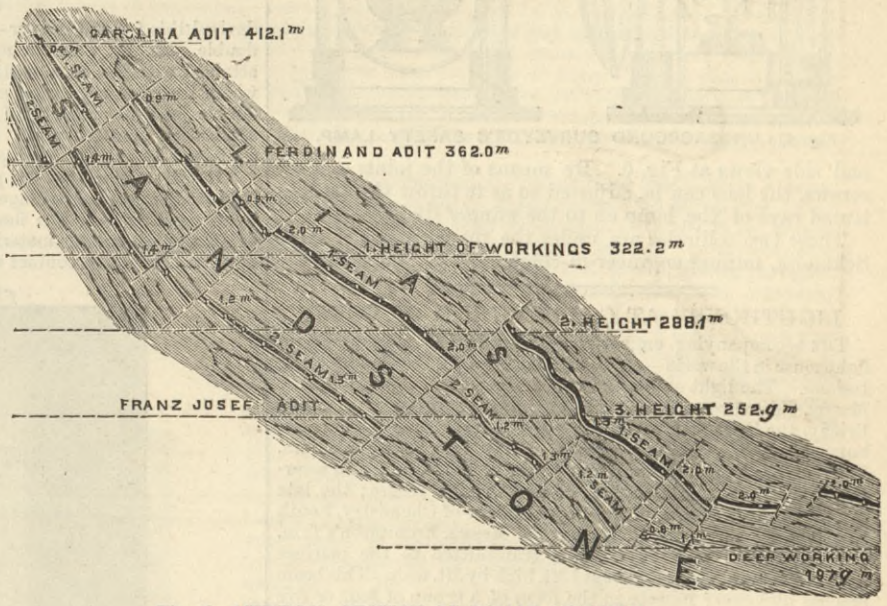


Fig. 4.—VERTICAL SECTION OF DOMAN COLLIERY.

is about 15,000 tons of coke, with an absolute heat effect of 6268 *calories* or 24,871 English heat units, and of the following average composition:—Fixed carbon, 83·85; volatile substances, 1·23; water, 0·75; ash, 14·17.

As will be seen by the geological plan—Fig. 2—of the district round Reschitza, and the section E F, the coal measures crop out to the surface at Székul, to the east of Reschitza. The four seams worked—shown by the section at Fig. 3—run north and south, and dip about 50 deg. towards the west. Their thickness is very variable, but averages respectively 0·8 m., 1·75 m., 1·4 m., and 1·6 m., beginning from the surface. The measures are tolerably regular for 500 m., but afterwards are much distorted. They are proved for a length of 1300 m. horizontally, and to a depth of 130 m. All the coal between the surface and the Dercsényi Adit, equal to a vertical height of about 152 m., or 83 fathoms, has been worked out; and in 1871 the Alfred shaft was put down to raise the deep coal to the adit, by which it is run out to the day. This shaft is now 330 m., or 180 fathoms deep; and the levels are driven regularly 40 m.—nearly 22 fathoms—apart, the fifth height being now begun. The method of working pursued is that known in German as *förstenbau*, that is to say, in reverse steps. Both the coal and the sandstone are mined by dynamite cartridges fired by electricity, great care being taken about the ventilation in the neighbourhood of a shot. There is a great deal of fire-damp, and Mueseler safety lamps, fed with mineral oil, are used. In the case of seams 2 m. thick and under, the whole thickness of coal is extracted at once, and the roof propped. The props are afterwards taken out, when the roof falls in. But with seams of over 2 m. thickness the working is effected in more than one lift, the space left by the extracted coal being afterwards gobbed with shale. The output is 60,000 tons per annum; and all the coal extracted, which is of good coking quality, is sent to the works at Reschitza, the cost of getting, raising, and transport being 60 kreutzers, or about 1s. a ton. About 700 hands

Fig. 5.—DOMAN COLLIERY.

are employed at Székul, of which 300 are Roumanians, and the rest Germans or Bohemians. The German miners retain their uniform with crossed hammers for highdays and holidays, and say "Glück auf" on passing, while children make use of the early Christians' salutation, "Gelobt sei Jesus Christus."

It will also be seen from the geological plan—Fig. 2—already referred to, that the outcroppings of the lias measures form the ridge between the Domán and Berzava valleys. They enclose two workable seams of coal, averaging 1 m. 9 and 1 m. 3 in thickness, shown at sections A B and C D, Fig. 2, and also enlarged at Figs. 4 and 5. These sections are both taken on a line running N.W. and S.E., but Fig. 4 is east, and Fig. 5 west of the shaft. The seams dip to the south, and run generally east and west, but with the eastern end inclining towards the south. They were worked by adits as early as 1819, the coal being then carted to Reschitza by a long winding road. The colliery is now worked principally by the Szécsén shaft in the centre of the deposit—shown at *a* in the plan, Fig. 2—and by the Franz Joszef adit, 2320 m. long. The coal is proved to a depth of 140 m. below the adit, and for over 1500 m. on either side of it. The levels are, as at Székul, 40 m. or 22 fathoms apart, and are driven right and left to cut the seams. When the coal is struck, a level is driven along it of sufficient sectional area to admit of the trams being drawn by horses. This is followed a few metres above by a return air-way put in connection with the upper heights of workings. The main rolley-way only is lined with masonry, the roof of the levels being generally supported by prop-wood, consisting of oak and beech, while birch and poplar serve for sprags at the working faces. In places where the thrust is considerable, iron frames, consisting of two old rails are employed for supporting the roof. Hitherto it has been possible to raise all the water encountered in water-cages during the night; but a pumping engine is now being erected. Contrary to the usual practice, the air current is drawn downwards through the Szecsén shaft, and out of the mouth of the Franz Joszef adit, by a Guibal fan, 9 m.—nearly 30ft.—in diameter, and 2 m.—6ft. 6in.—wide, driven direct by a 100-horse power horizontal engine. The reason why this direction was adopted for the ventilation is that the cost of hauling the coal by horses along the adit for a distance of over 2 kilos. was found to be too great; and some small locomotives, the first of which was shown at the Paris Exhibition of 1878, were designed and constructed at Reschitza to do the work instead, with a saving in haulage of 92 per cent. on the 53,000 tons extracted. By closing the mouth of the adit with double doors, and placing the fan in a kind of siding or off-shoot, the products of combustion from the locomotive are drawn off at once instead of passing through the mine.

As at Székul, there is also much fire-damp at Domán; and safety lamps are used. For underground surveying, Herr Przyborski, the assistant mining engineer, has adapted a double convex lens to the Mueseler lamp, shown in front

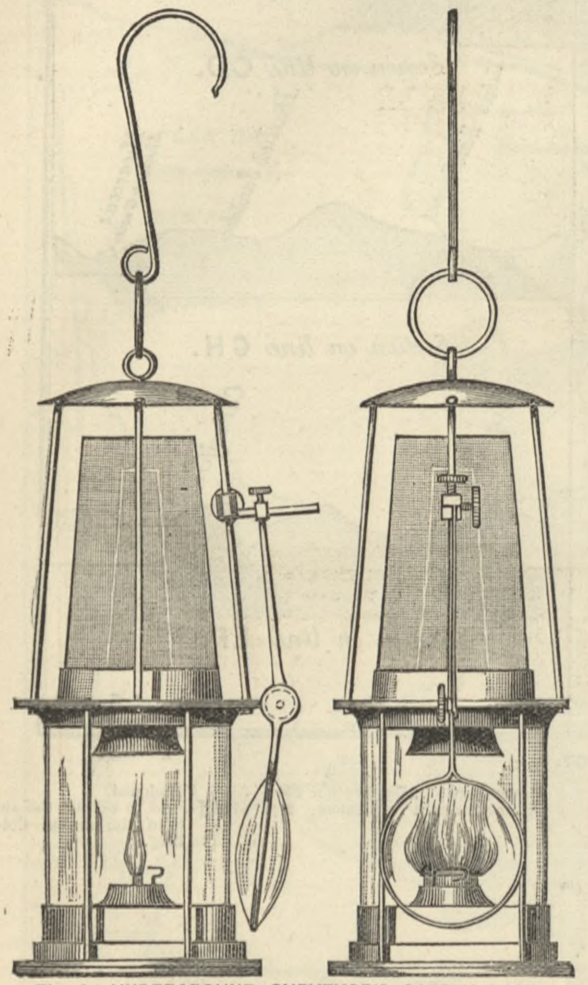


Fig. 6.—UNDERGROUND SURVEYOR'S SAFETY LAMP.

and side views at Fig. 6. By means of the joints and set screws, the lens can be adjusted so as to throw the concentrated rays of the lamp on to the miners' dial.

These two collieries are under the management of Herr Schmolik, mining engineer-in-chief.

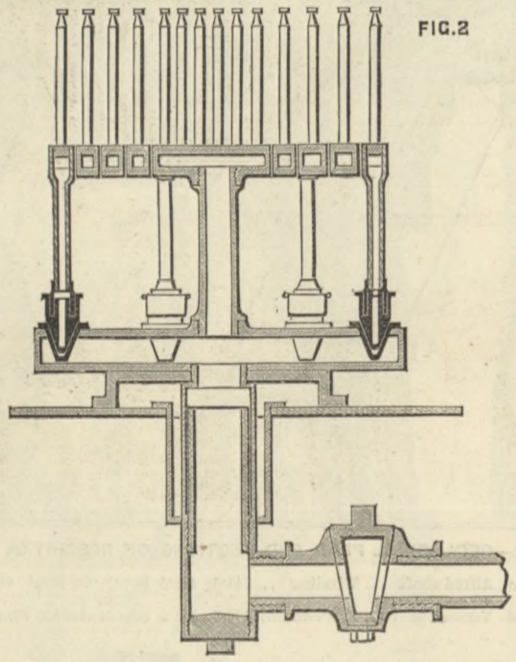
LIGHTHOUSE AT GALLEYHEAD, CO. CORK.

THE accompanying engravings illustrate the most powerful lighthouse in the world—that at Galley Head, in the County Cork, Ireland. The light apparatus was designed and constructed by Messrs. Edmunson and Co., gas engineers, Capel-street, Dublin. Briefly, the light may be said to proceed from four gas-burners, burned without chimney glasses or any interposing medium. Each burner has an illuminating power of 1253 candles, as ascertained by Sir James Douglass, of the Trinity House; the late Mr. William Valentine, of the Royal College of Chemistry, South Kensington; and Mr. J. R. Wigham, of Messrs. Edmunson's firm. The great beam of light which is transmitted to the mariner from these four burners is about 13ft. high by 3ft. wide. This beam reaches him every minute in the form of a group of four or five flashes. This is caused by the continual extinction and re-ignition of the gas by clockwork machinery, so that about one-half the consumption of gas is saved, while the effect to the mariner is exceedingly distinctive.

With respect to the novelty of this mode of lighting, it consists in the superposing of the lights and lenses. Until Mr. Wigham devised this plan, only one central illuminant was used in first-order lighthouses, the dioptric apparatus for which consisted of three parts, viz., the great central annular lens, the top prisms, and the bottom prisms. The light from these top and bottom prisms being but feeble,—practically about 20 per cent. of the whole—it occurred to Mr. Wigham that it would be better to use three of these central lenses superposed, with a light in the focus of each, thus securing an addition of light in the ratio of 240 to 100. The three superposed lenses do not take up more space than the original dioptric apparatus, consequently the same lantern will contain them; and as to the cost of consumption it is very trifling, for only one out of the three burners is used in clear weather, the other two being added when the weather becomes foggy. As there are only about sixty foggy nights in the year, this extra consumption contributes but to a small extent to the annual cost, while during these sixty nights, the benefits of having these three lights instead of one is incalculable. We have spoken of three lights in place of one, but it will be remembered that there are four lights at Galley Head, so that the effect is still greater. The lantern at Galley Head was made specially for this quadriform light, but, as we said above, any first-order light in the kingdom may be altered to triform without the necessity of altering the lantern. Why the lighthouse authorities should not at once alter all their great sea lights to triform is astonishing, more especially when Mr. Wigham's patent covers the use of oil, as well as gas, in this superposed arrangement.

We may now proceed to describe more in detail the installation at Galley Head. Galley Head is a precipitous cliff, near Cape Clear, County Cork, and the lighthouse was constructed from the designs of Mr. John S. Sloane, C.E., Engineer to the Commissioners of Irish Lights. Mr. Wigam readh a paper before the British Association in Dublin in 1878, in which he described his system of burning gas. "It occurred to me," says Mr. Wigham, "that if any plan could be devised by which the excess of carbon—the smoke—existing in rich gas flames could be turned to account as a means of increasing their illuminating power, a valuable desideratum would be obtained. I accordingly made many experiments with that object, and came to the conclusion that I could find no better basis for my efforts to that end than the ordinary well-known fish-tail jet. The fish-tail jet, it is hardly necessary to say, is bored diagonally on opposite sides of a small internal cone. The streams of gas issuing from the orifices impinge against each other with considerable force, and the result is the thin sheet of flame with which we are so familiar. This flame possessing a large surface to which the oxygen of the air readily gains access, is in consequence rendered brilliant and comparatively smokeless. But on closely examining the flame of a fish-tail burner it will be seen that towards the top, where the force of the stream of gas is nearly expended, it is thicker and inclined to be smoky. The larger the bore of the burner the thicker the stream of gas, and—its pressure and quality being good—the greater the amount of unconsumed carbon. When a number of fish-tails are arranged so that the upper extremities of their flames touch each other, they run up—because of the absence of air between each jet—into very smoky tails; but the light they give when thus united is increased—with hardly any increased consumption of gas—much beyond the mere multiple of their single flames, as may be seen in a moment by bringing two fish-tails together. I made this peculiarity of the fish-tail available for producing a large flame of highly illuminating power, and I

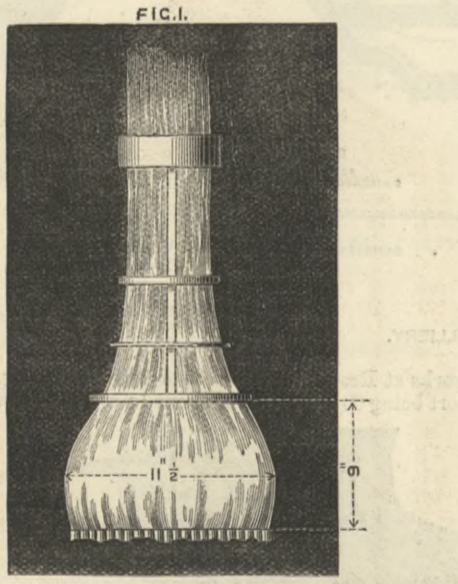
FIG.2



devised this form of burner—Fig. 2. I used in its construction double jets, by which a more effective combustion of gas is attained with less consumption for each jet than in the burners which I used in my earlier experiments. The principle of the double jet is not new, but I believe that the present form of its application is entirely so. It is exceedingly simple and may be explained by this ordinary gas-burner.

"It will be seen that the power of this burner is obtained not only by the peculiar arrangement of numerous fish-tail jets, but by suspending over the flame which they unitedly produce an oxidiser of talc or other material, Fig. 1, by means of which a current of air is brought in contact with its most smoky part, rendering

FIG.I.



it not only smokeless, but exceedingly white. The combustion is also assisted by a bottom cone for equalising the current of air to the flame. The oxygen of the air is thus twice availed of, first, at the bottom of the flame, through the medium of the several fish-tail burners; and, secondly, at the top of it, where its action raises to a white heat the large quantity of solid carbon found there. I may say, in passing, that burners like this are superior to any form of argand burner in this important particular, that they require no chimney glasses, the breaking and cleansing of which often cause much inconvenience in lighthouse maintenance, to say nothing of their presenting an obstruction to the passage of the light of the flame to the dioptic apparatus. The Irish lighthouse burner is so constructed that a light-keeper can increase the power of the light by five steps, according as the state of the weather may seem to require it, from the burner used in clear weather, consisting of 28 jets to the second, third, fourth, and fifth fog powers, consisting of 48, 68, 88, and 108 jets respectively. The changes from one power to another can be made very quickly by the use of mercurial joints.

"In the quadriform apparatus at Galley Head there are thirty-two lenses arranged in four tiers, eight in each tier. Each lens is of the size of the first-order lens, and one of these powerful gas lights is placed in the focus of each tier; thus there are four burners placed over each other. As the lenses touch each other the lights blend at the distance of a few yards and form a great pillar of light about 13ft. high by 3ft. wide, the illuminating power of which is calculated to be equal to nearly one million sperm candles. This great illuminating power, it is to be remembered, is so under the control of the light-keeper that only one-fourth of it is applied in clear weather, the other three portions being reserved for application as the weather thickens. This light is the largest in the world, and it ought to be a source of satisfaction to the Commissioners of Irish Lights to know that what they have done at Galley Head in furtherance of the benevolent work to which they gratuitously give so much anxious attention is likely to be of much benefit to the sailor. Indeed, since the completion of the Galley Head Lighthouse early in 1878 the Commissioners have received from the commanders of the great ocean steamers which pass Galley Head the most satisfactory testimonials as to its power and distinctiveness."

The method adopted for extinguishing and re-igniting the gas for producing the flashes is exceedingly ingenious, being caused by a motion produced from the clockwork on the valves, similar to the Cornish or bevelled valve, the bevel being underneath, but the surface of metal to metal is horizontal, truly turned. This bevel is formed to stop an instantaneous rush of gas; and the means of lighting is produced by a small pipe leading to one jet, which always has a small portion of light burning as required, and the moment the valve is opened, the small jet ignites the gas issuing from the sixty-eight jets, which gives a brilliant light, that must be seen to be appreciated. The other three burners are similarly worked. This lighthouse has two screens, which cut off the light east-northerly, and west by north-westerly. The flue to the chimney is inside the sector, and therefore does not obstruct the light. There are five retorts for production of gas, one only being required to produce the gas for consumption. There are two gas-holders for storage. The gas is extracted from cannel coal. In the event of anything going wrong with the gas, there is a provision made by which the usual Trinity oil lamp can be applied in less than half-a-minute, but this has never yet been required in practice. The joints to stop waste of gas are treated in a similar way to a common chandelier, with this exception, that ½in. of mercury answers the same purpose as the water in the chandelier.

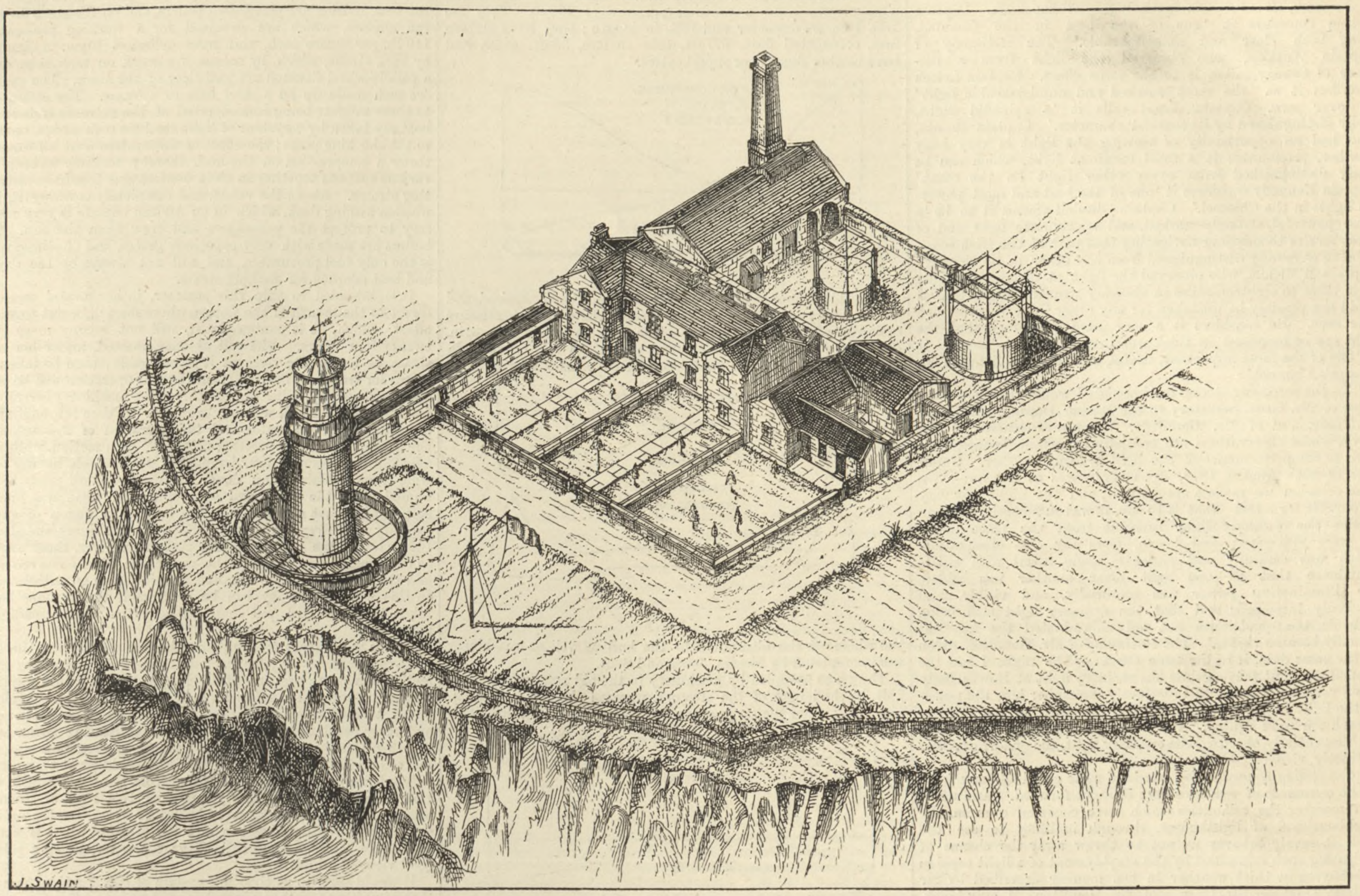
We cannot better conclude this article than with the following report sent in by Professor Tyndall, F.R.S., on the 9th May, 1879, to the Commissioners of Irish Lights:—

"Sir,—In compliance with the desire of the Commissioners of Irish Lights that I should visit and report upon the new lighthouse at Galley Head, I quitted London on the morning of 8th May, joined the Princess Alexandra at Milford in the evening, and reached Galley Head on the following day. At my request, the Commissioners were good enough to invite Captain Cole, their chief inspector; Mr. William Douglass, their engineer; Captain Galwey, commander of the Princess Alexandra; and Mr. Wigham, inventor of the system of illumination special to Galley Head, to be present during the observations. I examined in the first place the quadriform dioptric apparatus employed for the concentration, direction, and multiplication of the light. I was also present during the rehearsal of the experiments to be subsequently made afloat. The glass of the apparatus seemed singularly free from striæ and other mechanical defects. Looked at normally, moreover, it appeared very transparent; but on looking at it obliquely, so as to cause the light reaching the eye to traverse considerable thicknesses of the glass, the colour was of a decided green. The influence of this colour may be of small practical moment; but, so far as it is operative, its action is to withdraw from the beam a fraction of the particular rays which are most effectual in penetrating a hazy or foggy atmosphere. The light at Galley head has been named by Mr. Wigham 'the group-flashing light,' the flashes being produced by a method perfectly novel in lighthouse illumination. The occultation of a fixed light, as first illustrated by Mr. Babbage, may be effected by causing opaque screens to close at certain intervals automatically round the light; or the occultation may be produced, as at Wicklow Head, by the lowering at given intervals of a gas flame. The arrangement at Galley Head is totally different from either of these. Here a flame of a certain width, determined by experiments made at Rockabill, and described in my report to the Board of Trade of 18th September, 1871,* sends forth a beam of such divergence as to cause it to occupy fifteen seconds in passing over the eye of the mariner. But instead of allowing it to pass continuously, as in the ordinary revolving light, a simple automatic apparatus cuts up this broad beam into a series of flashes, sufficient in number to ensure that they can never wholly escape the attention of the mariner, and in each of which a flame of great power is brought into play. A burner of sixty-eight jets was found on the occasion above referred to admirably suited to these ends. In ordinary weather a single burner of this description placed, as in a revolving light, at the common focus of eight annular lenses, is employed at Galley Head. Four tiers of such lenses are erected, one above the other, each tier possessing its own burner. Hence the name of the apparatus. As the weather thickens, these burners are ignited in succession, the power of the light, if the adjustments be correct, being sensibly doubled, trebled, and quadrupled, when the biform, triform, and quadriform arrangements are respectively brought into play. At the usual sunset hour the single 68-jet burner was ignited, and it continued burning up to 8.50 p.m., when the experiments began. We were then equidistant from Galley Head and the Old Head of Kinsale, being 12½ miles from both. The night was a dark one, neither moon nor stars being visible; but though the upper atmosphere was filled with heavy clouds, the lower air was clear. Commencing with a power of twelve burners, we ascended through successive stages to a power of 108 burners, then fell to a power of twenty-eight burners—the automatic flashing of the light being continued throughout this entire series of experiments. The 12-jet burner yielded two bright flashes, the 28-jet burner three brilliant flashes, the 48-jet burner four strong flashes, the 68-jet burner five powerful flashes, while the 108-jet burner produced seven flashes of still greater intensity. The flashes here enumerated were, in each particular case, of sensibly the same strength; but besides these gushes of full power, each series was heralded and ended by a flash of minor intensity. With the larger burners, moreover, when the observer was placed in the angular space between two successive beams, a residual speck of light was observed winking in synchronism with the rise and fall of the flame within the apparatus. No mariner could, in my opinion, be in the least degree embarrassed by the effect here described. Indeed, this intermittent speck enabled us clearly to realise one of the principal advantages of the Galley Head Light. The speck accurately represented the aspect of a fixed light when enfeebled by distance or thickish weather. A great number of fishing boats were afloat on the night of the 9th, and had the speck been fixed, it could not have been distinguished from the lights of the boats. It would have formed one of a multitude of luminous points of approxi-

* See papers presented to Parliament by command in 1875. (C. 1151.)

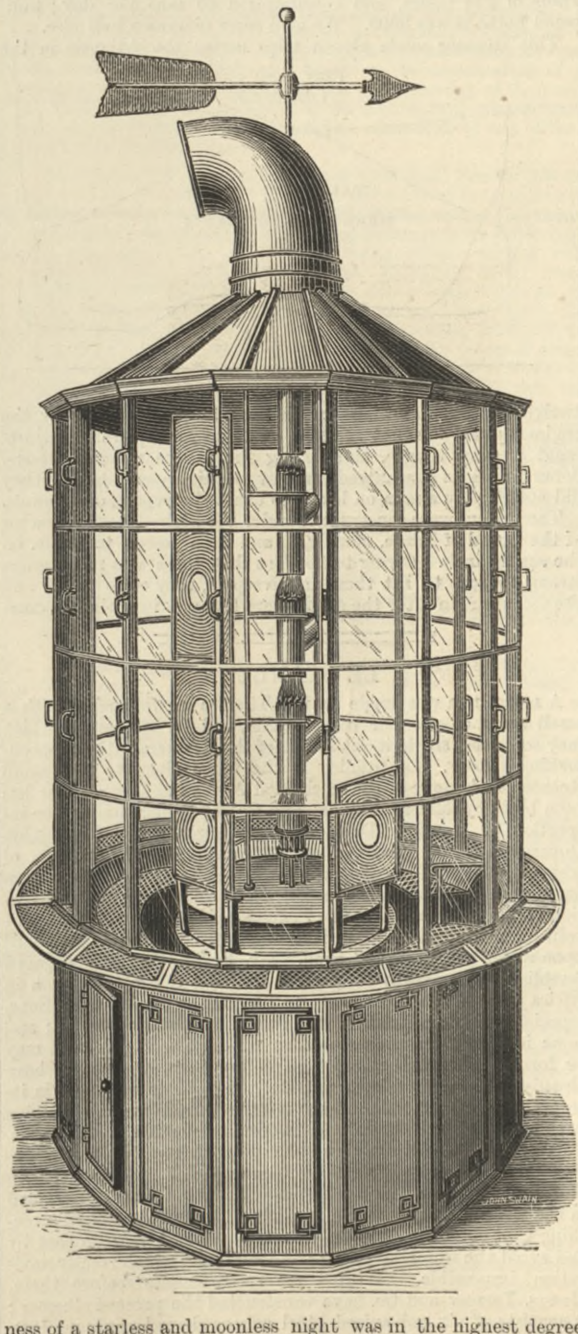
GALLEY HEAD LIGHTHOUSE AND KEEPERS' DWELLINGS.

MR. JOHN S. SLOANE, M. INST. C.E., ENGINEER



mately equal intensity. But, winking as it did, it immediately differentiated itself from its fellows, a confounding of the shore light with the ship's lights being thereby rendered impossible.

"In the next series of experiments—time 9.25—the apparatus was employed as an ordinary revolving light, the flashing being suspended; and instead of the beam from a single burner, the quadriform light was exhibited. The beam from the four 28-jet burners, which was strong, brilliant, and altogether satisfactory, required six seconds to pass over the observer's eye. The beam from the four 68-jet burners, which yielded a light much superior in intensity to that of the 28-jet burners, had, as before stated, a duratiou of fifteen seconds. It is this widening of the beam outside of the apparatus as the diameter of the burner inside is increased, that enables the 68-jet beam to be cut up into the five powerful flashes and the two minor flashes already alluded to. The augmented intensity of the beam from the larger burner is to be ascribed to the increased number of luminous layers from which the radiation comes. Supposing the radiation of any lens to emanate from a line of burners one deep, and parallel to the lens, the effect of augmenting the length of this line would simply be to increase the width of the beam outside the apparatus. There would be no increase of intensity. But if contemporaneously with the lengthening of the row of flames other rows were placed before and behind it, it is obvious that not the width of the beam only, but its intensity also, would be increased. This is what virtually occurs when the larger burners are brought into action at Galley Head. Wishing to test still further the increase of intensity as the number of jets were augmented, arrangements had been made for stopping the apparatus, and sending the beam for a time in a fixed direction. During this interval it was proposed to run through the series of powers, from the 28 to the 108-jet burner. The tide, however, had so far drifted us from axis of the beam, that before we recovered it the two first experiments were practically defeated. The opportunity of comparing the largest and smallest burners, which was my principal object in making the arrangement, did not therefore present itself. Evidence as to the augmentation of intensity with the augmenting magnitude of the burner was, however, furnished by the preceding experiments. On this point there was no difference of opinion. Mr. William Douglass, who stood at my side, pronounced the increase of light in passing from the 28 to the 68-jet burner to be considerable. My notes describe the fixed beam of the 68-jet burner as an extremely fine and steady light; while, in relation to the distance, the beam from the 108-jet burner is described as exceedingly powerful. Recurring to the group-flashing—time, 9.55—and beginning with the single burner of 68 jets, we passed to the biform, triform, and quadriform in succession. The beams, as might be expected, augmented in intensity as the number of burners increased, the flash from the quadriform being very powerful. Rendering the beam again fixed, we steamed across it with the view of observing any variations in intensity which might exist at different parts of its transverse section. The observation, which was inferior in delicacy to that of the flashes, corroborated the conclusion drawn from the latter, that the body of the beam is of nearly the same intensity throughout, the fall to obscurity at its edges being rapid. Returning to the single 68-jet flashing light, we steamed out until it dipped beneath the horizon. In the cloudy air above the lighthouse every pulse of the flame was distinctly visible, after the direct beam had disappeared. I cannot but think that these atmospheric thrills will prove of great importance to the mariner, even in atmospheres thick enough to render the light itself invisible. At fifteen minutes past midnight, the 68-jet quadriform was again brought into action, we then being twenty-one miles from Galley Head. On the bridge of the steamer the atmospheric pulses only were visible; but ascending to the top of the deck-house, the light itself came into view, its white blaze striking the eye as if the lighthouse were close at hand. On ascending from the bridge the sudden emergence of these powerful flashes out of the darkness of a starless and moonless night was in the highest degree impressive. My impression at the time was that, on the whole, I had never seen a finer light. Wishing, however, to check my own judgment by that of an independent and experienced observer, at the conclusion of the experiments I asked Mr. Douglass whether he knew of any light which, in point of power and distinctiveness combined, came up to that of Galley Head. His reply was that he knew of none. The programme of the night's experiments was carried out with accuracy and promptitude by Mr. Young, with the assistance of the light-keepers. I append the programme which summarises the night's observations:—



"*Testimonies regarding the Galley Head light.*—From a report presented to the Board of Trade on the 18th September, 1871,* I quote the following brief paragraph:—'Should it be thought desirable to give a revolving light so distinctive a character as to render it perfectly unmistakable, the "group-flashing gas light," as its inventor, Mr. Wigham, calls it, secures this end. I have not been called upon to offer any recommendation as to its adoption, and I would, therefoıe, merely refer to it as a light of unrivalled individuality, of great power, and, in Ireland at least, of moderate cost.' Appended to this paragraph is the following foot-note:—'It might be tried in the next new lighthouse, and thus tested without any disturbance of existing lights.' The light at Galley Head, which was started at the beginning of last year is the outcome of this suggestion; and I have now to adduce additional evidence in justification of my recommendation to the Board of Trade, that the group-flashing light should have a full and fair trial upon the coast of Ireland. During my experiments at Rockabill, in September, 1871, I was honoured by the company of Sir Leopold M'Clintock, who, in a letter addressed to Mr. Wigham, on the 18th September, 1871, thus expresses himself:—'No better means could be devised for distinguishing a light from other lights than this plan of a group of flashes. The half-minute interval between the groups is quite sufficient, and yet not greater than can easily be estimated by the observer, without having recourse to a watch to measure the time; and the periods recurring within 45 seconds, that short time is sufficient to determine which light it is; and both these are great practical advantages. I consider that the superior brilliancy of gas to oil, and its applicability both to revolving and fixed lights, is most satisfactorily established; and as I regard the proposed change solely from the seaman's point of view, I look exclusively to the relative efficiency, without any regard whatever to their comparative cost.' In September, 1874, the preliminary experimental arrangements, devised at Howth Baily to illustrate the construction and the power of the triform light, was inspected by Sir William Thomson. From a letter addressed to Mr. Wigham on the 12th October, 1874, I make the following extract:—'I have much pleasure in reporting upon the experiments on the Howth Baily Lighthouse arrangements, which I witnessed from Salthill on the evening of the 21st September, and from my yacht on the evening of the 22nd September. First: The great fog-power of 108-jet burners showed an immense superiority of light over the ordinary light of the lighthouse. The quick transition from the ordinary light to the high power was very remarkable, and seemed most satisfactory. Next day I was very much pleased to see, at the lighthouse itself, the simple and thoroughly trustworthy apparatus by which this transition was made. Second: The triform light exhibited from the lower position in the neighbourhood of the chief tower was strikingly superior even to the great fog-power of 108 burners exhibited on the chief tower; so much so that a heavy thunderstorm, which happily chanced to pass during our experiments between the Salthill Hotel and the lighthouse, completely eclipsed the light of the chief tower; while the triform still shone conspicuously through it.' The two weighty authorities here cited based their conclusions upon

*See papers presented to Parliament by command in 1875. (C1151) experiments made with apparatus temporarily erected at Howth Baily and Rockabill. I have now to refer to the testimony of seamen with regard to the merits of the light permanently established at Galley Head. Before me are various testimonials from commanders on the Inman, White Star, and Cunard lines of steamers, all of which speak highly of the light. Captain Fulton considers it 'one of the best in the Channel, being both clear and unmistakeable.' The testimony of Captain Watkins, who observed the light from a distance of twenty miles, is to the same effect. Captain Leitch describes it as 'the most marked and unmistakeable light' he ever saw. Captain Laud calls it 'a splendid light, easily distinguished by its marked character.' Captain Brooks, who had an opportunity of viewing the light in very hazy weather, pronounces it 'a most excellent light, which can be easily distinguished from every other light on the coast.' Captain Kennedy considers it 'one of the best and most powerful lights in the Channel.' Captain Gleadell affirms it to be 'a most powerful, strongly-marked, and appropriate light, and of great service to shipping navigating that part of the Irish coast, it being so readily distinguished from any other in its vicinity.' Captain M'Mickan, who observed the light at distances varying from three to eighteen miles in showery weather, states that it could not possibly be mistaken for any other light which he had ever seen. He considers it a very great advantage that the light can be increased in thick weather, and finally describes it as 'one of the most important, useful, and brilliant lights in St. George's Channel.'

"To the foregoing strong testimonials I would venture to add those of Mr. Gray, Secretary to the Marine Department, Board of Trade, and of Mr. Hamilton, Accountant-General of the Navy, whose observations are specially important, because they refer to the performance of the light in foggy weather. Under date of 30th August, 1878, Mr. Gray writes as follows:—'On that occasion we made a special visit, and the night was very favourable for a test—that is to say, it was sufficiently thick to render the ordinary light invisible from the place where we were stationed; and I can, from my own observation, which was carefully and patiently made, assert with entire confidence that as one light after another was added, the illuminating power was materially, and visibly, and markedly increased; and that the ordinary light still being invisible, the quadriform not only illuminated the fog, but actually became visible.' The testimony of Mr. Hamilton, given on the same date, is to the same effect:—'The night I saw the quadriform light tried against the ordinary light at Howth Baily was a very foggy one, and I distinctly remember how the power of the light to penetrate the fog was increased as the burners in each tier were lighted. I remember, also, that while the fog at times entirely obscured the ordinary light, the quadriform was distinctly visible.'

"*Concluding remarks.*—No words of mine could add any force to the consensus of evidence here brought forward. And when we remember the calamities which have occurred even in the neighbourhood of lighthouses, through inability to see the light, it surely behoves us not to throw away the chance of mitigating such calamities by the employment of a light capable of behaving in thick weather in the manner described by Sir William Thomson, Mr. Gray, and Mr. Hamilton. I only know, indeed, of one circumstance which could legitimately interfere with the extension to other important points on the Irish coast of the system of gas illumination, and that is inordinate cost of production. Regarding this point ample data must be in existence, and the Board of Trade, which has hitherto shown a marked liberality towards Mr. Wigham, has here, I think, a right to demand the fullest and most distinct information. The necessary and unavoidable accompaniments of the use of gas ought obviously, when the expense of this illuminant is in question, to be carefully kept apart from unnecessary ones. And here I am tempted to offer a remark which may be considered to lie beyond the strict limits of the present report. The cost of the lighthouse at Galley Head and of its adjuncts must have been very considerable. The quantity of land inclosed is large, a corresponding length of wall being needed to enclose it. The buildings are erected in the most substantial fashion, a finish being given to the doors, windows, and copings which must have entailed considerable expense. I will not say that in the long run it may not prove a wise economy to have incurred this outlay. But, with the exception of the gas-house and its appurtenances, it is not an outlay necessarily connected with the mode of illumination at Galley Head. Were oil instead of gas the illuminant employed, the expense of the buildings might have been substantially the same. In conclusion, I would observe that gas lends itself with admirable freedom to any change in its mode of application which it may be thought desirable to make. The suppression, for example, of the flashing apparatus at Galley Head would convert that light into an ordinary revolving light, surpassing any other in the world. Indeed, were the power of the burner reduced to forty-eight jets instead of sixty-eight, the light, with its full strength invoked, would still transcend all other revolving lights. Even the 28-jet burner would furnish a beautiful light. But the advantage of the present mode of illumination consists partly in the intensity and partly in the duration of the 68-jet beam, whereby the flashes are rendered so numerous and so powerful as to confer upon the light the individuality universally ascribed to it. I need not dwell upon the obvious fact that, broken into flashes, the 68-jet beam involves the expenditure of little more than half the amount of gas which would be required to feed it if used as a continuous light. It may be added that the 48-jet burner, with its four flashes, or the 28-jet burner, with its three flashes, would constitute a highly distinctive light; but I should deprecate the economy which would reduce either in number or power the flashes now sent forth from Galley Head.

"I have, &c.

"William Lees, Esq., (Signed) JOHN TYNDALL.

"Secretary Commissioners of Irish Lights."

THE ABYSSINIA.

LAST week we illustrated on page 10 the new steel boilers made and fitted on board the screw steamer Abyssinia by Messrs. John Jones and Sons in 1881, and the following additional particulars are of interest. The Abyssinia was built and engined by Messrs. J. and G. Thomson in 1870 for the Cunard Company, and was for many years employed by them in the regular mail service between Liverpool and New York. Her dimensions are—Length, 363ft.; beam, 42ft.; depth, 34ft. Her machinery at that time was a pair of inverted direct-acting surface-condensing engines, diameter of cylinders 72in., stroke 48in. Steam was supplied by four rectangular boilers, having twenty-four fires, 432ft. grate-bar, with 9698ft. tube surface, working at 30 lb. pressure; each boiler was 21ft. wide, 11ft. long, and 15ft. high; there was one cylindrical superheater fixed on the top of the four boilers 13ft. in diameter and 6ft. in length, fitted with tubes about 12in. diameter.

These engines required 80 tons of coal per day, and the indicated horse-power was 2070 horses. In the year 1881 the steamer was bought by Messrs. Guion and Co. for their Atlantic trade, and Mr. John G. Hughes, their superintendent engineer, designed the new boilers and general arrangement. The new boilers, which at that time were much larger than any in use, were arranged for a working pressure of 110 lb. They are 16ft. 10in. in diameter and 16ft. in length; they have sixteen fires, corrugated flues, 6774ft. tube surface, 336ft. grate, and have neither domes nor superheaters.

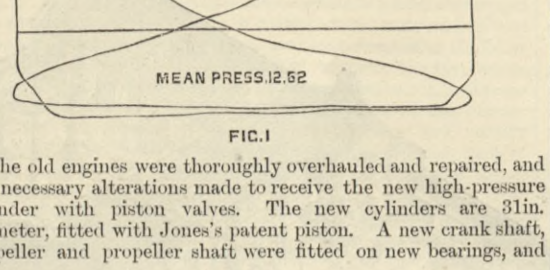


FIG. 1

The old engines were thoroughly overhauled and repaired, and the necessary alterations made to receive the new high-pressure cylinder with piston valves. The new cylinders are 31in. diameter, fitted with Jones's patent piston. A new crank shaft, propeller and propeller shaft were fitted on new bearings, and

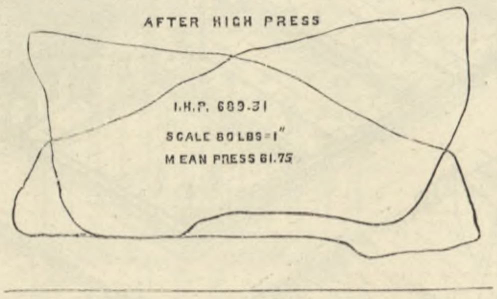


FIG. 2

the whole of the alterations to the hull as well as machinery were completed by Messrs. Jones and Sons.

The space occupied by machinery in the old arrangement was 78ft. in the length of the steamer, whereas the new only occupies 58ft.; thus the cargo space was increased by the alteration

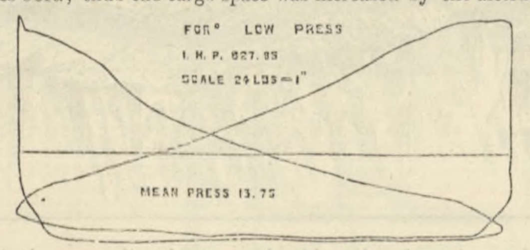


FIG 3

634 tons measurement. The effect of the change in speed and consumption is as follows:—Greatest day's run eastward 322 knots in 23¾ hours, and consumption 60 tons per day; indicated horse-power 3000. We give some diagrams half size.

This steamer made eleven trips across the Atlantic in the

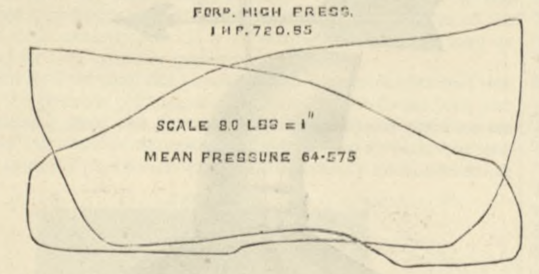


FIG 4

twelve months following her delivery to the company by the engineers, and was not stopped an hour for repairs or adjustment on any voyage, and during the twelve months Messrs. Jones and Sons guaranteed her new machinery and boilers they did not employ a man on board to effect any repairs or renewals.

The boilers were constructed under the highest possible factor of the Board of Trade, namely, 5, and were tested to 220 lb. on the square inch. Owing to the fact that there was not a crane strong enough to lift them in Liverpool, they were tubed and the stays put in after the shells were lowered into the steamer.

LE STANLEY.

A RIVER run was made in the Thames on Saturday, with a small vessel of peculiar construction, and for a purpose which may some day single it out as one of the steamers with an epoch-making history. Le Stanley is the name given to this small steamer, in honour of the celebrated African explorer. She has been built by Messrs. Yarrow and Co., of Poplar, under the inspection of Monsieur Delcourt, chief engineer of the Belgian Government, for l'Association Internationale of Brussels, of which the King of the Belgians is the head. It is an association having for its object the opening up to commerce and civilisation of the unknown regions of Africa, said to be wholly without political aim, and what it is doing must therefore be looked upon as for the universal good. Mr. Stanley, who is engaged establishing numerous stations, is the head of the expedition in Africa; the little steamer is to assist him in his operations, especially in the district of the Congo and its tributaries; and some idea of the magnitude of an expedition of this kind may be formed when it is stated that no less than 500 natives have already been engaged to accompany the steamer and assist in its transport overland. About the middle of last year the Belgian authorities placed themselves in communication with Messrs. Yarrow and Co., with a view to build a thoroughly serviceable steamer of exceptionally shallow draught and able to steam in places where there is not water sufficient for vessels constructed in the usual way. The main point however, was to design something that could be easily transported overland, so as to pass by and avoid the numerous rapids and cataracts which render navigation impossible. With these requirements before them, Messrs. Yarrow and Co. have constructed the present steamer; it consists of six galvanised steel square-shaped pontoons 18ft. long by 8½ft. wide by 4ft. deep; these sections, each of which is watertight and therefore floatable, are placed side by side, to these are added a bow piece and a stern piece, making together a hull 70ft. long by 18ft. beam. By means which we shall describe at more length at another time these sections can be readily united and disunited, and this can be done afloat. On the bow division are placed two boilers, and on the stern division the engines, which are designed for a working pressure of 140 lb. per square inch, and have cylinders 10½in. in diameter by 2½ft. stroke, which, by means of a crank on each side, drive a paddle-wheel situated aft well clear of the stern. The engines are each made up on a steel tube as a frame. The strain due to these weights being concentrated at the extreme ends of the boat are taken by a system of light steel tie rods above, secured to tubular king posts; the effect of this system is at all times to throw a compression on the hull, thereby tending to keep the various sections together in close contact and free from alternating strains. Above the vessel, and completely covering it, is a wooden awning deck, which in an African climate is very necessary to protect the passengers and crew from the sun. The boilers are made with very capacious grates, and of course wood is the only fuel procurable, and will not always be the dryest and best adapted for making steam.

It is intended to ship this steamer, in her several sections, direct to the mouth of the Congo, where she will be put together afloat, which, it is contemplated, will not occupy more than twenty-four hours. She will at once proceed, under her own steam, as far up the river as it is navigable; then be taken to pieces for transport overland; and in this operation will be seen one great novelty in her design. After the machinery is removed from the deck the hull will only draw 6in.; it then is brought into exceedingly shallow water and the operation of disconnecting the various sections proceeded with. To each section, while still afloat, will be secured four large light steel wheels having very wide tires. This being done, the divisions are ready to be hauled out of the water and over land, and what was once a section of a boat now becomes the body of a wagon of ample capacity to convey the lighter portions of machinery and stores. On arrival at the next navigable part of the river, these wagons so constructed are run into the water, the wheels are removed and the various divisions reunited, forming again an entire vessel. In this way the journey can be continued, the steamer being taken to pieces and put together as often as circumstances require.

At the preliminary trial on Saturday the vessel went through numerous manœuvres; the mean draft was 14in. in working trim, and with a steam pressure of 100 lb. per square inch a speed of nine and a-half to ten miles an hour was obtained—an excellent result, taking into consideration the proportion of length to beam and other peculiarities of the craft. Great steering power is of course necessary, and the most striking performance was the marvellous facility with which the boat could pivot on a centre only a little within a point a few feet from the stern, which was very remarkable, and clearly rendered this type of steamer admirably suited for tortuous and winding rivers. On the deck is a small well-ventilated saloon, and the steering wheel is placed high up on a bridge some 12ft. above the water, giving a pilot a good view all round.

It would seem to us that this system of construction, namely, that of uniting together a number of floating sections, so as to form a vessel of moderate and useful dimensions, and of good carrying capacity, opens up a new field, as the difficulty hitherto experienced in the development of trade with Africa has been due in a great measure to practical difficulties in placing vessels of light draft on the rivers.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

IN funds, membership, and general prosperity, the Royal Agricultural Society is gradually assuming the position which it occupied before the disastrous International Exhibition held in London under its auspices in 1879, when £13,000 were hopelessly sunk in the never-to-be-forgotten Kilburn mud, in which was also wrecked the finest collection of agricultural implements ever assembled. According to the half-yearly report of the Council lately presented to the members, after allowing for all the changes by death, withdrawal, or from other causes, there has been an increase during the past year of 394 members, bringing the total up to the respectable figure of 8352. Of these, seventy-four are life governors, a title conferred on those who, on election, subscribe the sum of £50; seventy-four are annual governors who pay £5 each year; 3115 are life members, *i.e.*, those who have compounded for all future payments by giving £10 to the funds of the Society; 5068 are annual subscribers of £1 each; and the remaining twenty-one are honorary members. Thanks, in great measure, to the economy exercised in connection with the York meeting last July, and in other directions, the funded capital of the Society has been increased by the investment of £6000, and now stands at £25,880 4s. 1d. new Three per Cents. In addition, a sum of nearly £3000 remains in the hands of the bankers. Reverting to the York meeting, the Council pronounce the opinion that it was "one of the most successful" which the Society has held for several years, whether judged by the number and quality of exhibits or the attendance of the members and the public—an opinion which, perhaps, it would not be easy to controvert, especially when it is backed up by the definite statement that the exhibition resulted in an addition of more than £4500 to the Society's funds. "The exhibition of implements," say the noblemen and gentlemen who constitute the governing body, "was remarkable for the number of new inventions which the judges considered worthy of an award, no less than nine silver medals out of the ten at their disposal having been allotted with the sanction of the stewards. The working dairy was also more completely organised than on some recent occasions, and attracted a large share of attention." Later on in the report it is intimated that a similarly constructed dairy is to form one of the chief features of this year's show at Shrewsbury, the implement department of which, it may here be mentioned, will be open to the public on Saturday, July 12th, the live stock department opening on the following Monday. As already notified to the readers of THE ENGINEER, in addition to the usual medals offered for new inventions, the Council have offered substantial prizes for self-binding reapers and for separate sheaf-binders, the binding material to be other than wire. They also offer a prize for an efficient machine for cutting and elevating materials to be preserved in silos. Sir John Thorold has been elected as one of the Stewards of Implements at the country meetings, and Mr. Jacob Wilson has been unanimously re-elected Steward of General Arrangements for a term of three years. The authorities of Preston and Chester are each anxious to secure the holding of the exhibition of 1885 in their vicinity, and so keenly does each town anticipate a favourable decision that local funds have already been raised to the extent of over £4000 in one case, and nearly that sum in the other. A committee has been appointed to report on these invitations.

RAILWAY MATTERS.

AT a recent meeting of the Executive Council of New South Wales the appointment of the following gentlemen as a Royal Commission to inquire into and report upon the stability of the iron bridges on the existing lines of railway was confirmed:—Mr. G. A. Morrell, C.E., Mr. Norman Selfe, M.I.C.E., Mr. W. M'D. Courtney, M.I.C.E., Mr. J. P. Franki, and Mr. J. Edgington.

THE engineers report that on Saturday morning last the distance to be bored between the ends of the tunnel, being carried forward simultaneously from the Lancashire and the Cheshire sides of the Mersey had been reduced to 61 yards, and that it was expected that a through passage underneath the Mersey would be established in about a fortnight from the present time. The rock is reported to be favourable for excavation.

THE West India and Pacific Steamship Company, of Liverpool, received on Saturday last a letter from their agent at Aspinwall, dated the 14th ult., stating that the negotiations which have for some time past been understood to be in progress between the American company owning the Panama Railroad and M. de Lesseps's Panama Canal Company for the cession of the railroad to the latter company, have been brought to an issue. The railroad was to be handed over to the canal company on the 1st inst.

A COLLISION occurred last week on the Grand Trunk Railway, at a short distance east of Toronto, between a train which daily leaves the city at 6.40 a.m., with a car attached to it for workmen belonging to the bolt works, and a goods train. Twenty-seven workmen were killed, and from twenty to thirty hurt. The guard of the goods train is accused of being responsible for the accident, and has been arrested. It is alleged that he had started his train without orders. Several of those who were injured are so seriously hurt that they are not expected to recover.

THE following are the rates paid on the New South Wales lines:—Clerks, £200 to £150 per annum; foreman, £5 10s. to £3 7s. per week; draftsmen, £4 15s. per week; timekeepers, £3 to £2 per week; firemen, 8s. to 7s. 6d. per day; fitters, 12s. 4d. to 8s. per day; blacksmiths, 12s. 8d. to 10s. 4d. per day; turners, 12s. 2d. to 10s. 2d. per day; machinists, 9s. 10d. to 7s. 6d. per day; boiler-makers, 12s. 2d. to 10s. 2d. per day; pattern-makers, 11s. 10d. per day; brass moulders, 11s. 4d. per day; plumbers, 11s. to 10s. per day; tinsmiths, 11s. to 10s. per day; brass finishers, 9s. 6d. to 9s. per day; carpenters, 11s. 6d. to 8s. per day; painters, 11s. to 9s. 8d. per day; strikers, 7s. 4d. to 7s. per day; cleaners, 7s. per day. In many instances the working day does not exceed eight hours.

OPERATIONS at the Mersey tunnel works during the past week have been unusually successful, exceeding all previous efforts in a similar space of time. The distance advanced under the river was no less than forty-six yards lineal; of these thirty-three were done by Beaumont's boring machine and thirteen on the Liverpool side by means of blasting. The reports consequent on the latter method of proceeding can be plainly heard by the men working in the opposite heading. The mean distance to be excavated is now under sixty yards, and it is estimated that the communication or passage under the Mersey will be effected in the course of next week. The rock continues sound and uniform in character. The quantity of water encountered does not increase, and no difficulty is experienced therefrom in any way.

IN concluding a report on the derailment which occurred on the 24th October, at Fenchurch-street station, on the Great Eastern Railway, Major-General C. S. Hutchinson, says: "It was certainly not the high speed which this time principally caused the accident; but it is probable that the damage which, when the engine was taken to the shops, it was found to have sustained in the spring of its right-hand driving wheel—of which four of the plates were broken, and in consequence of which and of the run over the ballast there was found to be a preponderance of weight on the right side of the engine—contributed, together—as before—with the stiffness of the engine and the somewhat tight gauge at the points, to cause the leading wheel to mount the second time." He adds: "To avoid a repetition of similar accidents at this and other sharp curves in the station, engine-drivers should be specially instructed to pass through them at a speed not exceeding five miles an hour, and these curves should be laid in as far as practicable loose to gauge. It would also be advantageous to place guard rails where practicable in advance of the facing-points, as well as on the curves themselves." This is another illustration of the fact, as pointed out in the "Proceedings" Institution Civil Engineers—1882-3, vol. iv.—that speed under many circumstances may not be an element in the cause of derailment on a curve. The resistance on the curves with rigid wheel base, or parallel axles, provides a sufficient cause for most off these curve derailments, even without any centrifugal tendency assistance.

AN extraordinary and fatal accident occurred on the Wigan and Pemberton Tramway on the 5th, resulting in the death of Mr. T. W. Barker, solicitor, of Southport, the coroner for the West Derby division for the county of Lancaster. The driver of the tram, which had just reached Pemberton, uncoupled his engine in order to get round to the opposite end of the car for his return journey, leaving the carriage on one side of the triangle by which the engine is turned round. While proceeding with his engine along the third side which leads to the main line for Wigan he observed a child in front, and immediately, it is alleged, he jumped down and snatched the child out of danger, but in doing so he was caught by the engine and thrown down. The engine increased in speed, owing to the incline, and although he managed to get up to it, he failed, it is said, to catch hold, and the engine sped on. From here to Newtown it is one regular descent, and for the last quarter of a mile a very steep one, the gradients varying from 1 in 40 to 1 in 25. As it rushed along the engine gradually gained in speed, to the terror of the passers-by. Near the Half-Way House Inn, about 1000 yards from the terminus, it overturned a horse and cart, then dashed down the Spring Bank, and smashed with great force into the tramcar which was standing at the junction nearly at the bottom of the hill. In this car there were only five passengers, all of whom escaped except Mr. Barker, who had been seated at the furthest end of the carriage. He was caught just as he was stepping off between the engine and the back part of the car, being tightly jammed in between the body of the vehicle and the engine.

AN interesting experiment is now being tried on the Metropolitan District Railway in connection with one of the suburban trains running from High-street, Kensington, to Putney, the carriages of which are lighted by electricity direct. In carrying this out, a Siemens dynamo and a Willans three-cylinder engine are placed in a luggage van which is attached to the train. Steam is supplied to the engine by means of a small boiler, which is also fixed in the van. The carriages are lighted by means of a total of twenty-eight Swan incandescent lamps of 20-candle power each, which give a very brilliant light. The present machinery was designed for a longer train, and, in addition to the lamps in the carriages, there are about thirty in the van which are always lighted when the others are. The object of this is to ascertain the exact cost of working a sufficient number of lights for the longer trains, which are usually fitted with fifty ordinary gas lamps. The experiment is being carried out for Lord S. Cecil, general manager of the District Railway, and Mr. J. S. Forbes, chairman of the London, Chatham, and Dover Railway Company. The first public trial of the light took place on Thursday week, and the results were considered very satisfactory. It is therefore intended to continue the experiment for some weeks, the train being all the time in regular work. In the event of the machinery proving effective and trustworthy, it is probable that a Willans engine and a dynamo will be placed on the engine of the train so that steam can be supplied from the locomotive boiler. This arrangement, which has been proposed by Mr. W. F. Massey, of Twyford, will necessarily prove cheaper, inasmuch as the small boiler and the special attendant in the van will not be required. It is anticipated that the cost of lighting a train by electricity direct will be much less than that of oil lamps.

NOTES AND MEMORANDA.

THE annual report of the Registrar-General for the year 1882 shows that the estimated population of New South Wales at the end of that year was 817,468 persons, the percentage of males being 54·97, and of females 45·03, These figures show an actual increase of 36,203 persons on the estimated population at the end of the previous year.

As wood changes under the influence of the air, growing brown and consequently diminishing the durability of the paper in which it has been employed, it is of great importance, both for the dealer and for the consumer, to be able to ascertain whether a given sample of paper contains woody fibres or not. For this purpose, the *Chronique Industrielle* says, a solution of sulphate of aniline, or a mixture of one part sulphuric acid, three parts nitric acid may be employed. Either of these solutions produces immediately a yellow colour upon the paper if it contains wood, the depth of the yellow shade increasing as the proportion of wood increases.

PROFESSOR POLONI has been experimenting upon the influence of heat on the permanent magnetism of steel, and some of his results are described in the *Chronique Industrielle*. He finds that the diminution of magnetic intensity, by the increase of temperature in the steel bar, has no rigid relation to the increase of electric resistance in the metal itself. Indeed, while the permanent magnetism diminishes with increasing rapidity up to a temperature of about 200 deg.—328 deg. Fah.—and then less rapidly up to 300 deg.—508 deg.—becoming inappreciable at red heat, the electric conductibility of the iron diminishes uniformly with the increase of temperature.

IN a paper on patent for "Improvements in the Manufacture of a White Pigment," by T. Griffiths, the author states that in the calcination of "sulphide of zinc pigment," and also in that of the pigment consisting of "a double precipitate of sulphate of barium, strontium, or calcium, and sulphide of zinc," access of air is prejudicial to the colour of the product. He therefore proposes, not only to calcine the bodies in question "in crucibles, or in closed furnaces," but also to first mix them with from ¼ to 2½ per cent. of "an ammoniacal salt that will not easily volatilise, such as the sulphate of chloride," in order that "an artificial atmosphere" may be maintained "round the material" during its calcination.

ACCORDING to a suggestion for the "Decolorisation of Crude Resin Oil," by G. Schwarz, in the *Seifensied-Zeit.*, 23,271, the oil to be decolorised is heated in an iron boiler over a clear fire until it has become fluid. It is then drawn off into a wooden vat, frequently stirred, and 10 lb. of concentrated sulphuric acid is next added for every 100 lb. of oil. After being allowed to rest twelve to eighteen hours, the oil is drawn off and washed several times with hot water. When it is completely freed from acid it is dark yellow, and almost inodorous. In order to obtain a bright yellow product, the oil is now mixed with 50 per cent. of water, 10 per cent. of soda ash, and 10 per cent. of slaked lime, and finally submitted to distillation.

NOTWITHSTANDING important differences of interpretation, the results of analyses of London waters obtained by Mr. William Crookes, Mr. William Odling, and Dr. C. Meymott Tidy, are usually in fair accordance with those reported to the Registrar-General. Thus the mean amount of organic carbon in 100,000 parts of the water furnished during the six months preceding October, by the five companies taking their supply exclusively from the Thames was, according to their experiment, ·116 part, and according to the reports made to the Registrar-General, ·123 part, a difference of ·007 of one part only. As regards, however, the discrepancy noticeable in the two sets of results for October, Messrs. Crookes, Odling, and Tidy mention that their report was based on an examination of *nineteen* specimens of Thames-derived water, each collected on a *different* day; and that their determinations of organic matter by means of the combustion process were checked by the results of a wholly different process of examination. On the other hand, the report made to the Registrar-General on the character of the Thames "waters supplied to the metropolis during the month of October," was based on an examination of *five* specimens only, all collected on the *same* one day of the month. Further, the results, furnished by the combustion process applied to these five specimens were wholly unchecked by any different method of examination.

THE report of the United States Geological Survey has been received at Washington. It places the value of the metallic products of the Union for 1882 at 219,766,004 dols. The items in this account, which exceed one million dollars, are the following:—Pig iron, spot value, 106,336,429 dols.; silver, coining value, 46,800,000 dols.; gold, coining value, 32,500,000 dols.; copper, value at New York City, 31,603,809 dols.; lead, value at New York City, 12,624,550 dols.; zinc, value at New York City, 3,646,620 dols.; quicksilver, value at San Francisco, 1,487,537 dols. A table also appears in the report furnishing the values of some of the non-metallic products, which yield a total of 226,156,402 dols. The items in this table, which equal or exceed 100,000 dols. each, are the following:—Bituminous coal, brown coal, lignite, and anthracite, mined outside of Pennsylvania, 76,076,487 dols.; Pennsylvania anthracite, 70,556,094 dols.; crude petroleum, 23,704,698 dols.; lime, 21,700,000 dols.; building stone, 21,000,000 dols.; salt, 4,320,140 dols.; cement, 3,672,750 dols.; limestone for iron flux, 2,310,000 dols.; phosphate rock, 1,147,830 dols.; New Jersey marls, 540,000 dols.; crude borax, 160,000 dols.; chrome iron ore, value at Baltimore, 100,000 dols. With the exception of the last named article all these are spot values. A statement is also given which shows that fireclay, kaolin, &c., were produced, worth on the spot certainly not less than 8,000,000 dols. The grand total, therefore, of the various products is 453,912,406 dols.

ACCORDING to a paper on "The Constituents of Galician Petroleum," by B. Lachowicz, *Ann. der Chem.* 220, 188-206, an examination was made in order to compare this petroleum with others from America and the Caucasus, and for this purpose the presence or absence of the following series of hydrocarbons had to be determined, viz., the marsh gas, the ethylene, and the aromatic series. From an oil of boiling point 30 deg. to 125 deg. there were separated, by distillation and treatment with strong nitric or sulphuric acids, normal and isopentane, normal and isohexane, and normal heptane, and also from the higher boiling portions nonane—b.p. 148 deg.—and decane—b.p. 152 deg. to 153 deg. An oil boiling between 200 deg. and 300 deg. likewise shows all the properties of the paraffines, a whole series of which form the principal constituents of the petroleum. The first six fractions obtained in the distillation on the large scale of the crude petroleum are not acted upon by bromine, but the seventh and higher fractions absorb bromine vapour with evolution of heat. It is therefore most probable that the olefines do not exist in the petroleum, but are only formed during the fractional distillation from the higher paraffines. It has been shown that Caucasian petroleum contains no aromatic hydrocarbons, but that these are formed by passing the vapour over red-hot charcoal. It is possible that during the fractionation of the petroleum of high boiling points such a formation of aromatic hydrocarbons might take place, and therefore, in order to ascertain the presence of this class of bodies in the petroleum, the author examined the lightest portions only. By fractionation and nitration meta-dinitrobenzene, dinitrotoluene—m.p. 71 deg.—and dinitroisoxylene—m.p. 176 deg.—were severally isolated and analysed, and from a higher boiling portion trinitromesitylene—m.p. 231 deg. to 232 deg.—so that Galician petroleum contains a large series of aromatic hydrocarbons. From observations of the high specific gravity and the percentage composition of a portion boiling between 97 deg., and 100 deg., it is almost certain that it consists of heptane with some hexahydrotoluene. In an abstract of the paper the *Journal of the Society of Chemical Industry* says the author was not able to prove the presence of hexahydroisoxylene.

MISCELLANEA.

A PRACTICAL treatise on "The Electric Light in Our Homes" will be issued by Messrs. Warne and Co. in a few days. It is written by Mr. R. Hammond, of the Hammond Electric Light and Power Company.

THE number of houses built in London and the suburbs in 1882 was 23,310, forming 508 new streets and one new square, and covering a distance of about 75½ miles. There are no signs of any decrease in the growth of London, but there is an enormous number of empty houses in London.

THE difficulties which have hitherto attended the preparation of rhea fibre seem to have been overcome. Dr. Forbes Watson recently gave an interesting lecture before the Society of Arts on this strongest of fibres, which he has worked so hard to introduce into the markets, and referred to a machine which seems to have overcome the difficulties which attended the preparation of the raw product.

THE engineers' estimate in connection with the proposed Manchester Ship Canal undertaking has been lodged in the Private Bill Office of the House of Commons. The grand total estimate is £6,904,186 12s. 2d., and is made up as follows:—For the nine connecting lines of railway, £456,172 1s. 4d.; for dock works at Manchester and Warrington, £1,121,262 13s.; for canal works, £3,920,171 11s. 7d.; for estuary works, £1,390,419; and for new roads, £16,161 6s. 3d.

ON the 3rd inst. Messrs. Earles' Shipbuilding and Engineering Company, Limited, launched from their yard at Hull a fine iron screw steamer named the Chandos, built for Messrs. Hy. Briggs, Sons, and Co., of the same town. The dimensions of the vessel are as follows:—Length, P.P., 275ft.; breadth, 35ft.; depth, of hold, 20ft. She is built to the highest Liverpool class, and has water ballast in the after hold and engine room, and also a deep ballast tank in the main hold. The engines are compound surface-condensing of 150 nominal horse-power, also constructed by Earles' Company.

AN expensively illustrated report by Col. A. Ford to the Secretary of State for Home Department, on the circumstances attending an explosion of gunpowder which occurred at the gunpowder factory of Messrs. John Hall and Son, at Furnace Lochfoyne, near Inverary, on the 29th September, 1883, has been published. The explosion took place in a drying house or store which was destroyed, and one man and one horse were killed. Several people were injured. The peculiarity of these reports is that usually the cause of the explosion is untraceable; all the possible causes of explosion have to be reviewed at length.

A NEW lock has been opened at the Grand Sluice, Boston. The lock has a width of 30ft., and the cills are laid 3ft. below the cills of the sluice. The walls are chiefly concrete faced with blue Staffordshire bricks, and are 35ft. in height from foundation to cope. There are three pairs of gates built of English oak, the inner ones are fitted with large draw doors for sluicing purposes. The work has been executed by Mr. Rigby, contractor, of Worksop, from the designs of Mr. J. E. Williams, M.I.C.E., and in addition to the new outfall cut and other improvements on the Witham, costing about £200,000, will greatly benefit the drainage of a vast district of Lincolnshire.

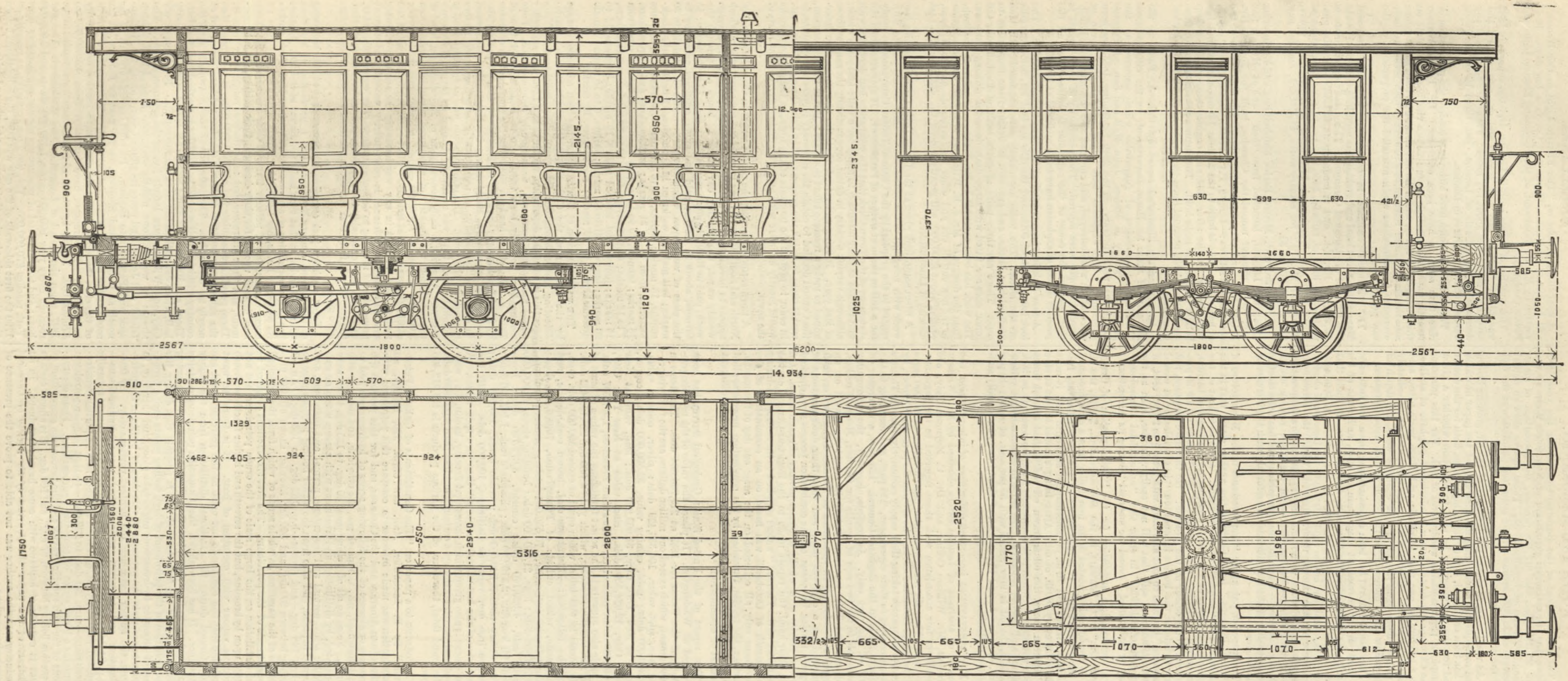
A DISCUSSION took place at the Dover Town Council meeting last week with reference to the course the Council should pursue with regard to the proposal by the Channel Tunnel Companies to apply for a Bill in the next session of Parliament. It appeared from the statement of the Town Clerk that the companies had deposited with him notices of their intention to apply for a Bill; also plans which, although varying slightly in detail, are practically the same as those of last year. It being understood that the companies were determined to make a resolute effort to obtain a Bill in the next session, the Council decided to obtain the necessary powers of opposition to enable them to watch the progress of the Bills through Parliament, in order to protect the interests of the town, as the proposed works would greatly interfere with property, drains, &c., in some parts of the town.

A DISCUSSION concerning the rate of wages in the chief towns of North and South Germany has brought out some particulars, which appear to have interested an American contemporary. The average weekly wages, the working day being 12 hours all through the week, paid in Berlin to stone masons vary from 15 to 28 marks; to turners, about 20 marks; gold and silver artificers, according to the class of work upon which they are employed, from 12 to 30 marks; belt makers, workmen in foundries, 12 to 18 marks; locksmiths, 15 marks; smiths, 15 to 24 marks; workmen in machine factories, from 17 to 31 marks; watchmakers and soap makers, 18 marks; tanners, 15 to 18 marks; linen and calico weavers, from 7 to 18 marks; cloth weavers, from 10 to 20 marks; carpet makers, 15 marks; joiners and kindred trades, 15 marks; butchers, 12 to 20 marks; brewers, 21 to 31 marks; tailors, 6 to 15 marks; female dressmakers, 7 to 12 marks; shoemakers, 12 marks.

THE water question at Southampton has been advanced a stage by the decision of the Corporation to adopt Deacon's waste-detecting meter throughout the town. The *Southampton Times* says this is what the deputation, which visited Liverpool and other places nearly two years ago, unanimously recommended. Four meters have recently been tried, two of Deacon's and two of Tyler's. The effect has been to reduce the consumption of water by 329,971 gallons per day, and to diminish by 10s. 6d. per day the cost of coal consumed at Mansbridge. Nothing further was needed to show the desirability of permanently adopting such meters throughout the town. The only question was as to which kind it should be, and that was eventually decided in favour of Deacon's system. Allowing a daily consumpton of 25 gallons per head of the population, the quantity of water used would be reduced from 3,000,000 gallons to 1,800,000 gallons, which represents a saving of £1000 a year. That reduction will be affected by the use of the meters, and without in any way lessening the quantity of water available, as the difference is now entirely wasted, and a great proportion of it owing to deffective mains. The course adopted is, therefore, unquestionably the right one, and we have no doubt that the results will fully bear out the indications which the last meters have given.

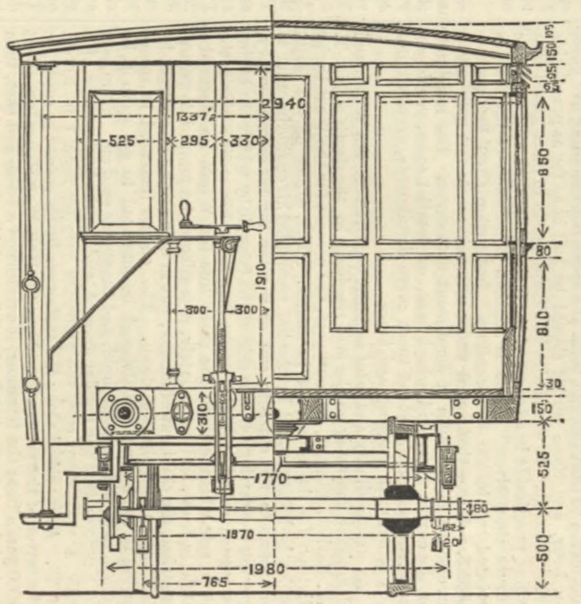
FROM statistics just compiled, it appears that at the beginning of the present century New York had a population of less than 60,000. London at that time had a population of 864,000. London has now a population of about 4,000,000, while New York, within its corporate limits, has 1,500,000. But it is pointed out that an enormous number of persons transact their business in New York and depend upon it for their incomes, their society, their amusement, and their literature, but nevertheless reside away from it. These people are calculated at nearly 1,000,000. It is claimed that the suburban population of New York has not been estimated at nearly its true value. The influence of the metropolis upon the country within a radius of 20 or 25 miles is marked and peculiar. There are 100 hamlets lying within an hour's reach of the city hall, which derive their life from the metropolis. Brooklyn, Jersey City, and Williamsburg largely live in the common centre. The stream of wealth flows nightly over into Long Island, Staten Island, and Jersey, and pours its affluent waves along the Hackensack and Passaic into Hudson. Its vital currents are felt as far north as Cornwall and Singsing, as far east as Babylon, as far south as the Raritan, as far west as Passaic. The enormous growth of the city, therefore, during the nineteenth century cannot fully be realised. The imports have increased from £5,600,000 to £76,000,000. Nearly 6,000,000 of immigrants have landed since 1847, when the Board of Emigration was established. The city receives every year 800,000 cattle, 1,500,000 sheep, and 2,000,000 hogs; and the sum total of produce per annum which enters New York reaches £70,000,000. Yet, the *Times* remarks, as recently as 1790 the first side-walk of the city was laid, the inhabitants before that time having to pick their way over planks and bricks.

THIRD-CLASS CARRIAGES, ST. GOTHARD RAILWAY.



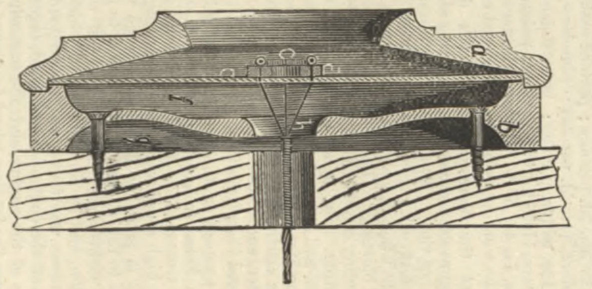
ABOVE we publish engravings of the type of third-class carriages at present in use on the St. Gothard Railway, between Lucerne and Milan. Of these carriages the company possesses sixty-one, giving a total of 3664 places. It will be seen that they are very much on the American type, being carried at each end on a four-wheeled bogie truck, swivelling round a central pin. The seats are arranged back to back in groups of four, on either side of a central gangway. The carriage is provided with brakes at each end, worked by screw gear from a platform outside the carriage proper. From this platform it is, of course, easy to step to the next carriage, and so travel along the whole length of the train. The chief particulars with regard to the carriage are as given below. For these we are indebted to Herr Stocker, locomotive and carriage superintendent of the line :—

No. of seats	72
Tare weight of carriage	13,400 kg.
Wheel base, bogie to bogie (inner axles)	6·2m.
Wheel base, wheels of each bogie	1·8m.
Length of underframe, including buffers	13·764m.
Distance between inner edges of side bars	2·52m.
Distance between buffers, centre to centre	1·75m.
Height from rail surface to centre of buffer	1·05m.
Length of buffers	0·585m.
Outside length of carriage body	12·144m.
Inside	12·000m.
Outside width	2·940m.
Inside width	2·800m.
Height of floor above rails	1·205m.
Height in middle of carriage	2·145m.
Height inside of roof above rail	3·370m.
Width of roof	3·050m.



MECHANICAL TELEPHONE.

THE mechanical or acoustic telephone herewith illustrated will transmit and receive speech with great clearness and accuracy of tone. The mouthpiece *a* has a central aperture for the passage of sound waves to the diaphragm *c*, whose edges are secured within a rabbet of the mouthpiece. The diaphragm is about 7in. in diameter and is made of spruce wood, which possesses great sonorousness combined with strength sufficient to sustain the tension of the line wire. The mouthpiece and diaphragm are held to the wall on a bed-piece *b* by the tension of the line wire. The bed-piece is recessed at both sides *f g*, and centrally apertured for the passage of threads connecting the line wire to the diaphragm. The front recess *f* affords a space between the diaphragm and the centre of the bed-piece for free action of the diaphragm, promoting clearness of enunciation when the instrument is used as a receiver, and the rear recess *g* secures a small marginal support for the transmitter, thereby avoiding a large contact with the wall and preventing excessive vibration.



To avoid indistinct articulation and the ringing sounds common to acoustic telephones, the line wire is connected to the diaphragm by silk cords, which are twisted about the end of the wire to obtain a firm connection therewith, and which diverge into three or more strands that are secured to a metal ring *c*, between which and the diaphragm a rubber or leather ring *d* is interposed. The line wire is made of strands twisted together and coated with varnish, to bind them and prevent them rubbing upon one another. This construction of the line wire makes it strong and protects it from the weather, and, combined with the silk cord connections, aids largely in clear transmission over line wires of considerable length. The invention has been patented by Mr. A. G. Miller, of Leyden, New York.—*Scientific American*.

THE ELECTRIC LIGHT IN AUSTRALIA.—Although Sydney, the metropolis of New South Wales, is brilliantly illuminated at night with thousands of gas lamps, the electric light is rapidly coming into favour, being used at the Houses of Parliament, the Theatre Royal, and other places. The Circular Quay, at which the magnificent vessels of the Orient, Peninsula and Oriental, and other companies are berthed, is also illuminated by means of electricity, the effect being almost fairy-like, especially when viewed from the waters of the harbour. The principal lighthouse at the entrance to Port Jackson is also illuminated by electricity, the light being one of the largest in the world. It is visible very many miles at sea, although during clear weather the intensity of the light is reduced one-half.

LETTERS TO THE EDITOR.

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

WATER WHEELS.

SIR,—When we consider the time that has been spent and thought expended on the steam engine, it does not surprise us to see the clumsy, wasteful, and necessarily expensive engine used by our fathers developed into the effective and economical motor of the present day. These facts bring home to our minds the neglect which other sources of power, through being less attractive, seem to have experienced. The steam engine derives its power from the expensively-worked coal-mine, which acts the part of a store-house for the sun's antediluvian heat; and can it be possible that this is the most economical means of obtaining power in localities where water, which has been raised by the attraction of the moon or heat of the sun, is flowing from a high level to a low one? It is only rational to conclude that, had the means of converting the potential energy of water into effective work been studied to the same extent, and by men of the same stamp as those to whom the steam engine owes its success, we should have first cost and the room taken up by water engines far less than at present, and find manufacturers giving more thought to the position of their works, and steam would be used where a fall of water was not attainable. Certainly, tidal power does not seem to be a thing of the present for England, where land is comparatively dear and coal cheap; but could not some of our valleys be cheaply converted into reservoirs of force, after the manner adopted by Mr. Thompson for supplying Greenock with domestic water and mill power, turning to account the water caught on the surrounding hills, which before ran wastefully to the sea?

In some of our colonies, where coal is £3 and more per ton and land cheap, the tidal energy might be utilised far more economically than coal. This might be done by taking advantage of an estuary, or making a dam of sufficient size to hold the requisite water, to be filled by the rising tide, and another small one with sluice gates, for the wheel tail-water to discharge into whilst the tide was rising; the gates to open automatically when the tide level was below the wheel-race. By this means nearly the full head of water might be utilised, and the wheel be a fixture—a great consideration. The writer has seen the tidal rise utilised very simply, but rather wastefully, by supporting a wheel between two barges braced together, carrying the whole plant of machinery, being anchored fore and aft. The stream carried the floats round, the machinery being arranged to allow the wheel to turn effectively both ways to suit the current. Generally the machinery to be driven cannot be conveniently arranged on a barge, and in such cases the wheel's axle is supported on floats, which rise and fall with the tide between two piers, the power being transmitted by an endless chain arranged radially from the wheel to the mill, situated above water level. In my opinion the most effective plan of getting over the difficulty of varying wheel heights would be to connect the axle of the wheel by links to the centres of the first mill shaft, in such a way that the wheel might rise and fall, its own axle describing a circle around the first mill shaft, the axle to have a pinion keyed on, which shall gear into the large spur wheel on the said shaft. By this means a variation of 20ft. or more could be dealt with effectively. To meet the alternate ebb and flow of the tide, additional gearing must be used to give the machinery continuous motion in the same direction.

Looking at wheels themselves, we find them to-day much the same as they were fifty years ago, and with the exception of turbines, come under the heads of "overshot," "breast," and "undershot." These terms have anything but a definite meaning, two manufacturers using various terms for the same wheel. The generally adapted terminology* is, (1) the "overshot" wheel, which receives the water at a high level, is moved simply by the weight of water, and is only applicable where a great fall is attainable—usually small mountain streams. This wheel is by far the most economical and efficient, Morin giving its modulus at from ·70 to ·75. (2) The "breast" wheel, which receives the water on paddles or floats nearly fitting a sweep, in which they revolve, and is thus put in motion, partly by the weight of water lodged on and between the floats, and partly by the pressure on the floats due to the velocity of the water. For these wheels Morin gave a modulus of from ·4 to ·7; the reason of the great difference will be apparent as we proceed. (3) The "undershot" wheel, that receives the water pressure on simple paddles or floats immersed in the current, and is acted on by its force only. These wheels are used where great volume and little fall is available, the modulus given by General Morin being from ·25 to ·3.

From the above it will be readily seen that the kind of wheel must depend entirely upon the fall of water obtainable, and the size depend on the velocity and quantity of water; quantity of water varying with the velocity for a given section of stream. This section can be obtained by the ordinary method of finding the area of a superfices, by means of perpendiculars, found in this case with the plumb line. Suppose we divide the stream into six equal parts, finding the depth at each part, then their sum, divided by 6 and multiplied by the breadth, will give the area. The velocity can be found by throwing a large float, well immersed, into said stream, and after it has acquired the velocity of the moving water, note the time it takes passing between two points of fixed distance apart. If it takes ten seconds to pass 50ft., then the velocity of mid stream will be 5ft. per second. If the course is much impeded by weeds, stones, &c., half of this might be taken, giving a mean velocity of 2½ft. per second. When the sides and bottom of the course are smooth and the friction comparatively little, Glynn gives the formula $S - \sqrt{s - 5}$ as the mean velocity of stream, s = velocity of mid stream in feet per second. Having ascertained then the velocity of stream area and fall, it requires but a simple calculation to determine the potential power of the water, and this multiplied by the modulus for the various wheels given above, would show the useful power that could be obtained. Mr. Imray gives the formulæ for finding the horse-power of a wheel as follows:—"Multiply the surface of float—in square feet—three times by the velocity of the stream in feet per second, and divide the product by 3·800, the quotient expresses the horse-power." From these two formulæ the size of wheel floats is easily deduced if it be an undershot one: the pressure in pounds per square foot on float boards at rest with the stream flowing at a given speed is nearly equal to the square of the velocity in feet per second, and this pressure on the boards decreases as the square of the velocity of the wheel more nearly approaches the square of the velocity of the stream. To obtain the most useful effect from the wheel, it will thus be seen that a certain ratio, derived from practice, must be followed out; Mr. Imray's and others' calculations, which agree with Mr. Smeaton's practice, give the velocity of water to that of wheel as 3:1. Thus the circumference of the wheel, whatever the diameter, should move at the same speed, viz., one-third that of the water, and the only way to effectively increase the power is to extend the surface of the floats; a wide float is far more economical, even where the stream admits of a deeper, than a deep one, because it presents itself to or enters and parts with the water more easily. "Overshot" has become a technical term, conveying a meaning only known to those acquainted with the subject; there are not many, and, indeed, ought not to be any, overshot wheels, if we are to understand the term in its literal sense. To get the theoretical amount of force out of the water is impossible, but the nearest approach seems to be with a bucket and endless chain, in such a manner that the water is effective for its whole height, and all its potential energy is thrown into the machine; but this kind of motor is seldom employed because of the liability to derangement. The most effective wheel at present is the so-called overshot, revolving towards the stream, with the water delivered on to it about one-eighth its diameter from the top, thus saving the fall on the horizontal part of the wheel, which would do little else than increase its friction. Thus the diameters of all overshot wheels at present constructed should be about one-eighth greater than the attainable fall; thus a 24ft. fall would require a 27ft. wheel. It is found that the buckets do not dash the water, and retard the wheel if the water falls at a little higher velocity than the wheel is revolving; but if the difference of the velocity of the water and wheel exceed a certain ratio, the water dashes into the buckets, causing them to be only partly filled; at the same time the impetus given by the dash to the wheel is far less than the power lost by the buckets being partially emptied of the weight of water. The stream must be just fast enough to fill the buckets when the wheel is moving under its maximum load, and the buckets must be so proportioned that they may retain the water in them till the last moment that its weight on the wheel is effective, and yet empty themselves as soon as it ceases to be so. Ventilation is obtained by making the width of stream flowing over the wheel about 4in. narrower than the wheel itself; another method adopted by Fairbairn, and frequently used, is to make a false back to the bucket, in such a manner as to allow the air to escape to the interior of the wheel. The buckets, which play an important part in overshot wheels, should be designed with the intention of allowing the water to act as long and effectively on the wheel as possible. Fairbairn's experience led him to consider the best opening for a bucket to be as 5 : 24 : *i.e.*, the contents of a bucket being 24 cubic feet, the area of opening should be 5 square feet. In wheels using the water a few degrees above the horizontal centre he adopted the proportion of 1 : 3. With these proportions he assumed the depth of shroudings to be three times the width of the opening, or three times the distance of lip from back of bucket. Mr. Grier, an old authority, gives the horse-power of overshot wheels in the following formulæ:

$$2\tfrac{1}{2} \times \frac{\text{height of fall in ft.} \times \text{quantity of water in c. ft. flowing per min.}}{5000} = \text{H.P.}$$

Where the fall is not sufficient for an overshot wheel it may be found to be enough for a breast wheel, which follows in efficiency. With these wheels, as they were constructed fifty years ago, it was found advantageous to deliver the water as high up as possible, for though they lost the impulse gained from the impetus of the stream lower down, yet the height through which the water acted is decreased, and the straining force on the wheel much more severe. Poncelet's wheel, however, utilises the momentum of water very effectively, and reduces the straining force considerably; but it does not give so good a modulus as the high discharge.

Mathematicians have shown, and practical men like Smeaton and Fairbairn have proved by experiment that the most effectual speed for a breast wheel to run is one-third the velocity of the water; but if the wheel fits the sweep tolerably well, as in Poncelet's wheel, a velocity as high as two-thirds can be obtained practically with advantage. When this is the case, the impulse from excess of stream velocity over float velocity is much diminished, and the principal element of power is the load of water contained in the buckets. The largest breast wheel was erected many years ago for Messrs. Strutt, of Belper, being 40ft. by 12ft. 6in. Mr. Grier also gives the following formula for the horse-power of breast wheels:—

$$\frac{\text{Height of fall in ft.} \times \text{quantity of water in c. ft. flowing per min.}}{5000} = \text{H.P.}$$

Undershot wheels are used where the fall of water is too small for any of the more effective kind. The advantage of using a large undershot wheel is derived from the floats entering the water more vertically than they otherwise would; indeed, some makers adopt the plan used on steamers, whose paddles, by means of an excentric motion, enter and leave the water vertically. The velocity of wheel to that of stream in this class, as in the previous one, follows out the proportion of 1 : 3. Mr. Smeaton, from his numerous experiments on undershot wheels, deduces the following facts:—"(1) That the virtual or effective head being the same, the effect will be nearly as the quantity of water expended. (2) That the expense of water being the same, the effect will be nearly as the height of the virtual or effective head. (3) That the quantity of water expended being the same, the effect is nearly as the square of its velocity. (4) The aperture being the same, the effect will be nearly as the cube of the velocity of the water." He also ascertained the ratio between the load a wheel would carry at the maximum of effect, and what would totally stop it, to be as 4 : 3; when this limit was exceeded, the whole worked irregular and intermittedly.

The results of these experiments help one to understand the otherwise perplexing, various performances of wheels, under apparently similar conditions. W. P. ABELL, Wh. Schr.

Derby, December 31st.

* "Water-wheels," by J. Imray.

ARITHMETICAL CHEMISTRY.

SIR,—I have but just seen the review of my "Arithmetical Chemistry," which appeared in your issue of the 7th inst. I am obliged to your reviewer for calling my attention to points that escaped my notice when looking over the proofs. I do not understand the remark: "On p. 23 we read of Thomas's analyses of coals *for* the South Wales Basin, when they were placed in the vacuum of a Sprengel pump." I think your reviewer must have overlooked page 93, or he would have noticed that there could be no ambiguity as to what was meant by the word "Roscoe." And, as regards his remarks about the exercise from a paper, set by the Science and Art Department, as I do not give any answer, I fail to see how it can be described as incorrect. C. J. WOODWARD.

Birmingham and Midland Institute,
Birmingham, December 31st.

[Mr. Woodward cuts the sentence on page 23 short. Let him quote it in full and he will give the title of a journal which did not exist, as given in his book, at the date he mentions. We regret the very obvious omission "of gases" before the words "from coals." We saw page 93, and maintain that "Roscoe" is misleading. The work Mr. Woodward refers to is also written by Schorlemmer, and the short title "Roscoe" for a book should be applied to one of two books written by Roscoe. As regards the question by the Science and Art Department, Mr. Woodward says in a footnote, "There seems to be a mistake in the numbers given," but he does not give the correction.—ED. E.]

THE NEW PATENT ACT, 1883.

SIR,—The pointing out of difficulties that beset inventors under the new Act in the columns of the last and former issues of THE ENGINEER, is of the greatest benefit to inventors, for it will dispel many delusions about the benefits of the new Patent Act, 1883. The official notice that no application which bears date prior to the 1st of January will be accepted by the Patent-office drew from Mr. Lloyd Wise a letter published in the *Times*, a strong protest, and an assumption that a foreign applicant could file an application on the 1st of January where it was denied to a home inventor. His words are:—A foreign inventor can send—some have already done so—a description of his invention to a London agent who can make a declaration and application on the 1st of January in his own name for a patent for invention communicated from abroad, but a London agent cannot do with an invention whose author is out of the kingdom.

Now if that is so it would be the grossest injustice to home inventors that a foreign inventor should be able to do so; and if it should happen that both have the same invention—which is probable, so many inventions having been kept back—the home inventor would have to shelve his invention, whereas the foreign inventor would have the full benefit of his invention—the home inventor beaten not by any of his faults but the laws of his country. Such, however, I cannot conceive to be possible, in which I am confirmed by looking over the new Patent Act, 1883, and rules. No such preference is thereby given to applicant for inventions communicated from abroad. Rule 27 does not say that it does. The special form A 1 for application communicated from abroad requires the signature of the inventor and declaration as to true, &c., before a consul, &c., and not of the agent but the inventor, and if the signature is affixed on the 1st of January—the official notice requires it—no agent could file an application on the 1st of January. In my own case I could not reach London in time to do so, but got the application posted the same day—yesterday—and am confident that if an application for the same invention was yesterday accepted I have a good ground on which to upset the foreign patent for the same invention.

2, Roseworth-terrace, Gosforth, C. L. H. LAMMERS.
Newcastle-on-Tyne, January 2nd.

SIR,—Will you permit us through your columns to call the attention of those who, like ourselves, are owners of current patents granted under the old law, to the extraordinary action of the Patent-office authorities in refusing to permit payment of the renewal fees by the annual sums stated in the second schedule to the new Patent Act, 1883. We have seen a letter written within the past few days from the clerk of the Commissioners of Patents stating that "on a patent dated in 1877 the renewal fee—due this year, £100—cannot be replaced by annual instalments." Now, referring to the Act of Parliament, section 45, sub-section 3, it is provided that "in all other respects—including the amount and time of payment of fees—this Act shall extend to all patents granted before the commencement of this Act, or on applications then pending, in substitution for such enactments as would have applied thereto if this Act had not been passed." Now in the case of which we write the term now covered by the £50 renewal fee will expire in the present year, 1884, and reading the above, section 45, and the second schedule, clause (C), to the Act, it seems perfectly clear that for the renewal of this patent granted under the old law the Legislature intended to provide that the patentee may either pay before the expiration of this, his seventh year, one full sum of £100, or at his own option pay the annual fees provided for seventh and following years. It will be seen from the schedule that these annual fees would amount to a total of £120 for the seven years, so that the revenue would be at no loss but rather a gainer by the alternative. K. AND S.

Dublin, January 2nd.

SIR,—Under the old law declarations were not required to be stamped with the 2s. 6d. duty. According to notice from the Patent-office all declarations made before a commissioner to administer oaths, &c., must be stamped with the 2s. 6d. stamp, and thus the applicant is taxed and put to the trouble of getting the declaration stamped. I am not aware that either the old or new law made any reference to this 2s. 6d. stamp, and if it was right to accept declarations for patents unstamped on December 31st, 1883, why should they require a stamp January 1st, 1884, when both are made under the Statutory Declarations Act, 1835? It saves agents and applicants much loss of time to be able to go to a solicitor who is a commissioner to administer oaths, and this is to be preferred rather than to have to beg the favour from a Justice of the Peace. I found a Justice of the Peace had a place of business in a central position, and sent to inquire if he would take declarations, and he refused, saying he had received a message from the Magistrates' Court not to take declarations but to send them there. This means that agents and applicants must go a mile and attend at certain hours at considerable trouble and loss of time, and pay fees into the Magistrates' Court. Justices do not want to be troubled with the taking of declarations. Why should the Patent-office or the law try to compel applicants to ask a favour from them? It would be best not to require the stamp, or to make it applicable to all declarations; or if a distinction must be made, to tax declarations made before a Justice of the Peace and let the other be free. That would give satisfaction to both parties, as one would get rid of a duty they do not desire and which the other would be glad to perform.

Manchester, January 7th. PATENT AGENT.

RIVET MAKING MACHINERY.

SIR,—Replying to your correspondent, "F. Y.," in last week's ENGINEER, there were two rivet making machines just as he describes working at Palmer's Ironworks, Jarrow-on-Tyne, ten years ago. They are probably working there; but as I completed my pupilage there ten years since, I have lost sight of them. I have seen them in other places as well. EDWIN J. WHITE.

Brass and Iron Works, Short-street, Lambeth, Jan. 3rd.

INTERNATIONAL FISHERIES EXHIBITION.—The Commissioners appointed by her Majesty's Government have, upon the recommendation of the International Juries, awarded a "diploma of honour" to Mr. Charles Lever, of Culcheth Hall, Bowdon, Cheshire, for special services rendered by him in connection with the lighting of the council chamber, lecture theatre, picture gallery, and dining rooms of the Fisheries Exhibition at South Kensington, by means of his Lever arc lamp.

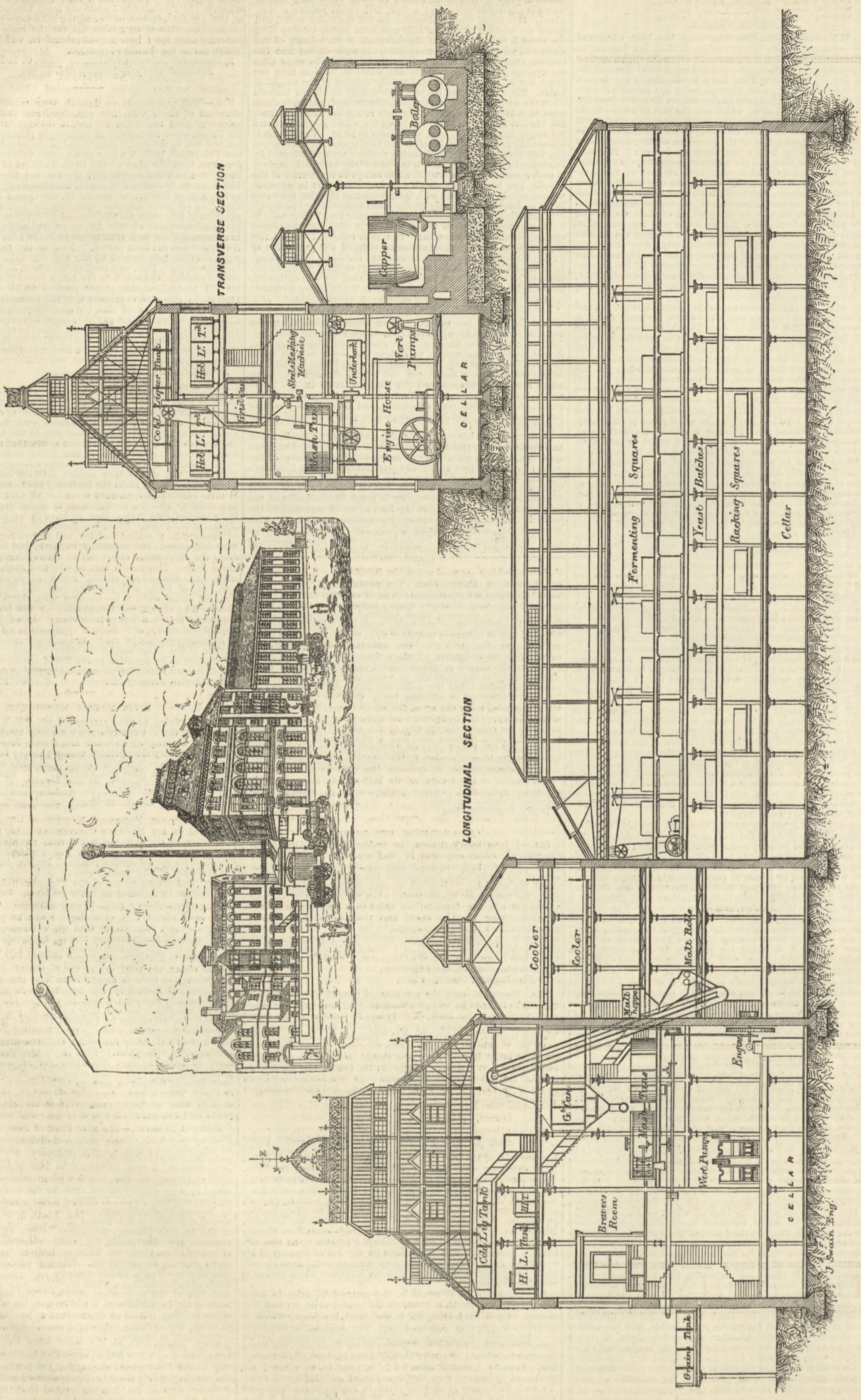
COAL GAS—WATER GAS—ELECTRIC LIGHT.—The illuminating folks have grown very quarrelsome; and at present there is a triangular fight going on the with the water gas, the coal gas, and the electric light advocates as mutual antagonists. It is amusing to read in the gas journals the horrible tales of accidents, and of destruction to health, eyesight, and complexion resulting from the use of either the rival gas or the electrical system of lighting. The prices, too, seem to bother them very much. The complaint made against Edison by the gas makers is, first, that his light cost too much, and second, that he charges too little for it. But if this complaint is true they ought to possess their souls in patience, for he cannot be expected to stand it very long. The coal gas representatives having been beaten by water gas in cost, attack it as extremely dangerous and the cause of most of the accidents by suffocation. This is "important if true," but it must be confessed that the water gas advocates have just as pretty tables of figures the other way, and between them all these lighting companies manage to leave us as much in the dark as ever. There is room for all of them, however, if they will be content with moderate profits. It is the charging of too high prices that attracts rivals into the field.—*Philadelphia Ledger*.

PRINCE'S THEATRE.—The new Prince's Theatre, for Mr. Edgar Bruce, now nearly completed in Coventry-street, Haymarket, in its construction presents several important features that tend to make the structure fireproof. The proscenium wall, separating the stage from the auditorium, rises from the basement and is carried right up through the roof, and the proscenium opening is entirely closed by a hydraulic fireproof curtain, which, under the direction of the architect, Mr. C. J. Phipps, F.S.A., has been constructed by Messrs. Clark, Bunnett, and Co. This curtain, which is the second of its kind in the United Kingdom, the first being erected at the Lyceum Theatre, Edinburgh, under the same architect, measures 32ft. 6in. by 26ft. 6in., and is constructed of two screens of wrought iron plates ⅛in. thick, forming a double division with an air chamber between of 6in. The top portion of the curtain is framed or rivetted to double wrought iron girders secured to the heads of hydraulic rams, which are fitted with their cylinders on each side of the proscenium opening. The supply of water for working the hydraulic rams is laid on from tanks placed on the top of the building. With an expenditure of only eighty-four gallons of water, the curtain, weighing about 7½ tons, can be raised or lowered in fifty seconds. The movement for working the curtain is in the prompter's box, and the prompter, by simply moving a lever, can drop the curtain; thus forming with the proscenium wall a solid fireproof division entirely separating the stage from the auditorium. On the stage fire hydrants are fitted in connection with the New River Company's mains. In carrying out these works the proprietor has incurred heavy expense, but has constructed as safe a building as can at present be devised.

160-QUARTERS BREWERY AT TADCASTER, NEAR YORK.

MESSRS. SCAMELL AND COLYER, WESTMINSTER, ENGINEERS.

(For description see page 32.)



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

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

TO CORRESPONDENTS.

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

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

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

J. A. (Bath).—*Messrs. Warner and Sons, Cripplegate, London, can supply you with the wind wheels you want.*

J. S.—*We cannot call to mind any particular article such as you speak of, but the subject has been frequently discussed in our pages. Perhaps you can give us some more precise information as to the date and title. That which you supply is too vague.*

J. P. S.—*Your question related to a square belt, the frictional grip of which in a V-grooved pulley would be very great and very different to that of a flat belt on a flat pulley, and to use which of the size you gave would require large wheels. Now you ask respecting flat belts in which greater allowance must be made for the frictional hold of the belt on the turned pulley. The formula you quote has been constructed with this view. For further information consult Unwin's "Elements of Machine Design," or "Rules, Tables, and Data," by D. K. Clark, which is probably in a library in Barrow, or in possession of some of its engineers.*

L. (Sheffield).—*It ought to be quite possible to lubricate the steam on its way to the hammers; all that you will need is a proper percolator. Apparatus of the kind has been repeatedly illustrated in our pages, and is made by a great many firms. It is in use in the present day on almost every type of steam engine. Should any difficulty turn up about equal distribution—which we do not anticipate—then a percolator might be fitted on each branch pipe. You will find one type of lubricator illustrated in* THE ENGINEER *for December 28th,* 1883.

ENGINEER.—*You do not say in which of your cisterns the rust is found. There are two ways in which its presence may be accounted for. In the first place, if the iron has been badly galvanised so that the water can obtain access to it, corrosion will set in, and large quantities of rust will be produced by the oxidation of small surfaces of iron; in the second place, if the water is soft, and does not throw down much deposit to protect the boiler, a galvanic couple will be formed by the zinc surface of the cistern and the iron of the boiler, the latter will be oxidised, and the rust will then be carried by the hot water pipes into the cistern.*

CANADA AS A FIELD FOR EMIGRATION.

(*To the Editor of the Engineer.*)

SIR,—Would any of the numerous readers of THE ENGINEER furnish me with the following particulars? Which part of Canada would give me the best opening for one who is used to the routine of office work as a civil engineer, can also level and survey? Would it be best to try for a place in a town, or as a railway engineer? Would also be glad to be put in communication with anyone going out in a similar way.

EMIGRANT ENGINEER.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Jan. 15th, at 8 p.m.: Ordinary meeting. Adjourned discussion upon the paper by Mr. W. H. Preece, F.R.S., M. Inst. C.E., "On Electrical Conductors." Thursday, Jan. 17th, at 8 p.m.: Special meeting. Third lecture "On Heat in its Mechanical Applications," "The Steam Engine," by Mr. E. A. Cowper, M. Inst. C.E. Friday, Jan. 18th, at 7 p.m.: Students' meeting. "Elements of the Propagation of Disease," by Mr. T. S. Bright, Stud. Inst. C.E.

ROYAL METEOROLOGICAL SOCIETY.—Wednesday, Jan. 16th, at 7 p.m.: Annual general meeting of the Society, when the report of the Council will be read, the election of officers and Council for the ensuing year will take place, and the President will deliver his address.

CHEMICAL SOCIETY.—Thursday, Jan. 17th, at 8 p.m.: "On Camphoric Peroxide and Camphorate of Barium," by Mr. T. C. Kingzett. "On the Decomposition of Silver Fulminate by Hydrochloric Acid;" Supplementary note "On Liebig's Production of Fulminating Silver without the Use of Nitric Acid," by Mr. Edward Divers, M.D., and Mr. Mechitada Kawakita, M.E. "On Hyponitrites," by Mr. Edward Divers, M.D., and Mr. Tamemasa Haga.

THE PARKES MUSEUM.—Thursday, Jan. 17th, at 8 p.m.: Lecture by Mr. Pridgin Teale, of Leeds, "On Economy of Coal in Private Houses." The chair will be taken by Prof. G. M. Humphry, M.D., F.R.S.

THE ENGINEER.

JANUARY 11, 1884.

PUBLIC LANDS AND PUBLIC WORKS IN NEW SOUTH WALES.

WE have more than once called attention to the manner in which engineering contracts are conducted in the colonies, and we shall never hesitate to point out, when we deem it necessary, abuses which affect our countrymen abroad. In New South Wales just now there seems to be a restless and aggressive spirit which is showing itself in several ways to the detriment of the community. The management of affairs does not appear to be in good hands, or, if there be able managers, they are controlled and hindered by political influences of a mischievous kind. Patronage is not well bestowed, for it is to a large extent in the hands of those who use it to their own advantage; the number of public servants under such circumstances tends to increase, and is already out of all proportion to the population. It is not our present intention to discuss the influences by which the power of mismanagement has been gained, although we may on another occasion investigate the economical fallacies by which the less intelligent majority in the colony is at present beguiled. Where manhood suffrage rules the State, it is a favourite demagogic art to promise material advantages, high wages, and the like, to the electors as the results of a certain policy, while private gain and personal aggrandisement are the real ends in view. There are no fixed lines in which operations of this sort are carried on. In America, which is often held up as an example to be avoided, the most notorious cases have been in the municipalities, where the taxes have found their way with but little circumlocution into the pockets of the party leaders. In New South Wales at present misappropriation of public lands and the diversion of railways to benefit private persons appear to be the methods adopted; and they are worse than the simple abstraction of public money just referred to, because the latter is measurable, and is limited to the amount stolen, while the future life of the colony is bound up in its land, which has in many cases an enormous potential value; and a railway wrongly laid out and constructed is a permanent and almost irremediable injury. The land laws of the colony offer, unfortunately, great facilities for malpractice; and when under such adventitious circumstances, members of Parliament become, either themselves or by their relatives, land agents, while permanent officials appointed to safeguard the public interests become land speculators, the result is not doubtful. Of the millions of acres which a few years ago were still available, almost all the good plots are appropriated, and are in the hands of a very small number of people. The jobbery to which we have referred has taken place more or less in all the Australian colonies, and bodes ill for the future public peace of the inhabitants when the facts are realised. But it is not of agricultural land we would speak here, but of what more immediately interests our readers, the vast mineral territory, the coal and iron fields which are to make of New South Wales the future workshop of the Pacific. All the best of these lands is alienated at prices and on terms ridiculously inadequate and disastrous to the well-being of the State. But misappropriation of the land is only the beginning of the evil. Having acquired the land, it then becomes necessary so to lay out the railways as to favour these private estates; and the scandal becomes glaring when for this purpose lines which have been projected by capable engineers in a sensible manner, namely, to serve best the public traffic and to allow of easy construction, are diverted to routes of an exactly opposite character affording the minimum of convenience, costly to construct, and expensive to work. We quote the following from a recent number of the *Sydney Mail*:—"What public but an American ring-cursed public, or an apathetic Australian public, would permit a number of its representatives to become the owners at a peppercorn value of vast tracts of its richest coal-lands—lands worth in themselves to any company a hundred times, aye, a thousand times, the price paid to a supine public for them, and then, forsooth, also allow these men in their representative capacity to complete their already most excellent bargains by delusory railway projects having for their real aim the development, simply and mainly, of those very lands and of their owners' interests." Sydney and her Parliament are in these days of quick communication too near us to allow these scandals to remain unnoticed; and we are glad to see that public attention has already been called to them on the spot, and that some of the most flagrant cases have been arrested.

Much of the evil arises from the anomalous position of the technical staff in the colony. The railways are under Government control, and engineers as able and trustworthy as any in England are in the public service. There is an engineer-in-chief for railways with the considerable salary of £1800 per annum, under whom all trial surveys are made and all new lines constructed. It would be thought reasonable that, having such an engineer, he would have the authority of his office, and that, in the usual way, there would be from the lowest subordinate upwards a chain of responsibility devolving finally upon him. But there is another official, the Commissioner of Railways, with a salary of £1200 per annum, who controls the "existing lines," and who has under him an engineer at £1000 per annum. Directly a new line is finished, it is turned over to this gentleman, who at once proceeds to criticise and alter the work just passed by the engineer-in-chief. And as at present there is a feud between the two departments, the proceedings are as might be expected under such a system of an aggravating kind, and rather costly to the public. For instance, bridges and roofs which have been made in England, inspected and passed here by engineers of the highest eminence, duly accepted by the engineer-in-chief and paid for by the colony, are reported against by the minor official, and pronounced unsafe. Unfortunately, the desire of the protectionist party to manufacture everything in the colony has found expression not in effective legislation to this end, which would be perfectly legitimate, though perhaps economically unwise, but in a wretched jealousy of everything done in this country for the public service of the colony; and this feeling fits in well with the feud between the departments just referred to. To criticise adversely what has been imported seems just now to be popular and praiseworthy. So accordingly the engineer of existing lines, aided by subordinates who have for various reasons left the department of the engineer-in-chief, find it a congenial task to criticise and condemn what has been passed and accepted by the responsible authorities in the colony as well as in England.

Surely the better opinion in Australia will reject a policy so mean and ignoble. The public always suffers in such a case, as is evidenced by the wretched condition into which railway affairs have been allowed to fall in Victoria. There the evils arising from divided authority and corrupt management have become unendurable, and public resentment has at last found expression. Mr. Speight, one of the best railway men in this country, and till recently assistant general manager of the Midland Railway, has just left England to take up the position of Chief Commissioner of Railways—not, we hope, to occupy the anomalous position of the similar office in Sydney, but presumably, with full authority to put matters right. We shall watch his progress with much interest, and appreciate fully any success he may achieve amidst the political strife and jobbery with which he will have to struggle. Some such heroic remedy seems wanting in the colony of New South Wales. We wish not to be misunderstood. The day is past when the mother country would attempt or desire to dictate to the colonies, whose contentment, if not always their prosperity, is bound up in the self-government which has been so lavishly granted there. But the colonies are not yet independent of home opinion, for the strong reason that they seek development by means of British capital; and good credit is the very life-blood of the borrower. Even as we write new loans are being negotiated in London, and investors will be the less inclined to accept low interest if they think their money is to be misapplied. The land which would have afforded so rich and increasing a revenue is already alienated, and if the railways are also to be ill-arranged and made unremunerative, the income out of which the fundholders are to be paid will be still further diminished. We write in the public interest, and also in that of engineers, who, as members of an honourable profession, must neither be made the instruments of jobbery, nor subjected to insult if they do their duty.

BOARD OF TRADE RULES FOR THE STRENGTH OF MARINE BOILERS.

IT will be remembered that at the last session of the Institution of Naval Architects a paper was read by Mr. Milton, one of the members, on "The Influence of the Board of Trade Rules for boilers upon the Commercial Marine." In this paper it was stated that the Board of Trade Rules for Marine Boilers as then enforced, not only were not based upon sound principles, but that they were exceedingly oppressive in their action, compelling marine boilers in passenger steamers to be worked at pressures much lower than experience had proved to be abundantly safe, and thus preventing steamship owners from taking advantage of the greater economy of which higher pressures would admit; and it was further stated that the rules actually prohibited further improvements in marine engineering because the thickness of boiler plates they demanded for high pressures were altogether too great to admit of their being properly worked. It was stated in the paper that hundreds of vessels not engaged in trades requiring them to conform to the Board of Trade Rules, have been running safely for years with boilers worked at pressures far beyond those which the Board of Trade Rules would permit. The President of the Institution took the matter up very strongly, and the Council have been in correspondence with the Board with a view of having the Rules modified. One of the results of the pressure thus brought to bear upon the Board is seen in the issuing of a remarkable document of fifty-seven pages, foolscap size, containing the observations of Mr. T. W. Traill, the head of the Consultative Branch of the Marine Department of the Board of Trade, upon the Board of Trade Rules and Lloyd's Rules for boilers, and also upon the paper read by Mr. Milton. This document bears date the 27th June, 1883; but it appears from the printer's marks at the foot of the first page that it was not printed until November. Apparently the Board required the long interval between these dates in order to make up their minds as to the advisability of allowing the document to see the light of day; and after careful perusal of its contents, we think that they were very ill-advised not to have indefinitely delayed its issue, as its dissemination amongst practical engineers cannot fail to lower whatever prestige the Board's Rules for boilers have up to the present enjoyed. It appears to us that the gravest charge against the Board's Rules in Mr. Milton's paper is that the Rules insist upon a less pressure being carried in all cases than could safely be allowed, as proved by the fact that hundreds of vessels have been running for years with boilers worked at much higher pressures than would be allowed by the Board of Trade. Mr. Traill does not in this document attempt to controvert the fact that the boilers of these vessels carry high pressures, nor does he state that the result has been disastrous in any single case. As a matter of fact, boiler explosions and serious boiler accidents have been very rare at sea; and when they have occurred they have been due to want of care in the management of the boiler, and not to deficiency of strength of structure in relation to the ordinary working pressure. The omission of any reference to this point leads to the conclusion that the charge was well-grounded, and that the Rules as they now exist require to be very considerably modified. This is further shown most conclusively in the document itself. In Part I. Mr. Traill is at great pains to show that previously to 1872, when the Board first insisted upon their Rules being adhered to, the practice of the makers of marine boilers was to assume that the strength of double rivetted joints was equal to seven-tenths of that of the solid plates, however the joints were proportioned, while in some cases they actually possessed only three-fifths of the strength for which they were credited. The Board of Trade Rules, by pointing out the weakness of such joints, no doubt made engineers make their boilers stronger, but at the same time the Board did not allow them to be worked at pressures increased proportionately to their increased strength; yet presumably the original comparatively weak boilers possessed sufficient strength for their purpose, for it is not stated that they in any case proved themselves to be weak by bursting. It follows then that in these cases the Board's Rules, by the showing of their chief surveyor, required the improved boilers to be worked at pressures of only three-fifths of those for which they would have been safe. Since 1872, the stringency of the Rules has been slightly relaxed, but not nearly to so great an extent as indicated by the above figures.

The same fact is shown also in this document in the reference to the boilers of the s.s. Ban Righ. The boiler in question had worked satisfactorily for six years at a pressure of 60 lb. per square inch, and was then condemned by the Board of Trade as being unfit to carry that pressure any longer. It was burst by hydraulic pressure after it had been taken out of the vessel, and the experiment showed that its strength was then as great as it was when the boiler was new, for it tore through a rivetted seam which had not suffered at all by corrosion during the six years' work. Its six years of work showed that this boiler with an ultimate strength of about four times the working pressure was perfectly safe; and the experiment proved also that the Board's action in this matter put the owners of this vessel to much unnecessary expense by compelling them to renew the boilers, which not only were perfectly safe, but which were as strong when condemned as they were when they were originally passed by the Board's officials.

Although in this document the main point at issue has been lost sight of, yet the criticisms upon some of the details of the Board's Rules have been replied to, and comparisons have been made between these Rules and those of Lloyd's Register, and some curious remarks concerning the latter are made. It appears to us that the Board of Trade and Lloyd's, in framing rules for boilers, should have very different objects in view. The Board of Trade is a Government Department entrusted with certain functions for the purpose of seeing that due provision is made for safety of the vessels and their equipment. Their surveyors have, so far as the boilers are concerned, only to declare that they are safe for a certain working pressure, and that the requirements of a certain Act of Parliament in regard to the safety valves are carried out. The Board's Rules for boilers should, therefore, be such as would permit of the greatest load consistent with safety being carried by the boilers, for the period for which they are passed, this period being never more than twelve months; and Government officials are not called upon to take notice of points in the construction of the boilers, not at all affecting their strength or efficiency for such a limited time, but which might perhaps, rightly or wrongly, be considered to have some influence upon their ultimate durability—say, for instance, as to whether they should remain serviceable for eight or for twelve years. Lloyd's surveyors, on the other hand, not only have to certify that the vessels they class, together with the machinery, are in safe and efficient condition, but they class the vessels for much longer periods than twelve months; so that the question of ultimate durability is one which really concerns them. Further, although Lloyd's at present only give one class to machinery, merely certifying to its safety and efficiency, it would at any time be open to them to classify machinery in a similar way to that in which they class the hulls of vessels, taking cognisance of many other points than mere safety, such, for instance, as design and proportion influencing ultimate durability, economy of coal consumption, and accessibility of parts—all very important points from a shipowner's point of view, but points upon which a Government Department cannot posssibly have any excuse to meddle. The Board of Trade Rules for boilers, however, do contain very many instructions as to different pressures which are to be allowed upon boilers, according to the particular methods of constructing the circumferential seams of the shell. Lloyd's Rules make no difference in the pressure allowed to be carried by the boilers on account of these seams, as their influence upon the strength and safety of the boilers is *nil*. In the criticism on this point of Lloyd's Rule, Mr. Traill says: "The chief cause of the circumferential seams being entirely ignored in this rule, is that practically they are not subjected to a stress of any importance due to the steam pressure, but the utility of that knowledge is *nil* when we know from experience that cylindrical shells are frequently severely strained, and that long shells have cracked circumferentially owing to one or more portions being either hotter or colder than the adjacent parts. So much is this the case, that there are very few marine boilers not fitted with apparatus for promoting uniform temperature that do not leak at the bottom, and it is a fact that quite as many cylindrical boilers have cracked circumferentially as have fractured longitudinally. These circumferential strainings and crackings are not very dangerous, and do not cause explosions, but they involve detention, as well as considerable annoyance and expense to the shipowner in the form of repairs." We have here Mr. Traill's own statement that even fracture of a circumferential seam would not result in an explosion, and would not be very dangerous. Then, we ask, why do the Board Rules attach so much importance to these seams? and since "they are not subjected to a stress of any importance due to the steam pressure," why is the steam pressure made to depend so largely upon the way in which these seams are made? If any legislation is required to prevent these "circumferential strainings and crackings," it should take the form of a measure to prevent "one or more portions being either hotter or colder than the adjacent parts." Further comment on this point would be superfluous.

The explanation given in the document for the elaborate series of coefficients to be used in determining the pressure to be allowed upon furnaces, according as the holes in the longitudinal seams are drilled or punched, and as the seams themselves are lapped or butted, and single or double rivetted, is one which is worth repeating here. "The object in allowing a higher pressure for drilled furnaces than for those punched was to encourage manufacturers to do that which would check leakage, and by that means not only prolong the life of the boiler, but reduce the working expenses and the risks incurred. Furnace tubes are generally made of high-class plates, which, by reason of their ductility, are better suited to resist the unequal expansion and contraction due to the unequal temperature of the various parts of the tubes; but when holes are punched in them, such as the holes in the longitudinal seams, they harden the plate in their vicinity, or at least destroy its ductility and produce a strip of hard or unyielding plate from one end of the tube to the other, which in time cracks, usually from the holes to the caulking edge, and causes leakage, corrosion, and repairs which are troublesome and costly."

In the first place, we would remark that cracks in the seams of furnaces are by no means uncommon, but they are always produced by the action of the fire upon the laps of the plate in the circumferential seams, and as the longitudinal seams of the furnaces in marine boilers are invariably placed beneath the line of fire-bars, such cracks do not occur in them. We would like to know also if "a strip of hard or unyielding plate from one end of the tube to the other" is such a serious defect as to warrant a great reduction of the working pressure being made, why a joint made with double butt straps, involving a treble thickness of plate along the whole length, should not be considered to be very much more efficient than a welded joint; yet furnaces made with either of these joints are allowed to work with equal pressures. Further, if a tendency to leak is observed with any form of joint, it appears to us that the practical remedy is to stop the leakage, not to reduce the pressure.

THE ROYAL ENGINEERS AND INDIA.

AN unforeseen difficulty appears likely to trouble the authorities at the Horse Guards with reference to the demands made by the Indian Government for officers of the Royal Engineers. Of course the arbitrary rules of the service, if enforced, suffice to overcome this for the present; but it is very evident that, if that enforcement is long persisted in, it will end in making a distinguished regiment, instead of being, as it is at present, the coveted service of the scientific branch of the army, one of the most unpopular and least to be desired among our youthful aspirants for military employment. Hitherto, to receive a commission in the Royal Engineers as the reward of attainments of a specially high character, and only to be secured by the hardest workers and men of exceptional capacity and ability, has been considered to be equivalent to being on the high road to a distinguished position, if but rarely to high military command. Hence that desire to be enrolled upon its lists which has secured for its relatively few vacancies so many competitors; but it is not difficult to predict that unless some measures of relief are soon determined upon, the right of selection between the Artillery and Engineers will lead most of those successful at the Woolwich examination to choose the former arm of the service, instead of, as has almost invariably been the case hitherto, the latter.

Until very recently it was never known to be necessary to order engineer officers to India—the list of anxious volunteers at the Horse Guards was always full, and service in our Indian Empire was looked upon as a prize to be courted. There were all sorts of good appointments to be secured in that country by officers who proved themselves of calibre, and their services were eagerly sought for for the Public Works Department. But all this has changed. It was evidently unjust to the trained civil engineers sent out from Coopers' Hill, or otherwise secured, always to pass them over in favour of military men. There was some show of justice in such a course as long as students at Woolwich could be said to have possessed the monopoly of high scientific training, but when that ceased to be the case the mere prestige of belonging to the military service could no longer weigh. From the cessation of this practice may be said to date the commencement of the disinclination of officers of the Royal Engineers to serve in India. It is but just to them to say that it was not alone the pecuniary advantages which weighed with them in their desire for civil employ. Every engineer desires practice in his profession, and in the Public Works Department of India this desire could be fully gratified. But when work is confined, as it must be now, almost entirely to the routine duties of barrack and station charge, life in India becomes burdensome in the extreme. There is an entire want of interest in such duties, and the mind becomes weary for want of the intellectual employment which from long habit has become a necessity.

From the two causes above enumerated therefore has arisen that disinclination to Indian service among military engineers which has given rise to the difficulty now felt in meeting the demand made for them by the Indian government. Instead of hundreds of men anxious to go out, large sums are now offered by officers whose turn it may be to serve to effect an exchange; but even this inducement rarely succeeds in obtaining a substitute. Only recently we have heard of a requisition being received from the Viceroy's Government for twenty officers, and in order to fulfil it men have had to be placed under orders for early departure who have been scarcely any time back from foreign service. Thus some officers whose misfortune it has become to take their turn on the roster will have passed, according to present arrangements, no less than twelve out of fifteen years of service in tropical stations; and now that the prizes formerly attainable are closed to them, such conditions must soon end in depriving this eminent branch of the army of the attractions which have hitherto been so alluring, for few positions in the service could have been considered so lucrative or honourable as that of an engineer officer in the past. No blame whatever can be attached to the authorities for the individual causes of hardship to which the present difficulties have given rise. They have had no alternative but to act upon regulations; but it may well be suggested to them that if they desire still to secure for the Royal Engineers the services of the best men, these must be accorded privileges which, if not widely exceptional, still must exempt them from undue hardship. An engineer officer in India but rarely has those duties connected with subordinates which occupy and interest other officers. In many cases they have nothing to attend to but office routine and work possessing little or no attractions of a scientific character. Taken from them the opportunities for lucrative or interesting employment, their life in India becomes barren of all inducements to submit to it.

Of course we cannot recommend a recurrence to the practice we have often condemned of superseding civil engineers by military men. There may be some few offices in the scientific departments of the Indian public service which it may be desirable to fill by officers of military training, but these are so small in number as not to weigh in the general question. We understand that by recent arrangements the emoluments of engineer officers serving in India have been considerably reduced, even when they are confined to ordinary duty; and if we have been correctly informed on this point, the difficulty arising from the causes we have already pointed out will become enhanced. It is manifest, however, that something must be done if the Government considers that the importance of the duties of the Royal Engineers demands for that regiment the continuance as heretofore of the services of the best men obtainable. What course should be pursued we shall not now suggest. We can merely call attention to the position, for which it is imperative a remedy should be found. Life in India, when active service is rare and work of interest absent, has few attractions; and the pay of a military man no longer represents, in the changed conditions of Indian social life of late years, anything beyond a bare maintenance. We have even had under our notice lately the fact that no qualified officer of the Royal Engineers has been found willing to accept a civil appointment of £1200 a year now vacant in that country, and which seems to be literally going-a-begging. We heartily desire to see some course resolved upon which shall stay the growing unpopularity of one of our most distinguished services.

THE ELECTRIC LIGHT IN HOUSES.

THE purveyors of the electric light have found a difficulty where this was little expected. The British public displayed a good deal of enthusiasm over the electric light in exhibitions and elsewhere; but now that those who are prepared to supply the light as a substitute for gas are giving would-be consumers their estimates for supplying electricity and for fitting up houses with the necessary lamps, lamp holders, and wires, it is found that the cost of a domestic installation is beginning to damp enthusiasm, and to make people question whether they want it in their houses after all so very much. To say the least the grapes are getting sour. To the uninitiated it may seem strange, but it nevertheless appears to be the fact, that the "wiring" of a house worth, say, £150 per year, costs a very considerable sum; and when to this is added the cost of even unpretentious fittings, lamps, switches, cutouts, the cost is generally enough to make private householders think they will rub along with gas. The cost of wiring seems to be one of the most deterrent items. The price of current has been reduced to a figure which will make the lighting of a room cost little more than with gas; but though this is done, people stand aghast at what they are asked to pay to get the current to the lamps. In the days when the price of gas was 12s. per thousand cubic feet, as it was in 1825, and everyone was provided with oil lamps and ornamental candelabra, the same difficulty turned up, though, perhaps, it was more easily got over. The price of gas soon came down, and it was so much less trouble than the old illuminants, that the expense of gas fittings was not quite so great a bar. It has now for a good many years been customary to fit up new houses with gas pipes before the house is completed or during its construction; the charge being borne by the landlord just as it is for water pipes. For these the tenant has, of course, to pay rent, but to this he does not object as it is included as a part of the whole rent. Moreover, the householders in any district, such as that, for instance, to be lighted by the Victoria Central Station, are already provided with their gas fittings, many of which are of a costly character. These they do not care to put aside merely to adopt another, though a better, cleaner, and more healthy light. The mere wiring, as it has been thought and spoken of, costs a prohibitive sum; and electroliers and brackets of any pretence to tasteful design cost as much, or more, than the well designed ornamental gasalier. The question is often asked, why not utilise the best of the gas fittings of this kind? The answer by experienced electrical engineers is, "We have done it over and over again, and will not do it any more." However well this is done, it is a makeshift, and those who have had it done will not have the gas connections removed. The result has in almost all cases been electric light failure or trouble after a year or so, because of the makeshift character of the electric arrangements, and because the gas atmosphere and slight gas leakage have always ruined the wire coverings at places. If householders would have the fittings taken down and properly converted into electrical fittings, and would have the gas connections removed, something satisfactory could be effected; but even then the electrical engineer is not satisfied, because he considers that hardly any of the gas fittings, whatever their design, are appropriate to the electric light; and here again the electric companies are in a difficulty at present, for there are hardly any good designs of electric lighting fittings yet to be had. They feel that something special is required for the new light, and none are able to show exactly what. A few, very few, firms have made a speciality of pendants and brackets and so on; but most of them are charging a very high price, just as they are at present for the more artistic modern gas fittings. The appreciation of good design is more rapidly extending amongst purchasers and would-be purchasers than it is amongst the manufacturers, and hence a few people pay the high price which the few artistic manufacturers demand, while the many are waiting until the manufacturers generally recognise the fact that many of the best designs could be more cheaply carried out than the tawdry things they are still making at a comparatively small profit. There is a demand now for good appropriate, yet inexpensive, designs for electric light pendants and brackets. The difficulty of getting these is really felt. The main difficulty, however, is with respect to the wiring. Householders object to pay for wiring a house, and especially a house which is not their own. The landlord will not do it. It has been proposed that the electric lighting companies should do this and charge rental, but as against this it is urged that this would increase the cost of lighting for supplying a thing the equivalent of which is not supplied by the gas companies. The gas companies stop at the meter, and even for this they make a small charge. The difficulty would not be so great if the electric light consumer would be satisfied to have the whole of the light in from one to three places in a room, as is the gas light, which reduces the piping to a minimum; but he is not. As soon as he entertains the idea of using electricity, he wants the lights distributed so as to get the best possible effect, and the electrical engineer wants to do the same. The householder has also heard that electric lamps can be fixed up in cupboards, cellars, and in every corner of the house quite easily where he could not safely have gaslight, and hence he no sooner thinks of adopting the new light than he wants at least twice as many points of light as he has been accustomed to. There is a feeling that to supply all these lights nothing is required but a few wires. All want to have the wires quite out of sight, and it is this that runs up the cost. If the wires are run along cornices, and so on, the cost is less; but few are satisfied with these.

We have only touched upon the multitude of small difficulties, the weight of which is distressing the electric light people who are really doing commercial domestic lighting, but perhaps enough has been said to call attention to the fact that the difficulties are nevertheless real. Several things must be done. Consumers must be taught to be moderate in the extent to which they would go in lighting what has not hitherto been lighted at all by gas. A compromise must be struck as to the use of gas fittings, and as to the mode of wiring. Designers must be employed in devising suitable and not too costly fittings of all kinds. At present it is necessary to solder the wire connections, and those who have had most experience seem to be strongest in insisting upon the necessity. More ready means of connection than this must be devised. Some of the electricians urge that this costs a good deal, as compared with gas pipes in lengths at about 2d. per foot, with screwed ends and collars all ready, or which only need to be smothered with white lead to be tight. This may be easy, but surely electrical people are not long to go about complaining that a system of iron gas pipes can be put up in a house so much more readily and cheaply than a system of electrical wires. The "mere matters of detail" are, as usual, turning out to be *the* difficulties. They are, however, of the order of things which can be winked at by many, and we should like to see the several chief questions concerned fully discussed. This question of willing appears to have assumed unwarrantable proportions, and so far as regards new houses it should present no difficulties at all. Unfortunately up to the present electricians have always been the last to see how a trouble of this kind is to be got over. A few hours with a bell-hanger might prove useful to not a few of them. Soldering is not necessary, but electricians as a body do not seem to know how to make a good contact without it. Engineers will be happy to teach them.

MARINE INSURANCE.

THERE are several new methods of insurance of vessels proposed in the North of England, which may, when carried out, alter considerably the bearings of the question. It has been usual hitherto to insure vessels against all risks in a large number of clubs or societies, and thus the risk has been spread over a very large area. One of the proposals aims at decreasing the number of clubs by increasing the amount that they may insure upon each vessel; and the advocates of this claim that it will secure a more complete supervision of the vessel in case of average repairs. Another club is proposed to insure one type of vessel that is considered to be very safe. A third is about to lessen the area of the assurances, by declining to replace certain parts of the vessel's outfit that suffer more by wear and tear than by actual loss; and there are several other proposals which are to be decided upon at the annual meetings of the old clubs at the beginning of next month. But it is doubtful whether any of these will lessen the gross cost of the insurance of the vessel, its cargo, and outfit. It is found that over a period of years the total loss of vessels does not very materially change, and therefore the cost of that part of assurance cannot be much reduced. But there is a large outlay, and perhaps the largest, paid for the repairs of vessels that are not entirely lost. It is known that the cost of this is excessive. At present it is not to the interest of the owner of the vessel to keep down this cost; when his vessel is injured his interest lies in seeing that the repairs are as complete and as speedy as possible; and it is evident that as these repairs may take place in any part of the world, the supervision of the assurers must be limited to some extent. Some abuses have grown up, and what is now aimed at is to lessen these or to eradicate them as far as possible. But as they have been of slow growth and have to some extent become incorporated with the system, the work is found to be very difficult, and it is only after much experiment that the desired end can be attained. Meantime, the variation in the rates of premium or the calls that are paid is one of the most remarkable features in the case, and it is becoming clear that before any Government interference can take place, there is need for an inquiry that would enable a better judgment to be formed as to the cause of the fluctuations, and the conditions under which marine assurance can be most cheaply and efficiently effected.

RAILWAY RATES.

THE opinions held upon the railway freightage question by the ironmasters and hardware manufacturers of South Staffordshire and East Worcestershire have been expressed with no uncertain sound at a joint meeting in Wolverhampton of the Railway Rates Committee of the Wolverhampton Chamber of Commerce, and the Railway Rates Committee of the South Staffordshire Ironmasters' Association. It has been resolved to form an association embracing all the trades of the district, whose object shall be to report to the Railway Commissioners the many cases of hardship to which the companies' policy gives rise; to represent that the companies' interests would be best served by assisting rather than "crushing" the traders and manufacturers of the district; and also to aid individual traders in dealing with cases of unequal and excessive charges. An offer of co-operation from the Associated Operative Ironworkers has been accepted, and invitations have been sent for the co-operation of the Associations of Miners and Hardware Operatives. The preliminary meeting of the Association is to be held in Birmingham on the 17th inst., when representatives of divers trades are expected from most of the chief South Staffordshire towns. The joint secretaries are the secretary of the South Staffordshire Ironmasters' Association, and the secretary of the Wolverhampton Chamber of Commerce. A guarantee fund, which it is intended shall reach some £20,000 or more, was begun at the meeting with offers aggregating £600. It is high time that energetic action was taken in the matter, and we are fully persuaded that no loss would be inflicted on the railway companies whose prosperity is inextricably involved with that of the districts which they serve.

LITERATURE.

Kinematics: a Treatise on the Modification of Motion, as affected by the Forms and Modes of Connection of the Moving Parts of Machines. By CHARLES WILLIAM MACCORD, A.M., S.C.D. John Wiley and Sons, New York; Trübner and Co., London. 1883.

THIS is a very valuable book. Nothing has been published since Willis's "Principles of Mechanism" which is more likely to prove useful to those who have much to do with the design of gearing. In matter, method, and illustration it will be found alike excellent. It is to be regretted, however, that the author has selected a title which is calculated to mislead. Indeed, it is only by attaching a very elastic value to the word "Kinematics" that it can be made to apply to the book at all. Mr. MacCord is apparently aware of this, and he opens his preface by stating that "a word of explanation is due to the reader in view of the fact that the following pages relate to but a small number of the vast array of devices included in the broad term "mechanism." The book is really a treatise on gearing, and nothing else, for only incidental reference is made to link work. "The endeavour has been made," says our author, "to treat the theory of the subject in a practical manner for the benefit of the practical man. That is to say, the demonstrations are made as far as possible directly dependent upon the diagrams; and the latter, in most cases reduced from work actually executed upon a large scale, are accompanied by explanations which it is hoped will enable any ordinarily expert draughtsman to lay out the movements with ease and accuracy." He has been very successful in his endeavour to attain a praiseworthy object.

Questions connected with spur gearing are usually regarded under two different aspects. The "practical" man regards the production of a good spur wheel and pinion as a comparatively easy matter; and the result is that not one pair of wheels out of fifty is nearly perfect. Much of this imperfection is the result of ignorance. It is very nearly as easy to make a pattern right as wrong when the draughtsman and the pattern-maker know how. As a rule, however, they do not know how, and all parties are well satisfied if the wheels run without making a great deal of noise and without cutting each other to pieces in a short time; and here we would specially warn those who have to deal with gearing that a pair of ill-fitting wheels will never get better, in which respect they are unlike some other portions of machines. A bearing, for example, bad to begin with, may by degrees be got into good condition; but wheels never improve, they get worse the longer they act on each other. There is, perhaps, one partial exception to this—a worm wheel and screw. The screw will sometimes be found to cut a badly fitting wheel into adjustment; but nothing of this kind can possibly take place between two wheels. The teeth will polish each other, and so far improvement will take place, but no further. The second point of view is that of the mathematician. He knows that the problems which gearing present may for the most part be solved, and he can also tell, which is perhaps more important, which problems cannot be solved. We have heard it argued by men of some experience that it is impossible to make teeth work perfectly on each other—that is to say, that no mathematically exact solution applies to such a case, let us say, as that presented by a spur flywheel driving a pinion. This is quite untrue. There are improprieties as well as impossibilities in gearing, such as present themselves when we attempt to drive pinions with very few teeth; but these are quite exceptional, and not only is it true that a very excellent form can be imparted to the teeth of any given pair of wheels, but that more forms than one may be employed.

Mr. MacCord's object is to combine the two plans referred to into one, and to show how it is possible to apply the mathematical principles on which accuracy depends with practice. This has often been attempted before, but unfortunately the mathematician has too often made very simple matters appear repulsive. When the practical man, who wants information finds pages filled with formulæ and constant references to sines and tangents, he gives up in despair and goes back to the carpenter's compass as a solution of all his difficulties. Now, Mr. MacCord has happily avoided all this, and even the most complex problems, such as those connected with lobed wheel gearing, he has handled in such a way that it will be the engineer's own fault if he fails to understand what our author has to say. As an example of our author's style we quote the following passage:—"Although not coming strictly within the scope of this treatise, the practical ill effects of using wheels with incorrectly shaped teeth are so closely connected with the subject as to demand a brief notice. It is to be observed then that the noise and the vibration which often attend the action of toothed gearing, especially at high speeds, are not necessarily identical in origin. It is true that the causes which produce noise will also produce vibration: but vibration may be produced by other causes, and may at least be imagined to occur without noise. To explain: suppose two wheels of perfect form and finish to gear with each other, the power and the resistance being absolutely uniform; then, whatever the amount of backlash, there would be neither vibration nor noise. Now in practice this uniformity of power and resistance seldom or never exists, and the variations in speed cause the fronts, and often the backs, of the teeth to strike together at short intervals. These blows cause a rattling noise, which is worse the higher the speed, and is accompanied by vibrations due to the impact between the teeth. The sole cause of the noise evidently is the existence of backlash; but even were the teeth so perfect as to have no backlash at all, these irregularities in the power and the resistance would still give rise to vibrations, more or less injurious, according to the suddenness of the changes. They would, however, take place in quiet. But again, vibratory action may result from a totally different cause, namely, incorrect forms of the teeth. To illustrate this, imagine two engaging wheels whose teeth are, as before, of perfect finish, but not of proper contour; let the speed of the driver be absolutely uniform, and the resistance such as to keep the acting outlines always in contact, so that there is none of the rattling above mentioned. The average velocity ratio will be correct. If the driver has, for instance, 100 teeth and the follower 50, each revolution of the former will cause two revolutions of the latter; and further, one-hundredth of a revolution of the driver will cause one-fiftieth of a revolution of the follower. But during this fractional motion the velocity ratio is not constant, the follower being driven too rapidly during one part of the action, too slowly during the other part. Thus the action of each pair of teeth, though correct as a whole, is faulty in detail, being made up of two counterbalancing errors. The speed of the driver is uniform, but that of the follower is fluctuating; its motion consists of a series of pulsations, not necessarily audible at low speeds, though practically certain to become so at high ones. But even at moderate velocities this vibration acts injuriously upon the whole mechanism, and in many cases it is easy to see that the perfection of work done by the machine may be impaired by irregularity of its motion, no matter how slowly it runs."

Our author, in handling this part of his subject, has not given sufficient prominence to the question of "drop," which is quite distinct from backlash. If a pair of wheels are properly made and put to work, then there will be no interval, however small, during which the teeth are not in contact. If, on the other hand, the gear is imperfect, then one pair of teeth will go out of contact before another have come into contact, and the result is that the next tooth in order of precedence on the driver, will fall on the tooth to be driven with a blow more or less heavy. This is one of the commonest defects in gearing, and does much to make it noisy. Concerning another point of much importance our author is almost wholly silent, namely, the importance of keeping the pitch lines in their proper places. These lines should be in rolling contact, and neither cut each other, nor lie apart; but in practice it is difficult to find this rule complied with. We often see wheels pitched too deep in gear to begin with, because as wear takes place in the bearings they will get further apart. This is obviously bad practice, because it is just the thing to spoil the wheels at the outset. Again, the millwright who mounts the wheels is often sore bestead to find the pitch circle; in a large wheel a mistake of $\frac{1}{4}$in. in the radius is easily made. In all cases the pitch circle should be marked by the maker, either by punch dots or scoring.

In this book will be found a good many things not dealt with in any other treatise of the kind; we may refer specially to the section on pin gearing. It is not generally known that lantern pinions, such, for example, as are used in Dutch and American clocks, possess certain advantages over leaved pinions, and they can be produced so cheaply and accurately that they deserve the attention of all interested in gearing.

Finally, it will suffice to say that the book specially commends itself to those who have to do with such mechanism as that employed in spinning and weaving, because in it are fully described forms of gearing concerning which next to nothing has hitherto been written; such, for example, as dissimilar lobed wheels, derived from similar ellipses, and interchangeable logarithmic spiral multilobes. There is also in the book a good deal of useful, practical information on the preparation of cutters for wheel teeth. The volume is a large octavo, containing 335 pages, and 306 well executed engravings.

DEATH OF MR. FISKEN.

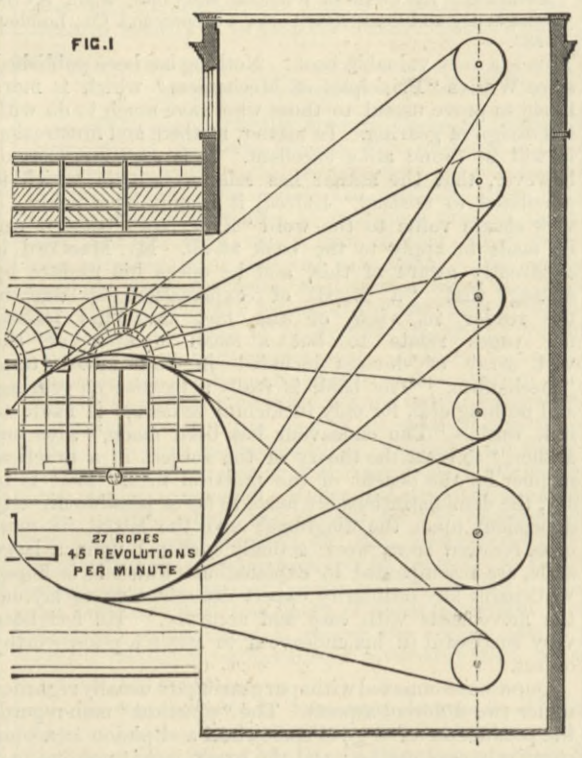
WE announce with much regret the death of the Rev. William Fisken, which took place very recently at Stamfordham. Mr. Fisken was more than seventy. He was a native of Perthshire; and alongside the study of theology, diligently pursued mechanics. In this latter science his brothers, Thomas and David—of whom Thomas is a survivor—were equally proficient. Mr. Fisken will be remembered by posterity, as he well deserves to be, and especially by agriculturists, as having been one of the two inventors of a steam plough, the other being his brother Thomas. Several years ago an important trial came off at Westminster upon the merits of the invention. The parties were Messrs. Fisken and Messrs. Fowler, Leeds, and the finding of the jury was that the Presbyterian minister at Stamfordham and the schoolmaster at Stockton-upon-Tees were the original discoverers. Mr. Fisken worked on the fly-rope system. An endless rope, running round the field or across it, according to circumstances, was put into motion direct by the fly-wheel of the engine, and this rope drove windlasses of an extremely ingenious type, by which the plough or other implement was put in motion. A great deal of excellent work was done on this system, especially with tackle made by Messrs. Barford and Perkins, of Peterborough, but for some reason the system never quite "took" with farmers, and we believe that very few sets of Fisken's tackle are now at work. Personally, Mr. Fisken was much liked. He was an extremely genial, shrewd north-countryman, and his absence from the showyards and trial grounds of the Royal Agricultural Society will be much missed by many old friends and acquaintances.

THE *South Wales Daily News* announces that the chairmanship of the Departmental Government Committee which is to investigate the question of the load-line for merchant ships has been accepted by Sir Edward Reed.

ROPE DRIVING GEAR.

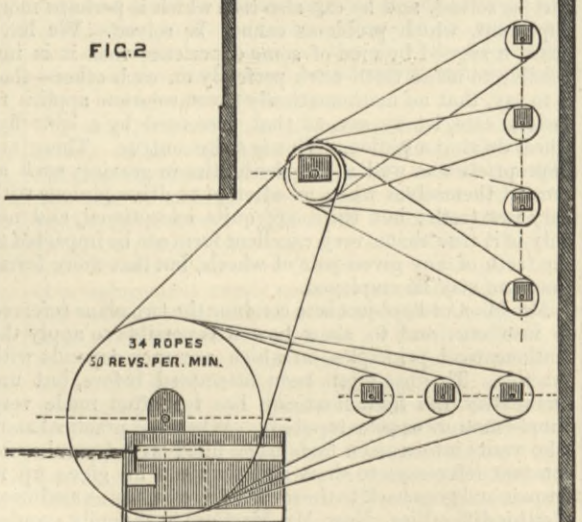
The special adaptability of rope gearing for the transmission of power where continuous high speeds are required has for many years past been fully appreciated in the large cotton mills of Lancashire, where a considerable proportion of the machinery is now driven by this means. There are, however, one or two important considerations connected with rope gearing upon which very largely depend its successful application, to which it will be of interest to draw attention. There has been a number of cases in which rope gearing has been tried and has failed, and it cannot be too emphatically asserted that as a first and most essential basis for its successful introduction, the mill in which this system is to be used should either possess ample facilities for enabling rope-driving to be carried out on right principles, or it should be specially laid out and designed for the transmission of power by this means. The first requisite is ample space for pulleys of sufficiently large diameter, with shafting so arranged that the power may be transmitted in direct line from pulley to pulley; that is, the ropes, whatever their number or however the power may be distributed, must run as nearly as possible in straight parallel lines off the drum or driving pulley on to the second motion pulleys on the line shaft. These are the primary requirements for success. There are of course numerous other details which contribute towards securing the best results, and it is to these we wish more particularly to refer. Where rope gearing has been a failure it is chiefly in old mills originally laid out to be driven by wheel gearing, but which has been replaced by the rope system of transmitting power under conditions so unfavourable that satisfactory results were impossible, and after a short trial a return to the old method has been the only alternative of such ill-devised experiments. These failures of the rope system in old mills, a few years back, had a tendency to create an unfavourable impression, but where it has been properly applied under suitable conditions, the inquiries we have made throughout the cotton districts surrounding Manchester show that the most satisfactory results have been obtained, and with the erection of new mills the system has been, and is rapidly extending. Wherever mills do not possess the proper facilities for applying rope gearing under right conditions, it may be stated at once that it is far better to adhere to the old system of wheel gearing. Various devices are sometimes introduced to overcome the difficulties connected with the introduction of rope driving into old mills; where the pulleys cannot be erected in line an intervening pulley is sometimes employed, but this causes an extra amount of friction on the rope which enormously increases the wear and tear; the ropes, in cases of absolute necessity, are allowed to divert from the straight line in transmitting the power from the drum pulley to the second motion pulley, but although they will do their work, this again is at a great sacrifice in the life of the rope. Another equally serious objection in some old mills is that the diameter of the pulleys has to be so curtailed for want of space that it is impossible to get the high travelling speed which is an essential to the success of rope driving, whilst the small diameter of the pulleys has further an injurious effect upon the wear and tear of the rope. In a paper on rope gearing, read before the Institution of Mechanical Engineers at Manchester in 1876, Mr. James Duril laid down certain facts as the result of the experience which, up to that time, had been gained on this subject:—"The velocity of the periphery of the grooved fly-wheel and pulley is always arranged," says Mr. Duril, "to be between 3000ft. and 6000ft. per minute." And he adds, "It is very essential that the right proportion between the diameter of the ropes and the pulleys should be obtained; if the diameter of the pulleys is too small, the rope, in continually bending over them, is apt to strain the strands and grind the core into dust, and on the size of the pulleys in great measure depends the life of the rope. As a general rule, the circumference of a pulley should not be less than thirty times that of the rope which works on it. In apportioning the distance between the driver and the driven shafts, great latitude may be allowed, but a distance of 20ft. to 60ft. may be taken as a fair space." These facts may be accepted with very little modification at the present time. We may, however, state with a little more precision, what is now considered to be the best travelling speed over the periphery of the driving pulley. The invariable answer to inquiries upon this point is that an average of 4500ft. per minute is the speed at which the best results can be obtained with rope driving; in some cases 4000ft. is found to give good results, whilst some ropes are run at as high as 5000ft. per minute, but these two figures repsesent the minimum and the maximum speeds at which rope gearing when laid down under proper conditions is driven. In dealing with other conditions of rope gearing, the construction, diameter, and strength of rope is of course a feature of special importance. When rope driving was first introduced those made of flax were mostly in vogue. In Lancashire, however, a preference has of late sprung up for those constructed of cotton; for inside work, this class of rope is said to give the best results, and in the mills of the above district cotton ropes are now generally in use. As to the diameter of the ropes, this varies according to the special methods adopted by different makers. As illustrations, we may take two of the representative makers of rope gearing plant in Lancashire. Messrs. Hick, Hargreaves, and Co., of Bolton, have adopted a uniform rope of 5in. circumference, whilst Messrs. Buckley and Taylor, of Oldham, have as their standard, ropes of 2in. diameter. There is, however, in all cases, a more than ample margin of safety. The power to be transmitted by the ropes is distributed in the case of the smaller diameter at an average of from 30 to 40-horse power per rope, and in the case of the larger diameter at from 40 to 50-horse power per rope. In the 2in. diameter of ropes the breaking strain may be estimated at about 10 tons, whilst the actual strain on the rope travelling at 4000ft. per minute, and transmitting 40-horse power, would be only equal to 330 lb. per rope, and a proportionate margin of safety would be secured with rope of smaller diameter. The right method of setting the ropes upon the pulleys is a matter with regard to which there appears to be some misapprehension, and this is especially the case in some of the mills abroad, where engineers appear to be under the impression that the best results are obtained where the ropes are fixed perfectly tight. Of course it is essential that underneath the pulleys the ropes should have a tight lead from one to the other, but over the tops of the pulleys there should be sufficient looseness in the ropes to allow of a fairly good sag between the two pulleys, so that the ropes have a slight lap over the top rim. As regards the comparative cost of rope and other systems of gearing, and the average life of a rope, these are matters on which it is difficult to get any actually precise data. As compared with leather belting, it may, however, be stated, as some indication of the great difference as regards the first outlay in this system and that of rope gearing, that in two mills laid out on exactly the same lines, where it had cost in the one about £1200 to put on the leather belting, the cost of the ropes on the other did not exceed £150. As to the life of a rope, this is also a question upon which it is difficult to obtain precise information, but it is roughly estimated that with proper usage this should not be less than about seven years; whilst as regards the actual breakage of ropes, this would appear to be extremely small. We have met with very few instances of the sudden collapse of a rope, and the risk of these is reduced to a minimum by the fact that any defects in a rope, arising either from wear or other causes, will show themselves long before the point of danger is reached. The proper construction of the pulleys is another essential feature in the success of rope driving gear. The necessity of a sufficient diameter we have already alluded to, and we may add that the conclusions arrived at by Mr. Duril on this point are those accepted by the leading makers of to-day. No pulley should have a less diameter than 30 to 1 with that of the rope, whilst for the large or driver pulley this may be increased according to the results wished to be obtained, some of these pulleys having a diameter of as much as 35ft. Where sufficient diameter of pulley is not obtained two serious disadvantages are the result—increased wear and tear on the ropes, and a travelling speed below that which is the most effective for this system of gearing. The form of groove on the pulley is a matter upon which various opinions appear to be held. Some

FIG. 1



are of the V, others of the U-shape, with modificatioms between these two forms; but this point is of so much importance that one firm has spent many hundreds of pounds in perfecting the special system they have adopted. The general practice, however, is to give a sufficiently deep groove that the edges project considerably above the top of the rope. The invariable arrangement of the grooves is in parallel lines round the face of the pulley, about 2in. apart, according to the number of ropes that have to be driven, and frequently a pulley will carry on its face as many as forty separate grooves. With regard to the distance between the first and second motion pulleys, although it cannot be said that there is any particular rule so long as the rope will lead properly and carry its own weight, it is important that the pulleys should not be too close together. Between the two pulleys there should not be a less distance than 30ft., but sometimes the ropes travel a distance from pulley to pulley of 100ft. We have heard some objections raised with regard to rope driving—that it is impossible to get all the ropes to travel at one speed, and that they are constantly liable to twist. That this is so, it is pointed out, may be readily ascertained by drawing a white mark across the ropes when they are stationary, and afterwards

FIG. 2



observing the different positions of these white marks when the ropes have been put in motion. So far as the travelling speed is concerned, it would be an extremely difficult matter to secure exact uniformity in any set of ropes, as however carefully they might be made, exact uniformity of length would be impossible, but slight variations of speed are of little consequence. Where, however, the difference of travelling speed becomes serious, it may invariably be traced to some defect in the system, and in all probability will be due to some irregularity in the turning of the pulley, which, however slight, would necessarily be a continuing error. As to the twisting of the ropes, this would probably be produced by the same cause, or where they had not a perfectly straight run from pulley to pulley. To sum up the special features of rope driving, where they are applicable, and where they are not, it may be stated that this system of transmitting power is altogether unfitted for driving heavy machine tools where variations of speed are required, and consequently, except for special purposes, it has not been largely adopted in the shops of engineers. Where it can be best applied is in main driving for mills and such works, where constant and regular high speeds are necessary, and to these it is chiefly applied at present. One great advantage in rope driving is the absence of noise and the special facilities it affords for the distribution of power as required. Of course, as already stated, the system gives the best results when the ropes can be led in perfectly straight lines from pulley to pulley, however they may be split up on the line shafts, but there is certainly more margin for deviation. Where this is an absolute necessity it can be obtained with driving by belts, and this may be allowed as another point in the favour of ropes. Cost is also an important item, and in first outlay this may be set down as about one-fourth, as compared with belting. The safety of rope driving is another point which is secured by the large margin obtained in the strength of the ropes, whilst in the case of the failure of the rope the readiness and comparatively small cost with which it can be replaced without any serious interruption of work is an advantage which users of power can appreciate.

Having given generally the main features of rope driving a few practical illustrations of the system, both as regards the construction of rope driving plant and its application on a large scale will be of interest. In making our inquiries we visited several large works in Lancashire where special plant has been put down for manufacturing all descriptions of rope driving gear. Messrs. Hick, Hargreaves, and Co., of Bolton, have fitted up mills with rope driving for transmitting greater power than probably any other firm in the world. Recently we noticed an exceptionally powerful pair of engines they had completed for a cotton mill in India. These engines are of 4000-horse power, and the whole of this power is transmitted by ropes on a fly-wheel 30ft. diameter and 140 tons in weight. The power is transmitted by sixty ropes passing over one fly-wheel, which is 15ft. wide across the face, the ropes in this instance carrying more than is the average weight per rope in this country. This is probably the largest example of rope driving that has yet been applied, but when we visited Messrs. Hick, Hargreaves and Co.'s works, they had in hand plant of a similar kind representing a total of nearly 20,000-horse power, the whole of which was to be transmitted by ropes, and this will serve to illustrate the extent to which rope driving is being introduced. For power, various types of engines are used, but the pulleys are all made on the system of groove which after careful and costly experiments has been specially introduced, and the firm have pits in which they can turn simultaneously four pulleys of 35ft. diameter. Several very ingenious processes for the building up and turning of these wheels have been adopted, but into these we have not space to enter, and we will simply add two illustrations of rope gearing laid down by the above firm in modern mills as fairly representative of the most approved methods of applying this system for the transmission of power. In these illustrations the gable end of each mill is shown, but excepting the main fly-wheels, no other portions of the engine is indicated. Fig. 1 represents the arrangement of rope-gearing at Messrs. Illingworth Bros. mills, Bradford. The engine put down in this mill, which has been fully described and illustrated in The Engineer, indicate 1000-horse power. The fly-wheel, which is 30ft. diameter, is built up on an improved plan, is grooved for twenty-seven ropes, and is driven at 45 revolutions per minute, the power being distributed to the various line shafts as shown in the illustration. Fig 2 shows the arrangement of rope driving now being put down in a new mill which is being erected in the immediate district. In this case, the pulley is 32ft. diameter with thirty-four grooves, transmitting 1300-horse power at 50 revolutions per minute to the various line shafts as shown. We may add, that Messrs. Hick, Hargreaves, and Co., are introducing improvements in their rope-driving plant, by constructing the pulleys of steel for extra high speed, but these are not as yet in use, and we may have to refer to them hereafter. In the important cotton district of Oldham, Messrs. Buckley and Taylor are the leading makers of rope-driving plant. The average horse power in the Oldham mills does not exceed 1000 to 1200, and this is generally transmitted by about thirty ropes. The above firm have an illustration of their rope driving plant at the Oldham Exhibition, where a pair of engines of 60-horse power with eight ropes running with a fly-wheel 14ft. diameter, at 70 revolutions per minute, drive the cotton and other machinery shown in the Exhibition. Messrs. Wright, Turner, and Co. of Pendleton, near Manchester, are also makers of rope driving plant, and their experience is that 4500ft. to 5000ft. per minute is the most effective speed. The grooves they adopt are of the V-shape. When visiting this works we saw a toothed wheel running at the exceptional speed of 2700ft. per minute, but this is a high speed for wheel gearing which can scarcely be maintained with safety, and it is being replaced by rope gearing. The transmission of power by ropes will be through a fly-wheel 25ft. diameter with eight grooves, and to a second motion pulley 8ft. diameter, the engines running at 70 revolutions per minute, and the eight ropes transmitting about 400-horse power.

Apart from mill driving, rope gearing, as we have already said, has not yet been very largely employed. For wood-cutting tools and also for nut and bolt works it is being introduced. In engineering works it is also used for driving high speed foundry and other heavy cranes. Messrs. W. and J. Galloway and Sons, of Manchester, have used ropes at their branch works for driving the cranes lifting the boilers for a considerable time past, and at their Knott Mill Works the cranes lifting 20 tons are driven by ropes. Hemp and manilla ropes were at first employed, but recently cotton ropes have been introduced with very satisfactory results. Endless ⅞in. ropes are used, and these run at a high speed over grooved pulleys transmitting the power a distance of about 100 yards. Messrs. W. Hulse and Co., of Manchester, are also introducing rope driving for certain purposes in the new works they are laying out, and although, as we stated, rope gearing is not adapted for driving where varying speeds are required, there are many purposes to which it might, with advantage, be applied both as an economical means of transmitting power and as adapting itself for this purpose under exceptional circumstances more readily than under other systems would be possible.

The Wirral and Birkenhead Agricultural Society.—The next meeting of this Society will be held in the permanent show-yard on Wednesday, Thursday, and Friday, the 18th, 19th, and 20th of June.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Charles Francis Hulford, chief engineer, to the Pembroke, additional, for service in the Ready; Francis C. Alton, Chief Inspector of Machinery, to the Asia, additional, vice Ellis; Richard Irwin, chief engineer, to the Myrmidon; Henry J. J. G. Moon, engineer, to the Duncan, for service in the Wildfire, vice Davis; Robert W. Edwards, engineer, to the Indus, for service in the Albacore, vice Robins; Thomas Williams, engineer to the Indus, additional, vice Burner; George S. Cornish, engineer, to the Indus, additional, vice Williams; Edward Q. H. Denison, assistant engineer, to the Myrmidon.

THE STEEL FOR THE MONONGAHELA BRIDGE, PITTSBURGH, PA.*

EVERY heat of steel was tested and its quality determined before any more work was done to it. For the compression members and pins the steel was required to stand the following tests on specimen bars ⅝in. diameter:—Elastic limit, 50,000 to 55,000 lb. per square inch; ultimate strength, 80,000 to 90,000 lb. per square inch; elongation in 8in., minimum, 12 per cent.; reduction of area at fracture, minimum, 20 per cent.; cold bending, 180 degrees around its own diameter without crack; cold punching of holes in flat 3in. by ⅝in. bars, $\frac{7}{16}$in. from the edge without crack or distension of metal. All specimens and shapes were required to be finished at nearly the same heat, as it was observed that rods finished at a lower heat would give higher tension results than samples of same steel finished at a higher heat. The Andrew Kloman firm, in Pittsburgh, had contracted to procure the steel and to furnish the steel shapes. The intention was to use Bessemer steel for the compression members; a large lot of Bessemer steel was tested, but few samples were found to stand the desired tests. The difficulty seemed to consist in controlling the uniformity of the steel within close limits for quality and strength. After a while the attempt was given up and open-hearth steel was substituted. No trouble was then experienced in getting a uniform grade of steel of prescribed quality. The top chord sections consist of four leaves, which were originally designed to be each a 20in. steel plate with 4in. by 4in. angles for flanges. In ordering the steel, it was discovered that enough plates of that width could not be procured in the required time. Therefore, the chord sections were changed to 10in. and 12in. steel plates, with 4in. by 4in. angles.

Notwithstanding the great care used, the finished plates and angles were by no means a uniform product. Accordingly as they in rolling were finished at a higher or lower heat, they would have different degrees of hardness. Steel plates and angles finished at a lower heat had a smooth surface, and the noise of punching them resembled pistol shots, while plates finished at a higher heat had a rougher surface, and there was hardly more resistance to punching than in wrought iron. The specification for rivetted steel work provided that the punched rivet holes, ⅞in. diameter, should in the assembled parts be enlarged to 1in. diameter by reaming. The time for the delivery of the steel work growing short, the question was considered whether the reaming of the holes could be avoided to hasten the completion of the work at the shops. Messrs. Kellogg and Maurice, of Athens, Pa., had the contract for this part of the work.

To that end the following experiments were made:—Ten specimens were cut from the same steel plate ½in. thick; one specimen was tested to ascertain the tensile strength of the steel specimen. The nine other specimens, all alike in form, were prepared for the purpose of ascertaining the effect of punching holes, of punching and reaming, and of drilling. The tests were expected to show the amount of reaming required, and whether any annealing effects from the hot rivet on the injured steel around the punched hole could be observed. The conclusion from the tests was that the injured steel—of the quality used in this instance—around the punched hole was in part restored by annealing in contact with the hot rivet, the size of which was large in proportion with thickness of steel plates and angles as used in the chords. The reaming of the punched holes to a greater extent than to make the rivet holes smooth and straight was therefore dispensed with, and a reduction in the price for the finished work agreed upon. The steel pins are 6in., 5½in., 4in., and 3⅜in. in diameter. The same quality of steel as for the compression members was used for them; they were forged from solid steel billets and turned to size. No appreciable difference in the hardness of the metal in the pins was observed. For tension members and rivets the steel was required to stand the following tests on specimen bars ⅝in. in diameter:—Elastic limit, 45,000 to 50,000 lb. per square inch; ultimate strength, 70,000 to 80,000 lb. per square inch; elongation in 8in.; minimum, 18 per cent.; reduction of area at fracture, minimum, 30 per cent.; cold bending, to a loop 360 degrees around its own diameter without crack; cold punching in 3in. by ⅝in. bars, of 1in. rivet holes, ⅝in. from the edge without crack or distension of metal. Open-hearth steel of the above and uniform quality was obtained without trouble.

The eye bars were made by the Kloman process—that is, the bars were rolled from billets between reversible and adjustable rolls in such a manner as to leave the ends thicker than the bar. The ends were then spread and forged to the proper shape of the eye under a steam hammer. The heaviest steel bars for this bridge were 28ft. 6¼in. long centre to centre of eyes, and 1$\frac{11}{16}$in. thick. All steel billets and all steel bars required very close inspection for flaws, the detection of which was sometimes difficult. It has been stated that for the detection of flaws in steel or iron, a magnetic needle had been used with success, though the manner of its use the writer has not heard stated. A device for the certain discovery of flaws in steel bars is certainly needed. Where the solid metal sections are proportioned very economically to the work they have to do, flaws are a source of great danger, especially in attenuated steel structures. Flaws in wrought iron are more likely to happen in the direction of the fibre, but in steel they can as well happen crosswise to the direction of the tension strain as any other way. Three steel bars 9ft. long between centres of eyes, and 4in. by 1$\frac{1}{16}$in. in section were tested to ascertain the effect, if any, of annealing the finished bars. The results were as follows:—

	Bar A. Annealed.		Bar B. Not annealed.		Bar C. Not annealed.	
	Eye.	Eye.	Eye.	Eye.	Eye.	Eye.
Diameter of eye in inches	9	9	9¼	9¼	10	9
Least cross section of eye in square inches	5·72	5·82	5·83	5·72	6·83	5·77
Excess of metal in eye over bar, per cent.	29·4	31·7	38·1	25·5	57·7	33·2
Reduction of area in eye at pin-hole, per cent.	7·9	3·6	3	3·2	3	3
Elongation of pin-hole in inches	0·4	0·72	0·45	0·44	0·38	0·4
Average section of bar in square inches	4·42		4·22		4·33	
Average reduced area after test in square inches	3·96		3·97		3·89	
Reduction in per cents.	10		5·1		10	
Reduction at fracture, per cent.	43·87		37·5		37·55	
Elongation of whole bar, per cent.	10·5		10·3		11·1	
Elongation for 12in. near fracture, per cent.	24·6		23·2		22·1	
Elastic limit per square inch	43,140 lb.		45,360 lb.		40,940 lb.	
Ultimate strength	74,310 lb.		78,180 lb.		73,760 lb.	

All pin holes were 3$\frac{1}{32}$in. diameter. Pin hole in one eye of bar C was bored ⅛in. out of centre line of bar, and accounts for its lower ultimate and elastic limit. A specimen from the same heat of steel, of which the above bars were made, showed on a ⅝in. round: Elastic limit, 46,389 lb. per square inch; ultimate limit, 78,898 lb. per square inch; elongation in 8in., 18 per cent.; reduction, 30·2 per cent. The net section of the heads through the pin holes for all eye bars being at least 50 per cent. more than the bars, and the good effects from annealing being doubtful in the above tests, it was not thought necessary to anneal the steel bars. For steel rivets the above quality of tension steel proved very suitable. The rivets were tough and tenacious. It was, however, observed that the manufactured rivet heads would easily break off with few blows, the fracture in each instance showing a fine granulated appearance. Rivet heads, however, made by hand or rivetting machine were very tough, and could not be broken off, they had to be cut off. The cause for the brittle rivet heads was supposed to be the upsetting by blows in forming the head at a high heat in dies, producing sharp corners under the rivet head and around the rivet stem.

* From a paper by G. Lindenthal, read at the annual meeting of the American Society of Civil Engineers.

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

(*From our own Correspondent.*)

THIS week the quarterly meetings have been held, but they have not resulted in much business. In Wolverhampton yesterday—Wednesday—there was a good gathering of the trade. The Lilleshall Iron Company, Shropshire, early announced that their quotations would remain without alteration at 62s. 6d. for hot blast all-mine pigs, and 82s. 6d. for cold blast ditto. This example was quickly followed by the Staffordshire all-mine pig makers, who re-declared their quotations as 62s. 6d. to 60s. for hot blast sorts. Yet at these low prices very few sales were made. It is eloquent of the quiet state of the all-mine business that the Tame Iron Company, Bilston, has just blown out the one furnace which it has for some time kept on for this class of pig, and having sold off its unused stocks of materials, has permanently retired from the manufacture. In common with most other all-mine makers, it has now heavy stocks on hand.

The Barborough Field Company, of Bilston, finding that it is the middle and common class of pigs which are selling most, has just blown in an additional furnace, to be devoted exclusively to the making of medium quality iron. Messrs. T. and I. Bradley and Sons are pressing forward the relining of their second furnace at Darlaston Green. In a few weeks they hope to have it in actual work on part-mine pigs.

Native part-mine pigs are quoted at 50s. to 45s., and common sorts, in actual business, at 40s. down to, in a few cases, even 37s. 6d., vendors of Derbyshire, Lincolnshire, Northampton, and other foreign brands held off the market, being unprepared to sacrifice their iron for the money which buyers were alone willing to give. There were some Northamptons that changed hands at 43s., but best sorts were firm at 45s. Consumers of Derbyshires offered to place orders at 42s. and upwards, but without success, since vendors would rarely accept less than 46s. One maker indeed firmly refused anything under 46s. 3d., declaring that he was sold forward for three months, and that in the present state of the market he cared for no more business.

Hematites changed hands in encouraging lots here and there, and there were one or two agents who affirmed that they were making good sales. Barrow grey forge hematites were quoted 60s., and this figure was also the quotation for the Tredegar brand. As to both, however, orders might have been placed at 59s. by old buyers.

Finished iron yesterday—Wednesday—was declared unchanged upon the quarter on the basis of for best makes, £8 2s. 6d. for the bars of the Earl of Dudley, and £7 10s. for the bars of the other "list" houses.

Sheets and plates made by the marked bar houses who produce them, stand nominally at 30s. per ton in advance of the bar prices. In reality, however, they are to be had at about 20s. per ton advance upon bars, boiler plates and sheets being abundant on Wednesday at £8 10s. For superior plates £9 and occasionally £9 10s. was demanded.

Orders for sheets for the galvanisers, and for ordinary merchant purposes, were by no means plentiful at prices which makers were prepared to accept. Specifications, too, in execution of old orders, were still difficult to get in. The same remarks will apply, in some degree, to merchant sections of iron, such as bars, hoops, &c. At several of the works only a poor start has been made since the holidays. At some places scarcely anything has been done, whilst at others the mills and forges have only very partially resumed.

Galvanised sheets were £7 5s. for singles at works, £8 to £8 5s. upwards for doubles delivered at outports, and £9 to £9 5s. for trebles. The galvanisers themselves quoted £13 to £13 10s. for 22 gauge in bundles delivered in London or Liverpool, and were unanimous in the experience that trade was quiet. Good working up sheets were easy at £10 to £11 for singles and stamping sheets—doubles—£13. Makers of these last descriptions still have lots of orders.

Excellent bars were pressed upon the market at £7. Equally plentiful were second-class qualities at £6 15s. to £6 10s.; common bars were £6 5s. to £6. Hoops were £6 7s. 6d. to £6 10s. for shipment, and £6 15s. to £7 for superior qualities for home consumption. Gas strip was unchanged on the week at £6 2s. 6d., £6 5s., and £6 7s. 6d.

Tin-plate makers from East Worcestershire again reported a steady demand mainly on continental, colonial, and other shipping account. They quoted 18s. to 19s. per box for cokes and 21s. to 22s. for charcoals.

At the quarterly meeting in Birmingham this afternoon the declarations made in Wolverhampton yesterday as regards crucial quotations were confirmed. There was a large meeting, but the business results were unsatisfactory alike as to orders booked and the prices realised. The galvanised sheet-makers held their quarterly meeting, and it was reported that there was a considerable amount of business offering, but at low prices. No new rates were fixed. The wrought iron tube makers held their quarterly meeting, and it was reported that the demand was very quiet. It was decided to make no alteration in present discounts. The Welsh tin-plate makers held their quarterly meeting, and it was agreed that the large decrease in stocks was a favourable augury. On open 'Change Welsh cokes sold at 15s. 3d. per box—a drop on the quarter of 9d.—and charcoal at 18s. to 19s.

Coal of all sorts was quite abundant, so that contracts could be placed at very low figures. One or two at least of the Cannock Chase collieries have just officially reduced manufacturing coal 1s. per ton, bringing forge sorts down to 5s. 6d. and 6s. at the pits, long weight. Cannock Chase steam coal was to-day—Wednesday—quoted at 5s. to 5s. 6d. per ton, short weight, on railway trucks. The list prices for house coal were given as:—Deep seams, 11s. best, 10s. best one way, 9s. cobbles; shallow seams, 10s. best, 9s. best one way, 8s. cobbles. But in actual business there was a negotiable margin on these "list" rates of at least 1s. per ton. South Staffordshire forge coal was 6s. to 7s. per ton; mill coal, 7s. to 8s.; and furnace, 9s. to 10s. In one or two exceptional instances 11s. was being got.

In giving the customary notice on Wednesday in Wolverhampton to the mine owners of South Staffordshire that they would shortly be required to send in their returns of acreage occupied and tonnage of minerals raised for the half-year ending December 31st, 1883, the chairman of the Commission, Mr. Walter Williams, complained of the omission of statutory declaration, and suggested that in such cases where the Assessment Committee had hitherto met the difficulty by doubling the assessments they should in future treble them. He congratulated the Commission upon the success of the new Stow Heath engine, and upon the progress of levels, whose completion would permit a concentration of water at certain points, upon which it would no longer be necessary, as now, to keep several engines at blast. Referring to labour disputes in the district, the chairman said he was sorry to find the opinion held among the men that trade was better. Unfortunately, the returns of the Commission were getting less and less every year.

The best mails of the week have been from Buenos Ayres, Monte Video, and Rio Janeiro. India, too, is buying fairly well; Australia is steady, and the Cape is showing a little enterprise in respect of up-country requisites to meet the needs of the goldfield miners.

In the engineering and constructive ironwork departments there are several good contracts on hand, which will afford work for, in some instances, several months to come. The agricultural implement and machinery manufacturers also are steadily employed, whilst fencing wire and hurdles continue to be ordered in good lines, chiefly for the Australian colonies. Among current constructive work is the erection of a new gas-holder and tank, and also two new purifiers at Bilston for the Bilston Gaslight and Coke Company, who, during last year, sold more gas than in the year previous by five million cubic feet.

The galvanisers are seeking new orders in the roofing branch, and, but for the requirements of the agriculturists in barn work, the braziery department would be flatter.

The somewhat unusual order now upon the market for wrought iron casks and drums to an extent sufficient to meet the requirements of the Admiralty for five years to come will not yield much profit, so keen is the competition for the contract.

Manufacturers of wrought iron tubes describe business as quiet. Cut nails are in better demand for home. Iron safe and strong room firms keep active. One firm has in hand an export order of considerable magnitude.

An order for 7000 whistles for the Metropolitan Police Force, in substitution of the old and clumsy rattles, has just been given to Messrs. J. Hudson and Co., military, naval, and police ornament makers, of Birmingham.

The promoters of the scheme for supplying compressed air as a source of motive power in Birmingham have had the small lecture theatre placed at their disposal during the annual three days *conversazione* next week of the Birmingham and Midland Institute. Outside the Institute there will be a steam engine with compressed air. The compressed air will be conveyed into the theatre by an iron pipe, where it will be employed to drive machinery of an interesting character. The hydro-electric machine of Sir William Armstrong will be shown at next week's *conversazione* by Mr. E. B. Marten, C.E. The machine is a strong steam boiler on glass legs. Steam at high pressure from the boiler escapes through a number of peculiarly formed wooden jets, and, owing to the friction of the partially condensed steam against the wood, electrical effects are obtained, the boiler giving powerful sparks when the knuckle is presented to it.

The Institute of Mechanical Engineers will send to the *conversazione* their photographs and diagrams illustrating the inventions of James Watt. The photographs are those of models and machines in the famous "garret" at Heathfield Hall, now the residence of Mr. George Tangye, and are of intense interest. The powerful electro-magnet of the Institute will be used by Mr. Wm. Russell to show the curious effect of a powerful magnetic field upon copper and silver when moved in the field.

An extremely simple form of pneumatic machines for the despatch of messages through short distances will be shown by Mr. Edward Rivers, of Bristol, and Mr. A. H. Hirons proposes to illustrate to the members the interesting phenomenon of "flashing" as shown by gold when cooling from the melted state. Dr. Bjerknes' apparatus for illustrating attraction and repulsion produced by diaphragms in rapid vibration will also be exhibited.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The year has opened with anything but a cheerful tone in either the iron or the coal trades of this district. In the iron market the feeling is somewhat despondent, and an unsatisfactory feature is the fact that, although prices for outside brands of pig iron, such as Scotch and Middlesbrough, have now got down to a point at which consumers, who have hitherto been going on from hand to mouth, have professedly been open to buy largely, they are apparently not yet satisfied that the lowest possible basis has been reached, and orders are still held back. In the engineering trades there is also a tendency to slacken off. Some branches, such as special tool making, are kept busy, and locomotive builders have still a large weight of work in hand, but in the general branches of the engineering trade the weight of new orders coming forward is decreasing, and, as a rule, engineering firms commence the year with considerably fewer orders ahead than was the case this time last year. The rapidly lessening activity in the shipbuilding trade is, no doubt, having a considerable effect, and for marine engineering work and heavy tools connected with shipbuilding yards there are comparatively few orders being given out. The cotton machine making trade, which, with the exception of one or two of the very large firms, has been only indifferent for some time past, is also being adversely affected by the present unsatisfactory condition of the cotton trade in Lancashire, and many of the makers are very poorly supplied with work. In the coal trade the year opens with only a very moderate demand, and a weakening tendency in prices.

The Manchester iron market on Tuesday was tolerably well attended, but the weight of actual business doing was extremely small. Local and district makers of pig iron are, as a rule, nominally holding to late rates, Lancashire being quoted at 45s. and Lincolnshire at 44s. 10d. to 45s. 10d. less 2½ for forge and foundry qualities delivered equal to Manchester, but at these figures they were doing no business, as they were altogether undersold, old lots of Lincolnshire forge being offered at under 43s., whilst other brands in some cases could be bought at quite 2s. per ton under the price asked for local iron. Middlesbrough iron is now being pushed in this market at very low figures, and g.m.b.'s can be bought readily at 44s. 4d. net cash delivered equal to Manchester, with sellers in some cases open to take 1s. under this figure. Sellers are also open to take orders for long forward delivery at the minimum prices, but buyers are very chary about giving out orders.

In the finished iron trade prices are nominally unchanged pending the result of the quarterly meetings this week. There is, however, very little being done, and with some of the makers getting short of work, the tendency of the market is towards weakness. The average prices for delivery into the Manchester district remain at £6 to £6 2s. 6d. for bars, £6 7s. 6d. for hoops, and about £7 15s. per ton for sheets.

One or two sales of hematite have been made at prices averaging 55s. 6d. to 56s., less 2½, for good foundry brands, delivered here.

In the coal trade there is only a limited demand for all classes of round coal. The exceptional mildness of the season is, of course, tending to restrict the requirements of the better classes of round coal for house-fire purposes, and the general slackness of trade causes other classes of fuel for iron-making and steam purposes to meet with only a dull sale. The restriction of the output, as the result of the recent stoppage of the pits for the holidays, prevents any pressure of supplies upon the market, and so far as quoted prices are concerned, there has not as yet been any material giving way. There is, however, a good deal of underselling, and the one or two colliery proprietors who have been holding out for 11s. for best Wigan Arley at the pit mouth have had to come down to 10s. 6d., whilst generally, in house-fire coals, the tendency is to ease down. Engine classes of fuel are moving off fairly well, at late rates. At the pit mouth the average prices are about as under:—Best coal, 10s. to 10s. 6d.; seconds, 8s. to 8s. 6d.; common round coals, 6s. to 7s.; burgy, 4s. 6d. to 5s.; good ordinary slack, 3s. 6d. to 4s., with some of the best sorts fetching 4s. 3d. per ton.

The shipping trade has been only quiet, with prices rather easier, Lancashire steam coal delivered at the high level, Liverpool, or the Garston Docks, not averaging more than 8s. to 8s. 3d. per ton.

On Friday last a meeting of the Manchester Geological Society was held at Wigan, when a visit was paid to the Dairy pit, owned by the Wigan Coal and Iron Company, for the purpose of inspecting an improved ventilating fan which has been erected at the colliery, and the method adopted for enlarging a 9ft. upcast shaft to 14ft., with the arrangements introduced for the use of the electric light for working by in the shaft. A description of the fan, which is an improved type of Guibal, designed by Mr. Cookson, of Wigan, was given, and it will be of interest to give here a few particulars of the system adopted for stripping the shaft to the requisite width. This is effected by carrying the workmen on an iron grating suspended in the shaft, and allowing the material, as it is removed, to fall to the bottom of the shaft. In a paper which was afterwards read by Mr. Cookson, he said he could only compliment the officials on the wonderfully complete arrangements they had made to carry out what must have been a very anxious task in the stripping of the shaft. With regard to the electric light used in the shaft, he was told by the manager that they could hardly have done without it, and although it had been expensive to the company to buy the requisite plant, yet it had greatly lessened the risk to life and limb of the persons engaged on the work, and had also most decidedly saved loss of time and consequent loss of money. The lights in the shaft were three in number, of the Swan incandescent type, and of 50-candle power each, the engine and dynamo being sufficiently powerful to give ten lights of equal strength. Since the end of August, the enlargement of the shaft has been carried on continuously, and has now been completed for 170 yards.

As I intimated last week, the failure of Messrs Alexander and Hy. Brogden has not at all affected this district where the difficulties of the firm had long been known, and the business done here was of a very limited character.

The promoters of the Manchester Ship Canal have sent out circulars soliciting support to enable the scheme to be brought again before Parliament with renewed vigour and increased confidence. It is stated that the total amount subscribed to the last year's fund was upwards of £65,000, and the estimated further amount required for the second fund is £35,000, of which a large portion has been raised; but the committee confidently hope the total amount promised, and likely to be promised, may come to such a sum as will obviate the necessity of the whole amount of each individual subscription being called up.

Barrow.—The hematite pig iron trade still remains in a very unsatisfactory condition, and the business in all departments seems to be almost at a standstill. No change of any importance has been noticed during the past week in the state of the market, and there are few signs of any sudden revival for the better taking place. The exports for American, continental, and foreign purchases have lately decreased to an alarming extent, and the business doing at the present moment is practically *nil*. Makers still continue to restrict the output of metal in the hopes that the production will then more nearly represent the deliveries. Notwithstanding this, the stocks of metal now warehoused still increase and are very heavy, although not so large as they were some months ago. The outlook for the present year is not very promising; but as no great expectations are formed concerning it, any improvement will come out as a pleasant surprise. Prices are low and generally unprofitable. No quotable change is noticeable this week, but they are a little easier than usual. Sales have been effected this week at—No. 1 Bessemer, 47s. per ton net at works; No. 2, 46s. 6d., and No. 3, 46s. per ton. Steel makers are in a very unsatisfactory condition, and little business of any importance is coming to hand. Large numbers of men in North Lancashire have been thrown out of employment during the past week. Rails are selling at last week's prices. Shipbuilders appear to be on the eve of a serious collapse. Iron ore is in but limited demand at last week's prices from 9s. to 11s. per ton net at mines. Stocks are very heavy all round. Coal and coke steady.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE coalowners of Yorkshire and North Derbyshire have promptly replied to the new agitation for an advance of 10 per cent. On the 7th inst. a letter was received from Mr. Benjamin Pickard, the secretary to the Yorkshire Miners' Association, asking the coalowners' committee to arrange for a general meeting, with a view to hear a deputation on the question of the proposed advance, "and probably to try and arrange for a systematic regulation of wages in the future." The coalowners' committee, in their reply, declined to receive the deputation, the grounds of their refusal being that the coal trade is at this moment in a more uncertain and generally worse condition than it was when they last met and refused to concede any advance in wages, and that the year opens with such a depression in the iron trade, the shipbuilding trade, the cotton trade, and other large industries of the country, that it seemed to them to point rather to a reduction than an advance. On the second point, as to a systematic regulation of wages in the future, the secretary, Mr. C. E. Rhodes, intimated that, "whenever the union were prepared with a scheme to effect this end, the committee would have great pleasure in calling the coalowners together to discuss it." Some misapprehension has arisen in regard to certain advances made at several collieries in North Leicestershire and South Derbyshire. It appears that the 10 per cent. there given is the 10 per cent. given in North Derbyshire and Yorkshire in 1882, and that no advance whatever has been given in connection with the present agitation. The wages paid in these districts, even with the advances recently made, are not quite equal to those paid in North Derbyshire and South Yorkshire.

At the annual meeting of the Yorkshire Miners' Association, held at Barnsley on the 7th inst., Mr. E. Cowey was re-elected president, and Mr. M. Ramsden vice-president. Messrs. Cowey, Pickard, Faith, and Parrott were appointed a deputation to represent the Yorkshire Miners' Association, and join a general deputation who will wait upon Mr. Gladstone in London on the 30th inst. on the franchise question. Delegates were instructed to attend the conference at Birmingham on the 20th inst. on the wages question. A resolution was passed in favour of asking for an advance of 10 per cent. at all the collieries in the South and West Yorkshire. A vote of the members and workmen employed at the pits is to be taken before the end of the ensuing fortnight, respecting the 10 per cent. advance, as to the course which the miners consider ought to be taken in the event of the owners refusing the advance.

Messrs. Craven Brothers, the carriage and wagon manufacturers, of Darnall, are at present very busy on wagons, chiefly on account of home railways. They are just completing 750 wagons, with 600 sets of wheels and axles, for the Caledonian Railway Company, and 100 sets of wheels and axles for the Glasgow and South-Western Railway. They have also in hand 1000 wagons for the Great Northern Railway Company. Mr. S. J. Clay, of Long Eston, has taken an order for 100 wagons for the Great North of Scotland Railway.

For the Buenos Ayres Great Southern Railway Company, Messrs. Craven Brothers have just constructed a palace and dining car of unusual proportions, and containing several features of novelty and interest. It is 56ft. over the body, or 60ft. long over the buffers, 9ft. 4in. wide inside, and 9ft. 5in. high. The body of the car is of East Indian—Moulmain—teak wood, and the under frame and body are built solid, with the addition of steel-plates and angles to the sides of the car. The bogie trucks are made entirely of steel, with Mansell's patent boss-wheels. The axle-boxes are Craven's special arrangement for facilitating the examination of the bearings, by which the box can be seen from end to end. The car has been specially constructed for a very hot climate, and one feature to this end is a sun-blind from end to end, constructed of wood, and fixed at an angle to throw a shade which will effectually protect the occupants from the sun. By means of a gauze screen, concealed in ornamental scroll work, the dust storms are excluded, and by another still more ingenious arrangement a supply of pure cold air is admitted into the car and the fumes and hot air permitted to escape. The car is 2ft. 8in. higher in the centre than any English carriage. There is every convenience in the form of smoking-room, ladies' saloon, gentlemen's saloon, lavatories, and bath-rooms—for both ladies and gentlemen—attendants' room, &c. The large saloon is 24ft. long by 9ft. 4in. high, and is upholstered and furnished on a most luxurious scale. By night the seats are easily convertible into beds, and overhead, by a sliding arrangement, another tier of beds is obtained, forming a series of upper berths. The car is the first of the kind made in this country. It has been designed by Mr. T. F. Craven, acting under instructions from Mr. James Livesey, C.E., the engineer to the company. It is intended for the use of the general manager and officers of the company, who, it may be added, are mainly from Yorkshire and Lancashire.

Sir John Brown, the founder of the Atlas Steel and Ironworks, Sheffield, usually presides at the annual social meeting of All Saints' Church, of which he was the donor. Sir John has now retired from business, after an active and remarkable career, but his church being close to the great works with which his name will ever be associated, and to other immense establishments, he invariably has something to say on the trade of the old year and the prospects of the new. On the 7th inst. Sir John reminded his hearers that last year he did not predict for Sheffield a very prosperous state of business, and the result had justified what he then said. He had noticed with pain the restlessness among the artisans, and he deplored their unreasonable expectations, which he could only attribute to their desire for what was sometimes miscalled "recreation." In regard to 1884 prospects seemed to him to be still gloomy, and he began to fear that England had almost, if not quite, reached the summit of her prosperity. Our trade was being nibbled at right and left by our neighbours on the Continent and elsewhere, and we had so many competitors who used to be our customers that we must not again look for any material prosperity such as we had enjoyed for the last thirty or forty years. It therefore behoved both men and masters to pull together to conserve the trade we had, and if possible recover some of that which had gone. Two things were necessary to meet competition—to cheapen our manufactures, and improve the quality. During the last year Germany had sent to Newcastle and the North thousands of tons of steel plates, to the exclusion of our manufactures, at prices varying from 10s. to 20s. less per ton than Sheffield could supply them at. The Siemens-Martin plates, which originated in Sheffield, and succeeded the Bessemer process, were now being supplied to Earle's Shipbuilding Company—of which he was the chairman—by German firms, though the carriage was less from Sheffield to Hull than from Germany to Hull.

The Hadfield Steel Foundry Company, Attercliffe, the well-known manufacturers of crucible cast steel castings, has adopted the Lumley system of lighting its works by electricity, and finds it answers admirably.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE quarterly meeting of the Cleveland iron trade was held at Middlesbrough on Tuesday last. There was a large attendance, but the tone of the market was far from cheerful. Makers as a rule are by no means well off for orders and manifest considerable anxiety to sell. The official returns show that stocks increased considerably last month, and prices naturally continue to fall. Consumers are, therefore, more than ever inclined to hold off. Very few sales were made on Tuesday, and those only for small lots for immediate delivery. The usual quotation for No. 3 G.M.B. was 35s. 9d. per ton, but few buyers were disposed to give more than 35s. 6d. The stock of No. 4 forge iron is now very great. It is freely offered at 34s. per ton, but few buyers are found even at that low figure.

Holders of warrants quote 36s. per ton, but the best offers are 6d. below this, and no business is done.

There was no reduction of the stock of Cleveland pig iron in Connal's Middlesbrough store last week. The quantity held on Monday was 62,060 tons.

The manufactured iron trade is still in a depressed condition. Orders are being rapidly worked off, and fresh specifications are not easily procured. Competition is as keen as ever, and prices are with difficulty maintained. Consequently consumers keep back their orders in the hope of doing better shortly. Ship plates are £5 15s. per ton, shipbuilding angles £5 5s. to £5 10s., and common bars £5 7s. 6d. to £5 12s. 6d. per ton, all free on rails at maker's works, cash 10th, less 2½ per cent. Puddled bars are £3 7s. 6d. per ton net at works.

It is satisfactory to note that, whilst all else is so dull, exports from the Tees continue good. The shipments for last month were: Pig iron, 68,418 tons; manufactured iron and steel, 29,654 tons. The total exports during last year were heavier than in any year in the history of the trade, amounting, as they did, to a total of 1,350,194 tons, of which 992,815 tons were pig iron, and 357,379 tons were finished iron and steel.

The Cleveland ironmasters' returns for December, containing a statement of the make for the year 1883 and the stocks at the close thereof, were issued on Friday last. They show that 70,670 tons of hematite, spiegel and basic iron, and 161,996 tons of Cleveland iron were made in December. The number of furnaces at work was 117, or one less than at the end of November. The iron in stock and stores amounted to 253,105 tons, or an increase of 32,817 tons since November 30th. The make of iron of all kinds during the year was 2,760,740 tons, or an increase of 72,090 tons over 1882, and about 80,000 tons more than was made during any previous year. The stocks on December 31st were 13,074 tons less than at the end of 1882.

About 100 miners were paid off at Messrs. Pease and Partners, Upleatham Mines, New Marske, on Saturday last, owing to slackness of demand for ironstone.

The Maryport Hematite Iron Company and the Solway Hematite Iron Company, both of Maryport, has damped down its furnaces and paid off all its workmen, amounting to about 600 men. An offer was made by the employers to keep a portion of the works going if the men would accept a reduction of 10 per cent. This they refused to do, and all were discharged.

It is announced that Messrs. Andrew Leslie and Co., of Hebburn-on-Tyne, and the North-Eastern Marine Engineering Company, Limited, of Wallsend, are about to amalgamate. The new company will take over the shipbuilding yard at Hebburn, which is some 42 acres in extent, together with the engine works, which are directly opposite, and the two places will be worked as one concern. It is understood that the capital will be £650,000 in £10 shares, and that 32,000 shares will be offered for public subscription. Mr. A. Leslie will be chairman of the new company.

The workmen employed at Messrs. Short and Co.'s shipbuilding yard at Sunderland have agreed to submit to a reduction of wages, demanded by the employers owing to the scarcity of orders. Helpers will be reduced ½d. in the shilling per man, labourers and timeplaters 6d. per day, and rivetters' percentage not yet fixed. The new rates will remain in force until April.

The strike at the Bowesfield Ironworks, Stockton, still continues. It is not countenanced by the Ironworkers' Union, as it has taken place in defiance of the rules of the Board of Arbitration. There is no probability of the employers giving way.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE works and markets are only now assuming their normal position after the holidays, and there is consequently less than usual to report this week with reference to the iron and coal trades. In the warrant market business has been exceedingly flat—the quotations lower than any figures quoted for a long time. The great increase of stocks at Middlesbrough have had a depressing effect on our market, and the small shipments from Scotch ports, together with disputes in the steel trades, have likewise operated unfavourably. The number of furnaces in blast has been reduced to ninety-four, but most of these will be relighted after undergoing necessary repairs.

Business was done in the warrant market on Friday forenoon at from 43s. 0½d. to 42s. 10½d. cash, and 43s. 1½d. to 43s. one month, the quotations in the afternoon being 42s. 10d. to 42s. 10½d. cash, and 43s. to 42s. 11½d. one month. The market was flat on Monday morning at 42s. 9½d. to 42s. 10d. and 42s. 9d. cash, the afternoon's business being at 42s. 9d. to 42s. 8d. cash, and 42s. 11d. to 42s. 9½d. one month. On Tuesday the quotations in the forenoon were 42s. 7d. to 42s. 6½d. and 42s. 8d. cash, and in the afternoon 42s. 7½d. to 42s. 9d. cash, and 42s. 10d. to 42s. 11d. one month. On Wednesday the quotations were 42s. 8d. cash. To-day—Thursday—the market was firmer, and business was done up to 43s. 1½d. cash. Mr. Anthony Inglis, shipbuilder and marine engineer, Glasgow, died this forenoon after a brief illness.

The demand for makers' iron has been quiet, and the quotations, which are as follows, do not show much alteration :—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 50s. 6d.; No. 3, 48s. 6d.; Coltness, 55s. and 50s. 6d.; Langloan, 54s. and 50s. 6d.; Summerlee, 52s. 6d. and 48s. 6d.; Calder, 54s. and 47s. 6d.; Carnbroe, 51s. 6d and 47s. 6d.; Clyde, 47s. 6d. and 45s. 6d.; Monkland, 44s. 3d. and 42s. 3d.; Quarter, 43s. 6d. and 42s.; Govan, at Broomielaw, 44s. 3d. and 42s. 3d.; Shotts, at Leith, 54s. and 52s.; Carron, at Grangemouth, 49s. (specially selected, 56s. 6d.), and 47s. 6d.; Kinneil, at Bo'ness, 46s. 6d. and 45s. 6d.; Glengarnock, at Ardrossan, 51s. 6d. and 45s. 6d.; Eglinton, 45s. 3d. and 43s.; Dalmellington, 48s. and 46s.

The manufactured iron and steel trades are just now passing through a somewhat critical ordeal, viz., that of reducing wages. Such a reduction, it must be admitted by any unprejudiced person, is an absolute necessity, and it has also become necessary that the strictest economy should be practised in all departments. Some excitement was caused early in the week by reports in the daily papers of the West of Scotland to the effect that there were to be great strikes in the iron and steel branches. These rumours were founded on the fact that reductions of wages had been intimated, and that the workmen had prolonged their New Year's holiday beyond Monday morning, when they ought to have resumed. But while the idleness of the men was explainable in this way, there can be no doubt that much dissatisfaction exists, as is always the case when high wages are broken. The members of the Iron and Steel Workers' Association of Scotland ask that the agreement hitherto in force, by which wages are regulated by the awards in the North of England, should be abandoned, and that they shall be paid in future by the Scotch market selling price of finished iron, and they claim that the dispute be settled by a conference to be made up of one employer and one representative of the men from each ward. There are difficulties in connection with such a proposal, but it can hardly be believed that at a time when the trade is slackening, those interested will be so ill-advised as to render matters worse by a policy of no compromise. That a reduction in the steel trade should accompany the decrease of wages in the shipbuilding and engineering departments is only what was to be expected.

The shipments of iron and steel manufactures from the Clyde in the past week, exclusive of pig iron, are valued at close on £70,000.

Business in the coal trade is again almost fully resumed, although the shipping returns are still low in consequence of the past holidays. Fair shipments were despatched from Glasgow in the circumstances, while 4530 tons were sent from Ayr, 2922 from Troon, 980 from Leith, while at Grangemouth the quantity shipped was very small. During the past year the exports of coals at Burntisland aggregated 749,784 tons, as compared with 665,214 in 1882, an increase in 1883 of 84,570 tons.

A reduction of 3d. per ton in the price of coals has been intimated by the colliery owners of Fife and Clackmannan, and it is reported that the continental markets are at present completely stocked. This reduction applies only to foreign shipments, there being no change in the rates charged to inland consumers.

The Clydesdale Ironworks, at Holytown, have turned out a casting which is estimated to weigh about 250 tons, for the anvil for a 12-ton steam hammer which is to be used in hammering steel ingots, and for the best classes of iron. The operation of casting occupied about thirty-one hours.

The total export of gunpowder from the Clyde in 1883 has been 1,250,300 lb., against 1,445,874 lb. in the preceding year.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

LARGE consignments of rails have been sent off during the week to Bahia and Calcutta, completing some of the old engagements. New trade, however, is dilatory in coming to hand, and no improvement can yet be chronicled. Even the rejected rail trade is slow. There is a rumour of a possible conversion of Abernant Ironworks to steel works. I fear it is only dictated by hope. In the best years of Mr. Fothergill's career they did well, but it is questionable if any steel works could be constructed there that would compete successfully with such as Cyfarthfa, Tredegar, and Dowlais. The Brogdens' failure has been another blow, but not a severe one, to Aberdare, and some new industry is badly wanted there, even if steel works are not practicable. Gadly's Works, which used to supply a good deal of the best cold-blast iron for Armstrong guns, is still stagnant. It remains to be seen whether the purchase of the canal by the Marquis of Bute will give it another impetus.

Coalowners are evidently impressed with the view that the present is an admirable time to get rid of their collieries. To the long list of late I have another to add; the Messrs. Pyman, Wilson, and Co., of Cardiff, have become proprietors of the Ffaldan Colliery, Garw Valley. The price for which it sold has not been stated, but large extensions are intended.

The Windsor Slipways, Dry Dock, and Engineering Company has been registered at Cardiff with a capital of £180,000. The chief promoters are Cardiff coalowners and shippers. There is no difficulty in launching new enterprises of this sort, but it may be open to doubt whether this will not be overdone. The Bute and Treherbert Company is doing excellent work, and naturally prompts to rivalry and opposition.

There is no falling off in the prosperity of the coal trade, and it is but common justice to the railway and dock authorities to state that they now appear to have grappled the immense traffic thrown upon them and are going along successfully. It was noteworthy last week that the tips were oftener waiting for coal than ships for their turn at the tips. Prices are very firm both for steam and house qualities of coal, and there is little doubt but that colliers will soon again participate in the prosperous condition of the trade. Only in two quarters are there any notable difficulties amongst colliers, one at Caerphilly the other in the Ogmore Valley. Both appear now to be coming to an end. No. 3 Rhondda, the supplies of which are looked upon with increasing interest as their area lessens, is booked freely at 10s. 6d. This coal is expected shortly to be won by Messrs. Crawshay at Pontypridd, and its advent into the Merthyr Valley is regarded with interest.

I regret hearing that some kind of disaster has happened to the viaduct on the Newport, Pontypridd, and Caerphilly Railway at Treforest, which is likely to postpone the opening.

A Chamber of Commerce has been opened at Newport, and a kindred institution at Swansea is undergoing some necessary improvements.

A pit rope breakage at one of the Plymouth collieries has occurred near Merthyr, causing the death of two men.

I am glad to be able to report favourably of the shipbuilding trade at Cardiff, Chepstow, and Bristol. At the last-named place a new iron barque was successfully launched on Saturday at the yards of Messrs. Hill and Sons.

The Institution of Mechanical Engineers, which met at Cardiff in 1874, are again invited to make it their head-quarters in 1884. Last year they were at Leeds. There seems to be no end of hopeful incident for Cardiff. A new line of steamers from Canada to France is being established, having Cardiff as a port of call,

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

1st January, 1884.

1. Dividing Dough, G. Johnson, Glasgow.
2. Safety Cock or Tap, A. J. Boult.—(*L. Pillet, France.*)
3. Doughing, &c., Machines, G. Johnson, Glasgow.
4. Stool, A. J. Boult.—(*Leube and Jünge, Germany.*)
5. Developing a System of Trading, J. Denis, London.
6. Metal Roof, &c., H. W. Frampton, Winchester.
7. Flying Engine, J. K. Smythies, Great Bentley.
8. Photographic Cameras, F. W. Hart, London.
9. Attaching India-rubber &c., to Boot Soles, W. Smartt, Buckhurst Hill.
10. Electric Lamps, W. E. Debenham, London.
11. Fire-resisting Compound, W. J. B. Graham, Charlton.
12. Attaching Leather to Boot Soles, &c., W. Smartt, Buckhurst Hill.
13. Electro-magnets, W. Leffler, London.
14. Coin Separator, J. Ansted, Gravesend.
15. Locks, J. A. Walter, Rainham.
16. Extracting Ammonia, &c., from Coal Gas, J. Hanson, Bingley.
17. Kneading, &c., Machinery, P. Pfleiderer, London.
18. Musical Instrument, M. A. Wier, Norwood.
19. Musical Instrument, M. A. Wier, Norwood.
20. Musical Instrument, M. A. Wier, Norwood.
21. Type-writer, M. A. Wier, Norwood.
22. Lamp, &c., Burners, A. Hemingway, Roehampton.
23. Rope Carrying Gear, &c., O. Imray.—(*T. A. Appleing, Calcutta.*)
24. Electrical Accumulators, &c., H. H. Lake.—(*C. Dion and D. Lontin, France.*)
25. Spoons, Forks, &c., H. H. Lake.—(*L. Merlet and Co., Vienna.*)
26 Fasteners for Gloves, &c., H. H. Lake.—(*F. A. Burkitt, R. W. Cousley, and D. McI. Cook, Melbourne.*)
27. Compressing Air or Gas, H. H. Lake.—(*T. F. Freeman, New York.*)
28. Circular Railways, H. H. Lake.—(*F. Roehr, U.S.*)
29. Printing Machines, H. H. Lake.—(*C. B. Cottrell, Connecticut, U.S.*)
30. Pocket Flask, H. H. Lake.—(*A. Pittner and J. Medek, Vienna.*)
31. Journal Boxes, H. H. Lake.—(*R. W. Traylor, Virginia, U.S.*)
32. Compound for Plastering, H. H. Lake.—(*A. E. Scales, Massachusetts, U.S.*)
33. Stitching Button Holes, H. H. Lake.—(*B. Kahl, Paris.*)
34. Fasteners for Gloves, J. W. Pritchett, Clapton.
35. Fasteners for Gloves, J. W. Pritchett, Clapton.
36. Fasteners for Gloves, J. W. Pritchett, Clapton.
37. Tuyeres, W. B. Cavell, Plumstead.
38. Sanitary Traps, W. Henman, Birmingham.
39. Bedstead and Commode, W. W. Watson, London.
40. Galvanic Batteries, J. B. Spence and J. E. Chaster, London.
41. Vessels for containing Liquids, J. B. Spence and J. E. Chaster, London.
42. Galvanic Batteries, J. B. Spence and J. E. Chaster, London.
43. Alarm, &c., Apparatus, J. Howard, London.
44. Fastenings for Dress, &c., J. C. Jefferys, London.
45. Bread, &c., S. Birley, London.
46. Fireproof Building, E. L. Garbett, London.
47. Seatings for Valves, J. Phillips, London.
48. Aluminium, J. G. Willans, London.
49. Obtaining Volatile from Coal, J. G. Willans, London.
50. Lighting, J. S. Fairfax, London.
51. Boxes, E. M. Knight, London.
52. Ventilating, H. S. Simester, London.
53. Fire-arms, &c., T. Gilbert, London.
54. Castors for Furniture, E. Pfeiffer, London.
55. Ventilating, W. Jennings, London.
56. Looms for Weaving, T. H. Blamires, Huddersfield.
57. Organ Pedals, J. Rushton, London.
58. Organ Pedals, J. Rushton, London.
59. Organ Pedals, J. Rushton, London.
60. Continuous Brakes, E. Hawks, London.
61. Block Signalling, W. E. Langdon, Derby.
62. Furnaces, R. Paulson, London.
63. Torpedoes, R. Paulson, London.
64. Registering Games Played at Billiards, &c., E. C. T. Roper, Okehampton, and C. J. Davies, London.
65. Calculating Machines, S. Tate, London.
66. Connecting, &c., Boats, E. J. Evans, Sudbury.
67. Tag or Label, &c., W. Clark.—(*O. J. Cohn, U.S.*)
68. Pile-driving, N. G. Kimberley, London.
69. Buttoned Boots, J. Branch, London.
70. Perambulators, J. Robson, London.
71. Beverages, J. Armstrong, London.
72. Bleaching Rags, &c., A. C. Henderson.—(*L. de Roussen, Paris.*)
73. Circular Hair Brushes, J. Biggs, Bushey Heath.
74. Ruling Lines, L. Appleton, London.
75. Forcing Water, &c., W. H. Thompson, London.
76. Miners' Safety Lamp, J. T. Wharton, Durham.
77. Pedals for Velocipedes, W. A. Pick, London.
78. Garters, R. Hookham, London.
79. Button Fasteners, R. Hookham, London.
80. Lawn Tennis, &c., Poles, J. S. Pinder, Dulwich.
81. Tricycles, W. B. and M. Nation, West Ham.
82. Mechanism for Toy Figures, G. Cole, London.
83. Toy Velocipedes, G. Cole, London.
84. Sliding Window Sashes, J. D. Tucker, Bromley.
85. Supplying Air to Furnaces, R. Hepburn, London.
86. Combining Door Knockers with Gongs, &c., R. H. Hepburn, London.
87. Closing Cans, T. G. F. Dolby, Dulwich.
88. Horse-shoeing, R. Glover, Stratford.
89. Horse-shoeing, R. Glover, Stratford.
90. Receptacles for Effervescent Salts, R. Glover, Stratford.
91. Sweeping, &c., Streets, W. March, London.
92. Purifying Sewer Gas, S. C. Dean, London.
93. Purifying Sewage, S. C. Dean, London.
94. Treating Human Excreta, R. Nicholls, Hendon.
95. Metallic Packing, A. W. L. Reddie.—(*J. J. Crowley, Savannah, F. L. Manchester, New York, J. D. Richardson, Brooklyn, New York.*)
96. Slate Pencil Sharpener, W. S. Icely, London.
97. Bell Levers and Bell-pulls, J. Waller, Brighton, and J. W. Andrew, Hove.
98. Land and Water, E. H. Hollins, London.
99. Constructing Steam Boilers, J. Brown, London.
100. Constructing and Fixing the Heads of Rails, G. F. L. Meakin, Kingston-on-Thames.
101. Unsinkable Ships, J. S. Scott, London.
102. Smoke-consuming Apparatus, W. Whieldon and J. W. Haynes, London.
103. Life Guards and Brakes, J. W. Haynes and W. Whieldon, London.
104. Electric Switches, C. A. Bullock, Blackheath, and E. Shaw, Clifton.
105. Weathering Parapet, J. Robson, London.
106. Mechanical Toy Boats, G. Cole, London.
107. Stoppers for Bottles, &c., T. Jones, London.
108. Ventilators, T. Jones, London.
109. Melting Pot, J. Harsant, Twickenham.
110. Unstoppering Bottles, D. Griffiths, Birmingham.
111. Cigarettes, F. Plaister, Oxford.
112. Carrying Parcels, F. Small and Halsey, London.
113. Refrigeration, J. Harrison, London.
114. Vignetted Photographs, H. V. Weyde, London.
115. Reaping and Mowing, G. P. Barnes, London.
116. Artificial Fuel, T. E. Heath, Cardiff.
117. Steamships, A. M. Clark.—(*M. Sébillot, Paris.*)
118. Circulating Boilers, T. Wood, Broadmead, and G. Milton, Stapleton.
119. Stair-rod Fasteners, G. Nobes, London.
120. Checking Apparatus, R. H. Matthews, London.
121. Pencils, J. Hickisson, London.
122. Measuring Tape and Holder for Postage Stamps, &c., J. Hickisson, London.
123. Measuring and Registering Electric Currents, J. Tavener, Basingstoke.
124. Outward Form and Internal Construction, &c., of Sea-going Ships, W. Harvey, London.
125. Hydraulic Lifts, A. Clark, London.
126. Fastening Cravats to the Shirt Front, C. W. and H. F. E. Davis, and W. H. K. Jackson, London.
127. Smoke and Fume Condensers, W. E. Gedge.—(*E. M. Alderman, Tuscon, U.S.*)
128. Throwing on or off Belts of Sewing Machines, &c., R. J. Johns, London.
129. Stretching, Drying, &c., Woven Fabrics, W. E. Gedge.—(*A. Delharpe, France.*)
130. Automatic Supply Valves, A. Bell, Bexley Heath.
131. Electro-dynamic Machines, H. J. Allison.—(*R. N. King, Dayton, U.S.*)
132. Ventilators, J. S. Sweet, London.
133. Waterproofing Fabrics, J. S. Sweet, London.
134. Steam Boilers, J. Whitley, Leeds.
135. Constructing Ships, &c., J. Whitley, Leeds.
136. Rivets, J. Whitley, Leeds.
137. Materials for Building Ships, J. Whitley, Leeds.
138. Wooden Pavement, J. McG. Croft, London.
139. Steam Engines, T. Craddock, London.
140. Balance for Tricycles, &c., J. Shaw, Coventry.
141. Pins, C. R. Cundell, Weston.
142. Skates, C. Corneby, London.
143. Amalgamating Gold, &c., B. C. Molloy, London.
144. Domestic Stoves, H. Thompson, London.
145. Fire-grates, J. Bate, London.
146. Saving Life at Sea, W. Balch, Greenwich.
147. Water Heating Apparatus, M. Brophy, London.
148. Seatings for Valves, &c., M. M. Brophy, London.
149. Pulls for Electric Bells, C. Smith, London.
150. Producing Representations of Enamel Work, J. H. Johnson.—(*W. H. Guilleband, Paris.*)
151. Paper, J. H. Johnson.—(*J. A. Meyrneis, Paris.*)
152. Cultivating Oysters, A. P. Price, London.
153. Cement, &c., R. Stone, London.
154. Hammerless Drop-down Guns, J. Pinder, Dulwich.
155. Giving Alarm, &c., Signals, G. Nobes, London.
156. Boilers, J. Watson, St. Albans.
157. Slide Valves for Steam Engines, R. Cook, London.
158. Commutators for Continuous Current Dynamo-electric Machines, L. Hidvéghy, London.
159. Letter Receptacles, G. J. Harcourt, Clifton.
160. Fixing India-rubber Tires, W. Monk, London.
161. Railway Chairs, G. J. Harcourt, Clifton.
162. Bicycle Safety Attachment, W. Bevan, London.
163. Fountain Pens, J. S. Letts, London.
164. Window Fasteners, F. Lea, London.
165. Self-closing Cock, G. W. Foster, London.
166. Rivet-holders, G. W. Foster, London.
167. Lever Locks, C. Whittle, London.
168. Gear for Driving Velocipedes, S. Rich, Croydon.
169. Castor Bowls, &c., J. Parry, Birmingham.
170. Locking Device, W. C. Batten, Aston.
171. Knife-handles, A. J. Jones, Moseley.
172. Carving Forks, A. J. Jones, Moseley.
173. Flushing Apparatus, W. Baraclough, Edgbaston.
174. Producing Vapour Gas, D. Marcus, Birmingham.
175. Picture, &c., Mounts, W. Morgan, Birmingham.
176. Tricycles, W. T. Eades, Birmingham.
177. Suspending Apparatus, C. Showell, Birmingham.
178. Tricycles, &c., S. Martin, Stafford.
179. Metallic Spoons, D. R. Price, Birmingham.
180. Flushing Apparatus, W. Baraclough, Edgbaston.
181. Railways, &c., S. Woodall, Edgbaston.
182. Mechanism for Velocipedes, S. Martin, Stafford.
183. Flexible Ruler, J. F. Craddock, Warwick.
184. Tricycles, &c., S. Martin, Handsworth.
185. Nails, D. Higgs, Halesowen.
186. Lock-up Stop-valves, &c., G. Teideman, London.
187. Sheet Metal Tiling, C. J. Latter, New Southgate.
188. Burglar Alarms, A. M. Clark.—(*F. D. Hill and A. W. Bogart, New York, U.S.*)
189. Fire-arms, M. Kaufmann, Greenwich.
190. Filtering Apparatus, F. H. Landon, London.
191. Recoil Cushions for Fire-arms, H. J. Allison.—(*H. G. Pifford, New York, U.S.*)
192. Boot and Shoe, J. Gerard, London.
193. Artificial Leaves and Flowers, E. G. Brewer.—(*J. T. Noblom, Paris.*)
194. Turning Over Music Leaves, R. Padbury, London.
195. Taps, E. G. Brewer.—(*A. Berges, Paris.*)
196. Electric Currents, J. Brockie, Brixton.
197. Self-locking Apparatus for Railway Signals, &c., H. L. M. Goodridge and T. R. Davies, London.
198. Economising the Use of Gas, S. Müller, London.
199. Voltaic Batteries, R. Applegarth, London.
200. Ticket Delivery Apparatus, F. Rose, London.
201. Shirts, C. Mays and W. P. Pepys, London.
202. Microscope Slides, B. Piffard, Hemel Hempstead.
203. Purifying &c., Gas, H. R. Snelgrove, London.
204. Toilet Pin, R. Barlow, Dalston.
205. Gas, &c., Tubes, G. W. Wright, London.
206. Locomotive Boilers, S. Pitt.—(*J. Wootten, U.S.*)
207. Separating Strips of Embroidery, &c., H. H. Lake.—(*D. Guggenheim, New York.*)
208. Movable Decks, &c., G. W. Wright, London.
209. Producing Assimilable Phosphates, H. J. Haddan.—(*A. van Oldruitenborgh, Belgium.*)
210. Boot Soles, H. Haddan.—(*J. Larssen, Norway.*)
211. Exhaust Ventilators, G. W. Webb, Reading.
212. Ventilation, G. W. Webb, Reading.
213. Bicycles, A. Barham, Croydon.
214. Fastening Busks to Corsets, H. J. Haddan.—(*A. Hinrichsen and Co., Hamburg.*)
215. Coffee-pots, E. Boyes, London.
216. Self-acting Calendar, D. Gestetner and S. Levy, London.
217. Measuring Angles, H. Watkin, Waltham Abbey.
218. Adhesive Stamp, &c., S. Pulzer, London.
219. Pouch, S. Pulzer, London.
220. Facing Surfaces, W. Schonheyder, London.
221. Suspending the Corrosive Action of Acids, &c., D. Urquhart, London.
222. Tungstic Acid, &c., A. K. Huntington, London.
223. Opening and Closing Doors of Hansom Cabs, J. Saxby, jun., London.
224. Treating Scrap Zinc, A. K. Huntington and J. Humphrys, London.
225. Drawing Boards, &c., T. Taylor, Walthamstow.
226. Handles for Bats, R. S. Moss, London.
227. Drying Yarn, J., M., C., & L. Jefferson, Bradford.
228. Driving Belts, T. Wheelhouse, Brighouse.
229. Speculum, J. W. Ayres, London.
230. Bedsteads and Cots, E. Longley, London.
231. Dynamo-electric Machines, C. Bright, London.
232. Increasing Speed of Telegraph Cables, J. H. Carson.—(*E. Weedon, Newfoundland.*)
233. Crushing Mills, G. Buchanan & W. Keay, London.
234. Incandescent Lamps, J. H. Gardiner, London.
235. Combined Music Stool and Cabinet, G. Bugler and J. P. Hogan, London.
236. Propelling Boats, J. Bramall, London.
237. Valves, Cocks, and Taps, J. R. McNeil, London.
238. Oil Lamps, E. S. Copeman, London.
239. Envelope Cementing, R. Fenner, London.
240. Electrical Relays, J. A. Lund, London.
241. Setting Clocks, J. A. Lund, London.
242. Covers for Culinary Utensils, T. and H. Holcroft, Wolverhampton.
243. Milk-cans, E. Goddard, London.
244. Fastener for Boots, &c., R. Treleaven, London.
245. Furnaces, R. Morris, Doncaster, and J. Wood, West Stockworth.
246. Stereotype Matrices, T. & H. Daw, Sevenoaks.
247. Supporting Bodies in Water, H. T. Clanchy, London, and T. A. F. Hall, Southampton.
248. Feeding Lubricant, J. Simmons, London.
249. Sliding Flush Bolt, C. F. Hall, London.
250. Lifting, &c., Fluids, F. B. Hill, London.
251. Galvanic Batteries, L. J. Dopping-Hepenstal, London.
252. Lifting or Hoisting Machinery, &c., J. M. Day, W. R. Green, and H. C. Walker, Surrey.
253. Stays, &c., S. Dixon, Blackmoor.
254. Holding, &c., Boots and Shoes, C. Hare, Norwich.
255. Velocipedes, &c., F. Baden-Powell, London.
256. Chimneys, T. W. Philips, London.
257. Belting, R. R. Gubbins, London.
258. Clip Fastener for Neckties, J. C. Lines, London.
259. Fireproof Floors, H. H. Bridgman, London.
260. Fireproof Floors, H. H. Bridgman, London.
261. Drying, &c., Steam, W. Wise.—(*B. Röber, Dresden.*)
262. Dynamo-electric Machines, W. Mordey, Putney.
263. Displaying Ribbon, W. Wise.—(*J. Wiget, Arbon.*)
264. Travelling Table, H. Wellings, London.
265. Electric Baths, M. Humm, Loughton.
266. Hansom Cabs, I. D. Pollard, London.

2nd January, 1884.

267. Composition for Ships, W. Day, Blackheath.
268. Quatremaine Velocipedes, E. G. Colton, London.
269. Twin-boats, J. Linkleter & W. Mears, Tynemouth.
270. Glove Fasteners, E. Atkins, Birmingham.
271. Stays, &c., W. Hatchmann, London.
272. Pianofortes, I. Grindrod, Rochdale.
273. Looms for Weaving, A. Heyworth, Rochdale.
274. Bottle Stoppers, &c., G. R. Robinson, Newport.
275. Destroying Insects, W. G. Little, Conisborough.
276. Music Stands, J. W. Gordon, London.
277. Steam Engine Indicators, W. Jones, Blackley.
278. Illuminating Buildings, Shop-windows, &c., W. Broughton, Manchester.
279. Working, &c., the Recoil of Guns, A. Sauvée.—(*J. B. G. A. Canet, Paris.*)
280. Galvanic Batteries, J. Enright, London.
281. Door Locks, A. Lancaster, London.
282. Generating Electric Currents, W. Aldred, Sheffield.
283. Deep-sea Fishing, &c., S. Kemp, London.
284. Actions of Breech-loading Fire-arms, J. W. Smallman, Nuneaton.
285. Body Armour, A. Grant, London.
286. Waterproof Garments, I. Frankenburg, Salford.
287. Hydraulic Pumps, &c., W. Hutchinson, Salford.
288. Cutlery Handles, T. and J. Brooke, Sheffield.
289. Distributing Manure, G. Gibbons, Manchester.
290. Bronzing &c., Paper, D. Dodds and R. Fletcher, Manchester.
291. Bicycles, &c., J. Cheshire, Birmingham, and N. Wright, Coventry.
292. Toilet Combs, C. E. Wheeler, London.
293. Folding Chairs, L. Field, Birmingham.
294. Ornamental Walls, J. B. Gausby, Birmingham.
295. Tricycles, &c., J. S. Edge, jun., Birmingham.
296. Window Ventilator, &c., J. Walsh, London.
297. Metal Tubes, E. Deeley, Walsall.
298. Opening, &c., Casements, J. Bruce, Birmingham.
299. Raising, &c., Window Sashes, F. Smith, Birmingham.
300. Cocks and Valves, H. J. Harman, Manchester.
301. Checking Apparatus for Carriages, W. Thompson.—(*M. G. Buchholtz, Brussels.*)
302. Polishing Paste, L. Cohen, Liverpool.
303. Cases for Holding Bottles, D. Davies, Wrexham.
304. Charcoal Box Irons, C. Clark, Wolverhampton.
305. Screw Gear, J. H. Abercrombie, Glasgow.
306. Baking Powder, A. McDonald, Langsine.
307. Printing Machines, H. H. Lake.—(*C. B. Cottrell, Connecticut, U.S.*)
308. Coupling for Shafts, &c., J. Jamieson, Lower Wincobank.
309. Windmills, A Taylor, Bradford.
310. Temples for Weaving, J. Parkinson, Bradford.
311. Regulating, &c., Shuttle-boxes, J. Poole, Bradford.
312. Grate-bars for Furnaces, J. Stephenson and W. Topham, Dudley Hill
313. Shoes and Boots, W. England, Great Malvern.
314. Dynamo-electric Machines, S. Williams, Newport.
315. Pulley Blocks, R. Priest, Cradley Heath.
316. Coal Scuttles, J. A. de Macedo, Leeds.
317. Fuzee-boxes, G. J. Harcourt, Clifton.
318. Lowering, &c., Ships' Boats, J. Nelson, Belfast.
319. Photographic Cameras, S. D. McKellen, Manchester.
320. Whip Sockets, &c., C. Peters, Birmingham.
321. Rollers for Washing Wool, H. Allison, Bradford.
322. Picking Arm for Looms, R. Marchant, Huddersfield.
323. Railway Signals, I. C. Schofield, Halifax.
324. Valves, J. Hargreaves, Widnes.
325. Thermo-dynamic Engines, J. Hargreaves, Widnes.
326. Domestic Fireplaces, &c., J. Smith, Liverpool.
327. Tramway Facing Points, T. E. de Tomanzie and T. Bromilow, Liverpool.
328. Stair-carpet Rods, G. J. Harcourt, Clifton.
329. Finger Board for Violins, W. Buchanan, Glasgow.
330. Fastening, &c., Boots, G. Lindsey, Brighton.
331. Dynamo-electrical Machines, J. H. Johnson.—(*E. C. Barton, New Zealand.*)
332. Fountains, A. J. and H. C. Needham, London.
333. Umbrella, W. Cheesman, London.
334. Turnscrew, W. Cheesman, London.
335. Stew Pan, W. Cheesman, London.
336. Lay Figure Stand, W. Cheesman, London.
337. Lowering, &c., Boats, R. Eyles, London.
338. Steel Wire, &c., C. M. Pielsticker.—(*Dr. F. C. G. Müller, Germany.*)
339. Telephone Transmitters, H. J. Allison.—(*D. Drawbaugh, Pennsylvania, U.S.*)
340. Preserving Ships' Bottoms, E. Pearce, Southsea.
341. Boats, W. H. Denham, Southsea.
342. Regulating the Height of Desks and Seats, W. H. St. Ruth, Liverpool.
343. Adjusting Looking-glasses, &c., W. F. Allcock, Birmingham.
344. Sash Fasteners, W. F. Allcock, Birmingham.
345. Tramcars, &c., C. L. H. Lammers, Gosforth.
346. Cleansing Tramway Roads, C. Norton, London.
347. Tobacco-pipes, J. Kerry, Hove.
348. Valve Gear, J. McCammon, Belfast.
349. Velocipedes, J. McCammon, Belfast.
350. Inlaying Wood, H. Forrester, Milton.
351. Kilns, H. Knowles, Woodville.
352. Ovens, H. Knowles, Woodville.
353. Stone-breaking Machines, S. Mason, Leicester.
354. Fan or Ventilator, F. L. Jeyes, London.
355. Screw Wrenches, C. W. Asbury, Sparkbrook.
356. Gas-burners, M. Steel and J. Teasdale, Gosforth.
357. Guiding Vessels, M. Gill, Huddersfield.
358. Fuel Economiser, T. Nicholson, Hoole.
359. Clothes Peg, C. Chipps, Southsea.
360. Motive-power, J. Horrocks, Southport.
361. Spinning, &c., Machinery, S. Lord, Rochdale.
362. Sectional Book Stitching and Folding Machine, S. H. Hall and S. Gee, Leeds.
363. Metallic Bedsteads, T. Jefferies, Birmingham.
364. Edging Machines, S. Gibson, Hebden Bridge.
365. Raising and Lowering Windows and Sashes, J. G. Ackroyd, Sowerby Bridge.
366. Stretching Trousers and Garments, G. Wilmer and A. Baxter, Leeds.
367. Smoking Pipes, J. F. Walsh, Hipperholme.
368. Brake, W. Hough, Headingley.
369. Spreading, &c., Fabrics, E. Outram, Greetland.
370. Turning-off, &c., Gas, G. Foster, Halifax.
371. Hinges, I. Whitehouse, Birmingham.
372. Lamps and Reflectors, H. Salsbury, London.
373. Combination Tools, H. J. Haddan.—(*A. E. Lytle, Chicago, U.S.*)
374. A Polishing Cream, F. H. Stevenson, Forest-gate.
375. Chin Holder for Violin F. Upton, London.
376. Extracting Simple Bottle Stoppers, A. Longbottom, Driffield.
377. Lanterns, J. Haynes and W. Whieldon, London
378. Self-feeding Swilling Brush, M. Byron, Sheffield.
379. Cleaning Furniture, A. J. Bradley, Clough Fold.
380. Velocipedes, C. Sipman, Nottingham.
381. Bicycles, &c., J. B. Bell, Nottingham.
282. Printing Surfaces, I. B. and E. S. Shaw, Tunstall, and W. S. Shaw, Wolverhampton.
383. Printing Inscriptions, &c., I. B. and E. S. Shaw, Tunstall, and W. S. Shaw, Wolverhampton.
384. Ceremic Plates, I. B. and E. S. Shaw, Tunstall, and W. S. Shaw, Wolverhampton.
385. Elastic Printing Surfaces, I. B. and E. S. Shaw, Tunstall, and W. S. Shaw, Wolverhampton.
386. Artificial Marble, &c., I. B. and E. S. Shaw, Tunstall, and W. S. Shaw, Wolverhampton.
387. Sinks and Gulleys, T. Softley, Gateshead.
388. Washing Machines, G. Roby, Turnworth.
389. Hoisting Machinery, J. M. Day, W. Green, H. Walker, and R. Carey, London.
390. Perambulators, J. Smith, Nottingham.
391. Couplings, F. Keeling and R. Rigley, Bulwell.
392. Window Cleaner, R. W. Kenyon, Accrington.
393. Vermin Trap, G. E. Smart, Tunbridge Wells.
394. Bricks, W. Parry, Bangor.
395. Tubular Electric Conductors, B. Finch, London.
396. Hose Reels, J. T. Foot, London.
397. Mouthpiece for Cigarettes, N. Bauman, London.
398. Door Springs, S. Coombs, London.
399. Sleeve Boards, F. Healey, Croydon.
400. Beer Taps, E. S. Norcombe, Birmingham.
401. Shives or Bungs, E. S. Norcombe, Birmingham.
402. Sash Fasteners, E. S. Norcombe, Birmingham.
403. Air-tight Barrel Bung, J. Dawson, Sheffield.
404. Velocipedes, A. Kirby, Bedford.
405. Saving Fuel, &c., D. Cockshaw, Glass Houghton.
406. Testing the Quality of Milk, F. Bond, Gloucester.
407. Stoves, F. T. Bond, Gloucester.
408. Spades, &c., T. Parkes, Bilston.
409. Electric Lamps, S. H. Emmens and R. Barlow, London.
410. Lamp-shades and Reflectors, R. Barlow, London
411. Holder for Electric Lamps, R. Barlow, London.
412. Electrodes, S. Emmens and R. Barlow, London.
413. Cornice Pole Bracket, F. Gaunt, Birmingham.
414. Combing Machines, J. C. Walker, Shipley.
415. Food for Young Cattle, R. Jordan.—(*H. Lederrey, Vaud, Switzerland.*)
416. Storing Chemicals, &c., G. Macdougald, Dundee.
417. Eyelet Studs, W. Edridge, Birmingham.
418. Fire-proof Paints, C. Mountford, Birmingham.
419. Luggage Label, J. Haigh, Manchester.
420. Suspender for Garments, J. Haigh, Manchester.
421. Printing Textile Fabrics, G. H. Underwood, Manchester.
422. Substitute for Fog Signals, C. Bailey, Newton Heath.
423. Carding Engines, W. H. Oates, C. J. H. and T. B. Schofield, Oldham.
424. Flyers for Spinning, J. Heginbottom, Oldham.
425. Breakdown Hammerless Guns, F. Beesley, London.
426. Coverings for Umbrellas, C. Bromhall, Moston.
427. Securing Buckles, C. McDougall, Manchester.
428. Calico Printing, &c., D. Haworth and W. Hanson, Mottram.
429. Fastenings for Horseshoe Pads, &c., R. Lewty, Manchester.
430. Securing Labels, &c., J. Jackson, Manchester.
431. Cans, H. Talbot and G. Glossop, Sheffield.
432. Scissors and Shears, A. J. Hobson, Sheffield.
433. Knife Holders, J. Appleby, Birmingham.
434. Compound for Cleaning, J. Leedam, Burnley.
435. Fasteners for Driving Belts, G. H. Hebblethwaite, Huddersfield.
436. Looms for Weaving, C. Catlow, Burnley.
437. Ventilating Sewers, P. M. Walker, Halifax.
438. Shedding Apparatus for Looms, F. Leeming, Bradford.
439. Carding Fibres, A. Orrah, Huddersfield.
440. Fastenings for Travelling Trunks, &c., E. C. Thomasson, Worcester.
441. Door Knobs, &c., E. V. Bailey, Birmingham.
442. Tennis Poles, F. Cooper, Kivernells.
443. Coking and Distilling Coal, C. E. Bell, Durham.
444. Pump Gear for Fishing Smacks, J. Plaistow and E. Richardson, Grimsby.
445. Shelling Peas, R. Owen, Boston.
446. Cutting or Mincing Meat, G. Herbert, London.
447. Valves, J. Day, Bath.
448. Reversible Wristbands, W. Owston, Pontefract.
449. Electric Arc Lamps, J. H. Greenhill, Belfast.
450. Electric Arc Lamps, J. H. Greenhill, Belfast.
451. Velocipedes, C. Hart and B. Barton, Birmingham.
452. Harvesting Machines, A. C. Bamlett, Thirsk.
453. Corsets, W. Pretty, jun., Ipswich.
454. Gas Engines, R. Skene, London.
455. Roasting Coffee, A. M. Clark.—(*O. Offrion, Paris.*)
456. Bicycle, &c., Wheels, H. J. Pausey, London.
457. Arranging Bricks, J. Jones, Johnstown.
458. Rowlocks, C. F. Woosnam, Southend-on-Sea.
459. Increasing Illuminating Power of Gas, M. Steel, Gosforth.
460. Heating Water, M. Steel, Gosforth.
461. Scarfs, P. Everitt, London.
462. Boots and Shoes, H. Daniel, Nantgaredig.
463. Carriage, &c., Brakes, J. Allen, London.
464. Telephonic Apparatus, S. Vyle, London.
465. Steam Pumping Engines, S. G. Browne and W. Boby, London.
466. Pens, &c., A. B. Cruickshank, London.
467. Swimming Appliances, W. P. Winsor, London.
468. Note-pedals of Pianofortes, J. Shaw, Leeds.
469. Opening, &c., Windows, E. and J. M. Verity and B. Banks, Leeds.
470. Toy Locomotives, &c., G. Cole, London.
471. Stair-rod Holders, A. W. Child and G. B. Childs, London.
472. Concertinas, F. W. Seume, London.
473. Preventing Collision of Steamships, W. Bevan, London.
474. Heating Kilns, &c., H. Knowles, Woodville.
475. Kilns, &c., H. Knowles, Woodville.
476. Weighing, &c., Weights, J. W. G. Monk, London.
477. Horseshoes, J. S. Robertson, Dumbarton.
478. Studs, &c., E. Lansard, London.
479. Transporting Loads, W. L. Wise.—(*P. R. and P. R. Bedlington, Bilbao.*)
480. Holding Lucifer Matches, E. Edwards.—(*P. Gillaux, Belgium.*)

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481. Purifying, &c., Water, H. J. A. Bowers, London.
482. Dagger Umbrella, W. Nicholas, New Southgate.
483. Permanent Way, W. Colam & R. Phillips, London.
484. Carding Engines, &c., G. Bernhardt, Radcliffe.
485. Boilers, &c., W. H. Mirfin, Manchester.
486. Reels for Yarns, &c., G. Bernhardt, Radcliffe.
487. Saddles for Bicycles, W. Woolley, Birmingham.
488. Joint for Sewage Pipes, J. Parsons, Netherfield Carlton.
489. Saving Ships at Sea, T. Bridge, Eastbourne.
490. Oven Soles, &c., R. Wallace, Blackburn.
491. Self-acting Retorts, B. P. Walker, Birmingham, and J. A. B. Bennett, King's Heath.
492. Ruling Paper, J. Shaw, Honley.
493. Treating Fibres, &c., J. Illingworth, Batley.
494. Joint for Pipes, T. H. Harrisson, Liverpool.
495. Hinges, W. Wilkes, Bloxwich.
496. Velocipedes, W. Parnall, Bristol.
497. Engines and Boilers, W. Wilkinson, Kempston.
498. Coupling Vehicles, E. Richmond, Leicester.
499. Temples for Looms, J. Cook, Eccles.
500. Fruit-dressing Machines, J. G. Hopkinson, Harrogate.
501. Range Boilers, W. Baird, Dublin.
502. Combing Wool, F. T. Pollard, Leeds.
503. Jet, G. Hirst, Aislaby.
504. Pulleys, J. H. Boddy, Leeds.
505. Lamps, &c., J. H. Radcliffe, Oldham.
506. Spindles, &c., T. Ashworth, Davyhulme.
507. Mules for Spinning, T. Griffiths, Bury.
508. Propulsion of Boats, E. Chrimes, Lower Broughton, and R. Cooke, Manchester.
509. Cutting, &c., Iron, T. Horton, Birmingham.
510. Oil-can, J. and H. Lucas, Birmingham.
511. Lamps, J. and H. Lucas, Birmingham.
512. Fire Ranges, J. Dean, Oxford
513. Velocipedes, J. Ferguson, Bowdon.
514. Potato Diggers, W. Kirkham, Westby.

515. Boots and Shoes, W. Thurman, Birmingham.
516. Fire Hose Couplings, S. B. Wilkins, Edinburgh.
517. Cramps for Fixing Boards, E. and J. M. Verity and B. Banks, Leeds.
518. Reception, &c., of Stamps, &c., R. Owen, London.
519 Warming Rooms, J. Petrie, Rochdale.
520. Preventing Mustiness in Casks, W. and W. B. Butler, Wolverhampton.
521. Water-closets, W. H. Renwick, Newcastle-upon-Tyne.
522. Pulleys, &c., C. L. Watchurst, Lee.
523. Ventilators, R. Pollock and T. H. Herbertson, London.
524. Wax, D. West, Keighley.
525. Stock-taking Machine, J. Grosart, Kilwinning.
526. Pavements, &c., J. H. Chavasse, Kingswinford.
527. Stoppering Bottles, &c., J. Cox, Birmingham.
528. Water Filter, P. Parker, Keighley.
529. Stoving, &c., Tobacco, A. T. Lendrum, Cork.
530. Stemming, &c., Stalks of Leaf Tobacco, A. T. Lendrum, Cork.
531. Cranes, G. Russell, Motherwell.
532. Stuffing-boxes, D. Robertson, Govan.
533. Boots and Shoes, J. Tilley, London.
534. Fireproof Concrete Roofs, &c., A. W. Lake.—(*T. Hyatt, Brooklyn, U.S.*)
535. Digging Machine, W. Allan, Mungoswells.
536. Finishing Velvets, &c., T. Schofield and F. Barker, Cornbrook.
537. Fastening for Baskets, &c., J. P. Milbourne and T. Humphreys, Manchester.
538. Washing Machine, G. Gaskell, Chorley.
539. Ring Throstles and Doubling Frames, T. and J. Smith and J. Leigh, Stockport.
540. Football Case, R. W. Harrison, Blackburn.
541. Attachment or Card Clothing, J. M. Hetherington, Manchester.
542. Polish, E. A. Russell, Burnham.
543. Tuning Pegs, T. Fletcher, Redditch.
544. Valves or Stoppers, H. Forman, Chellaston.
545. Shifting Apparatus, A. H. Wallis, London.
546. Wicks for Lamps or Stoves, C. Barton, Brandon.
547. Velocipedes, J. J. Speed, Waltham Cross.
548. High-pressure Water Meters, W. Cox, Horfield.
549. Continuous Sight for Rifles, &c., E. C. Worman, Canterbury.
550. Life-saving Apparatus, L. A. Groth.—(*O. Hirt, Karlsbad.*)
551. Extracting Metals, L. A. Groth.—(*R. Grätzel, Hanover.*)
552. Extracting Biphosphates, L. A. Groth.—(*R. and A. Schliwa, Dortmund.*)
553. Suspending, &c., Boats, J. Nixon, Loughborough.
554. Blocking Tunnels, &c., R. Roper, Lewisham.
555. Boots and Shoes, J. Bridge, Northampton.
556. Window Fastenings, W. Fairweather.—(*A. Kasilister, Habana.*)
557. Insulated Wires, A. Millar, Crosshill.
558. Pianoforte Actions, J. Semple, Glasgow.
559. Lithographic, &c., Machinery, H. Tuke, Leeds.
560. Gas Engines, R. Steel and H. Whitehead, Leeds.
561. Hook Couplings, P. Jensen.—(*A. Rendell, India.*)
562. Life-saving Apparatus, J. Gillingham, Chard.
563. Looms, J. Fletcher, Chorley.
564. Cleaning Tram-rails, G. G. Byrne, Brixton.
565. Steam Generators, G. Hardingham, London.
566. Breech-loading Guns, J. Bullough, Accrington, and G. P. Appleyard, Halifax.
567. Mules for Spinning Fibres, J. S. Cooke and A Hardwick, Liversedge.
568. Lawn Tennis, &c., Shoes, A. F. Graves, Dublin.
569. Self-locking Pad and other Locks, H. P Lavender, Wolverhampton.
570. Metallic Packing, J. I. Hemmingway, Sheffield.
571. Kitchen Range, H. M. Ashley, Ferrybridge.
572. Armatures of Dynamo-machines, C. F. Cooper, Kingston-on-Thames.
573. Working Trains by Ropes, S. Pitt, Sutton.
574. Life-saving Raft, O. G. Lambart, Southend.
575. Boots and Shoes, I. B. Harris, Fountainbridge.
576. Tobacco Pipe Cleaners, J. W. Haynes, London.
577. Ironing Machines, W. Whieldon, London.
578. Wood Staining, &c., M. Williams, Wigan.
579. Drying Oils, M. Williams, Wigan.
580. Artificial Human Figures, A. and G. B. Childs, London.
581. Receptacles for Colours, C. Davis, London.
582. Sewing Machines, J. Heggan, Dromore.
583. Converter Furnaces, B. J. B. Mills.—(*P. David and P. Manhès, Lyons, France.*)
584. Capstans, S. Baxter, London.
585. Governors, H. B. Howse, London.
586. Smelting Furnace, C. Bramall, Oughtibridge.
587. Axle Bearings, A. M. Clark.—(*A. E. McConnell and J. R. Balfour, New Orleans.*)
588. Cleaning, &c., the Fibres of Plants, A. M. Clark.—(*P. Cohn, Mexico.*)
589. Tobacco Stopper and Cap for Pipe Bowls, A. M. Clark.—(*C. Vuillard, St. Claude, France.*)
590. Preparing Fibrous Materials, A. M. Clark.—(*A. Malewany, Gnesdovo, Russia.*)
591. Bracket Hinge, A. M. Clark.—(*J. McGrath, U.S.*)
592. Stoppers for Bottles, C. H. Ryder, London.
593. Paper Felt, A. Davidson, Wimbledon.
594. Saddle-bars, T. J. Mortin, Woking.
595. Communication and Electric Lighting in Trains, T. J. Mortin, Woking.
596. Registering Fares, T. J. Mortin, Woking.
597. Receptacles for Periodicals, A. Slade, London.
598. Centrifugal Pulverising Machinery, H. J. Haddan.—(*P. Freygang, Leipzig.*)
599. Dung-catcher, H. Haddan.—(*R. Buzer, Germany.*)
600. Feeding Troughs, R. Spurway, Bath.
601. Envelopes, J. J. Aston, London.
602. Propelling Steamships, J. J. Aston, London.
603. Treating Sulphides and Oxides of Metal, F. C. Knowles, Isle of Wight.
604. Railway Couplings, A. Clark.—(*T. Jones, U.S.*)
605. Spring Bedstead, A. Phillips, Birmingham.
606. Machine Guns, H. S. Maxim, London.
607. Velocipedes, B. Carr, Walthamstow.

4th January, 1884.

608. India-rubber Tires, W. Golding, Manchester.
609. Cranks or Levers, W. Golding, Manchester.
610. Tube Vices, W. Devoll, Birmingham.
611. Quilts, &c., L. Slater, Manchester.
612. Folding Box, W. Blake, Liverpool,
613. Dynamo-electric Machines, G. Scarlett, Liverpool.
614. Bicycles, C. Lee, Tottenham.
615. Aerating Liquors, A. M. Davis and H. des Forges, London.
616. Tag and Envelope, J. C. Kenwood, St. Leonards.
617. Fixing Split Driving Pulleys on Machinery Shafting, W. G. Storey, York.
618. Split Driving Pulleys, W. G. Storey, York.
619. Preparing Hides, &c., R. Middleton, York.
620. Braiding Machines, N. J. Amies, Manchester.
621. Washing Machines, R. J. Urquhart, Manchester.
622. Forging, &c., Machines, D. Matthews, Newport.
623. Pad for Corns, &c., J. J. Kennedy, Dublin.
624. Taps and Dies, E. Cooper, Sheffield.
625. Lock Furniture, E. S. Norcombe, Birmingham.
626. Safety Valves, T. Foster, Manchester.
627. Tubular Formation for Ships and Boats, J. Lees, Suffolk, and J. E. Lees, Oldham.
628. Bricks, &c., D. Millward, Worcester.
629. Nut Lock, E. Cooper, Sheffield.
630. Security of Coal Miners, &c., Exposed to Explosive Gases, H. H. Ford, Macclesfield.
631. Communicating Apparatus, J. R. Gibson, York.
632. Rotary Steam Engine, J. Bryan, Preston.
633. Steam Boilers, F. D. Rose, Flixton.
634. Mechanical Stokers, F. D. Rose, Flixton.
635. Steam Boiler, F. D. Rose, Flixton.
636. Lap Machines, J. Clegg, Radcliffe.
637. Consuming Smoke, W. E. Leyland, St. Helen's.
638. Ladders, T. Jones, Sedgley.
639. Elevators for Grain, W. G. Herbert, Liverpool.
640. Packing for Valves, &c., F. C. Bell, London.
641. Penholders, A. McC. Gordon, Wrexham.
642. Mowing and Reaping Machines, J. Whitaker and J. E. and R. J. Powell, Wrexham.
643. Belts, R. B. Jones and J. Hughes, Liverpool.
644. Suspension Seats for Bicycles, &c., W. P. Thompson.—(*B. F. Peet, Springfield, U.S.*)
645. Centrifugal Machines, G. H. Bolton, Widnes.
646. Drawing Tramcars, &c., W. Harte, Londonderry.
647. Moulding, J. Bowling, Bunslet.
648. Safety Lamps, A. B. Taylor, Wolverhampton, and E. Taylor, Kilnhurst.
649. Floors, &c., T. Jones, Sedgley.
650. Window Fastenings, T. Jones, Sedgley
651. Cord Tension Regulator, T. Stidolph, Woodbridge.
652. Recording Pressure of Gas, W. Cowan, Edinburgh.
653. Braces, J. C. Henry, London.
654. Buffers, W. Boucher, Newnham.
655. Cork Mat, J. Deane and J. Winfield, London.
656. Polishing Metals, &c., D. Smithies, London.
657. Connecting Supply Apparatus with Water-closet Basins, T. Twyford.—(*E. Aspinall, New York.*)
658. Travelling Grates of Furnaces, T. Milburn and C. W. Haydon, Stalybridge.
659. Cooking Stove, T. Barrow, Rock Ferry, and C. H. Berry, Birkenhead.
660. Section Blocks, J. Crompton, Farnworth.
661. Ventilators, E. Woolfenden, Rochdale.
662. Burner for Gas Fires, W. Bell, Sheffield.
663. Umbrella Furniture, W. Ward, Sheffield.
664. Studs for Soles of Boots, J. Claydon, Yorkshire.
665. Valves, G. Temple and J. Davis, Sheffield.
666. Iron Bedsteads, G. Rogers, Birmingham.
667. Gas Burners, T. Heron, Manchester.
668. Mirrors, F. Schreiber.—(*H. Reichard, Germany.*)
669. Hoists, &c., W. McCausland & J. Gilfillan, Belfast.
670. Chimney Cowls, T. G. Barlow, Wexford.
671. Wood Floorings, A. Putney, London.
672, Steam Boilers, R. Abell, Derby.
673, Call Bells, &c., P. E. Ayton and W. Winwood, Birmingham.
674. Corrugating Plates of Iron, J. H. McCarthy, Walsall.
675. Eyeletting Machines, C. H. Guest, London.
676. Fishing, H. L. Hunter, Lewisham.
677. Washing, &c., Coal, C. E. Hall, Sheffield.
678. Lubricator, J. Dewrance and G. H. Wall, London.
679. High-pressure Injector, J. Dewrance, London.
680. Revolving Motion, &c., W. Jones, Manchester.
681, Self-acting Heald Knitting Machines, H. Walters and J. Saxon, Reddish.
682. Sewing Machines, M. Brodersen, Hamburg.
683. Engines, T. McCarter and T. Cooper, Londonderry.
684. Velocipedes, C. W. Wasbrough, Bristol, and J. S. G. W. Stroud, Knowle.
685. Railway Keys, R. D. Sanders, Norwood.
686. Mixing Tea, A. Carson, Stirling.
687. Looms, B., C. W., and F. Ratcliff, and J. Batley, Upper Wortley.
688. Propelling Man through Water, F. Healey, Croydon.
689. Cocks or Valves, B. Rhodes, London.
690. Metallic Packings, B. Rhodes, London.
691. Backs of Brushes, L. Denning, Bristol.
692. Pocket Razors, A. B. Ball, Sheffield.
693. Shears, T. Brown, Sheffield.
694. China, &c., Ware, T. G. Cooper, Hanley.
695. Cranked Axles, A. E. and H. Butler, near Leeds.
696. Card Fasteners, D. A. Lowthime, London.
697. Feed Apparatus, O. Imray.—(*A le Comte de Dion, G. T. Bonton, and C. Trépardoux, Paris.*)
698. Stockings, J. Imray.—(*J. D. Raverdeau, Paris.*)
699. Interlocking Apparatus, C. Adams, London.
700. Paper-cutting Apparatus, H. Grafton, London.
701. Needles, E. Edwards.—(*P. Bevernage-Standring, Ghent.*)
702. Finishing Articles of Hosiery, E. Edwards.—(*P. Bevernage-Standring, Ghent.*)
703. Water-closets, &c., J. B. McCallum, Blackburn.
704. Hydraulic Mains of Gasworks, F. H. Bacon and B. Donkin, jun., London.
705. Game of War, D. C. B. Griffith, Brighton.
706. Ornamenting Leather, T. Bayley, Nottingham.
707. Points, &c., for Tramways, C. Winby, Rochdale.
708. Moulds, W. Whitfield, Gateshead.
709. Controlling Gas, E. Crowe, Middlesbrough.
710. Measuring, &c., Apparatus, J. Muller, London.
711. Window Sash Fasteners, G. Bisley, London.
712. Washing Apparatus, F. Hazeldine, London.

5th January, 1884.

713. Indicators for Gas, &c., S. M. Thomas, Bristol.
714. Glazing Roofs, &c., T. W. Helliwell, Brighouse.
715. Wheel, J. Blunn, Rawdon.
716. Carding Wool, &c., W. H. Kellett, Cleckheaton.
717. Ink and Pencil Eraser, E. Behar, Leeds.
718. Voltaic Batteries, W. P. Thompson.—(*E. E. Senet, Paris.*)
719. Slotting Machines, J. Harper, jun., Aberdeen.
720. Raising, &c., Apparatus, W. Hunter, Plumpton.
721. Propelling Cycles, J. A. Stephan, Fernville.
722. Securing Bundles of Letters, &c., without Tying a Knot, J. C. Carter and T. Trotman, Stroud.
723. Cooking Ranges, S. Smith, Smethwick.
724. Spring Joints, W. Davies, Birmingham.
725. Direct Gas Furnace, R. Hanson, Chesterfield, and J. Fernee, Sheffield.
726. Self-lubricating Carriage Bearings, J. Coxon, Gateshead.
727. White Lead, J. Kay, Bury.
728. Floating Flushing Valve, F. Alford, Gloucester.
729. Bicycle Springs, H. D. Taylor, Hepworth.
730. Knife-cleaning Machines, T. Shepherd and J. D. Hodgson, Newcastle-upon-Tyne.
731. Postcard Holder, G. Weddell, Newcastle-on-Tyne.
732. Bath or Lavatory Cocks, &c., H. and W. Sutcliffe, Halifax.
733. Furnace Fire-grates, J. Wright, Wimshill.
734. Wood-paving, W. J. Wheeler, Richmond.
735. Tricycles, C. Lee, Tottenham.
736. Blending Tea, J. G. Douglas, Dublin.
737. Preparing Hides, &c., R. Middleton, Leeds.
738. Gun Locks, W. W. Greener, Birmingham.
739. Ball-cock Hydrants, S. B. Wilkins, Edinburgh.
740. Fishing, J. Marwood, Doncaster.
741. Camera for Surveying, M. Gill, Huddersfield.
742. Galvanic Batteries, H. Blackwell, Manchester.
743. Electric Arc Lamps, J. Matthews and T. Vann, Birmingham.
744. Spinning Cotton, W. H. Rhodes, Longsight.
745. Garment Holder, T. Bradford, Sandymount.
746. Shoes for Horses, R. Longdon, Deansgate.
747. Fire-lighter, G. A. Biddis, Newbury.
748. Protecting Underground Electric Wires, H. H. Slade, Bristol, and W. A. Slade, London.
749. Fish Hooks, W. Guise, Redditch.
750. Preventing Incrustation of Boilers, G. Iles, Gloucester, and T. Morgan, Oldland.
751, Doing away with Writing, &c., on Lines, A. F. Snell, East Finchley.
752. Dress, &c., Fastenings, A. Keats, Stanley Moor.
753. Ornamental Articles, M. Lyons, Southsea.
754. Miscible Tar, J. Wheeler, Ilfracombe.
755. Quelling Waves at Sea, J. Sansom, Glasgow.
756. Jack Bars, J. Carver, Nottingham, and J. Roe, Basford.
757. Propulsion of Bicycles, &c., L. A. Groth.—(*F. Jeschek and R. Perl, Vienna.*)
758. Securing Broom Handles, B. Pearson, Sheffield.
759. Spring Mattresses, J. Westgarth, Elmside.
760. Mules for Spinning, R. C. Haworth and R. Ryles, Hindley.
761. Straining Pulp, R. Cooper, Over Darwen.
762. Serrated Wedges, W. and J. Pollard, jun., Burnley.
763. Regulating Feed of Cotton, G. Nutter, Burnley.
764. Cleansing Beer, A. G. Southby, Jersey.
765. Coupling Apparatus, H. Stephenson, Beighton.
766. Drying Grain, &c., J. Milne, Aberdeen.
767. Forging, &c., Metals, M. Gledhill, Manchester
768. Dynamo-electric Machines, J. Hopkinson, London, and W. Mather, Manchester.
769. Pencilholder, H. J. Haddan.—(*J. Helmreich and G. Dinkelmeir, Bavaria.*)
770. Dynamo-electric Machines, T. Parker and P. B. Elwell, Wolverhampton.
771. Razor Strops, G. W. Edwards, Wolverhampton.
772. Splint Links for Chains, J. Phillips, Willenhall.
773. Knife with Rocking Shaft, C. F. Herzog, Paris.
774. Purifying Gas, G. D. Malam, Bingley.
775. Inhaling Apparatus, G. Stoker, London.
776. Cutting Paper Webs into Sheets, H. Grafton, London.
777. Pianoforte Actions, D. M. Davis, London.
778. Hosiery Dresses, T. Walker, Leicester.
779. Brooch and Flower Holder, H. J. Davis, London.
780. Registering, &c., Apparatus, W. Rowan, Ventnor.
781. Dredging Machinery, J. Welman, Poole.
782. Smoking Pipes, H. Bandmacher, M. Friedlander, and J. H. Macaulay, Glasgow.
783. Boots, R. Dickinson, Bramley,
784. Shaping, &c., Clay, C. H. Murray, London.
785. Infants' Feeding Bottles, W. S. Simpson and J. W. Phillips, London.
786. Trawl Gear, R. Porter, Lowestoft.
787. Treatment of Blood, W. G. Strype, Wicklow.
788. Signalling on Board Ship, H. H. Dott, London.
789. Floating Pontoon Bridges, S. Lampard, London.
790. Waste Water Preventers, G. Homewood, Cuckfield.
791. Drinking Vessels, C. Wrench and B. Lees, Birmingham.
792. Carriage Handles, R. E. Thacker, Walsall.
793. Fish Hooks, J. Willis, Redditch.
794. Lamp Brackets, W. Whiston, Birmingham.
795. Feed of Scribbling, &c., Engines, H. Marsden, Huddersfield.
796. Lamps, C. R. Illingworth, Clayton-le-Moors.
797. Controlling run-away Horses, &c., R. Winder, Farningham.
798 Perambulator, &c., Wheels, W. Brassington, Lower Broughton.
799. Window Fasteners, E. H. Harling, London.
800. Spring Balances, T. B. Salter and J. Hughes, West Bromwich.
801. Door Springs, T. B. Bache and G. Salter, West Bromwich.
802. Scarf Ring, W. West, Birmingham.
803 Substitute for Vent Pegs of Beer Barrels, E. G. C. Bomford, Fladbury.
804. Gathering Reaped Corn, &c., E. G. C. Bomford, Fladbury.
805. Extracting Minerals from Mines, T. Lishman, West Hartlepool.
806. Electric Safety Lamps, T. Coad, London.
807. Date Calendars, A. W. Doery, London.
808. Printing Paper Hangings, W. G. Wilkins, Derby.
809. Heating Water, T. Fletcher, Warrington.
810. Packings for Glands, C. Moseley and B. Blundstone, Ardwick.
811. Felt Hats, J. Perrin, Hyde.
812. Horseshoes, W. H. Carmont, Manchester.
813. Looms for Weaving, C. Thompson, Halifax.
814. Lighting Fires, J. Cowan, Liverpool.
815. Chain Links, H. Rongier, London.
816. Colour-yielding Products, L. Gans and M. Hoffmann, Frankfort-on-Main.
817. Ammunition, R. S. Ripley, France.
818. Wire, S. H. Byrne, Brighouse.
819. Saddle-bars, A. E. Pease, Guisbrough.
820. Connecting Pipes, R. Good, Carshalton.
821. Harvesting Machinery, J. Harrison, Thirsk.

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822. Chimney Cowl, &c., A. C. Smith, London.
823. Two-wheeled Carriages, J. Powell, Cornwall.
824. Mashing Potatoes, T. Rimmer, Bickerstaffe.
825. Raising Sunken Vessels, W. P. Thompson.—(*R. W. Doherty, Liverpool.*)
826. Castors, W, C. Jones, Chester.
827. Locks and Bolts, W. C. Jones, Chester.
828. Weighing by Electricity, G. C. Browning, Manchester.
829. Weaving, &c., Wire, J. H. Cairns, Armagh.
830. Spring Apparatus, D. W. Petrie, Liverpool.
831. Elastic Pressing and Feeding Rollers, S. S. Hazeland, Cornwall.
832. Rotary Engines, S. S. Hazeland, Cornwall.
833. Drilling Machines, S. S. Hazeland, Cornwall.
834. Rowlocks, S. S. Hazeland, Cornwall.
835. Painting Machines, S. S. Hazeland, Cornwall.
836. Boots, &c., S. S. Hazeland, Cornwall.
837. Water-closets, J. G. Strong and Sons, Dublin.
838. Stop Valves, I. Barnsley, Sheffield.
839. Electric Motors, S. P. Thompson, Bristol.
840. Folding Machinery, J. H. Buxton, M. Smith, and D. Braithwaite, Manchester.
841. Ordnance, J. P. Bayly, London.
842. Trunks, Boxes, &c., W. S. Icely, London.
843. Orthoptics, J. Garrud, London.
844. Punching, &c., Machine, J. Tushaw, London.
845. Spinning Frames, H. Roberts, Mytholmes.
846. Stitching Machines, R. Livesey, Nottingham.
847. Bicycle, F. N. Dyer, Macclesfield.
848. Safety Saddle-bar, M. and J. Cooper, York.
849. Button Fasteners, H. Andrews, Birmingham.
850. Iron Bedstead, J. H. Cairns, Armagh.
851. Cigarettes, T. V. Riordan, Cork.
852. Disinfectant, A. J. Shilton, Birmingham.
853. Drop Tips for Boots, T. Payne, Bristol.
854. Driving Gear, R. Nicholls, Landport.
855. Making Short Memoranda, R. Parry, Hoole.
856. Driving Belts, J. Moxon, Sheffield.
857. Link Driving Belts, J. Moxon, Sheffield.
858. Glazing Glass Structures, F. Matthews, Slough.
859. Preventing Irregularity in the Flow of Gas, T. Bradbear, Birmingham.
860. Pianoforte Actions, G. Green and C. Savage, London.
861. Sliding, &c., Bracket, M. H. King, Beckenham.
862. Compensating Watches, J. Richardson, London.
863. Anemometers, J. Richardson, London.
864. Station Indicator, E. Cornelis, London.
865. Type Cases, A. M. Clark.—(*W. H. Golding, U.S.*)
866. Match-holder, A. O. Durrant, Sudbury, and A. Groves, London.
867. Pencils, R. W. Hunt, Scarborough.
868. Candlesticks, H. King, London.
869. Shipbuilding, A. N. Cochrane, London.
870. Fire-escapes, W. Davison, London.
871. Bows for Violins, &c., A. W. Adams, Penrith.
872. Metallic Boot Protectors, S. Hall, Rodley.
873. Tag, D. W. Fessey, London.
874. Stationary Steam Boilers, T. Calverley, Burnley.
875. Spinning, &c., Machinery, B. Dobson and W. Paley, Bradford.
876. Casing Ships' Cables, &c., C. Anderson, Leeds.
877. Nursery Chairs, A. C. Robinson, Manchester.
878. Signal Lamps, H. Defries, London.
879. Preserving Milk, E. Loeflund, Stuttgart.
880. Executing Mechanical Drawings, G. E. Cory, Charlton, and B. A. Barczinsky, London.
881. Glazing Conservatories, T. Shelley, Birmingham.
882. Removing Superfluous Gold Leaf from Book Covers, E. Straker, London.
883. Tapping Casks, H. J. Haddan.—(*J. B. Kuttendreier, Munich.*)
884. Registering Apparatus, J. Maskelyne, London.
885. Locking Railway Switches, H. Williams, Mount Florida.
886. Valves, E. Pocock, London.
887. Warming, &c., Apartments, S. Reeve, London.
888. Tips for Heels of Boots, G. Chambers, London.
889. Lids for Desks, J. Glendenning, Norwich.
890. Extracting Tannin, &c., Acid, J. D. Wilson, A. Ambler, and J. C. Marshall, Sowerby Bridge.
891. Spring Loop Fastener, G. Knightley, London.
892. Chronographic Watches, W. R. Lake.—(*F. Fitt, Switzerland.*)
893. Tubes and Washers, C. Brigg, Bradford.
894. Feathering Paddle-wheels, A. M. Clark.—(*C. L. Petersen, Boston, U.S.*)
895. Obtaining Tin, W. Beatson, Rotherham.
896. Cutting Sticks, C. F. Parsons, East Greenwich.
897. Ventilating Waterproof Coats, E. Busby, London.
898. Arc Lamps, J. Brockie, London.
899. Cisterns, F. C. Biddiscombe, Manchester.
900. Locking Device for Nuts of Fish Plate Bolts, T. P. Carswell, Murrayfield.
901. Pumping, &c., Engines, J. Fielding, Gloucester.
902. Ridge Tile, J. G. Stadler, Zollikofen, and E. Schmid, Zurich.
903. Sulfoconjugate Violet Dyes, J. Imray.—(*La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis, A. Porrier, and A. Rosenstiehl, Paris.*)
904. Screening Apparatus, C. Schlickeysen, Berlin.
905. Cigar Cutter and Piercer, E. J. Davis, London.

ABSTRACTS OF SPECIFICATIONS.

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

1854. Breech-loading Fire-arms, *W. Gardner, London.*—*12th April*, 1883. 8*d*.

The improvements are chiefly applicable to pistols, but can also be applied to rifle carbines and other breech-loading fire-arms with two or more barrels. The barrels are all in one piece, and are jointed to the frame for opening and closing the barrels. A hammer is provided for each barrel, the mainspring and sear being formed with three branches, one for each hammer. The barrels are discharged in succession by actuating a single trigger.

1857. Electric Telegraphs, *A. A. Favarger, London.*—*12th April*, 1883. 10*d*.

The receiving apparatus is provided with type, so arranged that printed together they produce a monogram, or that any combination printed simultaneously shall produce the separate letters and signs comprised in the monogram. The combinations are effected by transmitting through the line wire a succession of currents, with suitably adjusted intervals, the currents actuating, at the receiving station, circuit closers, which, in turn, close the local circuits of electro-magnets by which the types are moved.

1863. Washing Machines, *W. R. Lake, London.*—*12th April*, 1883.—(*A communication from K. Grav, Norway.*) 6*d*.

In a box lined with tin is fitted a cylindrical vessel carried in bearings at each end, and made of two discs connected by a number of pieces of corrugated metal fixed in the form of a ring, such pieces being fixed so that some of them overlap and leave a space to admit water when the vessel is rotated, the corrugations directing the water towards the centre. A number of longitudinal and radial ribs are fixed in the vessel.

2056. Apparatus for Working Brakes and Springs of Railway Vehicles by Fluid Pressure, *J. Armstrong, New Swindon.*—*23rd April*, 1883. 1*s*. 2*d*.

In a convenient part of the engine a steam piston and cylinder are opposed by a vacuum cylinder and piston, the two pistons being on the same rod. The steam piston is in communication with the boiler, and the vacuum piston in communication with the main pipe for the brakes. When the vacuum is destroyed in the main pipe, the steam causes the brakes to be applied. The brakes are taken off by creating a vacuum in the main pipe by an ejector or pump. In compressed air brakes the vacuum cylinder is replaced by a compressed air cylinder.

2120. Retention and Circulation of Steam in its Application to Engine Power, &c., *R. M. Marchant, London.*—*26th April*, 1883. 8*d*.

The steam from the generator acts first in a small cylinder of a tandum pair, and then passes to a pump which delivers it to the large cylinder, whence it passes by a pipe to a surface condenser.

2148. Generation, Storage, Regulation, Distribution, Measurement, and Utilisation of Electricity, and Apparatus therefor, &c., *J. S. Williams, Riverton, N.J., U.S.*—*27th April*, 1883. 10*d*.

Relates to converting natural forces into power, and utilising such power, or surplus of such power, by its conversion into electric energy. The generators may be adapted to operate as fly-wheels of steam or other engines. The production of current is regulated by a centrifugal governor and variable resistances, the return flow of current being checked by an automatic "cut-off." The currents may be utilised for the extraction of metals from their ores. The force of the current may be regulated and held in reserve by employing secondary batteries. Fourteen previous specifications are referred to.

2194. Railway Brake Apparatus, *B. J. B. Mills, London.*—*1st May*, 1883.—(*A communication from D. Torrey, New York.*) 10*d*

This relates to brake mechanism in which the force to operate the brakes is stored in an accumulator, and is sufficient to charge, at the proper time, a working spring which, when released, effects the succeeding application of the brakes. The longitudinal movements of the drawbar or buffer of the car, or the energy of wheel rotation is used to charge the accumulator spring.

2195. Electric Ways or Conductors, *B. J. B. Mills, London.*—*1st May*, 1883.—(*A communication from E. M. Bentley and W. H. Knight, Washington, Col., U.S.*) 10*d*.

Relates to the arrangement of conductors used for electric light, telegraphic and telephonic purposes, in close proximity to each other, so as to be undisturbed by mutual induction. There are sixty-one claims.

2304. Automatic Regulation at a Distance of Electric Currents, &c., *E. G. Brewer, London.*—*7th May*, 1883.—(*A communication from La Société Anonyme des Ateliers de Construction Mecanique and d'Appareils Electriques, Paris.*)—(*Not proceeded with.*) 4*d*.

The regulation is effected by two special valves controlling the steam supplied to the engine, these valves being operated by a system of electro-magnets, the currents to which are controlled by a testing apparatus of varying form situated at the end of the circuit.

2315. Enamelling Cast Iron, *G. J. Rhodes, Wolverhampton.*—*7th May*, 1883. 4*d*.

The gases are partly expelled from the pores of the iron, and the pores partly filled with oxide of iron by the Bower-Barff process, and then the gases are completely expelled and the pores filled by applying to the surface of the iron a glaze or enamel containing borax, or oxide, or carbonate of lead, which will act upon the oxide, and dissolve a film of the same, with which it becomes chemically combined, and forms a smooth surface adapted to protect the iron from rust.

2317. Embroidery Machines, *A. W. L. Reddie, London.*—*8th May*, 1883.—(*A communication from J. Jonson, New York.*) 1*s*. 6*d*.

This relates to the "Heilmann" or "Swiss" embroidery machines, and consists in the combination in machines containing a fabric frame and needle carriages having an outward and inward traverse, or movement from and towards the frame, for the purpose of inserting the needles into the fabric alternately from opposite sides, and of drawing them and the thread through the fabric, of driving mechanism arranged upon the carriages for imparting motion to them, and reversing gear, also on the carriages, for automatically reversing the driving mechanism to terminate the outward movement of the carriages and move them inward.

2340. Self-levelling Ships' Sleeping Berths, *H. H. Lake, London.*—*8th May*, 1883.—(*A communication from W. T. Milligan, Boston, U.S.*) 8*d*.

The object is to enable the berths to be hung nearer the side wall of the state-room than hitherto, and it consists of a berth, the longitudinal axis of which is adapted to move laterally with respect to the walls of the state room as the berth swings, but in an opposite direction to that in which the berth swings; also in the combination of a swinging berth with a governor, which controls the movements of the berth; also in a berth adapted to swing upon a transverse axis and provided with two sets of springs placed one set on each side of the axis, and so arranged that a weight tending to contract one set will also tend to contract the other set; also in a berth hung by flexible supports over suitable lateral pivots and provided with mechanism to adjust the head and foot.

2356. SELF-ACTING READERS FOR JACQUARDS, *R. W. Sutcliffe, London.—9th May*, 1883. 8d.

The object is to simplify the construction and manipulation of readers for jacquards, and it relates to the general construction thereof. The pointers and punching levers are connected by cords and pulleys, and the pointers are adjusted by means of hollow rods and levers and bars.

2358. SECONDARY VOLTAIC BATTERIES, *A. Parts, London.—9th May*, 1883.—(*Not proceeded with.*) 2d.

The electrodes are made from thin plates of carbon, which are soaked in a boiling saturated solution of acetate or nitrate, or infused chloride of lead, the absorbed salt being reduced by chemical or electrical action. Or a mixture of about equal parts by weight of powdered carbon and minium, to which a small quantity of shellac is added, is subjected to hydraulic pressure, the agglomerated plates being then heated sufficiently to melt the lac. To render currents from accumulators independent of the state of the anodes, the electrodes prepared as stated are used as the cathode, the anode being of amalgamated zinc.

2360. ADJUSTMENT OF TRICYCLE AND BICYCLE SADDLES, *W. S. Honywood, Aston, and G. T. Cashmore, Handsworth.—9th May*, 1883. 6d.

The saddle is attached to a flat steel spring bent into a scroll, one long arm of which can be adjusted on the body of the machine by set screws, and the other long arm of which receives the saddle.

2362. APPARATUS FOR ELEVATING AND DISCHARGING GRAIN, MUD, &c., *G. J. Hone, London.—9th May*, 1883. 6d.

This relates to the construction of the grap skips and to the mechanism for working the same.

2363. MANUFACTURING CAST IRON, *W. Spence, London.—9th May*, 1883.—(*A communication from A. Braconnier, Nancy.*)—(*Not proceeded with.*) 2d.

The invention consists in the process of injecting through the tuyers of a blast furnace, the gases issuing from any suitable coal gas generator, by previously heating such gases elsewhere or external to the furnace at as high a temperature as required.

2364. MACHINERY FOR MAKING KNITTED UNDER-SHIRTS, *M. Grieve, Leicester.—9th May*, 1883.—(*Void.*) 2d.

This relates to an apparatus for shaping and narrowing the necks of knitted under-shirts, so that the neck is lower in front than behind, and is in a suitable state for the subsequent attachment of an elastic ribbed collar.

2367. WEAVING AND BROCADING DESIGNS AND FIGURES ON SILKS, &c., *W. C. Kipling, London.—9th May*, 1883. 4d.

This relates to the application of woven and brocaded designs and figures on one side only of silks and other fabrics.

2368. MANUFACTURE AND ARRANGEMENT OF STRIPS OR LENGTHS OF EMBROIDERY OR SIMILAR DRESS TRIMMINGS TO FACILITATE THE MEASUREMENT AND SEPARATION OF PORTIONS THEREOF, *H. H. Lake, London.—9th May*, 1883.—(*A communication from M. Guggenheim's Sons, New York.*) 6d.

The inventors claim a bolt of embroidery containing two or more rows separated by a line of perforations adapted to be folded and secured by ties at the folds.

2370. APPARATUS FOR THE MANUFACTURE, MEASURING, AND CUTTING OF PAPER, *M. Clark, St. Mary's Cray, and A. Masson and R. Scott, London.—9th May*, 1883.—(*Not proceeded with.*) 2d.

The inventors substitute for the ordinary drum, measuring arms at the end of which a small roll or cross-bar is carried across the machine, the length of sway of which roll or bar determines the length of sheet.

2371. MACHINERY FOR SUPPLYING SAND TO MOULDS USED IN THE MANUFACTURE OF BRICKS, *H. H. Lake, London.—9th May*, 1883.—(*A communication from J. A. Buck, Crescent, J. W. Tubbs, Cohoes, and A. Selkirk, Albany, U.S.*) 8d.

This relates to a machine for sanding moulds for use in brick making, in which a rotary sanding cylinder, having a chamber for holding sand, and a series of three or more mould receiving openings provided in its periphery, operates to receive the moulds to be sanded, and hold such moulds in such a relation to each other that when one or more of said moulds is or are down below the plane of centre of rotation of the cylinder and receiving the sand, one or more other moulds will be carried up above the said plane of centre of rotation, and be emptied of sand, and be in convenient situation for ready removal and replacement; and also in which an elastic supporting bed, supported wholly from the frame of the machine, operates, in conjunction with the said sanding machine, to automatically hold the moulds in place in the mould receiving openings, made in the periphery of said cylinder.

2373. INSULATING SUPPORTS FOR TELEGRAPH AND TELEPHONE WIRES, *S. Woolf, Mexborough, Yorks.—9th May*, 1883.—(*Not proceeded with.*) 2d.

Consists of an earthenware sheath and arms moulded in one. The sheath is closed at its top, and of such dimensions as to envelope the top of the pole. The wires are bound to undercut oblique grooves in the arms.

2378. APPARATUS FOR CHECKING THE RECEIPT OF MONEY IN PUBLIC VEHICLES, &c., *J. M. Black, London.—10th May*, 1883. 6d.

The object is the construction of a portable box or case, designed for containing rolls of consecutively numbered tickets representing classes or fares, the arrangement of said box being such that the tickets contained therein can be readily withdrawn therefrom, and severed with facility from their respective continuous rolls, the tickets or piece so severed being given by the person in charge of the box as a receipt or check for money received.

2379. LOOMS, *G. H. Hodgson, Bradford.—10th May*, 1883. 6d.

The object is, First, to construct shedding motions in such a manner that the motion is positive, and the card or lag cylinder capable of regulation by hand, whilst the loom is standing; Secondly, to reduce the liability of sliding picket tappet motions breaking, and arrange the same that the sliding tappets can be removed out of action when required; Thirdly, to mount the reed in the "going part," so that the reed is loose whilst the shuttle is crossing the piece, but fast during the time the weft is being "beat up."

2381. MANUFACTURE OF BUOYANT CONTRIVANCES FOR LIFE-SAVING AND OTHER PURPOSES, *F. W. Brewster, London.—10th May*, 1883. 6d.

This relates to the manufacture of a flexible buoyant life-line or buoyant device (which can be used for various purposes) of any desired length, by flexibly connecting end to end series of buoyant sections composed of or filled with any suitable buoyant material.

2382. CUPOLA AND BLAST FURNACES, &c., *A. Stewart, Bradford.—10th May*, 1883. 8d.

This consists principally in improvements in cupola and blast furnaces giving a third zone of fusion, and arranging the top row of tuyeres in such a manner that the tuyeres can be opened and closed by the action of a handle; also in an arrangement of ejector and injector valve for exhausting hot air from a receiver and passing the compressed air into the heated metal.

2384. TREATMENT OF ORES OR METALLIC MIXTURES, &c., *J. Cross and G. I. J. Wells, Widnes.—10th May*, 1883. 6d.

The inventors claim, First, the process and apparatus for calcining ores or metallic mixtures by a revolving calciner connected with a chamber formed with a pocket and condenser. Secondly, the process and apparatus for rapidly cooling the liquors drawn off from the attacking cistern, by causing the said liquors to circulate in a series of shallow troughs. Thirdly, the process and apparatus for maintaining a circulation of the acidulated liquor or solution, in order to bring all particles of the solution into contact with zinc immersed therein.

2383. KNITTING MACHINERY, *S. Lowe and J. W. Lamb, Nottingham.—10th May*, 1883. 1s. 4d.

This relates to improvements on patent No. 2552, dated 23rd June, 1880, and consists in modifying the motions of the jack sinkers and the dividing sinkers, and also of the needles.

2385. GAME OF SKILL AND APPARATUS EMPLOYED THEREIN, *E. Edwards, London.—10th May*, 1883.—(*A communication from E. Stevens, Brussels.*)—(*Provisional protection not allowed.*) 2d.

This relates to a game played by two players upon a board with counters or pieces similar to those used in the game of draughts.

2386. EXTRACTING SILVER, LEAD, COPPER, AND ZINC FROM BLUESTONE, &c., *J. Cross and G. I. J. Wells, Widnes.—10th May*, 1883. 6d.

This consists in digesting the unroasted ores (reduced to a fine state of division) in hot hydrochloric acid, in vessels preferably constructed of stone. The lead is then converted into chloride which becomes soluble in certain menstrua. The liquor is then nearly neutralised with lime or carbonate of lime, but leaving only a slight excess of acid, then well boiled, settled, and run off whilst hot, through a suitable filter into a tank, when it is allowed to cool.

2387. BLAST FURNACES, &c., *J. Arthur, Harthill, N.B.—10th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to removing the back pressure of the gases, and giving an increased draught and a freer combustion; also to arrangements for drawing off and purifying these gases; also to the separation of the soluble and condensible matter from these gases.

2389. APPARATUS FOR SHEARING AND PUNCHING METAL PLATES, &c., *A. J. Lehmann, West Hartlepool.—10th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to improvements in machines for shearing and punching metal plates, &c., in which rotating disc cutters are employed.

2390. OBTAINING GOLD, SILVER, COPPER, AND OTHER METALS FROM THEIR ORES BY ELECTROLYTIC ACTION, &c., *C. D. Abel, London.—10th May*, 1883.—(*A communication from M. Body, Liege.*) 6d.

The ores are treated in a lixiviating vessel with ferric salts, they then pass into a vessel where they are allowed to subside, from which they pass to a precipitating vessel provided with electrolytic precipitating plates. For argentiferous ores a cast iron drum containing iron balls is connected to the negative pole of a generator, and has a hollow perforated shaft insulated from it and connected to positive pole. The shaft serves for the introduction of the lye, and has connected to it carbon precipitating plates.

2391. BELTS, CORSETS, &c., *H. H. Lake, London.—10th May*, 1883.—(*A communication from A. Bridgman, New York.*)—(*Not proceeded with.*) 2d.

This relates to a belt or other article which can be adjusted as desired, within certain limits, to suit different persons.

2393. ROTARY ENGINES, *A. Boyd, Bromley-by-Bow.—11th May*, 1883.—(*Not proceeded with.*) 2d.

The objects are an improved mode of forming and mounting an oblique disc; a mode of balancing or partially compensating the opposing pressures on the respective sides thereof, whereby friction is reduced and leakage of steam diminished; improved methods of and means for packing certain portions of the apparatus; and improved modes of arranging and working the valve or valves for controlling the supply and distribution of the steam or other fluid employed.

2396. PENCIL OR CRAYON CASES OR HOLDERS, *A. Hoster, London.—11th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to the arrangement for bringing the lead into position for use.

2397. MEASURING TAPE, *H. L. Symonds, London.—11th May*, 1883.—(*Not proceeded with.*) 2d.

At one end of the tape is attached a link or loop through which the measuring tape is passed, so as to form a noose, and at a certain distance on said tape a bar or stop is fixed, and limits the contraction of the noose.

2399. CHAMBER OR STORE-ROOM FOR STOWING ENSILAGE OR GREEN FODDER, *O. Reynolds, Rockland, St. Mary.—11th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to the general construction of the silo and means of draining.

2405. CONSTRUCTION OF STEAM BOILERS, *H. Lane, London.—11th May*, 1883. 6d.

This relates to arranging the tubes so that each tube is free to expand independently, and the expansion of each and all the tubes may vary indefinitely without causing leaks.

2406. TUNNELS, *T. R. Crampton, London.—11th May*, 1883. 6d.

This relates to a combination consisting of three tunnels each suited to a single line of traffic, such tunnels being connected together near the centre of their lengths, and connected by passages having valves at an intermediate place with a branch or auxiliary tunnel, from which air can be withdrawn, so that in operation an air current passes by one tunnel to the centre of the other tunnels, and in these air currents pass in opposite directions to the branch or auxiliary tunnels.

2407. BREAKING-UP AND DISPOSING OF SLAG FROM FURNACES, *W. Cochrane, Newcastle-on-Tyne.—11th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to means for cooling and breaking-up the large blocks of slag.

2409. MILLING MACHINES, *H. H. Lake, London.—11th May*, 1883.—(*A communication from P. P. Huré, Paris.*) 10d.

Three carriages are provided, two of which are actuated by a lever serving to move the cutter-bearing spindle in all directions, so as to produce various shapes according to a template which is larger than the piece which is intended to be cut. The template is fixed in a vice, the template being curved so that the radius of such curve shall be equal to that of the curve described by the tracer. The motion of the tracer is regulated in accordance with the diameter of the cutter, and to it may be substituted a spring point designed to trace on the template from the profile of the article which is to be cut.

2410. APPARATUS FOR TREATING WOOD FOR SEASONING, HARDENING, AND PRESERVING THE SAME, *J. B. Blythe, Bordeaux.—12th May*, 1883. 6d.

This relates to the arrangement of the ovens and to the injecting apparatus.

2411. MANUFACTURE OF COLOURING MATTERS SUITABLE FOR DYEING AND PRINTING, *J. Erskine, Glasgow.—12th May*, 1883.—(*A communication from C. Rumpff, Germany.*) 4d.

This relates partly to the separation of the old isomeric mono-sulpho acid of the Beta-napthol of Schaeffer from the new isomeric Alpha-mono-sulpho acid of Beta-napthol described in specification No. 1225, A.D. 1881, produced in mixture with it by the action of diazo-benzol, diazo-toluol, diazo-xylol, diazo-napthaline, or their homologues, or any of them, on the watery and alkaline solution of both salts.

2412. CONSTRUCTION OF SHIPS-OF-WAR, *E. J. Reed, London.—12th May*, 1883. 8d.

This relates to the placing of the magazines, boilers, and the steam-containing and other more or less delicate portions of the propelling machinery, or any of the same higher up in the ship than they have hitherto been placed, and protecting them from beneath by means of an armoured deck or inner bottom of thick plating, or of other material suitable for their protection, in combination with a lightly constructed external hull or bottom.

2413. APPARATUS FOR SPACING AND MARKING FOR RIVET, BOLT, AND OTHER HOLES ON SHEET AND OTHER METAL SURFACES, *R. K. Jones, Birkenhead.—12th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to the combination with the punch of a gauging apparatus for spacing.

2416. EXTRACTING SUGAR FROM MOLASSES, SYRUPS, &c., *C. Steffen, Vienna.—12th May*, 1883. 6d.

This relates to several improvements upon patent No. 967, dated February 22nd, 1883.

2417. STENCH TRAPS FOR STREET GUTTERS, &c., *J. Whitehouse, Tipton.—12th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to means for preventing the escape of sewer gas into the atmosphere, and whereby the cleaning of the trap of the dirt and mud deposited in it is much facilitated.

2418. LIGHT FENCING, *R. Howarth, Wolverhampton.—12th May*, 1883.—(*Not proceeded with.*) 2d.

This relates to supplying the wires with a current of electricity.

2419. MACHINE FOR FILLING, CORKING, AND SYRUPING BOTTLES, *F. Foster, London.—12th May*, 1883. 6d.

This relates partly to the employment of a slotted tube controlled by the movement of the plug of the stop cock, which admits the supply of the liquid to the filling machine, for the purpose of delivering the liquid well into the bottle neck, in such a manner as to run down the sides of the bottle, and also to keep the passage for the return of the surplus gas and air free from froth.

2420. APPARATUS FOR LIGHTING FIRES, *G. W. von Nawrocki, Berlin.—12th May*, 1883.—(*A communication from C. Pockel, Berlin.*—(*Not proceeded with.*) 2d.

This consists mainly of a reservoir, which contains ashes soaked in petroleum or oil or spirits, which reservoir, when portable, is covered with a lid, or is cast on to the under part of the grate.

2421. FOUNTAIN PENS, *J. Morton, London.—12th May*, 1883. 6d.

The air tube in antistylographic pens is dispensed with. The ink duct, for conveying the ink from the reservoir to the nib, is made of the same diameter to near the bottom; and a short distance above the ink opening, a small hole is made to admit air to the duct.

2422. APPARATUS FOR TAKING AND EXAMINING SAMPLES OF WINE, &c., *A. J. Boult, London.—12th May*, 1883.—(*A communication from P. Constant, Rheims.*) 6d.

This relates to a pocket pump for sampling liquids, consisting of two tubes, one sliding within the other.

2423. RE-AGENT FOR TESTING WINE, *A. J. Boult, London.—12th May*, 1883.—(*A communication from C. Pradines, Molières, France.*)—(*Not proceeded with.*) 2d.

The re-agent is produced by complete saturation of pure ammonia with rectified ether.

2427. MANUFACTURE OF SUGAR, &c., *J. Görz, Berlin.—12th May*, 1883. 6d.

The inventor claims the process of extracting sugar from syrup, molasses, or other saccharine liquid, which process consists in heating the same, passing electric currents therethrough, and allowing the said liquid to settle.

2428. METHOD OF AND APPARATUS FOR UTILISING AN EXPLOSIVE COMPOUND FOR BLASTING, &c., *R. Punshon and R. R. Vizer, London.—12th May*, 1883. 2d.

This relates to the utilisation of picric acid and nitric acid, by enclosing them separately in cartridges, vessels, or containers in such a manner that the said acids are kept apart for transit or storage, and can be liberated and combined at or in the place where the explosive force of the compound is to be utilised.

2429. ROCK DRILLS AND STANDS THEREFOR, *A. M. Clark, London.—12th May*, 1883.—(*A communication from T. W. Sterling, New York.*) 8d.

This consists in novel arrangements of parts whereby a series of hammers are made to revolve in concert about a common centre, and each of said hammers is brought successively in line with the drill or drill holding spindle of the machine by the mechanism which revolves the series of hammers, and which, acting in concert with other devices, causes each hammer to deliver its blow upon the drill or drill holding spindle that is or may be made to continuously revolve.

2430. VELOCIPEDES, *H. H. Lake, London.—14th May*, 1883.—(*A communication from W., J. P., and J. G. Ahlert, San Francisco.*) 6d.

This relates to a single-wheel velocipede or monocycle, in which the rider occupies a saddle or seat placed within the circumference of the wheel and below the centre or axial line thereof.

2431. COMPOUND MAINTAINING PRESSURE APPARATUS FOR GAS, VAPOUR, OR OTHER FLUIDS, *J. C. Stevenson, Liverpool.—14th May*, 1883. 6d.

This refers to apparatus for maintaining a constant, or an approximately constant, pressure of gas or other fluid by the use of floats within a casing having inlet and outlet passages.

2432. CARDING ENGINES, *G. and E. Ashworth, Manchester.—15th May*, 1883. 8d.

This relates to several improvements in the general construction of carding engines.

2433. JOINTS OF DRAIN PIPES FOR LAND DRAINING, &c., *D. Edwards and J. Williams, Cardiff.—15th May*, 1883. 4d.

The pipes are made with scalloped ends consisting of any number of scallops or projections of any suitable shape, so as to form a bond in such a manner as to prevent any deflection or irregularity at the joints.

2434. PRODUCING, DISTRIBUTING, AND UTILISING ELECTRICITY FOR LIGHTING, MOTIVE POWER, &c., *E. L. Voice, London.—15th May*, 1883. 6d.

Relates to "motor indicators" in which mechanical effect is produced on completing the motor circuit, whilst on breaking contact induced currents are obtained which are utilised in circuits containing translating devices. The rotating armature is formed of a number of electro-magnets, having their poles alternately arranged. The field magnets consist of a number of electro-magnets, having alternating poles. Between the "motor indicator" and the generator which supplies it with current, a shunt conductor forming the consumption circuit is joined to the positive and negative wires of the motor circuit. The commutators are suitably arranged to make and break their respective circuits at the necessary intervals.

2435. TREATMENT OF PHOSPHATIC SLAGS FOR THE PRODUCTION OF PHOSPHATES OF EARTHS AND MANGANESEOUS OXIDES OF IRON, *C. Pieper, Berlin.—15th May*, 1883.—(*A communication from C. Scheibler, Berlin.*) 2d.

This consists in the transformation of phosphatic slags into a fine powder, in which the protoxides of iron and manganese are converted into sesqui oxides and combinations of sesqui oxides with protoxides, by reducing the slags to lumps, roasting the lumps in oxidising flame, and then exposing the same to the action of steam or water.

2436. WINNOWING MACHINES, *H. J. Haddan, London.—15th May*, 1883.—(*A communication from H. Schmid, Budapest.*)—(*Not proceeded with.*) 2d.

The fan is placed immediately under the sieves instead of at the sides. Other improvements are described.

2437. DIFFERENTIAL GEARING APPLIED TO ELECTRIC MOTORS AND VEHICLES, *F. Wynne, London.—15th May*, 1883. 6d.

The motors are caused to rotate a pair of drums or discs which revolve in proximity but in opposite directions to each other. In contact with both discs is a suitably shaped carrier formed as a wheel, cylinder, or cone. This forms the driving gear. These are controlled by a regulating gear in such a manner that they shall rotate, relatively to a fixed point, in some definite ratio.

2439. MACHINERY FOR RUBBING, DRESSING, FINISHING, AND SETTING UP TYPES, *G. S. Eaton, Brooklyn.—15th May*, 1883. 6d.

This consists in several improvements in the general construction of the machinery.

2440. APPARATUS FOR REPRODUCING AT A DISTANCE THE FACSIMILE OF WRITING CHARACTERS, &c., BY ELECTRICITY, *A. T. Collier, Wadebridge.—15th May*, 1883. 6d.

The inventor claims, First, the means whereby perfect synchronism of the pendulums is obtained in both transmitter and receiver; Secondly, the means of producing the raised characters or designs on paper or other material employed; Thirdly, the apparatus for reproducing at a distance the facsimile of writing characters or any design by electricity.

2441. MACHINERY FOR THE MANUFACTURE OF LACE, &c., *F. E. A. Busche, Westphalia.—15th May*, 1883. 6d.

This relates more particularly to the beaters or mechanism employed in lace and braid making machines, for pushing the crossings or interlacements of the threads towards the braiding point, and to the mode of driving or actuating such mechanism, and governing its action by a jacquard machine or equivalent pattern mechanism.

2443. MACHINERY FOR PRODUCING RIBBED WIRE OF VARIOUS SHAPES, *C. A. T. Rollason, Birmingham.—15th May*, 1883.—(*Not proceeded with.*) 2d.

A block of iron or steel is attached to the wire drawer's bench hollowed out to receive two or more wheels fixed in position to suit the size of the wire to be drawn. These wheels are cut upon their face so that the wire being passed through between these receivers upon its surface ribs corresponding with the cuts upon the wheels.

2445. APPARATUS FOR CONTROLLING THE SUPPLY OF GAS TO GAS LAMPS, *S. Hyams, Guernsey.—15th May*, 1883. 6d.

This consists in the combination with the cock that controls the gas supply of a clock provided with hands suitably constructed and adjusted, and of intermediate mechanism in connection with the gas cock, and adapted to be acted on by the hands of the clock at given times for the purpose of turning the cock full on or partially off, as the case may be.

2446. APPARATUS FOR FEEDING CALVES, &c., *W. Osborn, Taunton.—15th May*, 1883.—(*Not proceeded with.*) 2d.

This consists of a cylindrical vessel to contain the milk, in combination with a piston-like cover fitting therein, said cover being provided with a teat for the animal to suck at.

2448. ELECTRIC LIGHT BUOYS, *E. C. G. Thomas, London.* 15th May, 1883. 4d.

The buoys have two of their sides vertical and concave, and in the approximately semicircular hollows so formed are placed water-wheels having their axes vertical. The motion of the wheels is communicated to an electric generator contained in the buoy, the current from which is delivered to secondary batteries and thence to a lamp.

2452. AUTOMATIC COUPLING FOR RAILWAY TRUCKS, &c., *G. F. Belling, Little Ilford.—16th May*, 1883. 4d.

The object is to avoid having to get between the carriages to couple and uncouple them, and it consists of a flat piece with a slot in it. On the top of this piece a movable bar is attached, and to its fore end a short movable pin is suspended and passes through a slot in the flat piece. The back part of the bar is raised or curved upwards, and the lower part of the flat piece is slightly longer than the lower and curved downwards forming an inclined plane. To the flat piece at the back of the slot a movable double shackle is attached, the front one of which slides up the opposite double shackle, along the incline, and into the slot, driving the pin back until it has passed it, when the pin returns to its former position and completes the coupling. A handle at the side is operated to raise the pin for uncoupling.

2453. APPARATUS FOR OBTAINING MOTIVE-POWER TO COMPRESS AIR AND STORE THE SAME FOR USE, AND IN MEANS FOR AUTOMATICALLY GOVERNING THE APPLICATION OF MOTIVE-POWER, *W. Ross, Peckham.—16th May*, 1883.—(*Not proceeded with.*) 2d.

Wind or water is caused to act on fans and drive an air pump connected with a reservoir, from which compressed air is automatically supplied by clockwork mechanism into motive-power engines.

2450. ENGINES FOR CARDING FIBROUS MATERIALS, *W. Tatham, Rochdale.—16th May*, 1883. 8d.

This relates to means for adjusting the card rollers and clearers the one to the other, and it consists in forming a screw nut in a pit fitted to swivel in the bracket carrying the bearing for the roller, and a similar swivel screw nut is fitted in the bracket of the clearer, one nut having a right-handed and the other a left-handed thread, with which corresponding threads on a rod engage, the rod being caused to rotate by suitable means.

2451. CALLIPERS, *St. J. V. Day, Glasgow.—16th May*, 1883.—(*A communication from A. Nimmo, Rhode Island, U.S.*) 6d.

The object is to facilitate the measurement of diameter, circumference, area, cubical contents, weight, and other measurements of spherical, cylindrical, and other shaped bodies. Two pivotted curved legs have elongations at their free ends, the inner edges of which meet when closed, and are radial to the axis upon which the legs pivot. The distance from the axis to the outer points is in the same proportion to the distance from the axis to the inner points of the elongations as the circumference of a circle to the diameter. The fractional parts of the circumference of a circle may be marked along the elongations, or the latter may be of a length to measure off any fractional part of the circumference of a circle at the outer points.

2455. PRIMARY GALVANIC BATTERIES, *G. G. André, Dorking.—16th May*, 1883.—(*Not proceeded with.*) 2d.

The copper or other negative electrode is placed in a cell containing nitrate of soda or potash in combination with a sulphate, such as that of copper, the zinc electrode being contained in a saline or acid solution. The porous cell may be made of brown paper between an outer and inner layer of parchment paper. The zinc electrode is enveloped by canvas, which is covered on the outside by woven zinc on which any copper that may penetrate by osmose is deposited.

2456. REFINING OR DECOLOURING SOAP MADE FROM COTTONSEED OIL, &c., *J. Longmore, Liverpool.—16th May*, 1883.—(*Not proceeded with.*) 2d.

This consists in adding sufficient caustic alkaline lye to refined or crude cottonseed oil or other oil containing colouring matters to produce saponification, and in separating the soap formed by the further addition of caustic alkali.

2457. LOOMS, *A. J. Boult, London.—16th May*, 1883.—(*A communication from M. Baltus, France.*) 6d.

The object is to diminish friction in looms, and it consists in the use of a brake acting on two stud wheels, so as to dispense with the central friction devices in the "check" motions of looms with several shuttles. A hooked pedal is employed to keep the wheels immovable after the shuttles are changed, and to release the same at the moment when they have again to start their movement, A compensating spring balances the movable boxes.

2459. DOMESTIC FIRE-ESCAPE, *T. Hale, Claydon.* -16th May, 1883. 6d.

This consists of a frame to be secured to a window, and carrying a grooved pulley, over which runs a rope carrying a bucket or lowering sacket.

2460. UTILISING THE FORCE OF WIND AND RUNNING WATER TO PERFORM WORK, &c., *E. A. Roy, London.—16th May*, 1883. 6d.

The force of wind and running water is caused to operate compressers which compress air into accumulators wherein it is stored, and whence it may be taken as required.

2463. Breech-loading Ordnance, *H. J. Smith and W. A. F. Blakeney, Glasgow.—17th May*, 1883.—(*Not proceeded with.*) 2*d.*

A circular or rifled bore is cut through the metal with its axis at right angles to the longitudinal bore, and in it a hollow cylinder can traverse this transverse bore. A solid metal plug is carried at one end of the sliding breech barrel by trunnions fitting slots in the barrel. The breech barrel has a traversing motion and a partial rotation imparted to it.

2465. Grills and Gridirons, *J. Adams, Glasgow.—17th May*, 1883.—(*Not proceeded with.*) 2*d.*

The gridiron consists of two sets of bars superimposed, and placed over a screen.

2469. Separation and Utilisation of the Alkali used in the Extraction of Crude Carbolic Acid from Coal Tar Oils, *J. Lane, Elland, and D. V. Steuart, Manchester.—17th May*, 1883.—(*Void.*) 2*d.*

This consists in the use of sulphuretted hydrogen and lime, for the separation and recovery of the alkali used in the extraction of crude carbolic acid from coal tar oils.

2472. Extinguishing Fires, &c., *G. W. von Nawrocki, Berlin.—17th May*, 1883.—(*A communication from C. J. Mönch, Germany.*) 6*d.*

This consists in the use of compressed carbonic acid, which is stored in a wrought iron vessel, and conveyed to places where fires are likely to occur by means of pipes, having weak parts, which will burst at a certain temperature, and allow the carbonic acid to escape into the rooms.

2473. Insulating Electrical Conductors, *A. J. Boult, London.—17th May*, 1883.—(*A communication from J. G. Sanderson, New York, U.S.*) 4*d.*

An insulating compound is made from melted asphalt, into which is mixed a non-conducting metallic oxide and sulphur, both previously reduced to a fine powder. The compound may be applied directly to the conductors or cast into blocks for future use.

2476. Construction of Wheels for Railways and Tramways, &c., *R. C. Mansell, Highgate.—17th May*, 1883. 6*d.*

This consists, First, in forming projections on the inner face of tire-retaining rings to enter recesses in the tires, so as to prevent the bodies of wheels turning within the tires; Secondly, in making ribs on the tires to enter passages or grooves on the circumference of the bodies, to prevent the latter turning in the tires; and Thirdly, in making the sand projections and recesses by moulding and compression.

2477. Machines for Uniting Knit Fabrics, *J. H. Johnson, London.—17th May*, 1883.—(*A communication from W. Pearson and J. W. Hepworth, Pennsylvania.*)—(*Not proceeded with.*) 4*d.*

This relates to machines for uniting or seaming the edges of knit or other looped fabrics technically called "looping frames," and it consists, First, in the arrangement of the needle, which operates in conjunction with the looper so as to reciprocate from the base or butt end of the needles upon which the pieces of fabric to be united are impaled toward their point; and Secondly, in the needle operating, as described, in combination with tension mechanism and the looper.

2478. Stays or Corsets, *F. H. F. Engel, Hamburg.—17th May*, 1883.—(*A communication from E. and G. Lerch and J. Meyer, Germany.*) 6*d.*

This consists in enclosing the busks in cases provided with a covering flap of metal provided with a spring fastening, and which allow the busks to be readily removed and replaced.

2480. Wheel Gear for Working Sight Bars for Guns, &c., *C. H. Murray, Newcastle-upon-Tyne.—17th May*, 1883. 6*d.*

The gear for actuating sight bars consists of a rack on the bar and a pinion engaging therewith, a wheel fast on the axis of the pinion, another fixed wheel with a different number of teeth, and a planet wheel engaging with both the other wheels and capable of being moved around their axis. Elevating gear and raining gear are also described.

2481. Manufacture of Compounds as Substitutes for Ivory, Horn, Coral, Malachite, Vulcanite, Caoutchouc, Gutta-percha, and the Like, *F. Greening, Southall.—17th May*, 1883. 4*d.*

This consists First, in treating with ammonia gas or carbonate of ammonia, in the state of vapour, fibre that has been converted into nitro-cellulose by subjection to the action of sulphuric and nitric acids; Secondly, treating nitro-cellulose—after it has been deprived of free acid—by steeping it in a strong solution of alumina sulphate, washing and drying; Thirdly, treating nitro-cellulose that has been deprived of free acid, and dried by adding to it a solvent, such as napthaline, together with zinc chloride and zinc oxide; and Fourthly, the combined process of producing uninflammable nitro-cellulose with ammonia gas or carbonate of ammonia in the state of vapour, then steeping the fibre in a strong solution of alumina sulphate, washing and drying, and afterwards adding to the dried product a mixture of napthaline, zinc chloride, and zinc oxide.

2486. Treatment of Indigo for Use in Dyeing and Printing, *W. Brookes, London.—17th May*, 1883.—(*A communication from T. Holliday, France.*) 4*d.*

Artificial alizarine, alpha or beta napthols, resorcine, or other bodies formed by heating sulpho compounds with caustic potash or caustic soda, for the purpose of introducing the hydroxyl from the melt produced by such heating, are precipitated by the use of sulphurous acid, added to the solution of the melt, until it shows an acid reaction. The resulting magnia is filtered, and the filtrate further saturated with sulphurous acid, and employed in dissolving and dyeing with indigo, by converting the same into impure hydro-sulphites with iron or zinc, the converted matters being mixed with indigo, sufficient lime being added to hold the indigo while produced in solution, and the same converted impure hydro-sulphite is used in dyeing with indigo, by adding it to an indigo vat, thereby keeping the indigo deoxidised during the process of dyeing.

2487. Oil Cans for the Use of Bicyclists and Tricyclists, *L. A. Walters, London, and J. Bradbury, Braintree.—18th May*, 1883. 6*d.*

This relates to the combination in one article of two or more oil holders, a match box, a wick holder for a spare wick, and a pricker for raising a lamp wick.

2489. Electric Current Meters, *W. Murray and H. M. Capner, London.—18th May*, 1883.—(*Not proceeded with.*) 2*d.*

A metal disc or other suitable device is made by aid of an electro or permanent magnet to revolve and operate a train of wheels.

2490. Looms for Weaving, *W. Tristram and W. Westhead, Bolton.—18th May*, 1883. 6*d.*

This relates to the method of constructing the picking bowl with its attendant connections. The picking shaft has a square hole through which passes a bolt with a square part to fit the hole. On the bolt is placed a bush on which a conical picking bowl revolves. The bush has a groove opposite the oil hole in the picking bowl so as to ensure perfect lubrication.

2492. Gas Motor Engines, *G. G. Picking and W. Hopkins, Bow.—18th May*, 1883. 8*d.*

This relates to engines in which the explosive mixture is in a state of compression before ignition, and the object is to increase the certainty of firing the mixture in the cylinder by the thorough cleansing of the firing chamber or cylinder each stroke and previous to the introduction of the next charge of explosive mixture, this object being attained by passing through the cylinder or firing chamber a charge of pure air previous to the next explosive charge being introduced, also to obtain greater economy of gas with regularity of speed, by giving the piston an impulse twice in each revolution, a charge of uniformly mixed gas and air being introduced alternately to each end of the cylinder, the refuse of combustion escaping at or near the middle of the cylinder. A pump supplies the mixture to the cylinder and makes two revolutions to one of the engine.

2497. Covers for Protecting the Bindings of Books, *S. S. Tuckerman, Kinver, Stafford.—18th May*, 1883. 6*d.*

A sheet of paper is folded so as to form a kind of envelope, one of which is placed on each flap or side of the book, so that the flaps of the envelopes overlap the back of the book, and are secured together by gumming.

2499. Insulation and Mechanical Protection for Electrical Wires, *W. A. Phillips, London.—18th May*, 1883.—(*Not proceeded with.*) 2*d.*

The wire is first covered with cotton and is then boiled in a bath of ozokerit or paraffin. It is then passed through a machine and receives a covering of strip lead coated with ozokerit. The lapped edges of the lead are further covered with cotton or tape, and the whole is passed through a bath of melted ozokerit and finally covered with copper wires which may serve as the return.

2505. Horseshoes, *T. Allen, Bradford.—19th May*, 1883. 6*d.*

The object is to prevent horses slipping, and it consists in fitting a tip of steel to the toe part of the shoe and inserting a strip of india-rubber in an annular groove in the shoe. In the heel of the shoe studs are inserted, and can yield under pressure springs placed inside the heel acting upon them to force them outward.

2508. Gaiters and Shoes or other Coverings for the Foot, *C. M. A. de Gauban du Mont, Paris.—19th May*, 1883. 6*d.*

At about the instep a gusset of deer-skin, calf-skin, kid, or other flexible and supple skin or india-rubber, is inserted. A heel-piece is placed outside the boot, so that there is no internal projection. Each side of the boot has a longitudinal slit the whole length of the leg, and is provided with a lace, by pulling the upper ends of which the openings are at once closed.

2509. Balanced Slide Valves of Steam and other Engines, *J. W. Hall, London.—19th May*, 1883.—(*Not proceeded with.*) 2*d.*

The valve has a working face on the back, and works against an abutment plate, at the back of which is fixed a shallow ring fitting steam-tight into a cylinder fixed on the valve chest cover. The abutment plate has recesses in its working face corresponding to and opposite the steam ports of the cylinder face. At the back of the abutment plate and corresponding to the recesses are fixed shallow rings or cylinders within the larger one, and in them fit corresponding pistons abutting against the steam chest cover. Openings lead steam into these cylinders.

2512. Stoppers or Valves for Bottles Containing Aerated Liquids, &c., *A. B. Vanes, Cape of Good Hope.—19th May*, 1883. 6*d.*

This relates, First, to internal stoppers, and consists in making them pear-shaped, the small end terminating in a flange with a groove above it, into which an elastic washer is inserted, and when the stopper is in position seats itself against a shoulder in the neck of the bottle. A notch or groove is formed in the narrow part of the stopper and extends above the washer, which until pressure is applied closes this groove, but which when open allows gas to escape. An instrument is described for ascertaining the size of stopper required for bottles, and consists of a rod with discs or spheres of increasing diameter formed on it, and which when inserted in the neck of the bottle at once indicates the diameter thereof.

2514. Apparatus for Making Steel by the Bessemer Process, *A. Davy, Sheffield.—19th May*, 1883. 6*d.*

The object is to enable cast ironfounders and others to make steel and steel castings without the costly plant now in use, and it consists essentially in employing in combination with a portable vessel of stand pipes constructed and adapted to discharge air into the metal by suitable blowing apparatus, so as to decarbonise the metal in the portable vessel.

2515. Carriage-wheel Tires, *H. R. Townsend, London.—19th May*, 1883. 2*d.*

The object is to prevent metal tires from skidding and slipping when crossing tram rails or other surfaces, and it consists in milling, grooving, or indenting the surfaces of the tires.

2516. Carriage or other Door Lock, *J. Holden, Swindon.—19th May*, 1883. 4*d.*

This consists in substituting for the ordinary tongue or bolt a disc of metal, the periphery of which is formed so that when the disc is revolved on its axis it engages with or disengages from the standing pillar or holdfast, and by a spring is maintained in the desired position.

2520. Combined Coupling and Buffing Apparatus for Connecting Tramcars and their Engines, &c., *W. Vaux, Bradford.—21st May*, 1883. 6*d.*

A compound coupling link is employed, and consists of two end portions with eyes and female screws, and a central portion with right and left-handed screws to take into the end female screws. The central portion has a depending weighted lever, by which it is operated. In the middle of the central portion is an enlargement, and against each face bears a metallic buffer plate, behind which is a rubber pad or a spring, next to which is another metal plate, one bearing against the draw-bar of the car and the other against a projecting part of a universal connecting link on the next car or on the engine.

2525. Water Slide Gasaliers or Gas Chandeliers, *W. Soutter, jun., and T. Edkins, Birmingham.—21st May*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to provide means for ascertaining when the water in the water slide of gasaliers requires replenishing, and it consists of a glass chamber connected with the water space so as to indicate the level of water in the latter.

2527. Apparatus for the Amalgamation of Gold and Silver from their Ores, *E. D. Chester, Surbiton.—21st May*, 1883.—(*Not proceeded with.*) 2*d.*

The apparatus may be placed at the discharge of a battery box or at the end of tables covered with amalgamated plates, and it consists of a copper cylinder or a copper covered or plated cylinder, having a coating of silver and amalgamated, placed at right angles to the tables. By suitable gearing the cylinder is caused to revolve at a slow speed in the same direction as the current of water carrying tailing, from which it takes up any runaway mercury.

2529. Operating Gear for Ships' Davits, *H. Mc Collin, Limehouse.—21st May*, 1883. 4*d.*

The davits are operated by two screw jacks arranged for moving them inward and outward as required, each davit working on a hinge put at its lower end. The jacks work in stationary bearings fixed to the deck, and the screw of each at its upper end is connected by a suitable joint to the inner side of the corresponding davit. The two jacks are geared together to ensure simultaneous action in working, a crank handle being provided for each.

2555. Apparatus for Holding Hats, *A. Pyke, London.—22nd May*, 1883. 6*d.*

This relates to apparatus for enabling hats to be suspended under chairs; and it consists of a tube, suspended by arms from a base-plate or bar, and containing rods, pressed outwards by a spring between them, so as to bear on the inside of the hat.

2565. Feeding Apparatus for Carding Engines, &c., *E. Edwards, London.—22nd May*, 1883.—(*A communication from A. Crémer Pirnay et Cie., Belgium.*) 6*d.*

This relates especially to improvements on patent No. 4001, A.D. 1879; and consists of a frame, across the lower part of which is arranged a transverse shaft, driven by gearing, and actuating by bevel wheels a vertical shaft, with an endless screw at top, driving a second transverse shaft, upon which is a cylinder, having a number of hooks, in the shape of cow horns on its circumference. These hooks take the fibrous material from an endless travelling band below, and carry it to a movable regulating comb, moving in an elliptical path, to lay the fibres parallel. A second movable comb is arranged above, and also travels in an elliptical path, so as to remove surplus wool from the hook cylinder to the carding engine.

2566. Manufacture of Sulphate of Lime or Plaster of Paris, *J. H. Johnson, London.—22nd May*, 1883.—(*A communication from P. G. Journet, Paris.*) 4*d.*

This relates to improvements in the manufacture of sulphate of lime, or plaster of Paris, consisting in treating lime with a solution of sulphuric acid so as to wholly or partially convert the lime into sulphate.

2567. Apparatus for Preserving Articles of Food, &c., *J. H. Johnson, London.—22nd May*, 1883.—(*A communication from Messrs. Liautand and Co., France.*) 6*d.*

This relates to a process of preserving alimentary substances, by the employment of a mixture of sulphurous acid and nitrogen, acting in special apparatus.

2569. Advertising Machines, *J. and R. J. Foot, London.—23rd May*, 1883.—(*Not proceeded with.*) 2*d.*

This consists of a frame containing a drum caused to revolve by gearing actuated by a spring, and to which cards bearing advertisements are secured.

2573. Manufacture of Porous or Spongy Plates, Applicable for Use in Secondary Batteries, &c., *F. T. Williams and J. C. Howell, Llanelly.—23rd May*, 1883. 6*d.*

The electrodes are made by inserting a suitably shaped perforated mould into a mass of molten lead, which has been allowed to cool slowly and assume the crystalline state, any excess of metal being allowed to drain through the mould. The edges and other portions of the plates so formed are compressed in a suitable mould by hydraulic pressure.

2625. Portable Forges, *W. Allday, jun., Birmingham.—26th May*, 1883. 6*d.*

The object is to construct portable forges so that they may be folded up into a small space when not in use, and it consists in hinging the legs to the case of the forge, which is made shallower than usual, and has sides and ends hinged to it, which when raised and fixed in position give the case the necessary depth.

2641. Cleansing and Bleaching Cotton, Flax, &c., *J. Imray, London.—28th May*, 1883.—(*A communication from H. Koechlin, Paris.*) 2*d.*

This consists in cleansing and bleaching cotton or other vegetable fibre by subjecting to steaming or hot air the material previously impregnated with alkaline substances, in combination with treatment in acid and hypochlorite baths.

2881. Fire Grates, *H. H. Leigh, London.—9th June*, 1883.—(*A communication from Société des foyer Economiques Goujet et Cie., Paris.*) 6*d.*

This consists in forming the bars in the shape of an anchor, air spaces being directed upwards through the head, while the bottoms rest on a bar which can be caused to reciprocate by gearing and so rock the anchor-shaped bars and break up the fuel. The partitions surrounding the grate are curved and perforated.

2939. Colour Boxes, *C. Davis, London.—13th June*, 1883. 6*d.*

In each compartment a spring is arranged so as to secure the pan or case of colour therein; while the long partition in the box is cut away at the centre of each compartment to enable the cake or pan to be removed when required.

3446. Manufacture of Marquetry Parquet for Flooring, &c., *G. Howard, London.—13th July*, 1883.—(*Complete.*) 2*d.*

The object is to make marquetry parquet in the natural colour of the wood with a darkened pattern therein from a single lamina (or series of laminæ) of wood, and it consists in cutting the pattern from the lamina of wood, and then darkening it and replacing it in its original position.

3658. Treatment of Fats for the Manufacture of Soap, *J. Imray, London.—26th July*, 1883.—(*A communication from I. A. F. Bang and J. de Castro, Paris.*) 2*d.*

The fatty matter, after being treated in the usual way for separation of the glycerine, is poured into a vessel lined with lead, and while still hot it is heated with sulphurous acid applied either in solution with water, or blown through the material, to which water is added.

4008. Gas or Inflammable Liquid Engines or Prime Movers, *E. K. Dutton, Manchester.—18th August*, 1883.—(*A communication from J. Spiel, Berlin.*)—(*Complete.*) 8*d.*

A mixture of gas or inflammable vapour and atmospheric air or oxygen is fired in the presence of vapour or steam arising from hot water in the firing chamber, the expansion arising from the combustion combined with the steam pressure supplying the propelling force acting upon the piston or pistons.

4145. Cleaning, Separating, or Disintegrating Cotton, &c., *H. H. Lake, London.—28th August*, 1883.—(*A communication from W. S. Archer, New York.*)—(*Complete.*) 6*d.*

By this invention waste can be cleaned and separated from foreign matter and used to manufacture goods, employing the finer grades of material. The fibrous material is subjected to the action of a picker roller provided with a stop or stops, whereby the fibre is separated from foreign matter and carried by a current of air into a blow-room, in which the rear end of the machine opens, while the coarser elements are arrested and descend to the floor or a suitable receptacle below the machine.

4211. Manufacturing Metal Tubes, *G. H. Fox, Boston, U.S.—31st August*, 1883.—(*Complete.*) 6*d.*

The essential feature consists in heating, coiling, and welding a strip of metal about a mandril until the entire tube is completed at one operation, the strip being heated, fed to the mandril, coiled about the latter, with its edges overlapping, and hammered or compressed to effect the welding of the joint.

4237. Construction of Toothed and Pronged Implements, *A. M. Clark, London.—3rd September*, 1883.—(*A communication from A. Holden, New South Wales.*)—(*Complete.*) 4*d.*

This consists in the use of a perforated cleaner plate to be worked up and down the teeth for the purpose of cleaning them, an elastic connection being provided between the plate and the implement, so as to return the former to its normal position.

4298. Telephonic Apparatus, *E. George, F. A. Pocock, J. S. Muir, and J. S. Muir, jun., London.—7th September*, 1883. 6*d.*

The diaphragm is replaced by a plate attached to wires stretched tight across a frame, so placed that the sound waves impinge directly on to the plate. The plate consists of two discs, between which granular carbon is confined.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

289,958. Motor for Sewing Machines, &c., *Alexander L. Bevans, Flushing, N.Y.—Filed October 11th*, 1882.

Claim.—(1) An open motor wheel composed of the rings *b c*, with cycloidal curved fans *a* between them, in combination with a case surrounding the wheel, and having a free passage between it and the wheel for the water, and a jet tube passing through the outer part of the case and being in the line of a tangent to the wheel, substantially as specified, whereby the wheel is caused to revolve at nearly the same speed as the issuing jet of water, as set forth. (2) The combination, in a motor, of a nozzle for an issuing jet of water, an open wheel with curved fans a case surrounding the wheel shaft *l*, a loose pulley, and a frictional connection to the shaft, substantially as set forth. (3) An open motor wheel composed of the cycloidal curved fans *a* around the periphery of said wheel, in combination with a case surrounding the wheel, and having a free passage between it and the wheel for the water, and a jet tube passing through the outer part of the case and being in the line of a tangent to the wheel, substantially as specified, whereby the wheel is caused to revolve at

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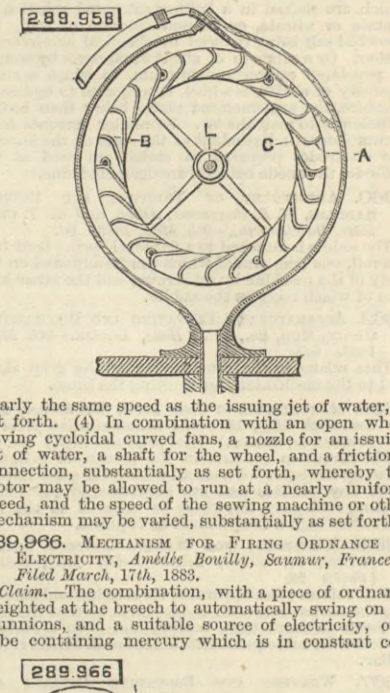

nearly the same speed as the issuing jet of water, as set forth. (4) In combination with an open wheel having cycloidal curved fans, a nozzle for an issuing jet of water, a shaft for the wheel, and a frictional connection, substantially as set forth, whereby the motor may be allowed to run at a nearly uniform speed, and the speed of the sewing machine or other mechanism may be varied, substantially as set forth.

289,966. Mechanism for Firing Ordnance by Electricity, *Amédée Bouilly, Saumur, France.—Filed March, 17th*, 1883.

Claim.—The combination, with a piece of ordnance weighted at the breech to automatically swing on its trunnions, and a suitable source of electricity, of a tube containing mercury which is in constant con-

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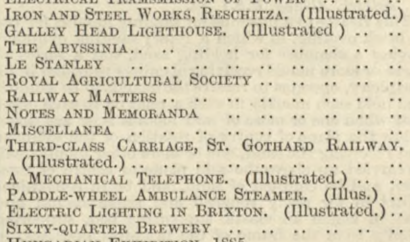

nection with one pole of the electrical source, said tube being provided with contact points at different elevations corresponding to the various angles of firing, said contact points being adapted to be immersed successively as the gun swings on its trunnions, as described.

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