DYNAMO ELECTRIC MACHINES AT THE VIENNA EXHIBITION.

No. I.

DECIDEDLY one of, if not quite, the most interesting features of the Vienna Exhibition of last year was the large number and variety of dynamo-electric machines displayed at work. Great advance has been made during the past year in perfecting the mechanical details of dynamos, and the machine galleries extending along the north and west of the Rotunda afforded ample opportunities of studying these improvements. Not only have the constructive details of the mechanism received much more careful attention than previously, but there is also observable the introduction of really scientific design of the electrical elements and dimensions of the machine. Hitherto it is to be feared that little calculation entered into the so-called "design" of a dynamo machine. Certain pieces of iron and copper wire of dimensions guessed at random were taken and built together into a dynamo.

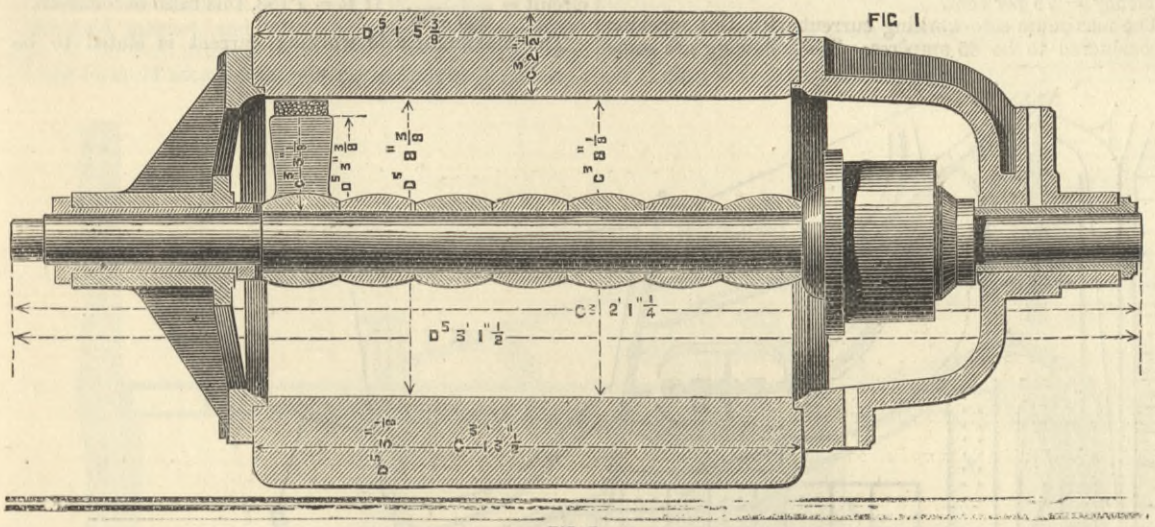


FIG 1

FIG. 2.

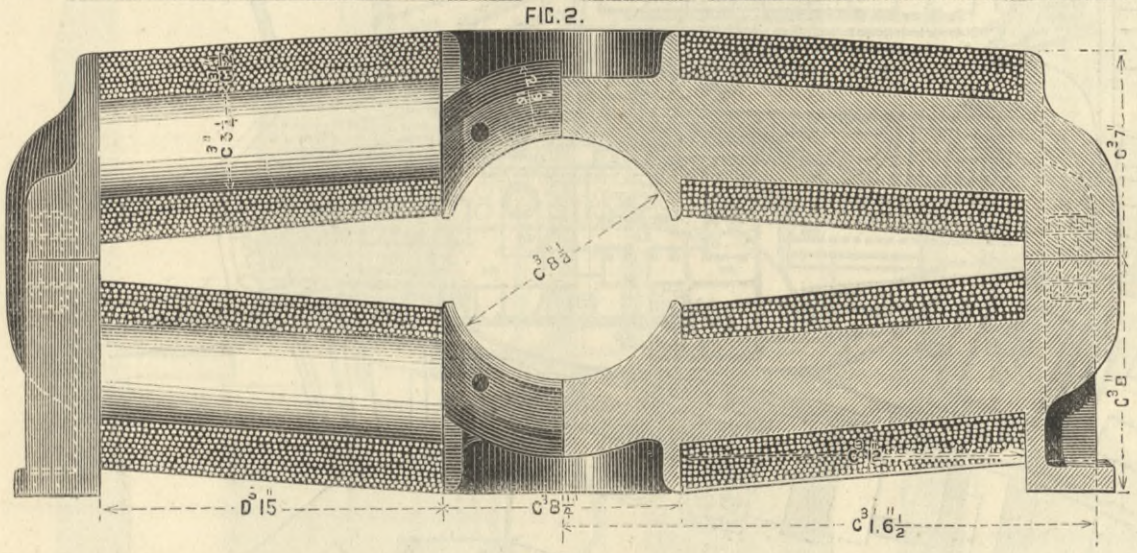
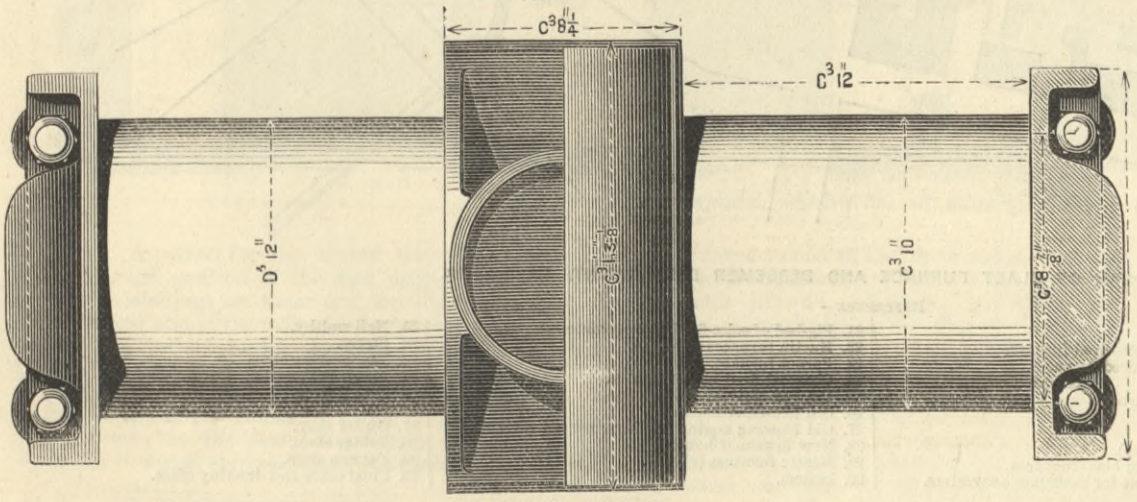


FIG. 3.



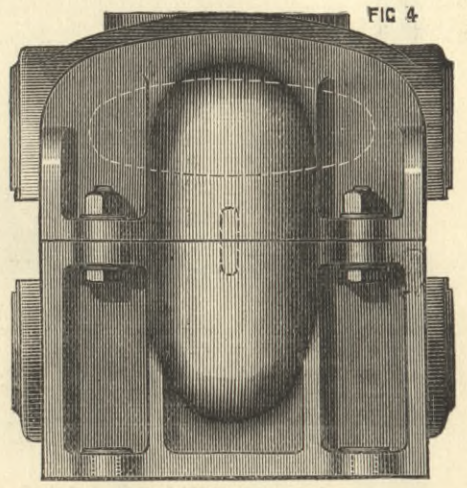
THE BURGIN DYNAMO.

The only conditions that the pieces had to fulfil at the outset were that their shapes were convenient for the operation of fastening them together, and that one part should be at liberty to rotate relatively to the rest. After it was finished it was run at as high a speed as possible in order to see what it would do. The properties of this haphazard production being thus investigated, any number of duplicates could be made and advertised as being of this particular "design," indicated in the catalogues by mysterious reference letters. It may be argued that there is nothing in this process to be much ashamed of. Are not most steam engines mere copies of other engines that have been made by "somebody else?" Are not 75 per cent. of "commercial" engines simply such copies? Is it quite certain that even at this late period of the history of the steam engine more than, say, 30 per cent. of the actual makers of steam engines would know how to start about calculating the necessary elements of the design of an engine for a stated desired purpose? It must be confessed that they would not; but decidedly this is a state of things to be mourned over. Similarly, we must rejoice to find that at last there is appearing a certain number of men who know how to calculate beforehand the necessary sizes and electrical dimensions of a given type of dynamo machine, in order to fulfil certain specified conditions, and perform certain specified work. The number of men thus qualified for such designing work is still very small indeed, but the class has come into existence, and having once done so, it is sure to propagate itself rapidly, the need of progress being great. There is one unfortunate tendency militating against the rapid multiplication of this useful species of engineer. Precisely because the demand for them is large, and the few individuals who possess the requisite knowledge and skill for this class of work obtain good remuneration for their labour, therefore those few find it altogether most profitable to keep their knowledge to themselves, and have a decided objection to the process of self-reproduction which would be of so much benefit to the community, but which would inconveniently multiply competitors and cheapen the market for scientific skill. We may preach in all the four quarters of the globe the fact, established by industrial and scientific history, that with the spread of knowledge among the mass of the population the demand for the highest skill increases in far greater ratio than does its supply; it remains next to impossible to get individuals to read history in this light, and to induce them to impart to the public the knowledge they have acquired for themselves with much labour and sacrifice of time and money. Most possessors of such special knowledge do, and will continue to, decline to enlighten the ignorant, or to communicate any of their really valuable results. A new style of catalogue literature has been cultivated, which aims at seeming, in a multiplicity of words, to explain all about an instrument or machine without in reality affording any information at all of an exact kind, or of any scientific interest. It is our duty in this journal—which endeavours, so far as its means allow, to educate its readers in engineering science—to do what we can to defeat this policy; and we will, therefore, present in these articles as full information as we have been able to obtain regarding the designs of the leading classes of dynamos exhibited at Vienna.

We owe it to the courtesy of Mr. R. E. Crompton that we are able to give tolerably complete details and drawings of two of the latest types of the compound Bürgin-Crompton dynamo. Figs. 1 to 4 show the chief parts and dimensions of the types D 5, and C 3, except such as are too well known to need reproduction here. The four field magnet-cores are made in two castings, firmly bound together by four $\frac{5}{8}$in. bolts. This forms the frame of the machine. It is secured to the floor by four $\frac{5}{8}$in. bolts, and in its extremities are formed the bearings in which the shaft of the armature revolves. Fig. 1 is a vertical section through the axis of the shaft, which shows only that portion of the frame actually cut by the section plane. The right-hand half of Fig. 2 shows the field magnet-cores in central section, and the left-hand is an outside end view of the frame. The shaft, its bearings, and the armature are omitted from Fig. 2. Fig. 3 shows a plan of the same portion, the right half being in central section, and the shaft, the bearings and armature being again omitted. Fig. 4 is an outside side end view of the machine parallel to the shaft axis, but with the shaft bearings omitted.

From Fig. 1 it is seen that these bearings are brass castings. That on the left-hand is in the shape of a spoked wheel with a long central hub in which is placed a gun-metal bush. The shaft bears the driving pulley at this end. The journal is $1\frac{3}{8}$in. by $5\frac{1}{8}$in. At the other end a similar journal $1\frac{1}{4}$in. by $4\frac{1}{2}$in. has its bearing in a bell-shaped brass casting, which surrounds the commutator, and to which the brushes are attached. The brushes are built up in a fashion which appears to us the best that has come under our notice. They are composed as usual of a series of sheets of copper each cut into a number of narrow strips—the width of each is about $\frac{3}{8}$in.—but these are so

FIG 4



arranged that the joint lines between the strips of one layer break joint with—*i.e.*, do not lie immediately over—those of the next layer underneath. The brush by this device retains ample lateral pliability, and yet if some strips are weaker than others they are kept down to their work by these others, so that the bearing pressure is equally distributed over the breadth of the brush. The part of the shaft bearing the armature is $1\frac{1}{2}$in. by $15\frac{1}{4}$in. long. The armature is composed of seven precisely similar rings. Each ring has a central brass boss, in one piece with which are cast six brass arms. The seven bosses are shown in Fig. 1, but only one arm is drawn in. Round these arms are wound iron wire, so as to make an hexagonal rim of nearly square section, measuring $\frac{1}{2}$in. radially and $\frac{5}{16}$in. axially. Round this rim is coiled the armature copper wire, a greater number of turns being wound on the central parts of each side of the hexagon than near the corners, so that the completed ring has an equal radius in every direction. The rings are arranged spirally on the shaft. Each one lies behind its neighbour by $\frac{1}{42}$ of a whole turn, 42 being 6×7, the product of the number of sides in a ring by the number of rings. Thus the rings of the series come in regular succession to their period of maximum of electro-dynamic action, the distances between the maxima in the fluctuations of the current-strength being only $\frac{1}{42}$ of a revolution of the armature apart. The coils on the different sides of hexagonal rings are connected, not from one side to the next of the same hexagonal ring, but from the front of one coil on one ring to the back of the coil $\frac{1}{42}$ of a circle back and on the next ring to the right hand. From the last coil to the right hand of one such spiral series of coils the connection is made to the first on the left hand of the next spiral series. If the speed be 1700 revolutions per minute, the period of fluctuation of current-strength is thus reduced to $\frac{1}{42 \times 1700}$ of a minute $= \frac{60}{42 \times 1700} = \frac{1}{1190}$ of a second of time. On each side of each hexagonal ring there are 76 turns of wire ·09in. in diameter. Thus in the whole armature there are $76 \times 42 = 3192$ convolutions of wire; and, since the average length of a convolution is rather over 4in., there are in all about 1100ft. of wire in the armature. Since the total current generated is always travelling through the armature in two equal branches, each about 550ft. long; and since these two branches may be, therefore, considered as coupled parallel or in multiple arc, what may be called the armature resistance is that of $\frac{1}{2} \times 550 = 275$ft. of ·09in. wire. As found by testing the resistance of this armature from brush to brush is ·45 ohm.

The pole pieces of the field magnets, as seen in section in Fig. 1, are $15\frac{1}{2}$in. wide by $2\frac{1}{2}$in. in radial depth. Each surrounds the armature through 140 deg. The pair of pole pieces are bored out true to $8\frac{1}{8}$in. diameter. The magnet cores are of solid cast iron, and are best seen in Figs. 2, 3, and 4. They are—each of the four—12in. long and of oval section, 10in. wide, and $3\frac{1}{4}$in. deep. The winding is $1\frac{1}{2}$in. deep, and the wire is laid on evenly from end to end. The series winding for the main current has 570 turns of wire ·140in. in diameter. Outside this comes the shunt winding, which has 915 turns, and is of wire ·035in. in diameter. The windings for the main current on all four magnet-cores are coupled parallel. Only one-quarter of the whole main current, therefore, circulates round each magnet-core, and the total resistance of the four parallel coupled branches is ·18 ohm. The question whether this arrangement, or that of taking the whole

current successively round all four magnet-cores in series is better, is more a question of practical convenience in manufacture than one of theoretical importance. If they were taken in series, the section of the wire should be taken four times as large, and in the same size of section and length of magnet there would be room for only one-fourth the length of wire. The wire on each arm would then have one-sixteenth the resistance it has in the actual arrangement, or one-fourth that of the group of four coupled parallel. Since the current would pass four of these lengths in series, we would have the same total resistance, and therefore the same total current, with the same electro-motive force. The whole current would have four times as much magnetising influence per turn as the quarter current actually used, but since the number of turns is now reduced in the ratio of one-fourth, the total magnetising influence would remain precisely the same. The wire of four-fold section would have $2 \times \cdot14 = \cdot28$in. as diameter, and we presume the actual arrangement is adopted because this is an awkwardly large size of wire to deal with.

The four shunt windings are coupled in series, and thus coupled give a resistance of 92 ohms. The shunt is taken from brush to brush.

If C be the whole current generated, and R be the whole external resistance, then evidently

$$\text{Main current} = C\,\frac{92}{92\cdot18 + R}$$

$$\text{and shunt current} = C\,\frac{\cdot18 + R}{92\cdot18 + R}$$

The electric work done on the external circuit is $C^2 \left(\frac{92}{92\cdot18 + R}\right)^2 \times (\cdot18 + R)$ while that spent in the shunt current is $C^2 \left(\frac{\cdot18 + R}{92\cdot18 + R}\right)^2 \times 92$. The ratio of the former to the latter of these amounts of work is $\frac{92}{\cdot18 + R}$. If R = 2·89 ohms, this ratio becomes 30. The whole work spent in the shunt circuit goes to heating the magnets. In connection with this subject, it should be mentioned that the spiral arrangement of the seven armature rings on the shaft seems to convert the armature into a fairly efficient fan, drawing a continuous and powerful draught of air into the interior of the machine, where centripetal force drives it through the interstices between the rings out upon the magnet pole pieces. Both the armature, which is heated by Foucault currents, and the magnets are thus kept very fairly cool. The whole electric work done is made up of four parts, namely, (1) work done in armature; (2) that done in the main current coils of the field magnets; (3) that in the external circuit beyond the field magnets; (4) that in the shunt circuit. The four resistances against which these four amounts of work are done are respectively ·45 ohm, ·18 ohm, R and 92 ohms. The currents being as above, the whole work done is

$$C^2 \times \cdot45 + C^2 \left(\frac{92}{92\cdot18 + R}\right)^2 \times \cdot18 + C^2 \left(\frac{92}{92\cdot18 + R}\right)^2 R + C^2 \left(\frac{\cdot18 + R}{92\cdot18 + R}\right)^2 92.$$

The third of these is what may be called the *useful* work, and its ratio to the whole amount is the *efficiency* of the dynamo. This efficiency is, therefore,

$$\frac{92^2 \times R}{\cdot45\,(92\cdot18 + R)^2 + \cdot18 \times 92^2 + 92^2 R + (\cdot18 + R)^2 \times 92 \over R} = \frac{R}{\cdot6321 + 1\cdot0315\,R + \cdot0109\,R^2}.$$

If R = 2 ohms, efficiency = 73 per cent.; if R = 3 ohms, efficiency = 78 per cent.

The maximum safe-working current with this machine is considered to be 45 ampères. The following are some of the results of tests of its electro-motive force with different external currents. The electro-motive force has in each case been reduced by calculation to the constant speed of 1700 revolutions per minute:—

Speed.	External current.	E.M.F. at machine terminals.
1700	0	133
1700	24·5	140
1700	40·9	132

In the first experiment the whole current goes through the shunt, and the machine is for the time being reduced to the condition of an ordinary series-wound dynamo without any external resistance in the circuit.

Figs. 1, 2, 3, and 4 also show the larger size of machine D5. The journals are 1⅜in. by 5in. and 1¼in. by 4¾in. There are eight hexagonal armature rings. The armature is 8¼in. in diameter, the pole pieces being bored to 8⅜in. The total length of the armature is 17½in., the shaft being 1½in. in diameter. Each side of each hexagon is wound with 43 turns of wire ·12in. diameter. The total number of convolutions in the armature is thus $6 \times 8 \times 43 = 2064$, involving a length of about 750ft, of wire. The armature resistance is ·189 ohm. The pole pieces are 17¾in. long by 3⅝in. deep. The magnet cores are 15in. long, of oval section, 12in. wide, and 4in. deep. The main current coil has 486 turns on each arm of the magnets, and is of wire ·16in. in diameter. The four being coupled in parallel arc give a resistance of ·127 ohm. On the outside of these main current coils come the shunt circuit coils, with 649 turns on each arm of wire ·0508in. in diameter. The four coils being coupled in series, give 32 ohms resistance. We have here a much larger proportion of the current sent through the shunt. Using the same letters as before, we have—

$$\text{Main current} = C\,\frac{32}{32\cdot127 + R}$$

$$\text{Shunt current} = C\,\frac{\cdot127 + R}{32\cdot127 + R}$$

Electric energy in external circuit $= C^2 \left(\frac{32}{32\cdot127 + R}\right)^2 \times (\cdot127 + R)$.

Electric energy in shunt circuit $= C^2 \left(\frac{\cdot127 + R}{32\cdot127 + R}\right)^2 \times 32$.

Ratio of energy in external circuit to that in shunt circuit $= \frac{32}{\cdot127 + R}$. If R = 1·153, this ratio becomes 25.

The maximum safe working current is stated to be 80 ampères. The tests gave the following results:—

Speed.	External current.	E.M.F. at machine terminals.
1700	0	111·8
1700	47·3	118·0
1700	69	118·0

In both these machines it will be noticed that the electro-motive force at the machine terminals remains very constant under extremely varied external conditions. This constancy is even more remarkable in the latter machine than in the first, and may, indeed, for practical purposes be considered exact.

Messrs. Bürgin and Crompton were very late in getting their exhibits in working order at the Vienna Exhibition; in fact, they were among the last to start running. It is due to them, however, to state that, as we were informed, their cases were detained on the railroad between Belgium and Austria an abnormal time, and that they were consequently only partially responsible for their unpreparedness. Their exhibition included arc lamps, one of which we have already described in detail, and also an ampère meter, the joint design of Messrs. Crompton and Kapp. We hope to illustrate this ampère meter in a subsequent article.

Mr. Crompton's manager, Mr. Kapp, has recently put into shape a new formula for the electro-motive force at

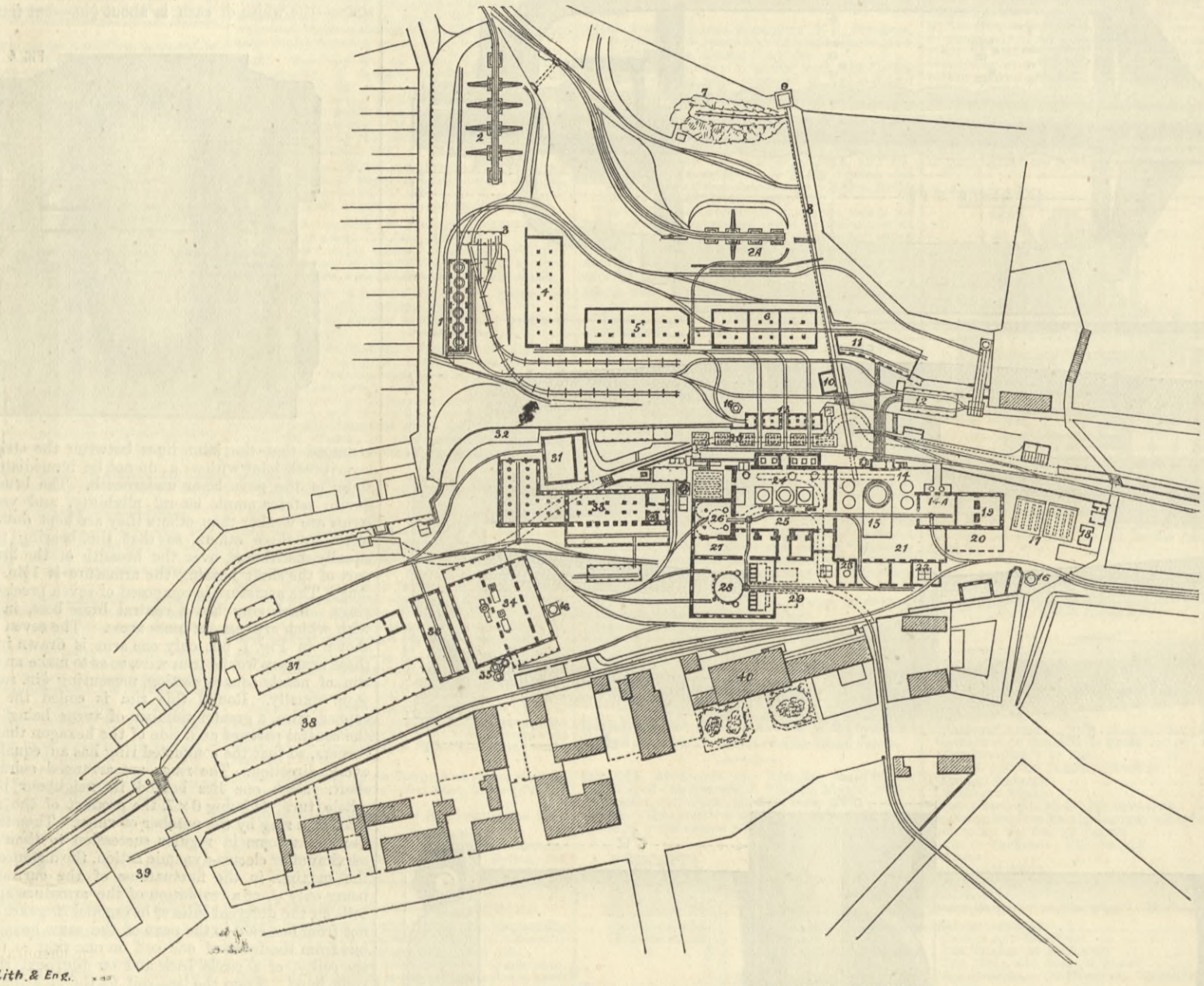


Fig. 7.—GROUND PLAN OF BLAST FURNACE AND BESSEMER DEPARTMENT, RESCHITZA.

Reference—

1. Kilns for roasting iron ore.
2. Ore depôt.
3. Ore crushers.
4. Charcoal stores.
5. Ditto. ditto.
6. Ditto. ditto.
7. Slag heap.
8. Incline for removing slag.
9. Drum of Incline.
10. Incline engine.
11. Coke stores.
12. Mixing floor for coke-fired furnace.
13. Ditto for charcoal-fired furnaces.
14. Hydraulic lift. 14A. Cupolas.
15. Coke-fired blast furnace.
16. Chimneys.
17. Boilers.
18. Belville boilers (two).
19. Blowing engines for blast furnaces.
20. New blowing engine for Bessemer converters.
21. Pig-bed of coke-fired blast furnace.
22. Martin furnaces (new).
23. Pernot furnace.
24. Charcoal-fired blast furnaces.
25. Pig bed of ditto.
26. Old Bessemer house.
27. Old blowing engine for Bessemer converters.
28. New Bessemer house.
29. Martin furnaces (old).
30. Boilers.
31. Nail smithy.
32. Stores.
33. Engineering shop.
34. Forge and smithy.
35. Two boilers.
36. Switch shop.
37. Girder shop.
38. Bridge shop.
39. Pattern shop.
40. Chief office and drawing office.

the terminals of a dynamo. We have received permission to publish it, which we do with much pleasure, at the same time not committing ourselves to any opinion as to its suitability to show the different effects of all possible variations in construction. It is, however, put forward as applicable to widely different sizes and styles of continuous current machines. It is as follows:—

$$E = \frac{\xi N t b a^3 n}{1{,}000{,}000}$$

where

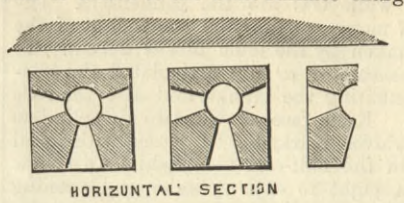
- E = electro-motive force.
- ξ = a coefficient different for different designs.
- N = number of sections in commutator.
- t = number of turns of wire round armature core corresponding to one commutator plate.
- Nt = total number of turns round armature core.
- b = length of armature core in inches.
- a = thickness of armature core in inches.
- n = revolutions per minute.

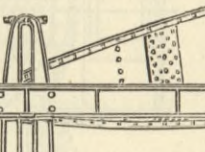
Mr. Kapp finds ξ lies between 35 and 40 for good fields taken at the maximum of electrical output the machine will stand. He thinks it varies with the quality of iron in the field magnet, and with the more or less perfect shape of the field magnets. We will only now point out that the formula takes no account of the dimensions of the field magnets. A perfect formula should take account of the shape, size, and position of the field magnet cores, of the number of windings on them and the disposition of the windings, and also of the ratios of the resistance of the various circuits internal to the machine. We have no doubt, however, that such formulæ as the above may be found very useful within limited ranges of variation of design; but the so-called "constant" ξ may be expected to be found to vary in the same surprisingly inconstant manner as, for instance, ship resistance constants.

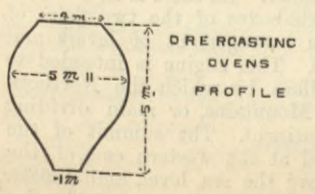
IRON AND STEEL WORKS, RESCHITZA, HUNGARY.

No. III.

Steel works.—The coke-fired blast furnace previously mentioned is shown at 15, and the charcoal-fired furnaces at 24, with their respective pig beds at 21 and 25, on the plan of blast furnace and Bessemer department, Fig. 7, page 84. The ore is brought by a high-level branch of the small-gauge railway from Bogsán, and tipped right and left into the ore depôts, marked 2 and 2A, of which a cross section is shown in the annexed sketch. The ore for the charcoal-fired furnaces is roasted in six kilns or ovens, shown at 1 in the plan, and in profile and horizontal section by the accompanying sketches. The ovens are fired with the screenings from the charcoal used in the three small blast furnaces; but as, after partially calcining the ore, a portion remains unconsumed and is also mixed with small particles of ore, 1 or 2 per cent. of this dust is added to the blast furnace charge. All the ore is crushed in two Blake machines—3 on the plan;—but that which has been roasted for the charcoal-fired furnaces is reduced to much smaller pieces than what is used in the coke-fired furnace. A wire tramway is now being constructed from the summit of the Kreuzberg—a high hill to the north of the plan, overlooking the Reschitza valley, and affording a fine view of the Transylvanian Alps—for the purpose of bringing down limestone for supplying the blast furnaces with flux. The mixing floors—marked 12 for the coke-fired furnace and 13 for the charcoal-fired furnaces—are on the same level as the depôts, being connected by lines of way. A double line runs over a row of square bins, the wagons depositing the various ores, flux, and fuel in regular layers. The materials taken from the face are thus thoroughly mixed on being loaded up into wagons running on a line of way between the two rows of bins. They are now on a level with the mouths of the three smaller furnaces and at half the height of the larger. They are raised the remainder of the distance by an Armstrong hydraulic lift—14. The slag is hauled up an incline of 1 in 4—marked 8 on the plan—by a stationary engine—10—and run out—at 7 on plan—into a valley, which it is gradually filling up.







The blowing engine for the coke-fired blast furnace, shown at Fig. 8, was erected at 19 on the plan, in December, 1880, by the Märkische Maschinenbau-Anstalt, formerly Kamp and Co., of Wetter-on-the-Ruhr. It is on the Woolf system, and gives out 269-horse power at nine revolutions a minute, its ordinary speed. The diameter of the small cylinder is 0·835 metre = 33in.—and that of the large cylinder 1·412 metre = 56in. The diameter of the blowing cylinder is 2·615 metres = 8ft. 7in.—and the stroke 2·51 metres = 8ft. 3in. A favourable angle is given to the connecting rod by the horse-head beam, the trunnions of which are carried by a wall.

The blowing engine for the charcoal-fired furnaces, shown on page 92, and made by the Société Cockerill in 1858, was originally erected, with two similar engines, at the company's Anina ironworks, and was brought to Reschitza in 1882, being re-erected in the same building—19. The steam, at 60 lb. pressure, expands in a single cylinder, steam jacketted, 40½in. in diameter; and the exhaust is condensed. The distribution of steam is effected by double-beat valves, worked by cams, which permit of the expansion being varied between wide limits. The stroke is 8ft., and the normal speed 12½ revolutions a minute; but the speed can easily be increased to 14 or 15 revolutions, in which case the piston speed is about 4ft. a second. The air cylinder is 9ft. in diameter. The inlet air valves, working on rectangular grids, are contained in cast iron boxes bolted to the cover. The delivery valves are simple clacks of leather covered with light plates, their lift being limited by elastic stops, which prevent shock and noise. They are contained in the hollow casting which is bolted to the two air passages at top and bottom of the cylinder. The bed plate is in three parts, firmly bolted and stayed together, the central portion being sunk to carry the bearings of the main shaft. The four columns of the frame, equidistant from each centre line of the cylinders, are bolted to the central portion, and also to the two side portions of the bed plate. They form ties by which the strain is equally distributed over the frame, so that the brick foundations have only to carry the weight. The power is coupled directly to the resistance by the wrought iron cross-head, trunnions at its ends receiving the side rods which turn the cranks. Here also the strains are equally distributed over the plummer blocks, whatever be the degree of expansion; and the weight of the fly-wheels, acting directly on either side, counteracts any tendency of the engine to rise, thus giving great stability. Since these engines were erected, 130 have been made on the same system. While the dimensions have been increased, and several improvements have been introduced, such as compounding the cylinders, the main principle has been maintained of making all the strains counteract each other within the frame, so that the foundations have only to carry the dead weight. This engine supersedes three old blowing engines of 300-horse power collectively, erected near the charcoal-fired blast furnaces.

Fig. 8.—BLOWING ENGINE RESCHITZA, BY MESSRS. KAMP AND CO.

The following tables give the average chemical composition of the charge for both classes of blast furnace:—

Charcoal fired.		*Coke fired.*	
SiO_2	17·750	SiO_2	12·385
Al_2O_3	4·106	Al_2O_3	3·460
Mn O	3·850	Fe_2O_3	56·340
Ca O	8·400	Mn O	2·325
Mg O	2·718	Ca O	16·280
Fe	38·356	Mg O	0·362
		Cu	0·030
		P	0·067
		S	0·027
	75·180	$H_2O + CO_2$	8·724

The proportion of oxygen in the silica to oxide in the bases is as 1 : 0·671 in the former case, and as 1 : 1·05 in the latter. The composition of the resulting pig iron and slag is as follows:—

Charcoal fired.				*Coke fired.*			
Pig.		*Slag.*		*Pig.*		*Slag.*	
Si	1·462	SiO_2	47·835	Si	1·391	SiO_2	38·85
Mn	2·179	Al_2O_3	5·491	Mn	0·802	Al_2O_3	8·40
Co	trace	Fe O	0·953	Cu	0·092	Fe O	0·81
Cu	0·040	Mn O	5·313	S	0·028	Mn O	1·40
P	0·137	Cu O	0·050	P	0·098	Ca O	46·50
S	trace	Cu O	36·033	C	3·306	Mg O	1·89
Cβ	3·507	Mg O	3·496	Fe	94·283	Ca S	2·38
Cα	0·038	Ca S	0·533				
Fe	difference	PO_5	0·086				
		Na O	0·209				
	100·000		100·23				

The slag from the charcoal-fired furnace is glassy, and of a pearl grey colour; its specific gravity is 2·8182. The gases are of the following composition:—

Charcoal-fired furnace.		*Coke-fired furnace.*	
CO_2	5·0	CO_2	9·6
C O	29·5	C O	25·2
O	0·2	O	0·2
N	65·3	N	65·0
	100		100

The blast furnaces are tapped in accordance with the

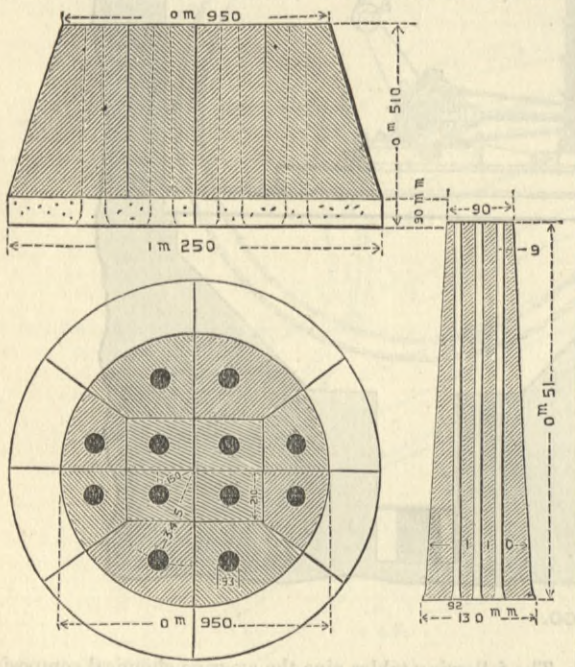
requirements of the Bessemer converters, but generally between seven and ten times in the ten hours. The metal is received in 8-ton ladles, and conveyed direct to the converters, unless, from any cause, it becomes cool, in which case it is run into pigs. The composition of the two classes of Bessemer steel is on an average the following :—

	From charcoal pig.	*From coke pig.*
Si	0·044	0·053
Mn	0·189	0·169
Cu	0·028	0·026
S	trace	0·022
P	0·118	0·070
C	0·153	0·314
Fe	difference	99·346
		100

The hardness is 7 h. in the former case, and 6 e. in the second, according to the following classification, with the corresponding point of carbon :—

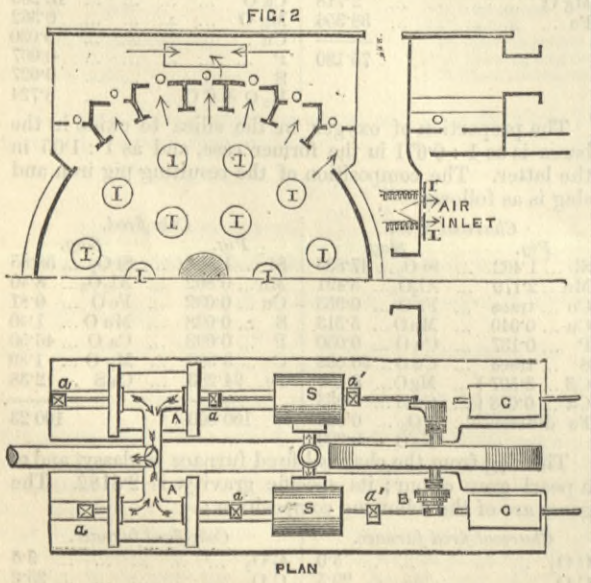
Hardness.	*Carbon.*
3	0·5965
4	0·4329
5	0·3374
6	0·2352
7	0·2318

These five classes are increased to fifteen by the addition of the letters *h* for *hart*—hard,—*e* for *eben*—even,—and *w* for *weich*—mild. Instead of the metal being entirely decarburised in the converter, requiring the addition of ferro-manganese or spiegeleisen, the blow is stopped when the required carbon point is reached ; and so practised has the eye of the manager become, that Bessemer steel is produced as uniform as by the Siemens-Martin process, and exactly of the degree of hardness required, although the only indications are afforded by the length of the flames and the colour of the slag. There is only a difference of 10 per cent. between the weight of the metal charged into the converter and that of the ingots obtained, not, however, including loss from breakage of ingots. There are two Bessemer houses, with two 8-ton converters each, the old house, begun in 1867, being marked 26 on the plan, Fig. 7, and the new 28, which was completed in 1879. The converter trunnions in the new house are arranged on the floor level, so that if required the Martin furnaces may discharge their metal into the Bessemer ladles, or even serve for melting pig for the converters. The Bessemer operation lasts about half an hour; and from fourteen to eighteen charges of 6½ to 7½ tons are made in the twenty-four hours. The only noticeable feature about the converters is the bottom, which is 1ft. 8in. thick, and consists of fireclay blocks, as shown in the annexed sketch. Each block has a hole to



receive the tuyere, which is more tapered than usual, and has very little shoulder. The bottoms stand from eight to fourteen charges. They are examined after each pour, when one or two tuyeres are renewed as required. At 27 is a two-cylinder 400-horse power blowing engine on the Meyer system, in which the travel of the slide valve is altered by hand,

FIG. 2



so as to give various degrees of expansion ; but it is now only held in reserve in case of breakdown. In the beginning of 1882 a pair of 1200-horse power horizontal engines were put down by the Märkische Maschinenbau-Anstalt at the spot marked 20 on the plan. In the accompanying sketches the steam cylinders, 1·334 metre = 52½in. in diameter, are marked S S : and the air cylinders A A are 1·65 metre = 65in. in diameter ; while C C are the condensers. The piston stroke is 1·57 metre = 62in.; and the weight of the piston and rods is taken by the slide blocks *a a a a*. To the piston-rod crossheads a^1 a^1 are articulated the connecting-rods B B actuating the cranks, and also the rods of the condensers. Each face of the two air cylinders has eighteen inlet valves, marked I I I, closed with spiral springs, as shown in the half-end view, while *o o o* show the delivery valves, eight to each cylinder end, opening into a chamber. The air cylinders have a water circulation for keeping down the temperature. The condensers are on Horn's patent system, which permits of the air and uncondensed steam being expelled at each stroke.

There are four Siemens-Martin furnaces—marked 22, 23, and 29 on the plan—each capable of turning out from 6½ to 7½ tons of steel every eight or nine hours. This number includes a Pernot furnace that was brought from Anina, when steel-making was discontinued there. Although the revolving arrangement is no longer used, the facility of withdrawal is found handy for repairs. No spiegeleisen is used in the Siemens-Martin process, and ferro-manganese only occasionally, when it is charged in cold. The Martin steel, used for castings, tools, plates, axles and tires, and occasionally for rails, is made up of the following five degress of hardness, each one with the addition of the three letters above mentioned, thus making fifteen, and with the annexed content of carbon :—

Degree of hardness.	*Carbon.*
2	0·9341
3	0·8181
4	0·5624
5	0·3442
6	0·2113

The following are the results of an analysis, made by Herr Anton Maderspach, assisted by Herr Friedmann, of an average sample of Siemens-Martin steel :—

	Pig iron after re-melting.	After melting in the 1st Addition	2nd Addition	3rd Addition	4th Addition	Finished product after adding ferro-manganese.
Si	0·7595	0·1073	0·0303	0·0163	0·0187	0·0198
Mn	1·0833	0·2037	0·0336	0·0342	0·0306	0·0883
Cu	0·0519	0·0519	0·0539	0·0519	0·0559	0·0539
P	0·1290	0·1140	0·1018	0·1158	0·1213	0·1095
S	none	none	none	none	none	none
C (combined)	2·8110	1·3580	0·2987	0·2497	0·2970	0·1738
C (uncombined)	1·0000	0·6600	0·8875	0·5350	0·3575	0·3000
Total C	3·8110	2·0180	1·1862	0·7847	0·6545	0·4738

In connection with this department there are two Belville tubular boilers—at 18—and several others of the locomotive type, fired by the waste gases from the blast furnaces. All the chimneys—16—are of plate iron lined with fire-brick for two-thirds of the way up. The steel works are capable of producing 50,000 tons of ingots yearly ; but the blast furnaces do not keep up a sufficient supply.

THE CHICAGO RAILWAY EXPOSITION.

No. XI.

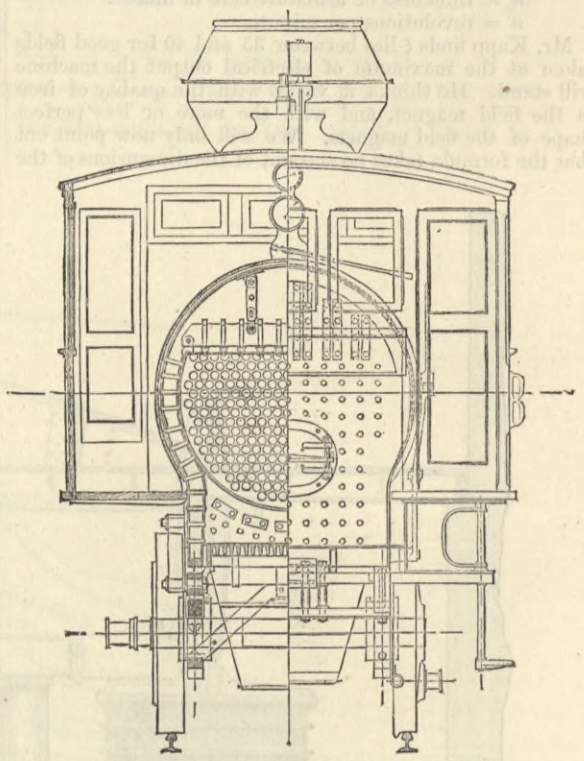
The Baldwin Locomotive Works exhibited four locomotives, illustrations of two of which will be found on page 88, of our present issue. The two engines not illustrated were for the narrow or 3ft. gauge, one being an American type of engine, that is to say, four coupled wheels with a four-wheeled bogie under the front end, and the other being a Consolidation engine, with eight coupled wheels and a two-wheeled pony truck in front of the cylinders. Their dimensions were as under :—

	American.	Consolidation.
Cylinders, diameter and stroke	12in. by 16in.	15in. by 18in.
Diameter of piston rod	2in.	2½in.
Size of steam ports	10in. by 1in.	12in. by 1¼in.
Size of exhaust ports	10in. by 2in.	12in. by 2½in.
Maximum travel of slide valves	4½in.	4⅝in.
Outside lap of ditto	⅞in.	¾in.
Inside lap of ditto	3/32in.	3/32in.
Lead	3/32in.	3/32in.
Diameter of driving wheels or tread	3ft. 5in.	3ft.
Diameter of bogie wheels or tread	2ft.	2ft.
Size of journals, coupled wheels	5½in. by 7in.	6in. by 7in. / 5½in. by 7in.
Size of journals, bogie wheels	3½in. by 6in.	3½in. by 6in.
Size of journals, main crank pins	3½in. by 3½in.	4in. by 4in.
Diameter of boiler inside smallest ring	3ft. 1¼in.	3ft. 11⅛in.
Thickness of plates	⅜in.	7/16in.
Diameter of tubes outside	1¾in.	2in.
Distance tubes centre to centre	2⅛in.	2⅜in.
Water spaces, sides, and back	2½in.	2½in.
Water spaces, front	3⅝in.	3½in.
Working pressure per sq. inch	130 lb.	130 lb.
Width of grate bars	⅞in.	⅞in.
Space between ditto	⅜in.	⅜in.
Grate area	8 sq. ft.	13·5 sq. ft.
Heating surface fire-box	52 sq. ft.	75 sq. ft.
Ditto, inside of tubes	387 sq. ft.	722 sq. ft.
Total	439 sq. ft.	797 sq. ft.
Diameter of each blast nozzle	2½in.	3in.
Diameter of tender wheels on tread	2ft.	2ft.
Size tender journals	2⅝in. by 5in.	3½in. by 6in.
Capacity of tank	1000 gals.	1250 gals.
Rigid wheel base engine	7ft. 2in.	11ft. 4in.
Total wheel base, E. and T.	35ft. 7in.	40ft. 2in.
Total length E. and T. over all	42ft. 7in.	49ft. 5in.
Total weight engine in working order	16 tons 18 cwt.	25 tons.
Weight on coupled wheels	11 tons 5 cwt.	21 tons 9 cwt.

The tenders of both these engines are supported on two four-wheeled bogies, and therefore the areas of the tender journals are not so small as they appear to an English eye accustomed to six-wheeled tenders. Both engines have rocking grates, iron boilers, and steel fire-boxes.

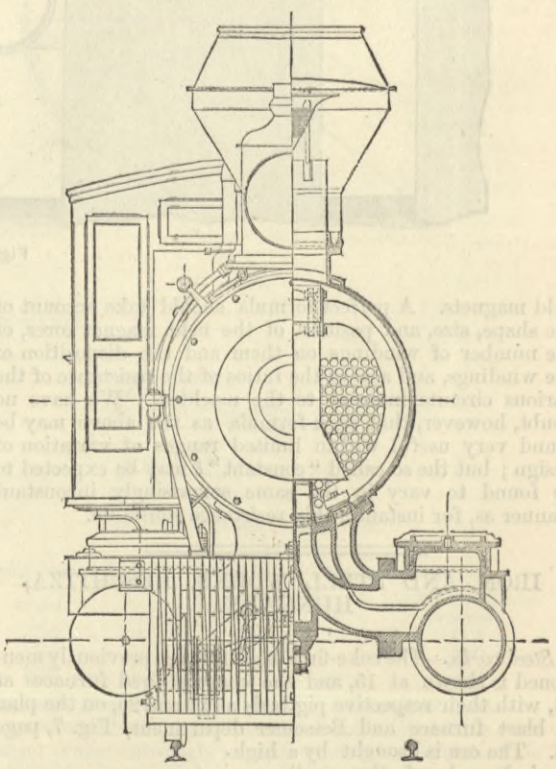
In both engines the fire-box foundation ring is completely above the main frame, so that the full width between the tires is available for the fire-box. This arrangement does not unduly increase the height of the centre of the boiler from the rails, which is only 5ft. 1½in., or 1·7 of the gauge, equivalent to a height of 8ft. on the standard gauge, or 5ft. 11⅜in. on the 3ft. 6in. gauge. The latter proportion has been successfully used in our Colonies on engines with side tanks, which in themselves increase the height of the centre of gravity, while the surging of the water has, under certain conditions, a tendency to increase the rolling of the engine when running over a badly-ballasted road. In Messrs. Baldwin's passenger engine the top of the bar frame is level with a horizontal centre line drawn through the coupled axles, and the fire-box is connected to the frame by means of clips, while on the Consolidation engine links, are used in the manner shown on our illustration of the standard gauge Consolidation engine.

The larger engines which we illustrate were built for the Northern Pacific Railroad, and are intended to burn an inferior sort of bituminous coal or lignite containing a large amount of ash, 33 per cent. being found in some of the samples of coal mined near that railway. Neither of these engines presents any strikingly novel features, but



END VIEWS, CONSOLIDATION ENGINE.

they are good examples of American practice, and embody the results of a long and varied experience in designing engines of a similar type. The ash-pans are suspended from the frame by bolts, which pass through cross bars on the under side of the ash-pan. This is a simple and convenient method, as the bolts are always accessible, and consequently the ash-pan can be readily got down, which is often a long and tedious job when it is secured to the foundation ring or fire-box casing. Another small but convenient fitting generally found on American engines is a lamp standing on a bracket, and arranged to throw a light on the pressure gauge. The glass is generally of a dark colour except in one spot, which, when running, is turned toward the gauge, which is thus brightly illuminated



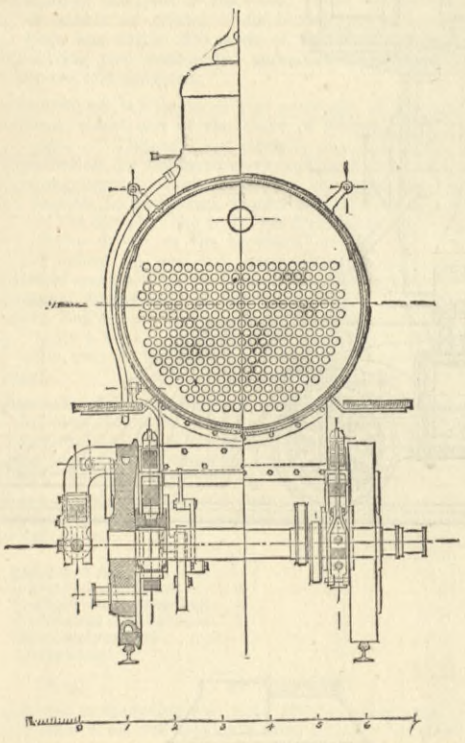
END VIEWS, CONSOLIDATION ENGINE.

while the rest of the cab is only dimly lit, so as not to dazzle the men's eyes. In both engines the pistons are solid, and are packed by two rings pressed against the bore of the cylinder by steam being admitted behind the rings.

In the Consolidation engine the driver stands on the right hand side of the fire-box and not behind it, while the fireman stands on the tender. As there is no room to place springs above the axle-boxes of the two pairs of trailing coupled wheels, an arrangement of levers and spiral springs is resorted to. This engine is intended to work trains over the inclines by which the Northern Pacific crosses the Rocky Mountains, or main dividing range of the American continent. The summit of the principal incline is reached at the western end of the Mullen tunnel, 5548ft. above the sea level, and 1668ft. above the foot of the incline at Ten-mile Creek, 18¾ miles

distant. The maximum gradient is 1 in 45·5, and the average gradient is 1 in 59·6. The engine is therefore more powerful and heavier than the usual American freight engine. Probably no locomotive in use in Great Britain or our Colonies exceeds this engine in tractive power, and few, if any, tender engines weigh within a few hundred pounds of 50 tons. This great weight is partly due to the exceptionally large boiler, an extra amount of heating surface having been provided in order to successfully burn the lignite fuel found along the route of the Northern Pacific Railroad.

Messrs. Baldwin exhibited only four and eight-coupled engines, as they consider these two types the most suitable for passenger and freight trains respectively. As the passenger engine nearly equals an ordinary English goods



TRANSVERSE SECTIONS OF CONSOLIDATION ENGINE.

engine in tractive force, it can, of course, be used for freight trains running over good gradients. The Consolidation engine is calculated to draw a load of 315 tons—exclusive of its own weight—up the Mullen incline. This weight is about equal to that of an ordinary English goods train of about forty-two wagons and a brake van.

The following table shows the leading dimensions and particulars of the two engines for the Northern Pacific Railroad illustrated on page 88 :—

	American.	Consolidation.
Weight and General Dimensions.		
Tractive force per lb. average pressure in cylinders ...	11211b.	19611b.
Total weight of locomotive in working order	37 tons 8 cwt.	49 tons 18 cwt.
Total weight on driving wheels	24 tons 5 cwt.	43 tons 6 cwt.
Total wheel base	23ft. 3¼in.	21ft. 5in.
Distance between centres of coupled wheels	8ft. 6in.	14ft.
Distance from centre of driving axle to centre of cylinders	11ft. 11¼in.	13ft. 6in.
Length of connecting rod, centre to centre	8ft. 1⅞in.	9ft. 7in.
Distance from centre to centre of cylinders	6ft. 2in.	7ft.
Cylinders, Valves, &c.		
Diameter of cylinder and stroke of piston	17in. by 24in.	20in. by 24in.
Diameter of piston-rod ...	3in.	3in.
Size of steam ports	16in. by 1⅝in.	16in. by 1¾in.
Size of exhaust ports	16in. by 2½in.	16in. by 2½in.
Greatest travel of slide valves	5½in.	5⅝in.
Outside lap of slide valves...	1⅛in.	⅞in.
Inside lap of slide valves ...	1/16in.	1/32in.
Lead of slide valves in full stroke	3/32in.	1/32in.
Throw of upper end of reversing lever from full gear forward to full gear backward, measured on the chord of the arc of its throw	3ft. 4in.	4ft.
Sectional area of opening in each steam pipe connected with cylinders	15·9 sq. in.	15·9 sq. in.
Wheels, &c.		
Diameter of driving wheels on tread	5ft. 2in.	4ft. 1in.
Diameter of bogie wheels ...	2ft. 4in.	2ft. 5in.
Size of journals coupled wheels, dia. and length ...	7½in. by 8½in.	8in. by 8in.
Size of bogie-axle journals...	5in. by 8½in.	5in. by 8½in.
Size of main crank pin journals	4½in. by 4½in.	5½in. by 5½in.
Size of coupling-rod journals	3½in. by 3½in.	3¼in. by 3½in. in f. & b. 4in. by 3½in. middle.
Length of driving springs measured from centre to centre of hangers ...	3ft. 2in.	2ft. 10in. front. 2ft. 7in. back.
Boiler.		
Description of boiler	Wagon top.	Straight top.
Inside diameter of smallest boiler ring	4ft. 3in.	4ft. 11in.
Material of barrel of boiler...	Iron.	Steel.
Thickness of plates in barrel of boiler	½in.	½in.
Kind of horizontal seams ...	Lap seams, double rivetted.	Lap seams. double rivetted.
Kind of circumferential seams	Single rivetted.	Single rivetted.
Material of tubes...	Steel.	Steel.
Number of tubes	196	266
Diameter of tubes, outside...	2in.	2in.
Distance between centres of tubes	2⅝in.	2⅝in.
Length of tubes, over tube plates	11ft. 11½in.	12ft. 8⅜in.
Inside fire-box, length inside	5ft. 9 7/16in.	8ft. 7⅜in.
Inside fire-box, width inside	2ft. 9⅜in.	3ft. 6⅞in.
Inside fire-box, depth to bottom of foundation ring, front	6ft.	4ft. 5½in.
Ditto, ditto, back	5ft. 11in.	4ft. 2½in.
Water spaces, sides, back, and front of fire-box ...	3½in., 3½in., 3½in.	3in., 3in., 4in.
Material of outside shell of fire-box	Iron.	Steel.
Thickness of plates of outside shell of fire-box ...	½in.	½in.
Material of inside of fire-box	Steel.	Steel.
Thickness of plates in sides, back end, and crown of fire-box	5/16in. 5/16in. ⅜in.	5/16in. 5/16in. ⅜in.
Material of tube plates ...	Iron front. Steel back.	Steel.
Thickness of front and back tube plates...	½in. ½in.	½in. ½in.
Crown plate stayed with ...	Girder stays.	Girder stays.
Diameter and height of dome	32in. by 30½in.	32in. by 30½in.
Maximum working steam-pressure per sq. in.	130 lb.	130 lb.
Kind of grate	Rocking.	Rocking.
Width of bars	1¼in.	1⅜in.
Width of opening between bars	½in.	½in.
Grate surface	16 sq. ft.	30 sq. ft.
Heating surface in fire-box...	117 sq. ft.	117 sq. ft.
Heating surface of the inside of tubes	1218 sq. ft.	1754 sq. ft.
Total heating surface	1335 sq. ft.	1871 sq. ft.
Kind of blast nozzle	Double.	Double.
Diameter of blast nozzle ...	3¼in.	3¼in.
Smallest inside diameter of chimney	15in.	17in.
Height from top of rails to top of chimney...	14ft. 6½in.	14ft. 6in.
Tender.		
Weight of tender, empty ...	12 tons 9 cwt.	13 tons 8 cwt.
Diameter of tender wheels...	2ft. 9in.	2ft. 9in.
Size of tender journals, diameter and length ...	3⅜in. by 7in.	3¾in. by 7in.
Total wheel base of tender...	14ft. 5in.	14ft. 8in.
Wheel base, tender bogies...	4ft. 5in.	4ft. 5in.
Water capacity of tank in gallons of 231 cubic in. ...	2333 gals.	3000 gals.
Engine and Tender.		
Total wheel base of engine and tender...	45ft. 1¼in.	47ft. 1½in.
Total length of engine and tender over all	54ft. 6in.	57ft. 7in.

THE INSTITUTION OF CIVIL ENGINEERS.

HEAT IN ITS MECHANICAL APPLICATIONS.

THE third of the six lectures on "Heat in its Mechanical Applications," was delivered on Thursday evening, the 17th of January, by Mr. E. A. Cowper, M. Inst. C.E., the subject being "The Steam Engine."

The lecturer, in introducing his subject, dwelt shortly upon the power produced by the actual creation of steam by the application of heat, and the mode of utilising that power when so produced. In passing shortly over the earlier attempts at forming the steam engine—such as Hero's, Leupold's, Savery's, Papin's, and others—he came to the construction of the first steam engine, namely, that by Newcomen, in 1712, and noticed the successful working of many of these engines for fifty-seven years, up to the time of Watt in 1769, when that great inventor introduced the beautiful idea of condensing the steam in a separate vessel from the cylinder; the separation of the boiler from the cylinder having been already effected by Newcomen. There was thus produced a practical engine, in which the steam might be applied to press on the piston, and such steam be condensed as quickly as might be necessary, thereby enabling a good working engine to be constructed. About eleven years after Watt introduced the mode of making rotative engines with double action, and other improvements tending to the more economical use of steam. Shortly afterwards steam began to be applied for navigation—at first on the Dalwinston Lake, and afterwards on the Forth and Clyde Canal. Numerous inventors followed quickly after 1800, notably Hornblower, Cartwright, Woolf, and others. Some years subsequently, when steam began to be more generally applied for navigation, many inventors arose with different forms of engines more particularly applicable for driving paddle-wheels, and in recent times screw propellers had been driven by engines especially adapted for the purpose. The pressure of steam had been constantly increased, and a more perfect mode of working it expansively introduced, resulting in very great economy. One of the special forms of engines now in favour was that of the compound engine, using the steam first expansively in a high-pressure cylinder, and then expansively in a low-pressure cylinder; many such engines had a steam-jacketted reservoir between the two cylinders, whilst the cylinders themselves were thoroughly steam-jacketted. Some peculiar forms of engines were next noticed, such as the Davey compound pumping engine with combined differential motion; the Brotherhood engine, with very quick rotation; Messrs. Simpson and Co.'s highly economical engines for pumping, and some of the larger forms of marine engines up to 9000-horse power, as made for the America by Messrs. J. and G. Thompson, of Glasgow. It was curious and interesting to observe the great contrast between the model of the first steam engine and one of the most recent, namely, Messrs. Maudslay, Sons, and Field's high-class marine engines. Many comparisons of indicator figures, some good, others exceedingly defective, were also made, and the true practical way of obtaining the greatest amount of power out of a given quantity of steam was sketched. Besides a model of the first Newcomen engine that of a very early Watt beam engine was shown, as well as of Trevithick's early locomotive. An instructive engraving of the first Newcomen engine—of which only two copies are extant—was also exhibited, and in the library was placed a large number of models, drawings, and working diagrams of some modern examples of engines by the most distinguished marine engineers. One interesting engine noticed was that by Mr. Webb, of Crewe, namely, his three-cylinder high-pressure expansive locomotive, fitted with Mr. David Joy's slide-valve motion, which was now being largely used both for marine and locomotive engines. Palmer's Shipbuilding Company, of Jarrow, also contributed some excellent models of engines, and Messrs. Rennie, of the engines of the Bacchante and Boadicea.

THE ADOPTION OF STANDARD FORMS OF TEST-PIECES FOR BARS AND PLATES.

AT the ordinary meeting on Tuesday, the 22nd of January, Sir Frederick Bramwell, F.R.S., vice-president, in the chair, the paper read was "On the Adoption of Standard Forms of Test-pieces for Bars and Plates," by Mr. William Hackney, B.Sc., Assoc. M. Inst. C.E. In breaking test-pieces of the same quality of tough metal by direct tension very different results were obtained according to the form of the test-piece employed. The sample that one engineer would define as stretching nearly 44 per cent. before fracture was classed by another, using a test-piece of different form, as stretching less than 28 per cent. In fact, to obtain from any bar of metal relatively high percentages of ultimate stretching, all that was needed was to use short or thick test pieces. Mr. J. Barba had shown, in a paper published in the *Mémoires de la Société des Ingenieurs Civils* in 1880, that test pieces of the same form, namely in which the ratio of length to diameter was the same, gave the same percentage of ultimate stretching whatever their size might be; but that in those of equal length but differing in diameter, or of equal diameter but of different lengths, the percentages of ultimate stretching varied very much. Notwithstanding the extent to which the result obtained in testing a sample of ductile metal was thus affected by the proportions of the test piece used, no standard dimensions or proportions for such pieces had been generally adopted, and those in common use varied very much. Sir Joseph Whitworth, for instance, advocated the use of a test piece 0·798in. in diameter by 2in. long, or 2·51 diameters long, and the test piece in use at Woolwich Arsenal was 3·75 diameters in length. From these proportions the ratio of length to diameter was increased in the test-pieces adopted by different engineers, especially on the Continent, to 10 or even more. The ultimate stretching of test-pieces cut from the same bar of mild steel, similar in form at the ends and of these different proportions, would be :—

Ratio of length to diameter.	Ultimate stretching per cent.
2·51	44·5
3·75	37·5
10·00	28·2

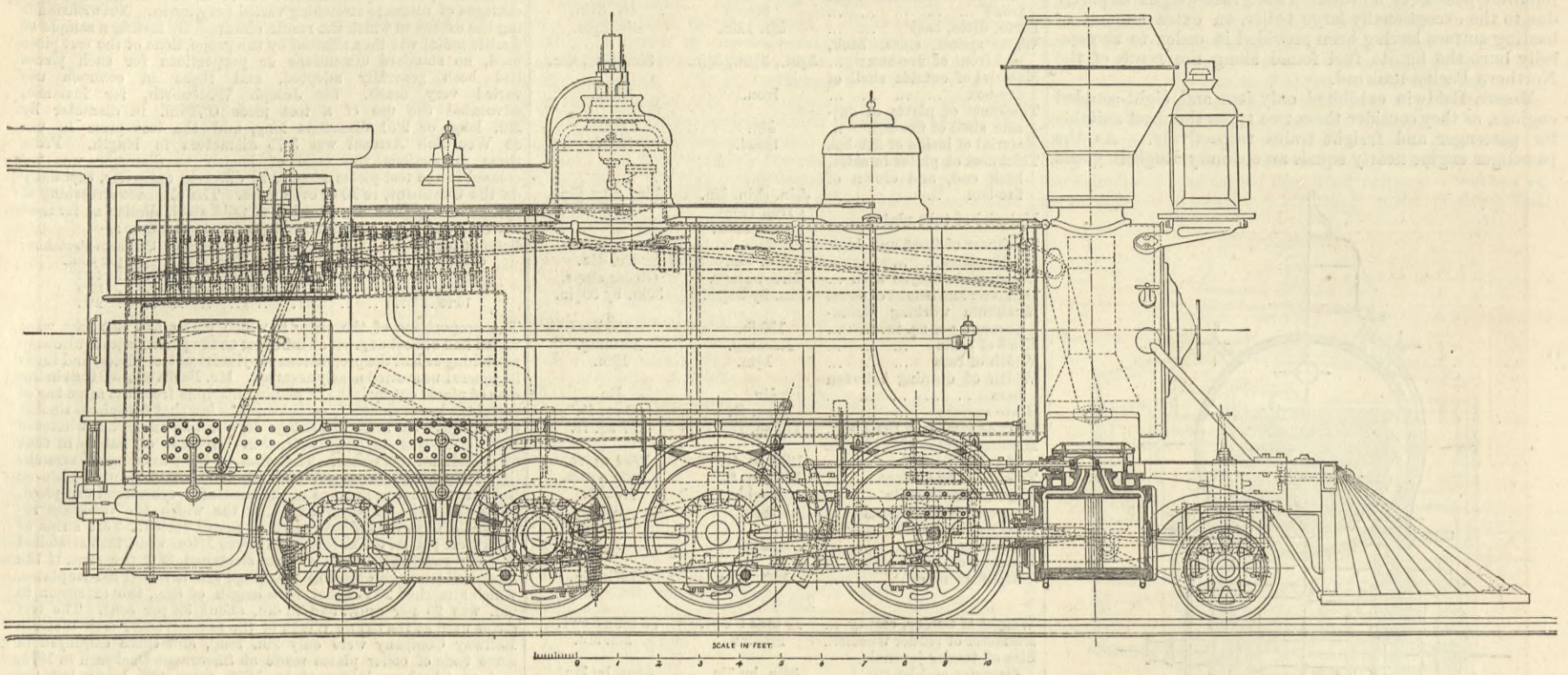
The proportions of the strips in which plates and flat bars were tested had almost as great an influence on the percentages of ultimate stretching as had the proportions of cylindrical test-pieces, and those in general use varied nearly as much. Mr. Barba showed that in the case of pieces cut by lathe or planing machine from the same bar of metal the law of similarity—that was, the law that test-pieces similar in form gave the same percentage of ultimate extension, whatever their size—was as strictly true in the case of flat as in that of cylindrical test pieces. The effect on the percentage of stretching of the transverse dimensions of an ordinary strip of plate or flat bar was not so great as in the case of a cylindrical test-piece, as in the strip, whatever might be the width, the thickness remained always that of the piece of metal tested. Test strips of mild steel plates, 0·5in. thick and about 1·4in. wide, that stretched 27·5 per cent. in a length of 8in., stretched 37·3 per cent. if the measured portions were only 2in. long; and in rather harder plates, which stretched 20 per cent. in a length of 8in., the extension in 6in. was 25 per cent., and in 4in. about 32 per cent. The test strips used at the Crewe Works of the London and North-Western Railway Company were only 2in. long, and those employed in some tests of boiler plates made at Sheerness Dockyard in 1875, and at Chatham Dockyard in 1879, were 4in. long; but the length of test strips adopted for plates, both in this country and abroad, was almost universally 8in. The impossibility of comparing the results of tests made by different experimenters of the ultimate stretching of metals, in the absence of standard forms of test-pieces, had long been felt by engineers, and has led to the adoption of several alternative methods of comparing their relative toughnesses. When a bar of ductile metal was stretched to breaking, it at first extended equally from end to end, with each successive increment of load, until the maximum load that it could carry had been reached, and up to this point the percentage of stretching was absolutely independent of the proportions of the test-piece used. This percentage of extension would thus appear to be the most important in comparing the structural values of metals, and to be that which should be always the most particularly noted; but practically testing in this way would be more tedious than the ordinary mode of loading the piece until it broke, and then measuring the elongation after fracture; so that in ordinary technical and commercial work this latter plan would always be preferred. Another method that had been adopted to a considerable extent for obtaining comparable measurements of the toughness of metals, without using test pieces of uniform proportion, had been to measure, not the linear stretching, but the percentage of contraction of area at the point of fracture. Practical objections, however, to this were that the contraction of area could be much less accurately measured than the increase in length, and that as a tough piece of metal often broke irregularly, it might be difficult to determine what its exact diameter at the point of fracture should be taken to be. Whether, on account of the difficulty of accurate measurement, or owing to the percentage of contraction of area not being exactly proportional to that of stretching, it was certain that the results obtained by the two modes of measurement seldom precisely agreed. A third mode of obtaining comparable results in testing by tension would be to use very long test pieces and to reject the percentages of stretching near to the point of fracture; but this would be expensive, and often inconvenient or even impracticable, and would not always give accurate results; for a long bar, when stretched to breaking, often began to draw down simultaneously in several parts of its length. The use of comparatively short test-pieces of some standard forms seemed thus to be the best method of making tests of the quality of bars and plates of ductile metal that could be employed. The length of 8in., in the testing of plates, was the only dimension of test-piece that appeared to be generally adopted; and as it was very desirable that the standard forms for cylindrical and for flat test-pieces should be such that the same metal might give the same percentage of stretching, whether tested in the one shape or in the other, this length, with a convenient width and an average thickness, might well be taken as the standard form, and that for cylindrical test-pieces be determined by experiment, so as to correspond with it. The effect of hammering or rolling in increasing the toughness of metals was so marked that, in determining the shape of the cylindrical test piece that would give the same percentage of ultimate stretching as the standard form adopted for plates, both shapes should be cut by lathe or planing machine from the same bar, so that one might not be made from metal more drawn down than the other. This increase in the toughness of iron and steel explained the fact that in testing plates and rivet bars, it was found that metal of the same quality stretched nearly as much in test pieces of the same length, whether the bars and plates were thick or thin. The use of a test piece 8in. long was a more severe trial for a thinner than for a thicker plate; but the toughness of the former had been so much increased by the greater amount of rolling to which it had been subjected, that the one stretched before fracture nearly as much as the other. As test pieces similar in form had been found to give the same percentage of ultimate stretching, whatever their size, it might be better to define the standard cylindrical test-piece rather as being of a certain form than of a particular length. This would facilitate the adoption of the same form by engineers of different countries, using different units of measure. In testing plates and bars such as rivet bars, which were reduced to the size of the test-piece by hammering or rolling, it would be best to retain, as at present, one length of test-piece, whatever the transverse dimensions. In fixing the standard forms, the effect on the percentage of stretching of the distance from the datum points of the test-pieces of the shoulders or enlargements at the ends by which they were to be fixed in the testing machine should not be overlooked. The enlargement might begin, for instance, half a diameter beyond each datum point, and its radius of curvature might also be half a diameter. The whole subject of the testing of metals by tension seemed to be well worthy of consideration. If a uniform system of testing could be generally introduced, so that tests made by engineers in all parts of the world might be directly comparable, the advantage would be very great.

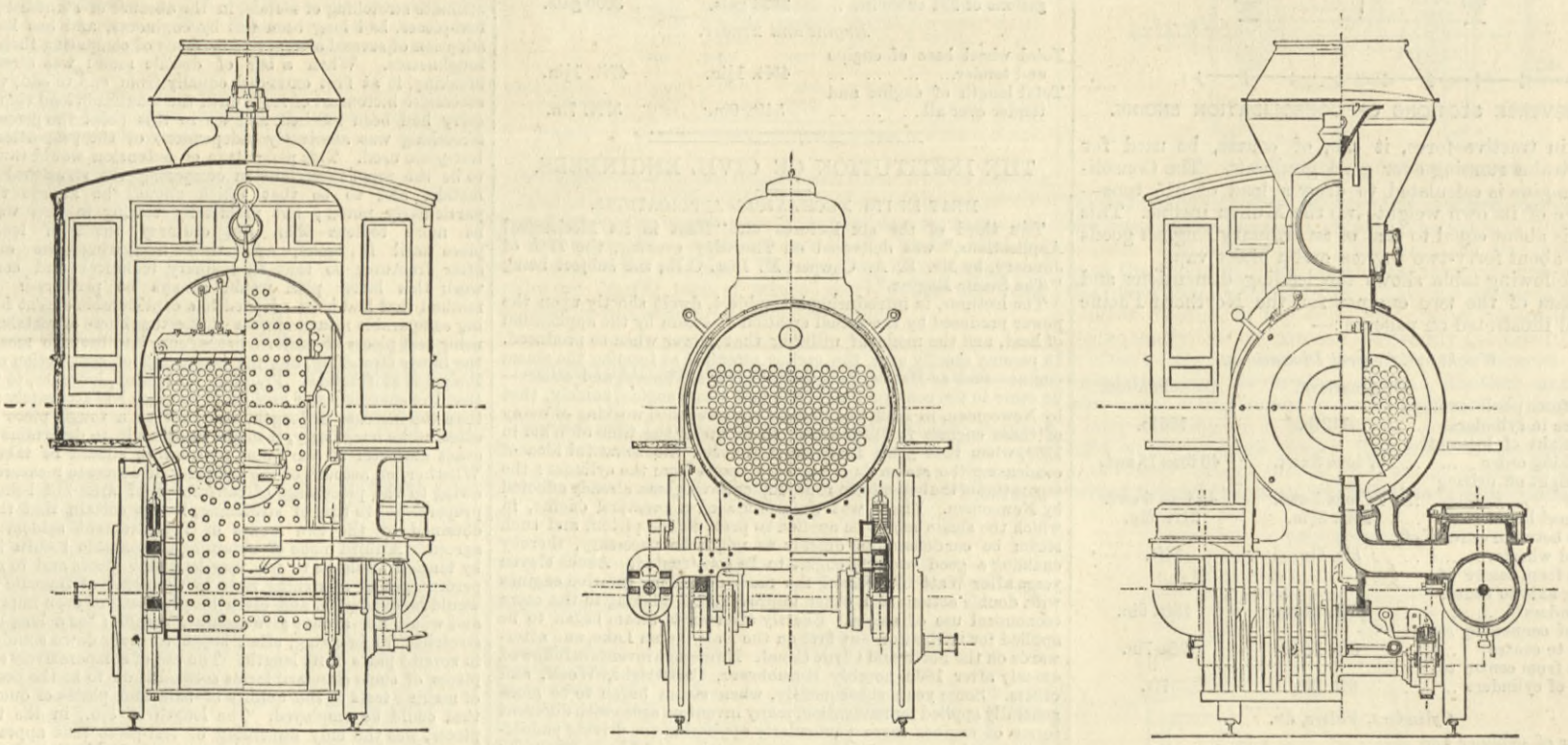
WESTON completed 3000 out of his 5000 miles walk at St. James's Hall, Manchester, on Tuesday. Mark Twain would say he might have done this tour by rail at less expense and in less time.

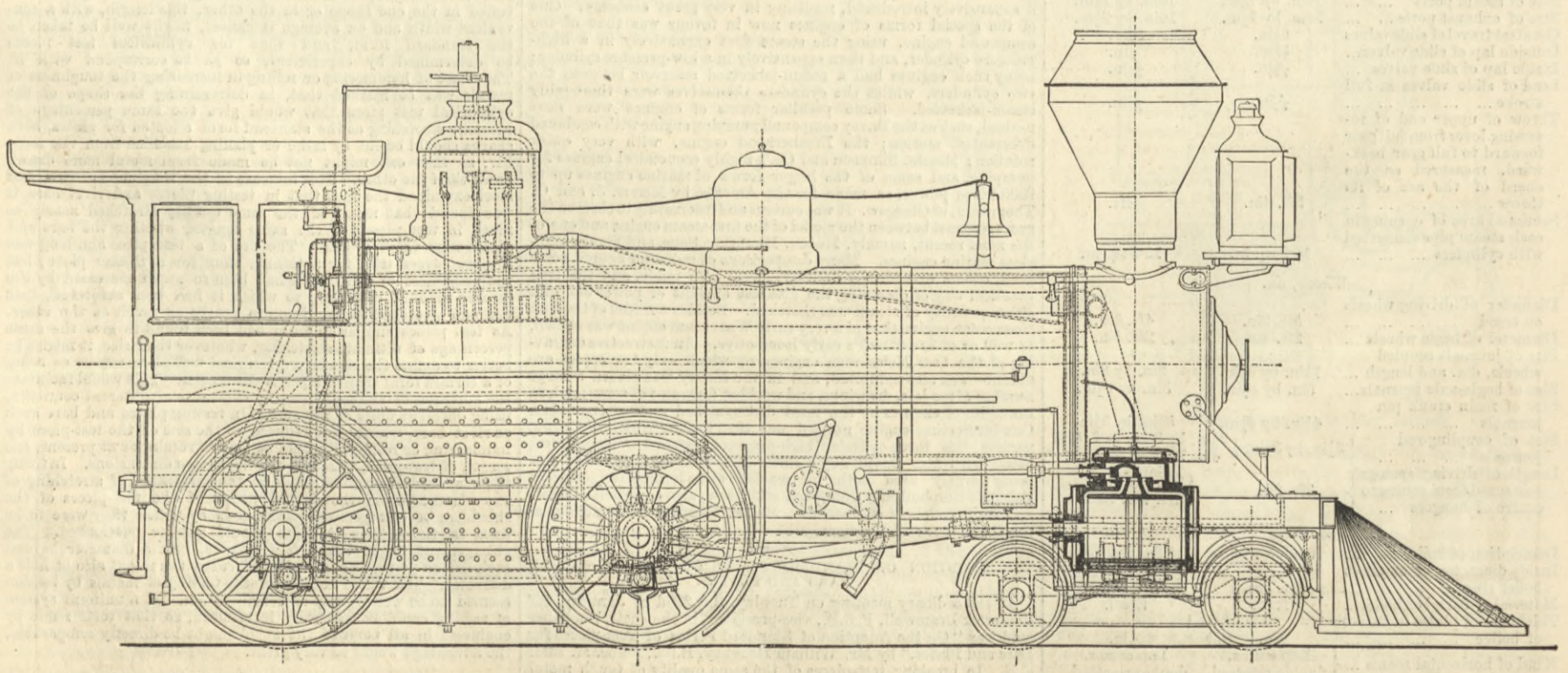
CONSOLIDATION AND AMERICAN ENGINES, CHICAGO EXHIBITION.

MESSRS. BURNHAM, PARRY, WILLIAMS, AND CO., PHILADELPHIA, ENGINEERS.

For description see page 86.)







RAILWAY MATTERS.

THE Great Indian Peninsula Railway Company has just placed an order for 100 steel crank axles with Messrs. Taylor Brothers and Co., of Leeds; and 602 steel straight engine, tender, and wagon axles with the Monkbridge Iron Company, Leeds.

THE Panama Railway has been ceded to the Panama Canal Company. Usually it has been that railway companies have bought up canals. The Panama Railway was handed over to the canal company on the 1st instant. It has been in existence about thirty years. In virtue of its monopoly of direct communication between the Atlantic and Pacific seaboards it has had a traffic of some magnitude; but upon the completion of the canal, which will closely follow its line of route, this will probably suffer considerable diminution.

DURING the great storm last Saturday, on the Northern Counties Railway, Ireland, three miles from Londonderry, a large breach was made in the embankment. For about fifty yards the entire ballast was swept away, and the rails with the sleepers attached sank down to the level of the river. This was discovered just in time to enable an official to display the danger signal, when the mail train was within 200 yards of the gap. A post car driver, when driving two commercial travellers to Killarney, was blown into the sea and drowned.

SPEAKING of the death at the early age of thirty-one of Lord Grosvenor, eldest son of the Duke of Westminster, the *Railway News* says:—"Although not officially connected with the railway administration, he displayed a very active interest in their working and management, and few, if any, of the passengers by the train from London to Holyhead, known as 'the wild Irishman,' were aware of the fact that the train was frequently driven by him. By every engine-driver on the northern section of the London and North-Western he was well known and much respected. Lord Grosvenor spent a large portion of his time in the workshops and mechanical department of the works of the London and North-Western Railway at Crewe. A correspondent informs us that he was 'really a worker,' and that he took an 'intense pleasure in the lathe, and in the finishing of any of the work which he took in hand."

SPEAKING of the accidents on American railroads last November, the *Railroad Gazette* says no less than nine derailments—an extraordinary number—were maliciously caused. Three of these train-wreckers operated by removing rail fastenings, three by misplacing switches, and three by putting obstructions on the rails. The number of these malicious derailments is an exceedingly bad feature of the month. A general classification of these accidents is as follows:—

	Collisions.	Derailments.	Other.	Total.
Defects of road	—	11	—	11
Defects of equipment ..	9	12	1	22
Negligence of operating.	9	8	—	47
Unforeseen obstructions.	2	15	1	18
Maliciously caused	—	39	—	9
Unexplained	—	15	—	15
Total	50	70	2	122

Negligence in operating was thus the principal cause of accident, 38 per cent of all the accidents being directly traceable to it as a general cause.

IN concluding a report on the collision during a fog which occurred on the 7th November at Bow Junction station on the North London Railway, Major-General Hutchinson says:—"The collision was primarily caused by forgetfulness both of the signalman and train register boy on duty in Tilbury Junction cabin, though some blame is attachable to driver, fog signalman, and guard, for the want of thought shown by their letting the goods' train run into the standing passenger train. He states that the North London Company is now engaged in putting down bars on the lines at platforms, which will make it physically impossible for a signalman to take off the signals in rear of a train standing at a platform so long as any wheel of that train stands on this bar. This no doubt will be useful in helping to prevent the recurrence of collisions such as the present, but the difficulty is to place the bar in such a position that it is sure to be stood upon by some wheel. It seems to me that an electrical arrangement, by which the rails between a home and starting signal would be kept charged and connection made between these rails by means of the first axle and pair of wheels that passes the home-signal, and this connection again broken by the last axle and pair of wheels which passes the starting-signal, might be made use of for interlocking with the home-signal; this would be free from the difficulty which attends the use of the bar."

A CORRESPONDENT writing to us with reference to the leading article which appeared in our last impression on the wear of plant, says: "Your article is about right, but you might have got illustrations nearer at hand than Legree or the cotton mill. Why, Sir, Legree knew very little about how far his policy would work and the cotton mill owner only tries it by accident. If you want to see the thing tried and worked every day just as far as it can go without being a dead failure, just look round at your railways. There the subject of how far does it pay best to set the nine stitches has long become a very science. I do not know whether the locomotive and carriage superintendents are the professors in the matter, or whether the chairmen and general managers hold that position, but I expect the latter, for it is on lines like the South-Eastern, South-Western, and Chatham and Dover, where you can best prove it by riding into town in the worst carriages in creation, often hauled by locomotives which snort, and chatter, and rattle, and perspire at every point—engines that have every appearance of having been put into the repairing shops every day for the past twelve months, but hauled out again every morning by the traffic manager for his extra trains. Every one of these days the shop foreman has put men down for these repairs to-morrow, but evidently the engine has been hitched off every morning. On some of these lines, Sir, you can just see how very long an engine will go after it got so bad that it can go no longer. It's a very long time barring accidents, and these will sometimes happen with the best of hard-worked plant."

A STATEMENT has been compiled by Mr. F. T. Haggard which, by extracts from the Board of Trade returns on railway traffic, proves the advantages which have accrued to railway companies and the travelling public in consequence of the adoption of the application of block signals, continuous brakes, telegraphs, and interlocking of points. These things may be costly, but the results show that the outlay is remunerative, even excluding the great reason for adopting continuous brakes which has urged the Metropolitan Railway Company, namely, that the cost of the whole of the brakes is recouped in a year or so by the reduced wear of wheel tires and rails, and the fact that so large a number of trains per hour could not be worked without them. For the sake of obtaining a fair average whereby to compare the advantages claimed, Mr. Haggard has taken the results of the three years, 1868 to 1870, and those of 1880 to 1882. In the first period the compensation per 100,000 train miles run is more than double that in each year of the latter period, and if the rate for compensation paid in the year 1868 be computed upon the mileage of 1882 in lieu of £223,000, as then paid, it would have reached the sum of £497,009, or a further charge of £274,000. A comparison of the two periods extracted shows that notwithstanding that over 121 millions more passenger train miles have been added, the compensation has been reduced by £206,009, or an average of nearly £70,000 a year. The computed saving of £274,000 in 1882 represents the interest at 5 per cent. of about 5½ millions sterling, and to this sum may be added the further saving to the companies through a diminished destruction of permanent way and rolling stock and a lesser interference with the natural traffic. As railway traffic cannot be conducted except at 50 per cent. or more of expenditure of receipts for working charges, every £100,000 lost or saved is the product of, and represents £200,000 gross take.

NOTES AND MEMORANDA.

DURING the gales of the 26th and 27th ult., unprecedented wind pressures were experienced at the Forth Bridge works. We learn from Mr. B. Baker, M.I.C.E., that the strongest gusts gave a momentary pressure of 35¼ lb. per square foot on the large board, 300 square feet area, put up under the instructions of Mr. Baker, and no less than 65 lb. per square foot on the small board, containing 1·5 square feet. Inertia is thus seen to reduce the effect of wind on structures.

FOR making gold ink the following has been quoted in the *Chemist and Druggist*:—Take equal parts of iodide of potassium and acetate of lead; put them on a filter, and pour over them twenty times the quantity of warm distilled water. As the filtrate cools iodide of lead separates in golden scales. This is collected when the filtrate has quite cooled, washed with cold water on a filter, and rubbed up for an ink with a little mucilage. The ink thus made must be shaken every time it is used.

M. REYNIER has suggested a modification of his maximum cell to serve as a standard of electro-motive force—namely, a cell having a very large copper electrode, and a very small amalgamated zinc electrode, immersed in a solution of sea salt. According to M. Reynier, this battery has an electro-motive force of 0·82 volts, and maintains this value within 1 per cent. even when the circuit was passed for two hours through a resistance of 820 ohms. M. Reynier prefers this combination to one containing sulphate of zinc in solution, because of the liability, *Nature* says, of the latter salt to contain free acid.

REFERRING to the recent mild but stormy weather, the *Standard* says:—"If we look back to Gilbert White's 'Summary of the Weather from 1768 to 1793,' we shall find that in the beginning of 1784 there was a hard frost from the 14th of January to the 19th of February. In 1782, after an open, mild January, frost set in on the 4th of February, and lasted to the 22nd. In 1777 frost and snow continued from the 20th of January to the 18th of February. And in 1785 a frost, which set in on this very day, the 28th of January, lasted to the 15th of March; and so on through the whole quarter of a century over which his calendar extends.

ACCORDING to extensive observations by G. Marek, it is more economical to gather seeds from small than from large sugar beets. There is a saving in land, in cultivation, in harvesting, and in the cost of storage, and the planting in the second year is accomplished much more cheaply and quickly. The seed development from small beets is limited to a small number of stalks, which grow higher and which show less disposition to bend. They produce heavier and brighter seeds, which ripen earlier. In the next planting these seeds produce beets which are rich in sugar and differ in no important point from those which spring from the seeds of larger beets.

DURING the week ending December 8th in thirty-two cities of the United States, having an aggregate population of 7,330,400, there died 2767 persons, which is equivalent to an annual death rate of 19·6, an increase—according to the American *Sanitary Engineer*—of 0·5 over the rate of the preceding week. For the North Atlantic cities the rate was 18·1; for the eastern cities, 20·5; for the lake cities, 15·7; for the river cities, 18·2; and in the southern cities for the whites, 24·0, and for the coloured, 32·5 per 1000. Of all the deaths, 34·6 per cent. were of children under five years of age, the proportion of deaths of this class still continuing highest in the lake cities, where it was 42·4 per cent.

THE *Scientific American* says:—"Wrought iron has the property, when cold, of being welded—a quality that in some instances makes trouble, but in others is utilised. Where iron washers have been put in the step of an upright shaft carrying a heavy wheel, with a view of dividing the friction, they have sometimes become welded solidly, so thoroughly united that not even heating them would separate them. Harness rings of iron wire, and others for hand bags, are solidly welded when cold by placing the formed ring in a die a trifle smaller in diameter than the ring, and bringing a corresponding die with great pressure on the ring, forcing the ends of the wire together." We have not seen this done.

LAST Saturday's gale was one of the largest and most violent storms experienced for many years. The fall of the barometer was exceptionally rapid, amounting to as much as an inch in six hours at Mullaghmore in the north of Ireland; with a fall about one quarter as rapid a gale might be looked for with some certainty. The reading of the barometer at Aberdeen at midnight on Saturday, when the centre of the disturbance was passing somewhat closely to the northwards, reached the exceptionally low level of 27·40in. The only other requirement necessary to the production of a violent wind fully existed, for the difference of barometer readings over a given area was very great, and amounted to as much as 2in. between Scotland and France.

DR. HAMMERL has devised an ingenious method for measuring the intensity of the light of electric lamps, by which the necessity for placing them at a great distance from the standard candle is avoided. He interposes a revolving disc, in which are cut out sectors, allowing only a portion of the rays to pass. For instance, if the sum of the angles of the sectors be 180 deg., half the light will be intercepted. It has been found that three sectors are sufficient to give a uniform light with a moderate speed of rotation. Consequently, to reduce the light to a third three sectors of 40 deg. are employed. With three sectors of 12 deg. the light is reduced to one-tenth of its actual power. By employing two discs, each provided with three sectors of 60 deg. cut out, and arranged one behind the other on the same axis, they may be made to give as great a reduction of the luminosity as may be desired.

M. DUCHARTRE was led, by the influence which a light of very feeble intensity exercises upon helotropic movements, to vary some experiments by using moonlight. He sowed seeds of plants which were very sensitive to light, such as *Lens esculenta, Ervum lens, Vicia sativa*. When the plants were a few centimetres in length he put them in a dark place, where he kept them until the night of the experiment. The stalks became slender, long and white; the leaves developed slightly, with a light yellowish tinge. On three successive nights when the sky was exceptionally clear the plants were placed behind a large window with a southern exposure, so that they received the direct light of the moon from 9 p.m. to 3 a.m. According to the *Comptes Rendus*, from the very beginning of the exposure the stalks began to bend, so as constantly to present their concavity and the terminal leaf bud to the moon, following it in its course.

AT a recent meeting of the Berlin Physical Society Prof. Neesen gave a short account of the contrivance by which in his lectures he measured the mutual attraction of two magnets by means of scales. In conclusion, he reported experiments instituted by him with a view to determining the influence of magnetisation on electrical conducting power. In these experiments he had made use of a magnetic substance of high specific resistance, a solution of chloride of iron. Two equal tubes were filled with the same solution, and inserted as the two branches of a Wheatstone bridge into the circuit of a galvanic battery; the two other branches being so arranged that the galvanometer stood at zero. The electrodes in the two tubes consisted of iron plates, and were exactly alike. The tubes, that is, the fluid conductors, had in the different experiments different shapes and different diameters. The contents of the one tube were then magnetised either by a magnetising spiral or by a powerful electro-magnet, and the galvanometer was observed during this process of magnetisation. The result of the experiments was in every case a negative one. Very slight deflexions were indeed observed in the galvanometer needle in the case of the experiments with the magnetising spiral, but these proceeded from the slight heating of the fluid, an effect which, notwithstanding the solution of chloride of iron was surrounded by a casing circulating water, had not been wholly avoided. In those experiments, on the other hand, in which the magnetisation was made by means of the electro-magnet, the needle remained invariably at rest.

MISCELLANEA.

IN a short notice in this column of our last impression, the list of section now published quarterly by Messrs. Bailey, Toms and Co., the name was incorrectly given as Bailey, Sons and Co.

IT would seem that the construction of tea-preparing machinery is growing into an important industry, judging by the illustrated catalogue of machines for this purpose which has just been published by Messrs. Marshall, Sons, and Co., of Gainsborough.

AS a preventive of the boiler explosions which occur in the early morning, when they are being fired up after standing with fires in all night, and the water on the simmer, it is suggested that a little air and cold water should be forced into the boiler before vigorous fires are made, so as to impart to the water some air, and destroy its superheated condition.

THE accountant to the North of England Board of Arbitration has issued his certificate for the two months ending December 31st. It states that the average net selling price of manufactured iron during that period was £5 17s. 11d. per ton, being a reduction of 2s. 8d. per ton since the end of October, and a decline of 10s. 7d. per ton since the beginning of the year. Wages are not now regulated by the sliding scale; but if they had been there would have been no change through a fall in realised prices to the above extent.

THE Dore and Chinley Railway, which will open up a most attractive part of Derbyshire if it is proceeded with, has passed the Standing Orders. It will be about twenty miles in length, and the capital is £1,050,000, with the usual borrowing powers. A strong feeling prevails among commercial men in Sheffield in favour of the London and North-Western or some other independent company having access to Sheffield. Though the Midland does not appear in the Dore and Chinley Railway scheme, it is believed to be at the back of it. An independent line from Manchester to Sheffield through Derbyshire would be very popular.

AN illustration of the application of auxiliary power for sailing craft is afforded by the 40-ton wooden yawl Clymene, belonging to Sir Patrick Keith Murray, Bart., of Ochtertyre, Crieff, which on the 22nd inst. went down the Clyde to try her speed with a screw propeller and steam power, recently fitted to the designs and under the direction of Messrs. MacNicholl and Co., Glasgow. The objects desired were a speed of four to five miles per hour in a calm, no material increase in the original draught of water, and no decrease of stability under canvas, with very slight sacrifice of cabin space. They have all been satisfactorily attained. Five miles were run in an hour in a dead calm against a slight flood tide.

MESSRS. TANGYE BROTHERS, of St. Nicholas-buildings, Newcastle-on-Tyne, have recently had completed electric lighting plant in their premises on the Swan system. For some years it has been proved that the highly-finished machinery which these show-rooms contain was much damaged by the moisture caused by condensation inevitable with coal gas. This difficulty has been overcome by the application of the electric light, which has been carried out by Messrs. J. H. Holmes and Co., Newcastle. The show-room in question has been fitted with four pendants, each of which carries five 20-candle power Swan lamps and a reflector so as to utilise the upward rays of light. The offices are lighted by ten lamps of the same power carried on standards, brackets, or pendants. The machine used is one of Siemens' self-regulating dynamos, and is capable of running forty 20-candle power lamps. The engine is of Messrs. Tangye's "Soho" type, mounted on the top of a "Colonial" boiler, and when running the lights developes about 4-horse power.

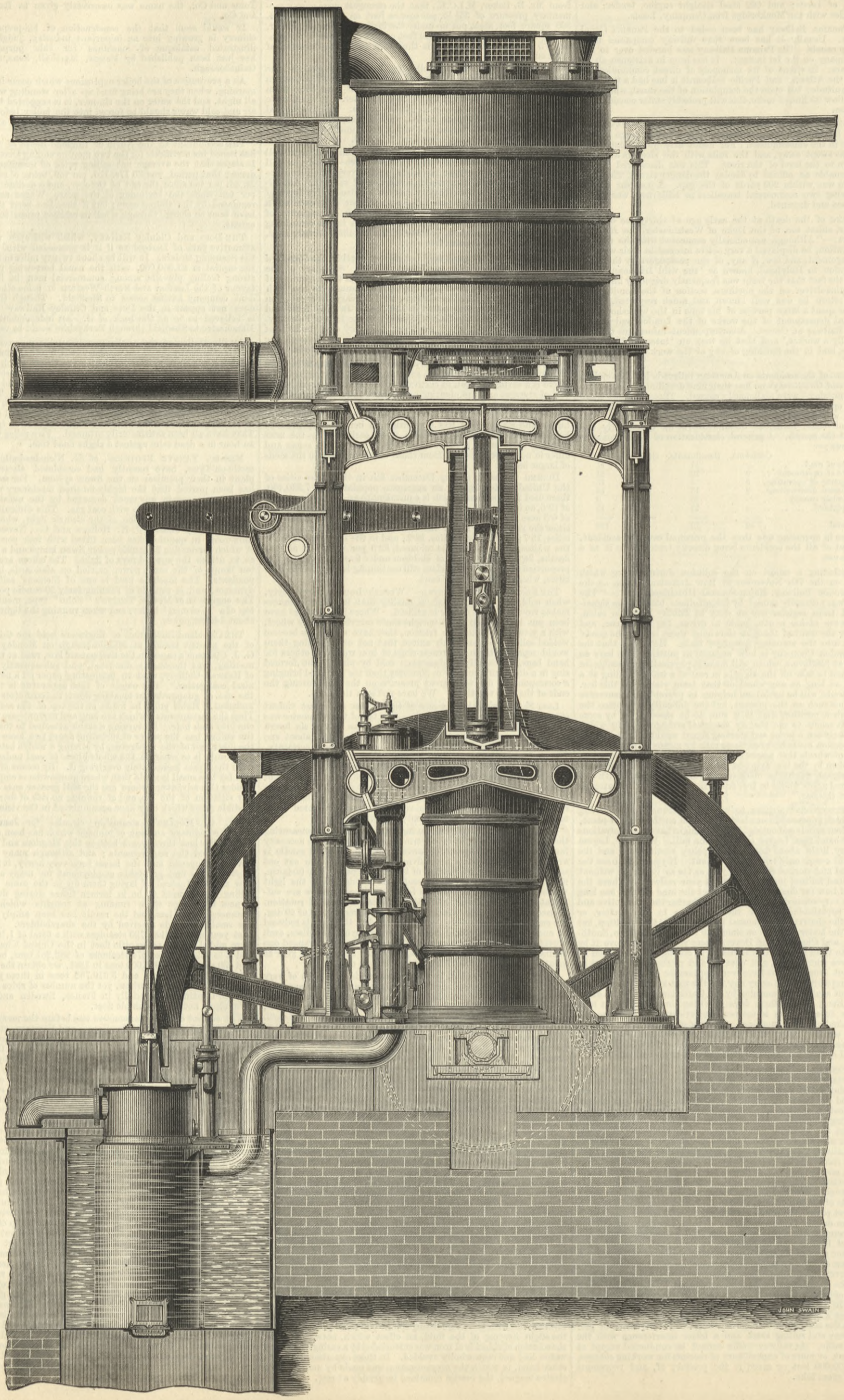
THE Cleveland Institution of Engineers held the third meeting of the present session at Middlesbrough on Monday last. Mr. G. J. Clarkson's paper on the new patent law, read at the previous meeting, was thoroughly discussed, and subsequently Mr. Lowe, of Haswell Colliery, read an interesting paper on a new "mechanical coal-getter." The object of this apparatus is to supersede the use of gunpowder in breaking down the coal after it has been undercut. Holes must be made at the top of the seam as usual. Then the instruments—which are long and narrow—are introduced, one into each hole. By turning a crank attached to the outer end, the collier has the power of thrusting apart two loose blocks near the inner end of the apparatus, by forcing a wedge between them. The result is to separate the whole block of coal under treatment from the strata immediately overlying it. By means of this invention far less small is made than where gunpowder is employed; and besides this advantage, there are the still greater ones of avoiding any vitiation of the air, and of running no risk of firing any combustible gases which may have accumulated in the vicinity.

MR. C. MOLLER'S steamship circular for January says, the extraordinary amount of tonnage which has been constructed during the last three years both in this kingdom and abroad has far exceeded the requirements; and although many new trades have been opened and the losses been very heavy, it has become impossible to find profitable employment for many of the ships now afloat. Instead of laying them up in the same way as the sailing vessels used to be in former times during dull periods, owners have kept them running at freights which, in many instances, left a loss, and the result has been amply verified by the small dividends received by the shareholders. During the past year no less than 720 steamers with a total of 1,102,801 tons, were added to the mercantile fleet in the United Kingdom alone, and if to this be added 674 steamers of 982,961 tons, built in 1882, and 630 steamers of 925,000 tons in 1881, we obtain the respectable total of 2024 steamers and 3,010,762 tons in three years. And although small in comparison, yet the number of ships constructed on the Continent, especially in France, Sweden and Germany, form also a not inconsiderable fleet.

THE subject of fuel economisers was before the members of the Manchester Association of Employers and Foremen, at their usual fortnightly meeting on Saturday. The question was introduced in a paper read by Mr. Daltry, of Manchester, who urged that nothing like the best possible results had yet been attained by the economisers at present in use. If they supposed that with any economiser the temperature at which the issuing gas entered the chimney was as low as 400 deg., there was still a deal more of heat wasted than if it were possible to let them emerge at the temperature of the feed-water. By a rough calculation he estimated that this would give an increase of economy of 15 per cent. of the coal burnt; and supposing that with a forced draught and a suitable economiser this result could be attained, nothing could better it. A somewhat animated discussion followed. Mr. Nasmith expressed the opinion that the present form of economiser was not a perfect one, nor did he think that any form of economiser would be perfect until they got a more efficient system of heating their boilers, They would have to adopt some method other than the use of green fuel before they could apply any system of economising the waste heat with the best results, and in his opinion they would only be able to effect this by the use of gaseous fuel. There was a wide field not only for a radical alteration in the fuel economiser itself, but also in the method of raising and applying the heat. Mr. Marmock did not see that much advantage was to be gained by the use of gaseous fuel; in some cases the use of gaseous fuel had given worse results than direct firing with coal. Mr. Baldwin was of opinion that under certain conditions gas fuel might be used with great benefit in the heating of boilers. The chairman—Mr. Thomas Ashbury, C.E.—thought there were many points in connection with fuel economisers that would have to be considered all round; the whole subject of fuel economy was one about which they had been rather careless, and in his opinion engineers had been rather remiss in taking advantage of every possible point. With regard to gas fuel, he thought the time was fast hastening when this method of raising heat would become pretty general.

BLOWING ENGINE, IRON AND STEEL WORKS, RESCHITZA, HUNGARY.

LA SOCIÉTÉ JOHN COCKERILL, LIEGE, ENGINEERS.



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.*

PUBLISHER'S NOTICE.

*** *This week we publish a Double Number of* THE ENGINEER *containing the Index to the Fifty-sixth Volume. The Index includes a Complete Classified List of Applications for Letters Patent during the past six months, together with a list of Abstracts of Specifications published during the same period. Price of the Double Number,* 1s.

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.*

W. H. T.—*No motor would be of any use to you. Employ manual labour. A boy can turn the handle for a quarter of an hour a day without the slightest risk of life or limb.*

MECHANIC.—*We could not publish your letter without further confirmation of its accuracy, as the statements contained in it are flatly opposed to the reports we have received on the subject. We have forwarded your letter to the inventor, who will probably communicate with you direct.*

M.—*We never heard of bogie wheels chattering. The distance between the centres of the axles should always be greater than the gauge of the road. If the bogie pins were moved as you suggest, you would have to run the cars always in the same direction, which would be very inconvenient.*

W. H. D. H.—*The longest tunnel in England is on the London and North-Western Railway. It passes through the Stand Edge Hills between Marsden in Yorkshire and Diggle on the Lancashire side. It is* 5435 *yards in length. See "Our Iron Roads," by F. S. Sims. London: Bemrose and Sons.* 1883.

A READER.—*Plan No.* 1 *is the best you can adopt. With it you need have no trouble with smoke, but you will have a great deal of trouble if you put in hanging bridges. Put in bridges resting on the bottom of the flue, but with the top edges sloped right and left alternately. The top edges should be struck to a curve of larger radius than that of the flue. If the bridges are used with judgment, and the boiler is well clothed outside, the absence of side flues will make only a small difference in the consumption of fuel.*

J. G.—*The point in a railway wheel which is in contact with the rail is obviously at rest no matter at what speed the train is moving, while the point directly above it in the circumference of the wheel is moving at twice the velocity of the train. The curve described by a point in a railway wheel is a cycloid. If you fix a pencil point in a small wooden disc and roll the disc along the table, holding a card stationary, with the pencil in contact with it, the pencil will describe a cycloid, and you will see that no point in the wheel describes a circle in space.*

NON-CONDUCTING COMPOSITION FOR STEAM PIPES.—*We have received several letters from rival makers of non-conducting compositions for steam pipes, elicited by the publication of Mr. D. K. Clark's report in our last impression. We cannot publish these letters because they contain no important statements of fact of interest to our readers. We will publish letters which contain reports of trials of such compositions carried out by independent observers, provided they are not too long, and are likely to prove generally interesting. More than this we cannot do in the interests of our readers.*

PATENT.—(1) *Unless you have an agreement to the contrary you have a right to patent the invention, but you ought to offer the right to use it to your employers in the first instance. The point is one, however, of much delicacy, and we would advise you not to take out a patent until you have consulted your employers—that is to say, if they are the makers of the machine in question.* (2) *No.* (3) *The law varies in different countries. In most European countries you cannot get a patent after you have secured one in England. In the United States you may take out a patent when you please, but it ends with the English patent.* (4) *A work by M. Gridley, published by Marcus Ward and Co., will answer your purpose.*

STORES AND STOREHOUSES.

(*To the Editor of The Engineer.*)

SIR,—Will any reader kindly say where I can obtain information concerning the construction, ventilation, warming, &c., of stores of various kinds? Has anything been published on the subject in a compact and useful form? BOILER STAY NUT.

Handsworth, January 30th.

WINDING ENGINES.

(*To the Editor of the Engineer.*)

SIR,—Can any of your readers give me information on the following questions? What is the best method of setting valves—Cornish principle—on a pair of winding engines so as to carry steam full stroke, or cut off steam at any required distances? A YOUNG ENGINEER.

Barnsley, January 29th.

STARCH AND GLUTEN.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers tell me if E. Martin's process for preparing starch from flour, or Viron's method of converting the gluten of wheat into a nutritious food, or Bullock's preparation of flour called Semola, are in use in this country, and where I may obtain information about any of them? X. Y. Z.

London, January 30th.

THE FRICTION OF WATER.

(*To the Editor of The Engineer.*)

SIR,—Will any reader please inform me what power is necessary to overcome the friction of water in a column or lift of 100 yards vertical, of 16in. diameter, the engine working ten strokes per minute, single-acting, stroke of engine 10ft.? If he will give a formula for ascertaining such resistance or friction I shall be very much obliged.

Newport, January 28th. AN OLD SUBSCRIBER.

DRAIN PIPES IN SEWERS.

(*To the Editor of The Engineer.*)

SIR,—The engineer intrusted to carry out some alterations in the drainage of a small town specifies that a 12in. stoneware pipe shall be laid in the bottom of an egg-shaped brick sewer 3ft. 6in. by 2ft. 9in. in section; that the pipe shall be tight-jointed against ingress or egress of water, and that it shall be tested for soundness of joints as the work proceeds, the test to be applied by plugging the pipe and admitting water to the sewer. The result was that the pipe being empty it became a pontoon and floated up, breaking the joints, and on entering the sewer was found lying about in a disjointed condition. Engineer insists that it shall be relaid and again tested. Contractor says it is useless to proceed as the same result is inevitable. Can any reader suggest a plan by which the scheme may be carried out? R. R. N.

January 24th.

[It ought to be possible to cement the drain pipe to the bottom of the sewer. We assume that this is a phase of the duplicate system of sewage.—ED. E.]

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MEETINGS NEXT WEEK.

THE SOCIETY OF ENGINEERS.—Monday, Feb. 4th, at 7.30 p.m., the statement of accounts for 1883 will be read. The President for 1883, Mr. Jabez Church, will present the premiums awarded for papers read during that year. The President for 1884, Mr. Arthur Rigg, will deliver his inaugural address.

CHEMICAL SOCIETY.—Thursday, Feb. 7th, at 8 p.m.: "On the Influence of the Temperature of Distillation on the Composition of Coal Gas," by Mr. L. T. Wright. "Researches on Secondary and Tertiary Azo-compounds," No. II., by Mr. R. Meldola.

SOCIETY OF ARTS.—Monday, Feb. 4th, at 8 p.m.: Cantor Lectures. "Recent Improvements in Photo-Mechanical Printing Methods," by Mr. Thomas Bolas, F.C.S. Lecture II.: Type blocks from line drawings and half tone subjects. Wednesday, Feb. 6th, at 8 p.m.: Ninth ordinary meeting. "Suggestions on the Rehousing of the Poor, and Reconstruction of Central London," by Mr. William Westgarth. Sir Frederick Abel, C.B., D.C.L., F.R.S., Chairman of the Council, will preside.

THE ENGINEER.

FEBRUARY 1, 1884.

ELECTRIC LIGHTING.

AT no time within the last three years has the position of electric lighting been more unhappy. Company after company has failed; the general public are apathetic; the local authorities are obstructive, and electricians do little to win favour for the light, to conciliate opposition, or to establish confidence in themselves. It is fortunate that electric lighting possesses so much intrinsic good that it can withstand onslaughts which must infallibly slay any enterprise which lacks admirable qualifications for rendering excellent service to the world. The time has come, however, when electricians will do well to take stock, so to speak, and consider their position with the ultimate purpose of ameliorating it, and restoring confidence in their schemes. It is a noteworthy fact that almost on the same day have been made public disastrous statements concerning the position of one Company, and a letter from Mr. Coupe, of Berechurch Hall, Essex, recording the results of twelve months' trial of the electric light. For the present we shall concern ourselves only with the last-named document.

Mr. Coupe, having built a new house—Berechurch Hall—resolved to light it throughout by electricity. As he is some distance from a town, his choice lay between constructing a private gasworks for his own use and putting down electric-lighting plant. The estimate for gas plant complete was £1333 18s.; for electrical plant £1490 8s. This plant consisted of 200 Swan 18-candle lamps, four Burgin dynamos, and one 12-horse semi-portable engine. The whole was supplied by Messrs. Crompton and Co., of Chelmsford. The estimated annual expense was:—200 18-candle lamps, each working 1150 hours per annum:—Coal, at 20s. per ton, £38 10s. 1d.; engine driver, at 30s. per week, £78; renewal of lamps, 153 at 5s., £38 5s.; depreciation, 10 per cent. on cost of machinery, £74; ditto, 5 per cent. on conductors, £4; total, £232 15s. 1d.; or, say, one farthing per 18-candle lamp per hour—the real figure being ·97 of a farthing. Instead of working the lamps at 18-candle power they have been worked at 20 candles, and the hours have been increased in number. Under these conditions the actual cost has been:—Coals—small, at 13s. 6d. per ton, mixed with coke at 18s. per ton—£90; wages, engine driver and lad, £79 14s.; renewal of lamps, 300 at 5s., £75; oil, cotton waste, &c., £20; repairs, £5 8s. 1d.; sundry small items and expenses, £7 16s. 8d.; depreciation, 10 per cent. on cost of machinery, £78; ditto, 5 per cent. on conductors, £4; total, £359 18s. 9d.; which is just under a farthing per 20-candle power lamp per hour—the exact figure being ·95 of a farthing.

Thus, then, the electric light has been supplied at the rate of, in round numbers, one farthing per hour. Mr. Coupe does not give the cost of similar lighting by gas. With good gas, 20 candles can be had from 5 cubic feet per hour, the value of which, with gas at 4s. 2d. per 1000ft., is just one farthing. As to this will have to be added something for maintenance of gas fittings on the one hand, while 4s. 2d. is a high price on the other, it may be assumed that the cost of incandescent lighting is just the same as that of gas, on Mr. Coupe's showing. But there are certain matters to be taken into consideration which Mr. Coupe has not mentioned. Thus, for example, he has not wanted to make a profit; but it is clear that, had a public or private company undertaken the work, it must earn a profit; and it is not too much to say that this profit would have raised the cost of the electric light to about one-fourth more than that of gas. Again, there are no long leads at Berechurch, nor were there preliminary expenses of any kind, so that the conditions are the most favourable possible to electric lighting. No company can enjoy such conditions. Yet there is no reason to think that Mr. Coupe's undertaking has not been perfectly well managed. If no saving can be made on his expenses, then it is certain electric lighting by incandescence cannot be done by public companies at the same cost as gas lighting. What we mean is, of course, that the consumer cannot have the electric light as cheap as gas. Let us suppose, however, that circumstances were altered, and that Berechurch Hall was lighted for half a farthing per hour per lamp, and it will be seen that only little has been gained. The number of individuals who are prepared to spend £1333 on lighting plant is very limited—indeed the sum represents the price of a good suburban villa—and nothing which has been done at Berechurch Hall can be taken as a precedent in the great work of lighting, shall we say, suburban London. The story of Berechurch Hall is interesting, and that is all. There is only one thing connected with it of any real value, namely, that it probably shows the minimum cost of electric lighting by incandescent lamps under existing arrangements. It is quite evident that electric lighting can only be done in large towns by individuals or companies, who make the supply of the light a special businesss; but these persons must include in their estimates the heavy cost of conductors, and many other expenses which were not incurred at all at Berechurch Hall; and as we have said, if this is done it will be seen that those who undertake to supply the electric light may as well make up their minds at once to say honestly, "our light is dearer than gas but much better." This is a legitimate, honest contention, and will weigh with the public.

If electricians attempt to put their faith in incandescent lighting alone they will commit a grave error. While arc lighting was at a "dead level of flickering uniformity," to quote Mr. Crompton's words, there was everything to be said in favour of the incandescent system. But it is now evident that arc lighting can be used to great advantage for ordinary indoor work. Many months ago we stated our belief that it would be found possible to light even dwelling-houses with arc lamps, and recent progress in arc lighting has brought us within a measurable distance of this. If our readers doubt this we would refer them to what has been done now for some months by Mr. Clarke at Brixton. The conditions necessary are very simple and easy of fulfilment; given a good lamp, good carbons, and an electric current of the proper kind, and an absolutely steady silent white light can be had with perfect certainty. We regard such lighting as that which has been done by Mr. Brockie, and is now being done by Mr. Clarke, as being as distinct from such lighting as that which may be seen in too many of our streets, as incandescent lighting is from a flickering gas flame; and arc lighting has this in its favour, that it is very much cheaper than incandescent lighting. If we take 500 candles as the proper light to be got from an arc lamp for indoor work, it will be equivalent to 25 incandescent lights of 20 candles each, and taking a farthing an hour for each of these, we have, say, 6d. an hour; but the arc light can be made to pay all expenses and leave a good profit at 10s. for thirty hours, or 4d. per hour. The cost of the lamp itself in the matter of carbons would be less than one halfpenny an hour. That of coal is represented in small fractions of a penny. In short, the rent paid for the arc lamp is sufficient to defray the extrinsic expenses, which are not provided for at all in Mr. Coupe's estimate, and to leave a profit. The cost of arc lighting is really less than half that of incandescent lighting.

We have said that electricians have done little to induce the public to place confidence in them; and we can only qualify the statement so far as to say that there are a few exceptions. If we look at the recent history of electric lighting in this country, we shall find that it is a record of mistakes, for which the public have had to pay. One section of the public deserves no pity, for in its feverish haste to be rich it goaded the electrician to perform tasks beyond his powers; but the result has been bad for electric lighting, and the evil of defective education and want of experience has not yet been overcome. At this moment mistakes of the most serious kind are being made, and will have to be paid for ultimately by some one. This is especially true of certain so-called electricians to whom a dynamo is a dynamo, no matter what it may be. Again, we find not only ignorance, but want of forethought and of inventive power displayed to an astounding degree in the laying of conductors, the wiring of houses, the making of connections, and the thousand-and-one things necessary to render electric lighting competent to meet the wants of the general public. Thus, for example, we might cite more than one case where no provision has been made in a circuit for the putting out of some of the lights at one time, some at another time, with, of course, the usual result—a great destruction of incandescent lamps. Then we find a great deal of make-shift work being done, principally to save expense. In electricity, make-shifts can never be made to answer, and the young electrician should have this lesson firmly impressed on his memory.

As to the future of electric lighting, there is no room for doubt. It will succeed. The inherent merits of the light are so great that it cannot possibly be dispensed with; and, under the most adverse circumstances, it is steadily pushing its way. We hold, as we always have held, that arc lighting should be regarded as the pioneer of the incandescent system. Shopkeepers value it highly, if for no other reason, then because it is an advertising medium; but they must be supplied with a steady light. They will forgive almost anything but flickering. When the arc light has found its way into a district, the incandescent system will follow, unless, indeed, municipal and other restrictions stand in the way. Electricans may take heart. Bad as their prospects are just now, they can rest assured that there is a good time coming for the light which they advocate. But fortunes will neither be made nor lost in a hurry, and this is the best guarantee that the electric light will enjoy public favour and commercial prosperity.

THE COMMITTEE ON THE ROCKET EXPLOSION.

THE committee of officials appointed to inquire into the causes of the explosion of the rockets at the Royal Arsenal at Woolwich on September 24th last have sent in their

report. General Smyth, R.A., the commandant of the garrison, was president; he was assisted by Sir F. Abel and other members. The inquiry was a difficult and troublesome matter. It may be known to many of our readers that on the coroner's inquest very little was arrived at. The official committee of course dealt with the question in a more thorough way, in order to decide on the best system on which to conduct the work of the branch of the Royal Laboratory in which the explosion took place, for the future. With regard to the cause, it remains, and is likely to remain, impossible to speak definitely. It is one of those cases which occasionally come up, when every possible hypothesis seems to be so unlikely, when we consider each in turn, that it is difficult not to feel that it is not the real solution; and yet, since the explosion happened, one of those unlikely possibilities must have taken place. We term them unlikely possibilities, because it is easy to suggest means that probably would have been thought out of the question were it not that we are driven to suppose that one of them occurred. For example, it was undoubtedly possible for some one to have crept in and maliciously fired a rocket with a piece of slow-match; but happily no one believes that this took place. It was possible that a few grains of powder got into the iron screw of the tail piece of a rocket and were fired by friction, and made a sufficiently strong flash to fire the composition of the rocket. True there is evidence that the workman before the explosion had reported that all the tail pieces were already screwed in; but it is possible that he made a mistake, or for some cause operated on one afterwards. This gives an idea of the sort of explanation that has to be sought—an explanation that probably those most familiar with the work for the last few years have most difficulty in really accepting as the solution of the problem. At the same time, it is undoubtedly shown that the factory was not in so safe a condition as it is possible to have it. General Boxer has written to the *Times*, explaining in what a dangerous condition he found the department when he took it over thirty years ago, and what improvements were then effected. Nevertheless, the Laboratory has always suffered from want of space for the miscellaneous operations on explosive materials. Time sanctions such a state of things when no loss of life occurs in a long course of years. So it was here that the applications frequently made for more buildings were not granted, and in the meanwhile there crept in, in the shape of percussion fuzes and the like, elements of danger which did not exist in old days. A "fuze store" of the present day may mean a miscellaneous collection of articles representing several forms of liability to cause explosion, calling for intelligence coupled with care on the part of the men in charge. It was high time that a more perfect system of precautions, with the means of exercising them, should be established. Hence, were it not for the loss of the two lives on this occasion, the explosion might have been regarded as perhaps beneficial, on the score of safety for the future; nor do we think the expenditure of the rockets is to be regretted if future efficiency is the object in view. Officers have long pointed out that a rocket with its head plugged up with wood was a rocket that ceased to be injurious when it got home among the enemy. Sir William Congreve never contemplated anything like this. He filled his rocket-heads with powder or carcase composition, and we have never been able to trace out the man who is responsible for what we may call the "blockhead" arrangement at present in existence. Latterly objections were met by the statement that gun-cotton would doubtless be employed in the heads of future rockets; but if a war broke out now, we have stores of rockets plugged up with wood which could not be altered except by a regular manufacturing operation. The bombardment of Woolwich on the 24th of September ought to call attention to this. It was a serious thing to find that hundreds of rockets, fired in the same way as on service, did no practical harm to a town. The only living being that suffered was, we believe, the superintendent's cow, which had a premature calf. Even this result was only produced because the cow was at the firing-point. Near the point of arrival she would probably not have minded the rockets.

The future of rockets is still undecided. Doing away with war rockets is talked of. This we should regret. We should like to see them made more efficient by making shell rockets of them. This could not make them more dangerous in store, for the shells would be empty. Undoubtedly the Hale war rockets have a certain peculiar element of danger in the fact that they fly well without sticks. Life-saving rockets, at all events, cannot be got rid of. They save many lives annually from shipwreck, and we are glad to say that there is a simple plan devised in the Royal Laboratory for preventing the possibility of these rockets flying about. Some modification of the same idea might be applied to war rockets, which though apt to be uncertain and dangerous, have their own special value. A few years since, for example, we sent to Afghanistan some enormous rockets. Requiring no gun to fire them, they furnished a means of bringing a much more powerful projectile than could by any other device be carried into a mountainous country. They never were actually employed, and very likely now, after being in store for some years in a climate of very variable temperature, they would hardly be safe to use; for one of the evils of rockets is their liability to dangerous deterioration, the composition cracking or separating from the case, which would cause a sudden generation of gas sufficient to burst the rocket. It is not suprising that rockets have earned a bad reputation, so that officers were glad to get rid of them when the occasion for their use was over. For example, in the Abyssinian war, when Magdala was taken, we believe the navy fired away the rockets they had left on hand at monkeys—a sailor firing a rocket at a monkey being probably an example of a boisterous rather than a scientific operation of war. Since Congreve's death rockets have been nobody's child. The fact that Hale was working at them probably caused Boxer to leave them alone latterly, and Hale's improvements were made with a view to flight, not to destructive power or safety. It is in these respects that rockets have failed. We do not doubt that Colonel Lyon, with the help of Sir Frederick Abel, could produce a rocket which would be of great value under certain conditions of service, though it is questionable if it is worth while issuing war rockets except for immediate service.

To return finally to the question of safety of manufacture of explosives, there is little doubt that the recommendation of General Smyth's committee will lead to Colonel Lyon being given more buildings and the opportunity of carrying on the manufacture of explosives in the East Laboratory on a more perfect system.

THE VALVE GEAR OF MARINE ENGINES.

The old-fashioned side lever marine engine had two excentrics, two gab levers, and two hand wheels. The excentrics were loose on the shaft, in the sense that they could make a partial rotation round it until stopped in either direction by snugs. When the excentrics were in one position the engines went ahead, when in the other they went astern. To reverse the engines the gabs in the excentric rods were lifted off the gab pins in the valve rocking shafts, and the valves were then raised or lowered by hand until the crank had made half a revolution, when the crank shaft turning in the excentrics brought the snugs in contact with the driven faces on the excentrics. The gabs dropped on the pins and the engines were reversed. The handling of large engines so fitted was slow, but only because the slide valves required much power to move them. With the aid of modern appliances such as Brown's hydraulic starting gear, the valves could be handled with the greatest ease and rapidity.

The modern compound engine has five excentrics, three links, and a reversing wheel and screw, or a small steam or hydraulic engine, according to the size of the machine. We would ask our readers is all this really necessary? In other words, is it well to use a Stephenson link at sea. Heterodox as the statement may seem to be, we have no hesitation in asserting that the old-fashioned method of reversing was far better than the new; and we hope that many, if not all, our readers can be got to believe this before we have done. In the first place, let us ask ourselves what is the object served by the link? The answer is, that its sole purpose is to enable the engines to be reversed. It must be clearly borne in mind that with compound engines it is never used as an expansion gear. Compound engines, as usually made, when of small size, have an invariable rate of expansion. Of course this would not be the case if the link were used to alter it; but as we have said it never is so used, save very rarely and for very brief periods, when the engines are slowed down. Normally the reduction in speed is effected far more easily by the throttle valve. In large engines the fifth excentric is employed to drive a special expansion slide; and should any alteration be required in the point of cut off it is effected by shifting the link of this excentric in a way too well known to need particular description. Now if it could be shown that nothing objectionable was entailed by the use of the link motion, no more need, perhaps, be said on the subject. But this cannot be done. A link motion for a compound engine is a costly affair to begin with, and it very speedily gets out of order; not to such an extent to entail any risk, perhaps, but enough to spoil diagrams to some extent, and to give trouble to engineers. The die, or its equivalent, although brought right under the end of the valve spindle, is played upon by the link, and is not easily kept tight in the link. We have three distinct places to deal with, all liable to wear and become loose, viz., the joint between the excentric rod and the link; the die, which readily becomes loose in the link; and the joint between the die and the valve rod. If the link motion were dispensed with, then there might be but one joint, that between the valve rod and the excentric, to wear or to be attended to. There would be little or no lost motion between the valve and the excentric. There would be less noise, less lubrication, and less risk. The links have to be held in place by rocking shaft arms and a screw. Now, it is practically impossible to prevent shake in these things. The oblique action of the link on the die tends forcibly to shift the link or to bend the valve stem, and very heavy parts only can impart anything like the proper amount of rigidity. If the strain were always in one direction, it would be easy to deal with; but it is not. Even with piston valves, the weight of the link motion in large engines must be estimated by tons. The fittings must be of the best possible kind, and, as we have said, the cost is very heavy. Two of the five excentrics are of no more use on a voyage than a fifth wheel would be to a coach. It is not remarkable that some engineers begin to think that they can get on better without the link than with it, and Joy's and Marshall's valve gear grows in favour. But it is questionable whether anything more is wanted than such a modification of the old shifting excentric as will permit the engines to be handled rapidly; and this presents not the slightest difficulty. The unlocking of the excentric rod and the shifting of the valves, and the dropping in of the gab again, can all be done by extremely simple steam or hydraulic machinery, in no way more complex or costly than that now in use for working the link motion. Nothing more is needed than a modification of the hand-gear still employed extensively to reverse large oscillating marine engines. It may be asked how the link motion ever found its way on board ship. The answer is that it was copied from the locomotive, and used in the first instance, not only for reversing, but as expansion gear. The first screw engines fitted with it were, of course, non-compound; but pressures had been creeping up for years, and as much as 35 lb. was carried with injection condensers. It was found that such steam could be expanded moderately with considerable economy, and the link motion supplied just what was wanted; but with the advent of the compound engine the conditions changed. As we have often pointed out, one of the great points in favour of the compound engine is that it requires no special expansion gear; but people had got into the habit of making, selling, and buying marine engines with link motions. They have gone on to the present moment doing this, and if asked why? they would probably be unable to give any reasons more satisfactory than a few founded on precedent.

We have heard it contended that the shifting excentric cannot be used, because at the high speeds attained by screw engines, there would be risk of backlash, the excentric tending to run faster than the shaft now and then. This objection has no sound basis. One more to the point is that the weight of a large slide valve might cause the excentric to run away, so to speak, during the down stroke of the valve, but nothing is easier than to counterbalance the excentric and valve if necessary, and the weight of the latter is always provided for in large engines by balance pistons. So far as we can see, there is next to nothing to be said in favour of the retention of the link motion. To the locomotive it is admirably adapted, because it is used as an expansion gear. There is little or nothing in common indeed between the use of the link at sea and on land; and it is to be regretted that this fact is overlooked. As an expansion and reversing gear combined, Stephenson's link is an elegant device; as a reversing gear alone it is a costly and clumsy expedient. Indeed, if it be impossible for marine engineers to persuade themselves that one excentric is enough for one cylinder it would be better to resort to the use of the old locomotive gab gear, in use before the link was invented. With it the excentric out of use during a voyage could at least do no harm, and a far more direct action of the valve would be attained than is possible with the link. We cannot conclude this article without alluding to the very elegant devices used by many builders of launch engines for reversing without a link, by causing a single excentric to revolve on the crank shaft. Nothing of this kind that we have seen is applicable to heavy marine engines, for it would not do to risk cutting into the shaft in any way; and to cut into it would be indispensable. There is, however, a modification of the link motion practically useless as an expansion gear, which is worked with a single excentric, and is free from most of the defects, though not all, of the link motion. We refer to the open fixed link, with which no doubt many of our readers are more or less well acquainted, and which appears to deserve a trial at all events at sea.

PLATE PRODUCTION IN THE NORTH.

The extent of the production of iron plates by the associated makers in the North of England for the past year is now ascertainable. In the first half of the year there were sold 216,000 tons of plates, and in the last half of the year the sale was to the amount of 220,000 tons, so that it would seem that the extent of the production has been fully kept up. This is slightly less than in the year 1882, but with that exception, the total is the largest that has ever been attained in the North of England; and it is somewhat singular that there was in the last two months of the year a production that has exceeded that of the preceding two months, despite the fall in the price in that period. Comparing the plate trade of the North now with that of the past, it is evident that there has been an enormous increase in the extent of the production, although at the present time there are plate mills closed at Bishop Auckland, Stockton, and other parts of the north-east of England. In the briskness of the year 1874, the average production of iron plates by the associated firms was 14,000 tons monthly; in 1877 it had risen to 18,000 tons; in the dulness of 1879, it fell to about 16,000 tons monthly; and since then it has risen remarkably—to 30,000 tons monthly in 1880, to 41,000 tons in 1882, and to the quantity stated for the past year; and though there are two dangers before the trade—that of the dulness in the shipbuilding industry and the possible substitution of steel for iron—yet it is evident that there is a very large production of iron plates still; and it is not likely to be so speedily affected as some believe. A number of steamers have been laid idle in the Tyne and the Wear, and though this state of things has only been known for a month or so, there is already a relief felt by the freight market, and the outward freights have appreciably risen, whilst that relief is passing to and is likely to be felt by the homeward freight markets. Should this be case the shipping world will speedily right itself, and there will be a recovery of the demand for plates, if not quite to the full extent that has been known during the past three years. It remains to be seen how far the competition of steel may interfere with the iron plate trade; but up to the present the iron plate fairly holds its own in the North, though not on the Clyde. For some time to come it is likely that this class of plates will be preferred in the northern shipbuilding yards; and though the quantity of plates may show some diminution in the current year from the high figures of the past, yet on the whole there is the probability for a demand that will give continued animation to some of the plate mills, though the prices will be lower than they have been in the recent past.

LITERATURE.

Almanach für die k.k. Kriegsmarine. 1884. Herausgegeben v. d. Redaction der "Mittheilungen aus dem Gebiete des Seewesens." IV. Jahrgang. Pola. Gerold und Comp Wien.

Among the many matters where it may fairly be said that England does not occupy the first place in the civilised world, is the publication of pocket or handbooks for special professions. The great refresher of the English memory on matters of engineering is perhaps "Molesworth." This, though extremely neat and portable, and for this reason perhaps best adapted to the pocket, is very deficient in information compared with similar compilations on the Continent. For instance, the so-called "Engineers' Pocket-book" of the Society "Hütte," though one is not likely to have a pocket big enough to put it in, forms an office companion of much greater communicative capabilities than Molesworth. The truth is that there is too much knowledge required in general engineering to admit of the useful data, constants, and formulæ of all branches being condensed into a compact volume. Hence our continental neighbours are much in the habit of bringing out special handbooks for the different circumstances of professional life, generally in the form of an almanack of the year with additions, like a condensed Whittaker. Such a work is this Austrian "Almanac for the Imperial and Royal Navy," now in its fourth year. The book contains statistics which may interest a much larger class than naval officers alone,

The almanac proper, which is preceded by notices of eclipses, feasts, and fast days, gives the times of rising and setting of the sun and moon, and the morning and evening high tides at Pola for every day of the year. Foot notes give the moon's phases and times of perigee and apogee. Then follows a table for fixing the times of sunrise and sunset from the latitude and the sun's declination, and a table of the sun's declination and the equation of time at Greenwich mean noon. Notices of the reigning family, post and stamp tariffs, a table of the coinage of different nations, and a notice of the drawing of national lotteries for the year—of which there are forty-six—complete the preliminary part.

The rest of the book is divided into five parts. The first consists of tables of weights and measures of different countries and their reductions, to which are added a few useful items, such as thermal units, new English standard wire gauge, &c. The second part gives statistics of dimensions and loading of the different classes of naval artillery of all nations. The third has two sections, the first of which gives all data which refer to the construction and armament of all war-ships of all nations, which are capable of being put in a tabular form; and for unarmoured ships some characteristic details as far as space allows. The second section gives in a condensed form such further characteristic details for armoured and protected ships. The fourth part, which only applies to the Austro-Hungarian empire, contains the pay of officers and men, rules of the service, entrance conditions, pensions, &c., ending with a table showing the crews required by different classes of vessel in commission. The fifth part is the navy list of the empire.

The work professes to be complete up to November last, but we should be pleased to see a shorter list of errata, and to be assured of there being no more which are not corrected. In our rather cursory study of the book we noticed two errors not in the list of corrections. One is the printer's error of putting at 26 metres, instead of 2·6, the draught of a projected Uruguayan gunboat—p. 183; and the other is in the value of 4·05 Reichs mark, or nearly 4s., for the Brazilian milreis. It is a long time since the milreis even pretended to have this value. Its professed value is now 2·34 marks, or about 2·29s.; but, like the rupee, its actual value has descended to somewhere about 1·8s.

The effort to condense the book as much as possible has led to rather an extensive list of abbreviations, and the attachment of different signification to different types of print, which make the details somewhat puzzling on first examining the book; but this inconvenience would doubtless vanish speedily before constant use.

There are a few blank leaves for notes at the end, which might possibly have been more useful if they had been of finely-ruled section-paper, as in the German "Ingenieur Kalender;" and we are pleased to say there are only about half a dozen leaves of advertisements. If a book representing the labour that must have been spent on this will pay its way with so little advertisement padding, cannot some of our London diaries and almanacs afford to dispense with their sometimes 30 per cent. of useless bulk due to this cause?

The Tabor Indicator. By GEORGE H. BARRUS. The Ashcroft Manufacturing Company, New York. 1884.

THIS is a species of pocket book of seventy-five pages, which, Mr. Barrus tells us in his preface, has been "prepared at the solicitation of the Ashcroft Manufacturing Company, makers of the Tabor indicator." It is not "designed as an advertisement of the instrument, but as a book of reference and instruction for purchasers and others interested in the subject." Mr. Barrus has produced a very useful little work, and we have no hesitation in recommending it to those who want a hand-book of the indicator. We may add that we do not know where it can be bought in this country, but we suppose that it can be obtained through any scientific bookseller.

So much premised, we may proceed to consider the work more in detail. It is divided into eleven chapters, headed respectively:—Introduction—Description of the Tabor Indicator—The Management and Care of the Tabor Indicator—The Essential Features of the Indicator Diagram—The Uses to which the Steam Engine Indicator may be Applied—The Use of the Indicator on Locomotives—The Method of Indicating a Steam Engine—The Method of Computing the Horse-power of an Engine from the Diagram Indicator—The Method of Computing the Amount of Steam Accounted for by the Indicator—The Method of Constructing the Hyperbolic Curve—Comparison between the Performance of the Tabor Indicator and that of the Thompson and Richards Indicators. The little work concludes with a few useful tables.

It is now thoroughly understood that the difference between a bad and good indicator is principally a matter of the weight of the moving parts. The lighter these are the better will be the indicator. With slow running engines a fairly good card may be got with almost any kind of instrument, but at moderate or high speeds the momentum of the moving parts is quite sufficient to distort the curves and give all manner of waved lines. In the Tabor indicator the ordinary parallel motion is dispensed with. There is a considerable saving of weight, and some other good points; but we strongly suspect that the price of the instrument is too great to permit it to find favour in this country. It is somewhat remarkable that no English maker has, so far as we know, used aluminium, the lightest of all metals, in the construction of indicators. Perhaps some one will try it now that we have suggested it. In the last chapter of the book before us Mr. Barrus has given a series of examples of diagrams taken with the Tabor and rival instruments. These last are abnormally bad. One taken at 300 revolutions with a Thompson indicator and a "40" spring is like nothing in the shape of a diagram we ever saw. Another by the Tabor indicator under the same conditions is legible, and would give an approximate idea of the power exerted. The Richards indicator in its original form is well known to be quite unsuitable for high speeds, but it does excellent work when modified; and Mr. Barrus has evidently used one of the old type, which is not perhaps quite fair. However, the Tabor indicator seems to be able to give very good diagrams, and we do not wish to draw invidious comparisons. Mr. Barrus refers to Coffin's averaging instrument for calculating diagrams, so little known in this country that we propose to illustrate it in an early impression. It is an extremely simple modification of the planimeter; with it we are told that fifty diagrams per hour can be calculated.

Our author does not, we think, attach sufficient importance to accuracy in indicator rigging; some of the devices which he illustrates for reducing and leading motion being more ingenious than commendable.

In the fifth chapter is given a table of feed-water consumption for steam engines. Concerning this, our author says in his preface: "The table of engine performance, given in Chap. V., is offered in the hope of drawing attention to the value of feed-water tests of engines as opposed to simple indicator tests. It is given with some reluctance, however, owing to the scarcity of data on the subject of cylinder condensation. The allowances for this source of waste are assumed, but they correspond with those found in the author's practice, and are therefore believed to be not far from correct." The figures given are very suggestive. Thus we find that a non-condensing engine working with 40 lb. steam, cut off at one-fifth of the stroke, requires 38 lb. of steam per horse per hour; with 100 lb. pressure, 22·25 lb. suffice. Of course the principal cause of the difference is that the net work is much larger in the latter case than the former, the average pressure being much greater in proportion to that of the atmosphere. The best result given in the table is 17 lb. of steam per horse per hour with a condensing engine expanding 100 lb. steam tenfold.

ON THE CONDENSATION OF GASES.

A PAPER detailing results has appeared in the *Anzeiger der Wiener Akademie der Wissenschaften* and the *Comptes Rendus*, xcvi., 1140. It treats of the facts arrived at by S. von Wroblewski and K. Olszewski. They say that the results, which Cailletet and R. Pictet obtained in their valuable work "On the Liquefaction of the Gases," lead us to hope that the time is not far distant when we shall be able to as easily examine liquid oxygen in a glass tube as it is at present to look at a tube filled with carbonic acid in the liquid state. The one condition which must of necessity be arrived at is a sufficiently low temperature. In a paper published by Cailletet a year ago he directs attention to fluid ethylene as a means of reaching an exceedingly low temperature. This gas, in a fluid state, boils under the atmospheric pressure at −105 deg., as measured by a thermometer of carbon disulphide. Cailletet himself compressed oxygen in a very narrow tube, and cooled it down to −105 deg. in this fluid. In the moment of expansion he saw a tumultuous ebullition; it boiled during an appreciable time, and resembled the projection of a liquid in the cooled part of the tube. This ebullition was formed at a certain distance from the bottom of the tube. "I was not able to recognise," he goes on, "whether the liquid pre-existed or whether it formed at the moment, because I was not able to see the separation of the liquid and the gas." S. von Wroblewski has recently constructed a new apparatus for higher pressures, in which considerably large quantities of gas can be subjected to a pressure of 200 atmospheres, and with this apparatus it is proposed to study the temperatures at the moment of expansion. The experiments soon led them to the discovery of a temperature at which carbon disulphide and alcohol became solid, and oxygen is rendered completely liquid with the greatest ease. This temperature is reached by letting liquid ethylene boil in a vacuum. The boiling point depends, of course, in such a case on the goodness of the vacuum of the pump. By the vacuum which, up to the present, it has been found possible for us to attain, the temperature falls to −136 deg. This low point—in fact, all the temperatures which we place on record—are measured with the hydrogen thermometer. The critical temperature of oxygen is lower than that at which the liquefied ethylene boils under the pressure of one atmosphere. The latter is not −105 deg., as at first it was assumed to be, but lies between −102 deg. and −103 deg., as is shown by our thermometric observation. From a number of determinations which we have made we quote the following, which will serve to show where the point lies:—

Temperature.	Pressures in atmospheres under which the oxygen begins to liquefy.
−131·6 deg.	26·5
−133·4 ,,	24·8
−135·8 ,,	22·5

Liquid oxygen is colourless and as transparent as fluid carbonic acid; it is very mobile and exhibits a very beautiful meniscus. Carbon disulphide freezes at about −116 deg., and again becomes liquid at about −110 deg. Absolute alcohol at about −129 deg. is thick and viscous like oil, and at about −130·5 deg. solidifies to a firm mass. The more accurate numbers will be given in another paper. In the same way as referred to above the author endeavoured to liquefy nitrogen and carbonic oxide. The liquefaction of these two gases is brought about with more considerable difficulty than in the case of oxygen, and under such similar conditions that at the moment it is difficult to say which of the two gases is the easier. At a temperature of about −136 deg., and under the pressure of about 150 atmospheres, neither nitrogen or carbonic oxide appears to liquefy. The glass tube with the gases appears to be quite transparent, and no traces of liquid can be observed. If the gas is suddenly freed from the pressure, there is remarked in the tube containing the nitrogen a powerful boiling-up of the liquid, which is best compared with the boiling of liquefied carbonic acid in a Natterer's tube when it is placed in hot water. In the case of carbonic oxide the boiling does not take place in so strong a degree. If, however, the expansion be not allowed to take place so suddenly, and it be allowed to sink to 50 atmospheres, both the liquefied gases, nitrogen and carbonic oxide, evaporate completely, the liquids show a perfect meniscus, and rapidly evaporate. The two gases can only be retained for a few seconds in the form of liquid in the static condition. To retain them longer in that state a somewhat lower temperature must be reached than we have at present succeeded in attaining. Nitrogen and carbonic oxide in the condition of liquids are, both of them, colourless and transparent.

FOREIGN NOTES.

THE eight torpedo boats of the Flink class, built for the German Government at Bremen, have been unable to realise a higher speed than 16 knots per hour, which is considered by the Admiralty as quite inadequate for vessels of their type. A boat has therefore been procured from a London firm, and from this model nineteen vessels are at present being built at Bremen and Stettin, which, it is hoped, will be equal in speed to the original. Competent judges, however, maintain that the system pursued by the Berlin Admiralty of entrusting this class of work to general shipbuilders is a false one, as it is by no means an unusual occurrence to see an ironclad and a torpedo boat building side by side in the same yard, and by the same workmen. It does not pay the shipbuilders to employ permanently a staff of engineers and workmen for the sole purpose of constructing such boats, as foreign Governments prefer to place their orders with English firms, who have made this class of work a specialty. The natural consequence of this is that the Germans are unable to keep pace with the times, and are compelled to copy English models when, by dint of underbidding their foreign competitors, they have succeeded in securing an order. Now experience has taught, and Russia, for instance, has found it out to her cost, that such imitation torpedo boats, be they ever so conscientiously (?) copied, do not nearly approach their prototypes either as regards speed or quality of hull and engines. That this is especially the case when the hands employed in their construction are entirely unused to their work is not surprising, neither is the fact that their builders are often subjected to heavy fines for improper execution of contract. A few years back a great stimulus was given to the German torpedo boat trade owing to the circumstance that Russia suddenly required a large number of these craft in view of an impending rupture with Great Britain on the Eastern question. The boats were urgently needed, and as English builders were naturally excluded, a greater portion of the contract was placed with German firms. The work that was then turned out baffles all description. Many of the boats were shaken almost to pieces when they reached their destination, and the remainder are now for sale at almost any price. The Russian Admiralty are now procuring their boats in England. German shipbuilders assert that the conditions laid down by the German Admiralty in their torpedo boat contracts are such as would not be accepted by English builders, but this can hardly be recognised as a well grounded excuse for supplying doubtful work. On the contrary, it is only another example of the damage done to legitimate trade in Germany by the prevailing custom of giving contracts to the lowest bidders, regardless of their ability to meet their obligations. A case occurred not long ago which will serve to show to what a disastrous extent this system is sometimes carried. The case was briefly this:—Two gun vessels were required for the German Navy, and the private shipbuilders were called upon to tender for the same, according to specification and plans. The result was that three firms quoted prices which varied but slightly from each other, whilst a fourth firm offered to supply the vessels at a cost which was 50 per cent. lower than that of the next lowest bidder. Notwithstanding the circumstance that it was immediately perceived at the Admiralty that such a price was simply insufficient to cover the bare cost of building the vessels, the contract was concluded with the firm in question. As the work progressed the builders realised the fact that they were incurring a heavy loss, and petitioned Government either to release them from their contract or to add considerably to the price agreed upon, which was subsequently done to the extent of 25 per cent. on the original sum. Of what nature work delivered under such circumstances must necessarily be is too apparent to need further comment. At the present moment the German Navy includes thirty-five torpedo boats, of which nineteen are building and four are of English construction. It is reported that the sum of 3,800,000 marks will be applied for during the coming session of the "Reichstag" for increasing the torpedo boat fleet, and that the Budget for 1885-86 will provide for twenty further vessels of this class.

It is rumoured that a first-class torpedo-boat, built for the Russian Government for experimental purposes by a French firm, has given so little satisfaction that the boat has been returned to her builders.

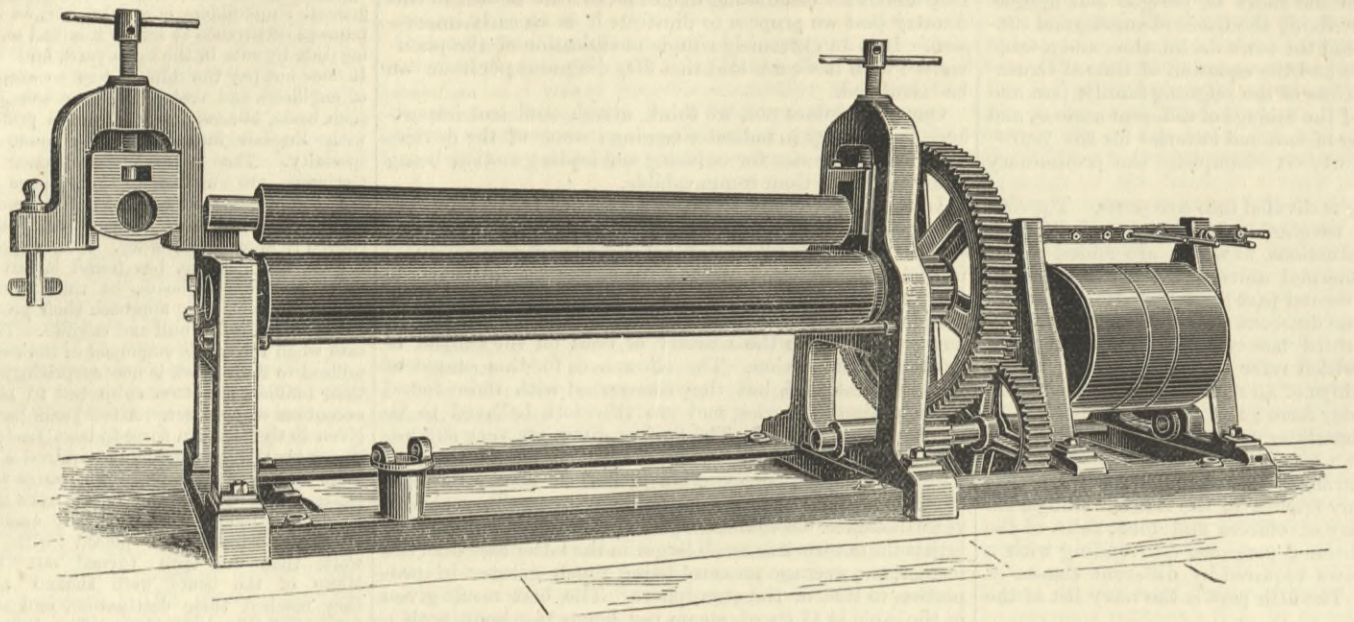
The Governor of Canton has sent an emissary, Mandarin Fock, to Europe for the purpose of contracting for the construction of several steel corvettes for the Canton division of the Chinese Navy. The Japanese and Portuguese Governments are likewise in the market as purchasers of ships-of-war, including an ironclad vessel. A small cruiser for the Government is at present building at Trieste.

IN the neighbourhood of the Puerto de Toledo, Madrid, the manufacture of artificial whalebone, from the horns of black cattle and buffaloes, has been started. It is said that the factory is provided with all modern improvements, and that its products are already competing successfully with similar articles which are imported from abroad.

THE TIN-PLATE TRADE.—Messrs. Arthur Bird and Co., of Leadenhall-street, state that the course of the tin-plate trade during 1883 has been singularly uneventful, and it may be recorded with satisfaction that the year has been free from those market fluctuations and crises which have always occasioned so much mischief. Compared with previous years the margins between raw material and the prices obtained for the finished plate have been such as to leave a profit, though maybe a small one, to the manufacturer; and in spite of a continually drooping market, our exports again compare most favourably with former periods, and show conclusively an ever steadily increasing trade. The year commenced with a favourable prospect, as the production was considerably reduced through the suspension of several large concerns; and although prices generally have fallen, in sympathy with the weakness of pig iron and tin, the expansion of the trade has been such as to cause the consumption at the present time to appear ahead of the production. A careful analysis of the position tends to show, as we say, that the exports and home consumption combined are in excess of the present output, and this being so, either the make will have to be increased during the current year, or the consumer will have to prepare for higher prices. In taking the present rate of production, we must not omit to state that the total stocks in Liverpool, London, and at Welsh ports, which stood at the commencement of the year at about 400,000 boxes, are now not more than 200,000 boxes, showing that during the last twelve months we have trenched upon our reserves to the extent of one half. Reliable figures are almost impossible to obtain, but we think the following may be taken as a fairly correct estimate. Number of works in existence 101, representing 384 mills; less mills standing idle, 63; less mills altogether stopped, 18; number of mills at present in operation, 303. Taking the average make per mill as 22½ tons per week, this gives an annual production of 6,812,500 cwt.; exports as per Government returns, 5,387,340 cwt.; estimated home consumption of tin and black plate, 1,500,000 cwt.; total, 6,887,340 cwt.; excess of consumption over production, 74,840 cwt., which excess is about represented by the reduction in stocks. The returns of the last twenty-one years show the growth of our export trade, and an analysis of more detailed figures, privately compiled, show that during the past year the following have increased their demands upon us, viz., America, Canada, the whole of the Continent—with the exception of France and Switzerland—India and China, while the requirements of the following seem rather to have fallen off—Australia, South America, West Indies, the Cape, and African markets.

BOILER PLATE BENDING MACHINE.

MESSRS. RUSHWORTH AND CO., ENGINEERS, SOWERBY BRIDGE.

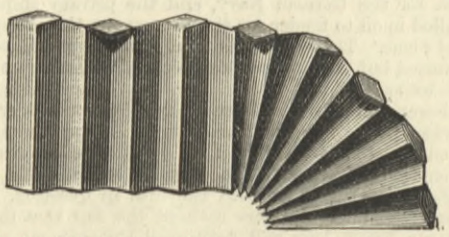


The accompanying illustration represents a neat arrangement for bending boiler plates, which explains itself. It will be seen that one of the housings is movable, so that the bent plate can be removed with ease by shifting it off the rolls endwise.

CORRUGATED DISC PULLEYS.

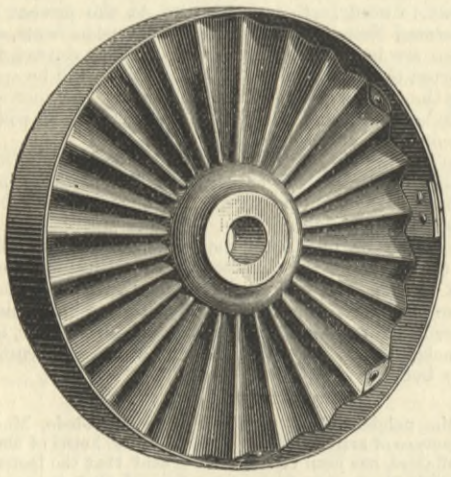
The accompanying engravings illustrate a novel form of light but very strong pulley now being made by Messrs. J. and E. Hall, of Dartford. It will be seen that the body of the wheel is

Fig. 1



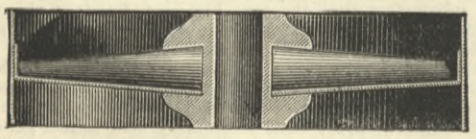
corrugated. This is not made, as will be at first thought, from a disc of sheet metal by stamping, but from an ordinary sheet of iron or steel, corrugated as shown at Fig. 1, and then bent

Fig. 2



round as also shown at Figs. 1 and 2, or more correctly, the corrugations are opened at one side and closed on the other in proportion to the diameter of the pulley. The centre part is cast into a

Fig. 3



boss, and the rim of the pulley is a hoop iron ring, bearing upon and fastened to ears turned over out of the material of

Fig. 4

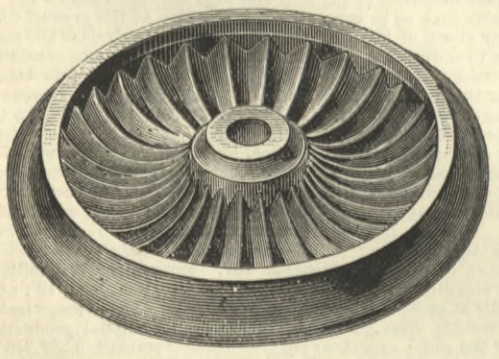
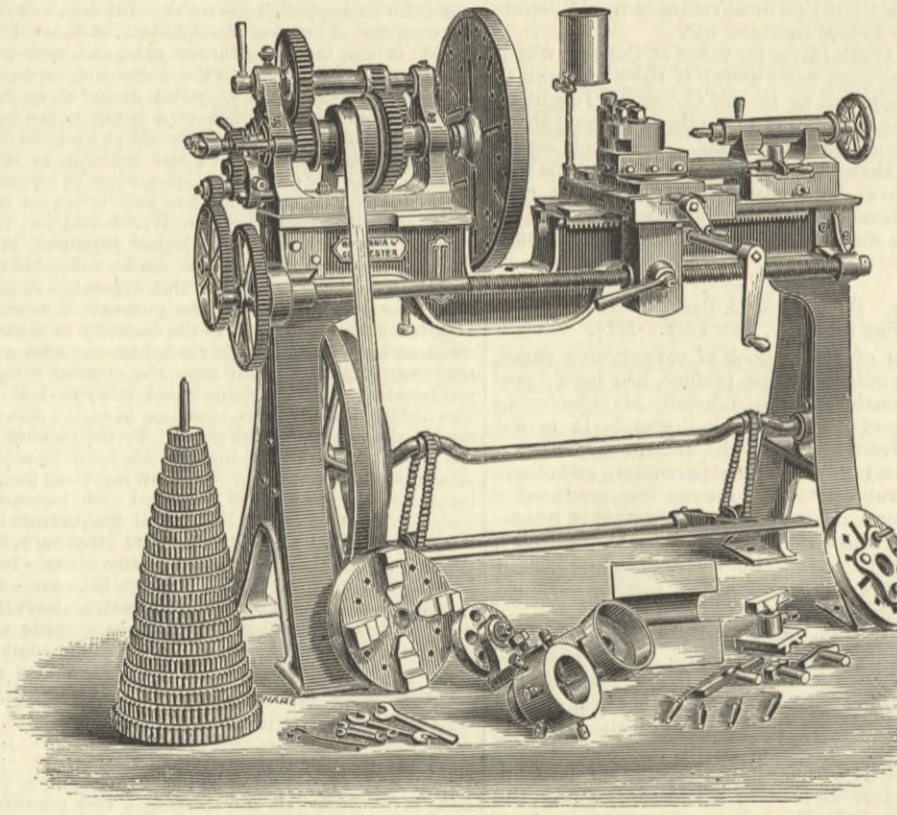


Fig 5

the disc. The complete pulley is shown in Fig. 2, and it is proposed to make use of the invention in application to railway wheels as shown at Figs. 4 and 5. As, however, the wheel will be very rigid, it is questionable whether the resilience, which should be a property of railway wheels, would not be wholly absent in this. As a pulley the design affords the advantages of rigidity with lightness, and the rim is supported throughout the whole circumference.

SHIPS' LATHE.

A few months ago the Admiralty decided that it would be advisable to fit ironclad ships with lathes of a somewhat peculiar type. These lathes have been supplied by the Britannia Manufacturing Company, Colchester. The speciality about the lathes is that, although they are driven by treadle, they are so geared that comparatively heavy work may be done on them, of course at a slow speed. They are treble-geared, and will take a 24in.



pump cover, &c. A half inch cut can be taken off a 3in. shaft. The centres are 6in., and the gaps 7½in. wide and 6½in. deep. The beds are 4ft. 6in. long. The steel leading screw is 1½in. in diameter by ¼in. pitch.

We have had one of these lathes taken apart, and examined it in every detail. This was not a specimen lathe, but one ready to send away. We found it to be in every respect an exceedingly substantial, well-finished tool, quite fit to be worked by steam power if necessary. The surfaces are large and well fitted. For country shops, where heavy turning has to be done now and then and steam power is not available, and for amateurs this lathe is well adapted. It would be by no means out of place in large steamers, and would enable the ships' engineers to do much that has now to be done on shore.

SELF-STARTING GAS ENGINE.

One of the greatest objections which have hitherto done much to prevent the use of gas engines is the difficulty of starting. In all engines hitherto in use it has been necessary to obtain the first ignition by pulling round the fly-wheel. Where only small power engines were used it was not found to be a serious inconvenience except by those who personally did the fly-wheel turning. Now, however, that engines are in use giving out 20 to 50-horse, the difficulty which attends starting not only makes itself felt in the muscles of the turner but in the pocket of the owner

Whatever be the care exercised in construction, the friction of the moving parts in large engines is with difficulty reduced to sufficiently small limits to make it a pastime to work gas engines by hand. Many attempts have been made to make them self-starting, or rather to start by opening a valve, but none of them have been successful. In the Clerk gas engine the problem has been successfully solved.

Whilst the engine is running it is made to compress to about 70 lb. per square inch pressure, inflammable mixture in a wrought iron welded reservoir, and this compressed mixture is utilised to start the engine when required, only three minutes being required to charge the reservoir completely, which is of sufficient size to start the engine several times consecutively. The compressed mixture is admitted at the back of the displacer cylinder piston when its crank is at about one-fourth stroke This starts the engine, while the charge at the return stroke enters the power cylinder as usual. The attendant can then admit compressed mixture throughout another stroke of the displacer piston if necessary. The arrangement is very simple, and the compression of the mixture into the vessel is effected by the displacer piston into the port between which and the power cylinder is placed a flap valve. When this is closed the compressed charge goes into the receiver under pressure instead of the power cylinder at very low pressure, the work being done a few strokes at a time by fly-wheel stored energy, as in those strokes during which the mixture is sent into the receiver the power cylinder is deprived of it.

Mr. Clerk has recently protected this by patent, including modifications suitable for other gas engines than the Clerk. We recently saw an engine fitted in this way, and being accustomed to seeing gas engines started by hand and kept going this way until the engine started itself, it seemed somewhat astonishing to see a powerful gas engine move at once by a slight touch of the hand on a small lever. It is one step nearer to that perfection which the gas engine is supposed to promise. This method has now been thoroughly tested in daily work, a considerable number of engines being in operation in London and Glasgow. The Edison Electric Light Company's offices, West George-street, Glasgow, have had it in continued use for some months.

It is the first use of a self-acting method practically introduced to the public. It is daily in use, and exhibited at Messrs. Sterne and Co.'s City show-rooms, Cannon-street, where the engines are fitted with this improvement and driving two Edison machines.

Electrical Engineering.—The fourth of a course of lectures on "Electrical Engineering," by Mr. J. C. Fell, was delivered on the evening of January 28th, in the reading-room of the Society of Engineers, Victoria-street, Westminster, Mr. Jabez Church, past-president, in the chair. The lecturer again resumed the description of the principles on which the generation of currents is obtained from dynamo-electrical machines, giving large scale illustrations of the various methods in which the armature coils may be wound. He then explained in comparative detail the distinctive characteristics of the best known dynamo machines, such as the Gramme, the Siemens, and the Edison machines which were illustrated. Mr. Fell then proceeded with definitions of the laws of circuit resistances directly proportional to length and to sectional area of conductor, and gave some interesting examples of electric arc lamps, dating back as early as 1846. The defects in these lamps for practical lighting purposes were pointed out, and the steps of invention effecting mechanical improvement thus explained.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE annual general meeting of the Institution of Mechanical Engineers took place on Thursday and Friday evenings of last week as announced. The first proceedings of the meeting on Thursday related to affairs of the Institution, including a proposition with respect to the management of its business by the secretary, and a proposed change with respect to the staff of the Institute generally, under which the office of assistant-secretary was to be abolished, and an honorarium of £1000 given to the present assistant. These proposed changes were announced in our impression for the 9th of November last. In the meantime an agitation against them had been raised by a few members, the objection being nominally that the secretary was to be allowed to practice as an engineer or as he chose, the free use of the rooms of the Institution being granted him. This and the suggested change with respect to the staff caused certain members to take up the matter as a personal question as between the secretary as an engineer; the secretary in office; themselves as engineers, and the assistant-secretary as an old servant. The result of this was a discussion, or something which will probably have to be recorded as such, which was not quite creditable to the Institution.

It had been rumoured that the Council proposed an arrangement by which the whole affairs of the Institution would be "farmed out" to the secretary. What it really was proposed to do was explained by the then president, Mr. Westmacott, in a speech, the quiet tone of which ought to have been an example to those who followed. The result of this evening's meeting was that the matter was adjourned at a late hour; the only business transacted being the reading of the report and the installation of the new president, Mr. Bell.

On Friday evening, Mr. Cochrane in the chair, the proceedings commenced with a very temperate and dignified speech by Mr. Walter R. Browne, in which he announced that he no longer held the office of secretary, but addressed the Institution as a member. The resignation which he handed in to the Council some months since, but which had not been accepted, he now acted upon; and in view of the turn the discussion of the management of the Institution had taken, explained that it would be much simplified if the personal element imported into the matter were removed. Mr. Browne's remarks were very warmly received by most of those present. The proposed alteration of the bye-law No. 21, of which we gave notice last week, was then again read, and, with the proposed amendment of bye-law No. 20, was passed. The minutes of the meeting of November last and of Thursday evening were then read and signed, and the discussion was resumed on Mr. Beauchamp Towers' report to the Research Committee on "Experiments on Friction." This report was read at the November meeting, and as the figures obtained are of interest, we shall give the report in another issue. The discussion on Friday evening added nothing to that which had been previously taken, and of which we gave an account in our impression for the 9th November last.

The paper "On the Physical Conditions of Iron and Steel," by Professor D. E. Hughes, was then read by Mr. Browne, who will give the necessary attention to the business of the Institute until the appointment of another secretary has been determined upon. The commencement of this paper will be found at page 90.

Professor Hughes then explained at some length the magnetic balance and its applications by engineers. Like most of Professor Hughes' papers, it is characterised by novelty and by masterly simplicity in the treatment of a recondite subject. It will be remembered that in January last year Professor Hughes read a remarkable paper "On the Molecular Rigidity of Tempered Steel," in which he described experiments of an entirely novel character, by which he was able to show that the molecules of soft iron are as free to move as any molecular theory could require; but that the molecules of hardened steel are as undoubtedly rigid in their fixedness. It did not lead directly to an answer to the question, What is the cause of hardening in steel? but it enabled us to see what took place when a piece of steel was hardened. It proved a very remarkable molecular effect, but the cause is not yet clear. He showed that the magnetic capacity of iron depended upon its purity, and that any alloy of iron in which the component, other than iron, caused hardness or conferred upon it the capacity of receiving temper affected its magnetic properties. The mechanical properties of iron and steel varied with the magnetic properties in such a way as to indicate that the hardened steel was an alloy containing a larger quantity of fixed carbon than when soft, and, so far, to give support to a view long since propounded, but proved for the first time that molecular rigidity was, if not the cause of hardness of tempered steel, an accompaniment of the process of hardening which looked very much like the cause. The paper of which we publish a part at page 90 gives some of the results of the extension of this field of research, and describes an instrument, the magnetic balance, which promises to enforce steel manufacturers and metallurgists generally to turn more attention to the ever-increasing field for the application of electrical studies. By means of this instrument Prof. Hughes shows that there is a relation between capacity for tempering and loss of magnetism when tempered, and that there is apparently an absolute relation between the electric conductivity of iron and its magnetic capacity. There is a very evident relation between molecular rigidity and tensile strength, and thus the figures, read off from the scale of the magnetic balance, afford a comparative indication of ultimate tensile strength and of ductibility.

A discussion followed Professor Hughes' paper, and Messrs. the Hadfield Steel Foundry Company showed some specimens of steel castings and pieces of steel which, by being wholly without magnetic capacity, confirmed in a remarkable manner that which had been advanced by Professor Hughes. The steel castings referred to, including axes and other tools carrying a fine cutting edge, were the subject of very great interest to those present, for these cast tools require no treatment of any kind when they come from the mould. They are very hard, but what is the more remarkable is that they are very tough at the same time. They require no hardening or tempering. The steel of these remarkable properties is made by thoroughly incorporating, under Mr. Robert Hadfield's patent, from 7 to 12 per cent. of rich ferro-manganes, containing about 80 per cent. of manganese. The applications of this remarkable metal are, it need hardly be said, innumerable. Tools of almost every description can now go straight from foundry to grinding and finishing rooms, while for the numerous engineering purposes to which steel is applied, for strength, toughness, and hardness are now added.

In the course of his explanation of the magnetic balance Professor Hughes showed that by means of that instrument, almost every property of a piece of metal could be read off by scale, and that he hoped that after a while engineers would be able, by means of coils of different sizes, to test their specimens without pulling them to pieces—a method of trying a thing which Professor Hughes seems to think barbaric. This would, of course, be a very valuable result, but we do not see how those mechanical properties, such as elastic flexure, elastic extension, and total extension, up to destruction, can be obtained by any such means. It is not impossible, however, that a large and systematic series of experiments on the properties of iron and steel, carried out simultaneously by the testing machine and by the magnetic balance, might afford information which would afterwards enable the possessor of the latter instrument to indicate the whole of the properties of any piece of iron or steel, just as Saxby long ago devised means for testing iron plates and other forms for fractures or similar imperfections.

PRIVATE BILL LEGISLATION.

THE inquiries of the examiners into the petitions for Bills on the proofs of Standing Orders have been further proceeded with. The following schemes were amongst those in respect of which compliance was proved:—Perth General Station Bill, London and St. Katharine's Docks Bill, Colne Valley and Halstead Railway Bill, Wisbeach Dock and Railways Bill, Charnwood Forest Railway Bill, Caledonian Railway (No. 2) Bill, Caledonian Railway (No. 1) Bill, Great North of Scotland (New Lines) Bill, Usk and Towy Railway Bill, Wirral Railway Bill, Cranbrook Paddock Wood Railway Bill, Highland Railway (New Lines) Bill, Teign Valley Railway Bill, Great Western Railway and Bristol and Portishead Pier and Railway Company's Bill, Cork and Bandon and Clonakilty Extension Railway Company's Bill, Cork and Kenmare Railway Bill, Metropolitan Railway (Various Powers) Bill, Dore and Chindley Railway Bill, Hendon Railway Bill, Great Western Railway (No. 2) Bill, West Lancashire Railway Bill, South-Eastern and Channel Tunnel Railway Bill, South-Eastern Railway (Various Powers) Bill, Athenry and Ennis Junction, and Midland Great Western of Ireland Railway Company's Bill, Great Southern and Western Railway (Additional Powers) Bill, Great Southern and Western Railway (Tullow Extension) Bill, Bishop's Castle Extension to Montgomery Railway Bill, Ruthin and Cerrig-y-Drindion Railway Bill, Portpatrick Railway Bill, Ballyclare, Logonill, and Belfast Junction Railway Bill; Belfast, Strandtown, and High Holywood Railway Bill, Belfast Central Railway (Western Extensions) Bill, Belfast Central Railway (Steam Vessels and Traffic Arrangements) Bill, Halifax High Level and North and South Junction Railways Bill, Plymouth, Devonport, and South Western Junction and Devon and Cornwall Central Railways Bill, Liskeard and Caradon Railway Bill, North Cornwall Railway Bill, Cleveland Extension Minerals Railway Bill; Belfast, Holywood, and Bangor Railway Bill, Railway Clearing System Superannuation Fund Bill, East London Railway Bill, London and South-Western Railway (Various Powers) Bill, Highland Railway (Northern Lines Amalgamation) Bill, Port Dynallen Railway Bill, Severn Bridge and Forest of Dean Central Railway Bill, Belfast and Northern Counties Railway Bill; Bury Port and North-Western Junction Railway Bill; Northampton and Daventry Railway Bill, Leominster and Bromyard Railway Bill, Rosebush and Fishguard Railway Bill.

In the case of a petition, signed by Mr. Kersey and others against the Omnibus Bill of the London, Chatham, and Dover Railway Company, the complaint was of the inaccuracy of many of the descriptions contained in the books of reference, and various other allegations were made. Having the case at length the Examiner adjourned it. On Thursday the Examiner found, on the representation of the South-Eastern Railway Company, that the promoters had committed a breach of Standing Orders, inasmuch, as they had failed to deposit with the Clerk of the Peace for the county of Middlesex, copies of the plans and sections in respect of their widening of the new Blackfriars Bridge.

The Rhondda and Bristol Channel Railway Bill was, on the representation of a large number of complainants, found to have been in default, the promoters not having served the necessary notices of their intention to take land. The Examiner also decided against the promoter of the Golden Valley Railway—Monnow Extension—Bill, and of the Mersey Railway Bill.

The following Bills will not be proceeded with:—Worcester, Bromyard, and Hereford Railway; Mid-London Electric Railway; Carshalton, Sutton, and Wimbledon Railway; Walton-on-the-Hill; Banstead and Caterham Junction Railway; Pontypridd and Ogmore Railway; Anglesa and Carnarvon Direct Railway—No. 1—Bill.

The London, Reigate, and Brighton Railway Bill, on Monday came before Mr. Robinson, on the question of non-compliance raised in four petitions, three of which were signed by owners or occupiers of property, and the fourth memorial being that of the London, Brighton, and South Coast Railway Company, which, of course, is the principal opponent of the Bill. The scheme, which is said to have influential support, is for a railway from London to Brighton *viâ* Reigate and Shoreham, which, in the event of its being sanctioned and carried out, will cost, according to the estimate of the promoters' engineers, £3,075,765. The share capital of the company is to be £3,100,000, and the usual borrowing powers for a further sum equal to one-third of the share capital are taken under the Bill. By arrangement between the parties it was agreed to consider first the allegations arising on the book of reference, and under this head a very large number of objections were laid before the Examiner. The first allegation was that of certain ladies carrying on a convent and an orphanage at or near Croydon; and these petitioners complained that no notice of this line—which, it was admitted, the promoters were required to serve on the owner—had been furnished to them. The question turned on whether the ladies in question held this property by absolute right, or whether, as contended by the promoters, they acted merely in the capacity of managers of the institution. The solicitor to the petitioners was called and produced the deed of conveyance of the property, from which it appeared that the ladies were not prevented by law from selling or otherwise disposing of it. On behalf of the promoters, it was submitted that they had made application to the reputed owner, and in so doing the Examiner thought they had complied with the Standing Orders to the best of their ability. In the case of some of the other allegations, however, the promoters were not so successful, as the Examiner sustained certain of the complaints as to wrong description, neglect to serve the necessary notices, &c.

On Thursday the Manchester Ship Canal Bill came before Mr. Frere on the opposition of the Mersey Docks and Harbour Board of the Corporation of Liverpool. The scheme contained in the Bill is practically the same as that which was rejected by Parliament last year, proposing a canal 21¼ miles in length from Manchester to a point a mile above Runcorn Bridge, the access to which will be obtained by deepening the bed of the estuary of the river Mersey, and creating a channel by means of training walls suitable for navigation by large vessels. The total cost will be £6,904,186, consisting of £456,172 for railway works, £1,008,015 for the dock at Manchester, £113,247 for the dock at Warrington, £3,920,171 for the canal works, £1,390,419 for the estuary works, and £16,162 for new roads. The grounds of alleged non-compliance with the Standing Orders consisted in the fact that in the deposited plans and sections the promoters had neglected to define the width of their proposed low-water channel, and that the limits of deviation were of such an extent—three-quarters of a mile—that it was impossible to ascertain the course which it was intended that the channel should take. On behalf of the petitioners, Mr. Lyster, the engineer to the Docks Board, was called, and explained the necessity for the information in question. Mr. E. Leader Williams, the engineer to the scheme, gave evidence on behalf of the promoters, and stated that he was prepared to stand by what was in his plans. After hearing the agents on both sides, the Examiner held that the plans were sufficiently explicit on the question of the width of the channel; while as to the allegation that the limits of deviation were too extensive, he thought that was a question of merits, and therefore should be discussed before a Committee rather than on Standing Orders.

The Bill of the Metropolitan Railway Company providing for a railway from Paddington to Westminster, was on Wednesday the subject of a discussion before Mr. Frere. Powers are taken under the Bill to construct a line of railway commencing at Paddington and proceeding *viâ* Edgware-road, and the Hyde, Green, and St. James' Parks, and to Westminster, where it terminates in King-street. The engineers' estimate of the cost is £1,275,040, consisting of £1,131,389 for the railway, £56,102 and £20,217 for the improvements in Parliament-street and Charles-street respectively, and £67,331 for two new streets. The opposition to the Bill at its present stage came from certain gentlemen, who complained of non-compliance with the Standing Orders, on the ground of the inaccuracy of the deposited plans and sections. The alleged inaccuracy consisted in this—that while the proposed railway was to be constructed by tunnelling, the plans showed that a hard line instead of the dotted line was required by the Standing Orders in the case of a work of the kind projected. The answer of the company was that the plans were perfectly corrrect, and were in accordance with the requirement, inasmuch as where the hard line was shown on the plans, the tunnel was to be constructed by cutting and covering. On behalf of the petitioners, Sir Theodore Martin contended that, taking the only possible view of the case after the repeated assurances of the company and the provisions of the Bill, that this railway was to be constructed without any opening for any purpose whatsoever, the plans were inconsistent with what was proposed in the Bill. He submitted that it was not right that opponents to the Bill should be left in doubt as to what they had to meet; and therefore he asked the Examiner to find that the Standing Orders had not been complied with. Mr. Gaskell, C.E., was called in support of the contention of Sir Theodore. The Metropolitan Company called Mr. Hayter, C.E., under whose inspection the plans had been prepared. He stated that as it was proposed to construct portions of this railway by removing the surface, he was carrying out the regulations of the Standing Orders in indicating those places by the hard line. Of course, the manner in which the works were to be carried out was under the supervision of the First Commissioner of Works. Mr. Grabbe, the agent of the company, then addressed the Examiner on its behalf, and he said that it was intended, and always had been intended, to carry out portions of the works in the manner stated by his engineer—by cut and cover. He distingushed between "tunnel" and "tunnelling," his contention being that whereas the first embraced any covered way when completed, "tunnelling" was limited to the act of "boring." Therefore, the 8th clause of the Bill, which contained the alleged prohibition to make openings, applied only to openings made in the tunnel for purposes such as ventilation, lighting, &c., after the completion of the works. Adopting this view, there was, he submitted, no inconsistency between his deposited plans and the powers and restrictions contained in the Bill. The Examiner, after hearing Sir Theodore Martin in reply, expressed his concurrence with the views of the promoters, and accordingly held that there had been no breach of the Standing Orders. Mr. Grabbe then stated that an arrangement had been effected between the company and the First Commissioner of Works, by which the railway, if authorised, would be constructed by means of timber bridging, *i.e.*, the sods would be removed, and timbers laid, over which the sods would be replaced, thus practically causing no interference with the surface of the parks or of the public roads. The surface would only be broken in a few places, in order to enable the contractors to remove the soil.

IRON IN NEW SOUTH WALES.—In our advertising columns will be found a remarkable invitation addressed to the iron masters of Europe and America by the Government of New South Wales. This prosperous colony is very rich in iron and coal of excellent quality. The Government has within a few years constructed over 1200 miles of railroad, and more than 500 miles are in course of construction, all the materials for which, except the sleepers, have been imported at a heavy charge in the way of freight, &c., from England. These charges should operate as a large "protection," and afford great inducements to enterprising men to embark in the manufacture of iron and steel in the colony. It is stated that 1,250,000 tons of iron and steel, inclusive of permanent way material, have been imported into New South Wales and Victoria within the last ten years. The Government has determined to make a bold experiment to naturalise the iron industry in the colony, and has, in the terms of the notice which we publish to-day, called for tenders for 150,000 tons of steel rails—or any portion thereof—to be manufactured in the colony from New South Wales ores. Printed copies of preliminary specification, conditions of contract and other particulars may be had from the Agent-General of the colony, Sir Saul Samuel, K.C.M.G., at 5, Westminster-chambers, Victoria-street, London, S.W., by ironmasters and others desirous of obtaining authentic information on the subject,

LE STANLEY.

In a recent issue we described a steamer, 70ft. in length by 18ft. beam, of very novel construction, named Le Stanley, built by Messrs. Yarrow and Co., of Poplar, to the order of L'Association Internationale of Brussels, for the navigation of the Congo and to assist in the opening up and civilisation of the interior of Africa.

It will be remembered that the main feature of the vessel was its capability for subdivision, which admitted of its being shipped in moderate sized pieces, and on arrival being put together with great rapidity, also while afloat it could be separated into a number of water-tight sections, which sections are furnished with wheels so that they can be easily hauled overland, and what was once a portion of a vessel could within a few hours be converted into a wagon for transport by land; and as the draft of water was only 15in. the change from the one to the other could take place on the banks of the river in very shallow water. Our illustration on page 89 shows Le Stanley completely put together afloat, the other view giving an excellent idea of a section as it would appear on its way overland, drawn by natives, of whom no less than 500 have already been engaged.

Prior to the shipment of this little vessel to the Congo some interesting experiments were made in the presence of the Belgian authorities to test by actual trial how long it would take to connect the various sections together forming the entire hull after arrival, and also the time to sub-divide them again into portable pieces. Twelve men and three boys were employed for the purpose; they were able to completely and perfectly connect two sections while afloat in twenty-three minutes—consequently the entire hull, which consists of eight sections, could be connected up in about three hours, provided the sections were all afloat ready for speedily bringing together. The next trial was made to ascertain now long it would take to effect the subdivision of the hull; the same number of men were employed, and it occupied them eight minutes. This mode of construction seems undoubtedly to offer very marked facilities in contrast with the usual plan of shipping such vessels in pieces and rivetting them after arrival, entailing slipways, rivetters, and all the difficulties of launching, which are not always easily overcome in foreign lands, and even then at considerable expense and delay. Had the usual plan been adopted in this case it is estimated that it would have taken as many days to get Le Stanley ready for steam as it will now take hours.

LETTERS TO THE EDITOR.

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

THE EFFICIENCY OF FANS.

Sir,—Some of your correspondents in dealing with this question give a formula for the efficiency in terms of the peripheral speed, &c. Supposing such a formula to be true for a particular form of blade, say one with flat sides and straight blades—which may be comparatively long or short—and of medium comparative width, then it will be obvious to any one that it cannot also be correct for a fan, say, with sides tapering from the centre, or *vice versâ*, and comparatively broad, or *vice versâ*, and, moreover, with curved blades. But it seems to me probable that such formula, besides being adaptable to one type only, will not give more than roughly approximate results in any case. Would it not be preferable, when the greatest degree of accuracy is required, to adopt a method on the following lines?—Take a fan of any type, and suppose it to be running at a given speed with closed inlets; we want to know, in the first place, what amount of water gauge the fan will give under the supposed conditions. Commence by dividing the space in which the vanes revolve into a series of concentric hollow cylinders—the larger the number taken the better—one within the other, their common axis being the axis of rotation. Calculate the weight of one of these hollow cylinders of air, this may then be supposed to be collected at a point at a distance from the centre of rotation equal to that of the centre of gravity of a small sector of the hollow cylinder under consideration. With these data we can find the centrifugal force developed in this space by the formula—centrifugal force in pounds = ·00034 × weight in pounds × radius in feet × (number of revolutions per minute)^2. This force is distributed over an area equal to that of the convex surface of a cylinder described by a line drawn right across one of the vanes parallel to, and at the above distance from, the axis of rotation. The pressure so distributed will equal so much water gauge; then the centrifugal pressures in w.g. developed in the hollow cylinders having been found in this manner, their sum will be the w.g. which the whole fan will develope with ports closed. Of course, if we take an extreme case and imagine a fan with only one or two vanes, the angular velocity of the air in all parts of the path of the vanes will not be uniformly that of the vanes themselves clearly; but with a reasonable number of vanes, would not the foregoing method give more accurate results than the formulæ previously propounded?

With open ports the calculation becomes more difficult. Within the sector distended by the delivery orifice the motion of the air is spiral, and the outward—radial—component of the air's motion in each cylinder in this space must now be taken into account, as this will obviously diminish the centrifugal force, and in calculating this the lateral taper—if any—of the vanes and casing, from the inlets outward, will have to be considered. Finally, the forward sides of the vanes within this sector exert a pressure against the air in front, which imparts to it the increased angular velocity which it must acquire as it moves from the centre, and when the blades are curved backwards this pressure can be resolved into two components, one tending to move the air outwards radially, and increase the w.g. The amount of this pressure developed within each hollow cylinder may be determined by ascertaining the amount of circular acceleration imparted to the mass of air supposed to be passing through it in a given time. But vanes curved backward will not produce the same amount of angular velocity in the air as straight ones. Suppose the fan to be standing and air driven through it, this will be evident, for the blades will divert the air in a direction coinciding with their curvature, and give it a certain amount of angular velocity in the wrong direction; and in calculating the centrifugal force the mean amount of this must be deducted from the actual velocity of the vanes within that cylinder.

It will be apparent in the course of these investigations that if the fan be one which delivers its air all round, the minimum amount of centrifugal effect will be destroyed, for then the outward motion of the air is distributed all round—and for this reason, in my humble opinion, I should take such a fan as Schiele's, with its spiral air chamber round it, to be the most perfect centrifugal fan extant. Moreover, in fans like this the tangential momentum of the air as it leaves the blades helps to hurl it on through the pipes and augment the pressure at the tuyeres, or what not, if the fan be used for blowing purposes. In the Guibal fan for exhausting purposes this momentum is utilised beautifully by the *evasée* chimney; but this fan only delivers its air through a few degrees of its circumference, and there is little doubt but if two or more outlets with *evasée* chimneys could be formed it would be a more efficient fan even than it is.

In a fan constructed double like Mr. Capell's fan, which, I suppose, consists of a small fan rotating within a larger one, whose blades begin where those of the small one end, the small fan will admit of being driven at a much greater velocity than if it had been rigid with, *i.e.*, formed a part of, the large fan. This may partly explain the high efficiency—said to have been obtained—of this fan in regard to its bulk, but not in regard to the power required to drive it. R. Snowdon.

Widnes Foundry, Widnes, January 26th.

[Both sets of blades in Mr. Capell's fan are fixed on one axis and revolve together.—Ed. E.]

Sir,—Your correspondent Mr. Hodgson has misunderstood the figures I gave respecting the 15in. Phillips fan. The trials to which I alluded were the trials of the Royal Agricultural Society held at Reading July 19th, 1882, published in The Engineer July 28th, 1882. I strongly advise him to study them if he wants to know what any of the fans there entered can do. I overlooked the fact that at 6282ft. blade tip speed the Phillips fan took no less than 64,188 foot-pounds to work it. In his first letter he says his man got 7700 blade tip speed out of the same fan. I have not often come across such 2-horse power individuals in my fan testing experience. I shall be pleased to show Mr. Hodgson the 36in. fan repeating its usual performance, and he shall have an invitation to the trials of the fans next week. I quite agree with the remarks of your other correspondent about open ventilators of the Blackman type. To compare their weight and work with good fans of the Schiele and Lloyd type, giving at the speeds quoted nine or ten times the water gauge, is not just. The efficiency of all the windmill fans is greatly below even the ordinary open fans. I have succeeded in overcoming the worst point in the open ventilators, viz., the dead centre passing no air, by combination of a collecting cylinder with a disc with wings.

I have doubled the water gauge of this type of fan and increased both its blast and suction power, but it cannot be compared with the work done by my ordinary open fans where suction is wanted, as in a mine, or in drying grain, hops, &c. I cannot make out the description of the fan at Haland and Sons' works. It is said to be 4ft. diameter, and to discharge 35,000 cubic feet per minute at 285 revolutions. There must be some mistake, for this reason: Suppose the fan to have a circular outlet 2ft. diameter, we get about 3ft. area; therefore, cubic feet divided by area gives us discharge speed of air = 11,666ft. per minute, or wind gauge pressure of over 11in. water column. But at revolutions 285 the blade tip speed is roughly 3400ft. per minute with a 4ft. fan, and the water gauge due to this speed is 1in., not 11in. It is a physical impossibility for the discharge air speed of a fan to be double the blade tip speed, much less three times that speed. In most fans the inlet or outlet speed is half the blade tip speed; in many fans it is much less. When Mr. Hendy says of the fan he describes, "It is a fan constructed in obedience to the laws which govern the limits of rotary fans," I ask what laws? For 11in. water gauge with 3400 blade tip speed seems to my considerable experience a veritable pneumatic "castle in the air." G. M. Capel.

Passenham Rectory, January 29th.

WATER ANALYSES.

Sir,—In your issue of the 11th January I have read a paragraph referring to the reports and analyses prepared at the expense of the London water companies. It is there stated that the determinations of organic matter made by the combustion process were, in these analyses, "checked" by a totally different mode of examination, whilst the corresponding determinations in the official analyses for the Registrar-General were wholly "unchecked." As these words may be misleading to those not fully acquainted with the processes of water analyses, may I be permitted to make the following remarks concerning this so-called operation of "checking," to which it would appear that the writer attributes so much importance? The method of determining organic matter in water by the combustion process is now universally adopted by all water analysts of any repute, and it is only in laboratories where the necessary apparatus or skill for carrying out this beautiful process are absent, that it is replaced by the permanganate or "oxygen" method, which at best yields merely comparative results. This necessarily crude and uncertain method is, in fact, wholly unsuitable for checking the results obtained by such an accurate and reliable process as that of combustion. I would recommend the writer to examine for himself to what extent the oxygen process checks the results of the water companies' chemists obtained by combustion. Thus if the results yielded by this process really did form any check on those obtained by combustion, the results furnished by the two methods should be approximately in the same ratio, *i.e.*, if the amount of organic matter by combustion be divided by the amount of oxygen consumed in the permanganate process, the quotient should in each case be the same, or approximately so. A glance at the following figures, taken from the last report of the water companies' chemists, will show how far from concordant the results by the two methods really are:—

	I. Oxygen required to oxidise the organic matter.	II. Organic carbon and nitrogen by combustion.	Ratio of II. to I.
	grains.	parts per 100,000.	
New River Company	·032	·079	2·5
,, ,,	·040	·123	3·1
,, ,,	·032	·093	2·9
East London Company	·068	·166	2·4
,, ,,	·050	·202	4·0
,, ,,	·052	·232	4·5
Chelsea Company	·056	·124	2·2
,, ,,	·052	·183	3·5
,, ,,	·042	·131	3·1
West Middlesex Company	·044	·209	4·8
,, ,,	·056	·190	3·4
,, ,,	·036	·214	5·9
Lambeth Company	·064	·197	3·1
,, ,,	·048	·133	2·8
,, ,,	·032	·136	4·3
Grand Junction Company	·104	·364	3·5
,, ,,	·048	·195	4·1
,, ,,	·056	·171	3·1
,, ,,	·034	·144	4·2
Southwark Company	·084	·228	2·7
,, ,,	·048	·151	3·2
,, ,,	·052	·165	3·2
,, ,,	·034	·151	4·4

Percy F. Frankland.

Grove House, Pembridge-square, W., Jan. 29th.

THE INTERNATIONAL HEALTH EXHIBITION, 1884.

Sir,—There are many sanitarians in the provinces who think that the committee having the control of Group 3, the dwelling house, should have amongst its numbers some of the most eminent provincial authorities in addition to those of the metropolis. For many years past the management of similar exhibitions, though on a smaller scale, seems to have been almost entirely in the hands of a few prominent London sanitarians. It would be much more satisfactory to the class I represent, and I venture to think much more conducive to the complete success of the exhibition, if such representative men as the water engineer of Liverpool, Mr. Deacon; the consulting engineer of the Nottingham Corporation, Mr. Tarbotton; and the borough engineer of Birmingham could be induced to take a prominent part in the management of Group 3 and in the judging of the exhibits. C. E.

January 29th.

CLOTHING STEAM PIPES.

Sir,—I have read with much interest Mr. Clark's report of trial of boiler and pipe covering, but felt surprised and disappointed that silicate cotton was not amongst those tested. I herewith send the particulars of a test that was carried out some time ago with silicate cotton composition, which is now manufactured by Messrs. Carter, Bird, and Co., of West Hartlepool and Queen Victoria-street, London. You will see this gives a very high percentage of efficiency compared with those tested, and their price—£7 per ton—would make it compare very favourably for cost.

The following experiments are quoted from the "Transactions" of the North of England Institute of Mining and Mechanical Engineers, vol. xxxii., page 37. A steam pipe, 10$\frac{3}{8}$in. diameter, was coated with silicate cotton composition at thicknesses of 1in., 1$\frac{1}{4}$in., and 2in., and the observation resulted as follows:—

Name of material.	Thickness.	Temperature of			Heat loss, units per hour.				Efficiency.
					Per sq. ft.		Per ft. length.		
		Bare pipe.	Cover'd pipe.	Air.	Bare pipe.	Cover'd pipe.	Bare pipe.	Cover'd pipe.	Per cent.
	in.								
Silicate cotton composition	1	237	117	74	308·4	63·2	854·2	208·0	75·6
	1$\frac{1}{2}$	244	72	55	359·1	21·4	994·7	76·0	92·4
	2	244	63	54	360·8	10·4	999·5	39·8	96·1

Chelmsford, January 29th. S. Eddington.

HULL AND BARNSLEY RAILWAY.

Sir,—In your impression of the 25th inst. in speaking of the mode of working the Weighton cutting you state that it was a "somewhat novel method." The *modus operandi* described is a very old one. When I was resident engineer on the Sevenoaks Railway in 1860 this system was adopted in a chalk cutting something like three-quarters of a mile long and 60ft. deep, and even then I believe that there was no novelty in the practice.

15, Parliament-street, Westminster, January 29th. W. H. Thomas.

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

(From our own Correspondent.)

Mill and forge proprietors who are running their works full time have as much as they can do to get in specifications from purchasers who awhile back placed orders. The difficulty is not lessened by the circumstance that some of the galvanised corrugated sheet makers, and other local consumers, are stock-taking, and desire no deliveries at all. Ironmasters who have not many orders on the books, whether of old or recent date, have to be content with keeping their works on about two-thirds time, or less.

Much briskness was manifested on 'Change this—Thursday—afternoon in Birmingham, and yesterday afternoon in Wolverhampton, in looking after orders, but the success which attended the effort was not proportionate. Except as to small orders, buyers still hang fire. The expectation is entertained that during February business will show a revival, especially in the shipping department. Buyers cannot expect to gain much by further delay since prices are in their favour. For best descriptions, however, quotations are fairly strong.

The principal firms quote marked bars, flats, rounds, and squares at £7 10s. per ton; small rounds and squares, $\frac{3}{8}$in.; and flat bars from 6$\frac{1}{2}$in. to 9in., £8; $\frac{1}{8}$in., £8 10s.; and best marked Crown bars, £9; ordinary cable iron, £8; best Crown chain bars, £9; plating bars, £8 to £9 10s.; and double best chain bars, £10. Good quality angles are nominal at £8, and superior sorts £8 10s. to £9. Good rivet iron is £8 10s. to £8 15s., and best £9 10s.

On Australian, South American, and other export account, bars are being rolled at £6 10s. and £6 5s. per ton, and these are the descriptions which are mostly selling.

Hoop makers are quiet, whether in best quality or cheap sorts. The competition of outside districts is telling upon the local manufacture. Best hoops, of from 14 to 19 w.g., and ranging from 6in. to 1in. wide, were quoted this afternoon at £8; but orders were difficult to obtain at the figure. Yet for best hoops, of 20 w.g., not thinner than $\frac{3}{8}$in., £9 was quoted; and for $\frac{1}{2}$in., £8 5s. Plenty of good hoops, however, of from 16 to 19 w.g., were on offer at £7 10s. and £7 per ton. Other people, again, were prepared to take £6 15s., and even £6 12s. 6d.

Makers of sheets consumed by the galvanisers and for ordinary merchant purposes reported this afternoon that they were engaged chiefly on limited specifications. They quoted lattens at £9, doubles at £8 5s. to £8, and singles at £7 15s. to £7 12s. 6d. Such prices cannot leave very much margin for profit.

A lack of activity is observable in plates, and the mills are only quietly on, whether in tank or boiler qualities. The former were priced to-day at £7 12s. 6d. to £7 15s., and the latter at £8 10s. to £9, and on to £9 10s., and even £10 according to quality.

Speaking of finished iron generally, it was remarked this afternoon as an example of the unwisdom of cutting down prices, that those are not universally the most actively employed works whose proprietors press for orders.

The pig trade continues tame. One or two native all-mine makers, who have this year begun the manufacture of part mines, reported that they were not yet making much progress with their new brands. But they indulge the hope that when trade revives the step will prove to have been eminently wise.

Prices of pigs do not strengthen. Derbyshire qualities were 46s. to 45s. per ton; and Northamptons, 45s. to 43s. Hematites were 60s. to 57s. 6d. delivered at works in this district. Native all-mines were 62s. 6d. to 60s.; part-mines, 55s. to 45s.; and cinder pigs an average of 40s.

A two days' examination for mines managers' certificates was held at Wolverhampton on Monday and Tuesday. Thirteen candidates presented themselves, and certificates have been awarded to four candidates from Dudley, one from Hamstead, and one from Barnsley.

The Conference of Miners' Delegates to consider the wages and other questions, which was adjourned from Manchester on December 29th, was resumed in Birmingham on Monday and continued sitting until Wednesday, Mr. S. Woods, Wigan, presided over thirty delegates, representing, it was stated, 211,000 miners belonging to Lancashire, Yorkshire, Derbyshire, Notts, Forest of Dean, North Wales, North Staffordshire, Leicestershire, Durham, West Cumberland, and South Staffordshire. The gathering, after only debating the wages question, resolved on Tuesday: "That this Conference hereby agrees not to take any immediate action in the wages question, and therefore recommends each district to take whatever action is necessary; but that if any county be attacked, a conference be called to decide what action shall be taken in such a case." The meeting also approved of the establishment of a National Miners' Union.

The colliers in the Tipton district have resolved to use their utmost exertions to induce their fellow-workmen to pay contributions to the Coal Trade Wages Board, so that wages may be regulated without resorting to strikes.

The heavy ironfounders and constructive ironwork manufacturers hold some goed contracts given out by foreign merchants and home consumers, while the light ironfounders are more steadily engaged than they were a short time ago.

Among current speciality work in the engineering departments may be mentioned the manufacture, by Messrs. Player Bros., Birmingham, of a powerful planishing hammer capable of dealing with 1$\frac{1}{4}$in. material. A special 2 cwt. forging hammer, supplied to Sir W. G. Armstrong and Co., claims to be equal to a 6 cwt. self acting steam hammer. Messrs. Player are about to design for

them another forging hammer of similar type, but about twice the size. Messrs. Player are busy upon Longworth's movable fulcrum hammer.

Messrs. S. J. and E. Fellows, of the Vulcan Works, Wolverhampton, have under execution a considerable contract from the War-office for steel shells for buoys. Stamped in halves from 56in. mild steel sheets of ¼in. thickness, they are intended to be rivetted together when delivered at Woolwich. The depth of each half is about 20in. and the diameter 38¼in. Each half weighs about 2 cwt. The firm have had a powerful stamp in operation night and day for the past month, and as the order is urgent they will continue this double work during its completion, which will probably occupy some two or three months longer.

More than ever mild steel is being consumed in the hollowware industry for deep stamping purposes, and makers express much satisfaction with the behaviour of the newer metal.

The galvanisers give only a poor account of trade at the moment, either in the corrugated sheet or braziery branches, but some tolerable Australian and South American orders have recently come to hand in the former department. Prices keep a matter of much complaint; notwithstanding the existence of the Association. £13, delivered Liverpool, is about the figure for sheets of 24 w.g. in bundles.

South American business figures prominently in the hardware trades, and is sufficient to find active employment in various industrial establishments; but the reverse is the case with the United States, orders being very meagre. The East Indian business shows some extra life, both in heavy machinery and constructive ironwork, as well as for smaller goods.

Nothing but satisfaction has been occasioned in this district by the formation last week in Birmingham of a committee, representing Birmingham and midland traders generally, to take any proceedings that may be necessary for testing the validity of such of the railway rates and terminal charges imposed by the companies serving this part of the kingdom for the conveyance of goods as are considered excessive. It is believed that, for many years past, manufacturers and traders have in some cases been paying as much as from 25 to 40 per cent. more than the companies are legally entitled to charge. The matter of forcing a reform from the railway companies is being taken up in a spirited and business-like style, and the nucleus of a fund has already been formed for defraying professional or other expenses.

The Wolverhampton Railway Rolling Stock Company declared at its meeting on Tuesday a dividend at the rate of 3 per cent. on the ordinary shares. The chairman regretted that the business done had not been so large as was anticipated, and if it did not improve there would be no alternative for the directors but to call together the shareholders and ask them if it were not advisable to return a portion of the capital.

The Institute of Iron and Steel Works' Managers had a paper before them on Saturday at Dudley upon "The Chemistry of Purifying Crude Pig Iron, and of the Puddling Process," by Mr. J. E. Stead, of Middlesbrough. The paper was illustrated by chemical experiments. It was decided to defer the discussion.

The Birmingham Compressed Air Power Bill came before Mr. Frere, one of the examiners of the House of Commons on the Standing Order Proofs, as an unopposed measure on Monday. Formal proof having been given, the Examiner declared that the Standing Orders had been complied with, and this would be reported to the House.

With the interim dividend which the directors of the Birmingham Tramways and Omnibus Company, Limited, have just declared for the last half of 1883, the ordinary shareholders have received a total dividend for the year of 15 per cent. The adjoured inquiry into the case of the stoker who was killed by a boiler explosion on the 12th inst. at the Birmingham metal works of Messrs. Bolton and Sons, was held on Monday. He fired the flue of a Cornish boiler, and a few hours later steam was shut off by an engine driver, shortly after which the stoker was fatally scalded by escape. It appears that the boiler was not under inspection, and that the cause of the accident was the collapsing of the flue, owing to the strong pressure of steam, which had the effect of tearing away the plates attaching the flue to the boiler and thus permitting the escape. The jury returned a verdict of "Accidental Death," and recommended the firm to have their boilers inspected.

The Home-office has this week instituted an enquiry at Stoke-on-Trent to ascertain whether Mr. Wainwright, late manager of the Leycett Colliery, was responsible for the death of the six men whose bodies are not yet recovered, who were killed by an explosion at the colliery on October 21st last. On October 9th, "gobstink" made itself felt in the Fair Lady Pit, and Mr. Wainwright directed that a series of stoppings should be proceeded with. The Government inspector for the district held that upon the discovery of the "gobstink" no time should have been lost in closing the whole of that side of the pit by brick settings backed by sand or rubbish. Wainwright, however, contended that he had acted to the best of his experience. The Court ruled that Wainwright had resigned the responsibility of risking the men's lives by following out the instructions of the general colliery manager, and acquitted him and returned his certificate.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The tolerably large buying which has recently been going on in pig iron has naturally tended to leave behind it a steadier tone in the market. Makers have been able to fill up their order books pretty well for the next few months, and consequently are less anxious for business, with the result that higher prices are being asked than were taken a few weeks back. In the actual condition of trade, however, it can scarcely be said that there is any really substantial improvement. Consumers have bought pretty freely at low prices, and show little or no disposition to follow any upward improvement in the market, except where there is the further inducement of long forward deliveries extended over the second half of the year, and the result of even the small advance, which still leaves prices on a comparatively low basis, has been to cause a quietening down on the weight of business coming forward. The finished iron trade, which has been very dull ever since the commencement of the year, still shows no improvement, but rather a tendency towards weakness.

There was a moderately good attendance at the Manchester iron market on Tuesday, but business was without animation, and so far as merchants were concerned, there was a disposition to take a less favourable view of the condition of trade. Local and district brands of pig iron were firm at late rates, but in Scotch iron there was some underselling. Lancashire makers of pig iron were quoting 44s. for forge and 45s. for foundry, less 2½ delivered equal to Manchester, as their minimum, and on the basis of these figures sales to a moderate extent have been made during the week. The bulk, however, of the business which has been done recently in local iron, and which has filled up makers' books pretty well for the next three months, has been in the immediate neighbourhood of their own works, where they have had the advantage of low rates of carriage. In district brands of pig iron quotations remain at about 44s. 10d. to 45s. 10d. less 2½ for forge and foundry, Lincolnshire, delivered, and a few sales are being made at these figures, although there are one or two sellers who would take 6d. to 1s. per ton less. Middlesbrough iron is still quoted at 45s. 4d. net cash for good foundry brands delivered equal to Manchester, but the business doing is very small.

In the hematite trade business is for the present being practically held in suspense, pending the threatened blowing out of furnaces in the Cumberland district. For good foundry brands, delivered equal to Manchester, 56s. to 56s. 6d., less 2½, is being quoted nominally, but there is scarcely any buying going on.

In the finished iron trade there is no very material change to report. Business continues very slow, with good ordinary bars, delivered into the Manchester district, averaging £6 to £6 2s. 6d. per ton, and inferior brands in some cases to be bought at 2s. 6d. per ton less.

The condition of the engineering trades remains much the same as I have reported recently. In one or two branches, such as locomotive building and tool making, activity is well maintained, but generally there is a decided quietening down, and new work in most departments is coming forward very slowly.

In the brass foundry and coppersmith trade orders are slackening off for the various kinds of engineers' fittings, and lower prices are being taken to secure business.

Messrs. Smith and Coventry, of Manchester, have just completed for a firm in the North of England a specially constructed multiple drill, designed for heavy plate or boiler work. The machine has six drill headstocks, and these are carried on a cross slide 20ft. in length, supported on three strong standards, with provision for removing the centre standard when the size of work requires the whole span of the cross slide. Each headstock is traversed independently with its own feed, and clutch for disengaging, so that the spindles can be worked simultaneously or separately at varying pitch as required. The spindles are 2in. diameter, but there is sufficient power for working spindles up to 4in. diameter if necessary. The machine is arranged for using Messrs. Smith and Coventry's twist drills, and I may add that the firm is largely increasing their plant for the manufacture of these drills.

The coal trade of this district continues in a very depressed condition. Very few of the pits are being kept working much more than half time, and even with this restriction of the output stocks have recently been accumulating rapidly at many of the collieries. All classes of round coal both for house fire, iron making and steam purposes, are in very poor demand. Engine fuel moves off fairly well in some districts, but in others it is abundant, the strike in the cotton trade throwing a good deal of burgy and slack upon the market. Nominally there is no alteration in list rates so far as any actually announced reduction with the close of the month is concerned; but for temporary sales lower prices generally are being quoted, and in many cases where stocks are being pushed in the market it is not so much a question of any fixed price as of what buyers are prepared to give. So far as prices can be quoted they average at the pit mouth about as under:—Best coal, 10s.; seconds, 7s. 6d. to 8s.; common, 6s. to 6s. 6d.; burgy, 4s. 6d. to 5s.; and good ordinary qualities of slack, 3s. 6d. to 4s. per ton.

The recent stormy weather has had the effect of temporarily putting almost a complete stop to the shipping trade, and this has thrown a good deal of steam coal upon the market which would otherwise have gone away for shipment. Vessels have been unable to get either in or out of the Lancashire ports, and colliery proprietors have not been able to execute even the orders they have had in hand. Delivered at the high level, Liverpool, or the Garston Docks, Lancashire steam coal averages 7s. 6d. to 8s. per ton, but there is little or nothing doing.

Barrow.—No noticeable change has occurred in the state of the hematite pig iron trade of this district during the past week. The orders coming to hand on home, foreign, continental, and American account are both few and inextensive; indeed the shipments to foreign ports for some months past have been practically *nil*. From what I hear, few makers now express any hopes than an early revival will take place in the trade, and it is expected that some months will elapse before a change does occur. Any alteration that may occur must be for the better, as it is almost impossible for trade to occupy a worse position. The stocks of metal warehoused still remain very heavy. Prices are unaltered, and 46s. represents the quotations for mixed samples of Bessemer; inferior samples are offered at 44s. and 45s. per ton net at works, prompt delivery. The steel trade does not improve, and makers are beginning to find a scarcity of orders. The output from the rail department during the week has not been very heavy. Shipbuilders are very dull, and orders are difficult to obtain. Few men are now employed in this industry. The minor departments of iron and steel industries are but indifferently employed. Iron ore is in poor demand at from 8s. per ton net at mines, and upwards. Coal and coke steady, with easier prices. Shipping dull as freights are low.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

A CURIOUS error occurred in my notes last week through the insertion of "per week" instead of "per annum." The diminution of the output of pig iron in the Cleveland district, through the blowing out of eighteen furnaces should have been stated as "400,000 tons per annum."

The figures supplied to you at the end of last year as to the Sheffield exports to the United States have been borne out by the Blue Book just published by the Government printing-office at Washington. These returns are still incomplete, being confined to the first two quarters of 1883. For the quarter ended March 31st the total value was £204,655, and for the quarter ended June, £204,530, as compared with £334,671 and £409,185 for the corresponding quarter of 1882. The decrease for the first six months of 1883, as compared with the first six months of 1882, is no less than £251,926. The chief falling-off has been in steel and Bessemer rails. In the latter the decline was most startling during the second quarter of 1883, the total value of rails exported to the States being then only £7922, while in the June quarter of 1882 the value was £115,321. Steel also showed a falling off, the comparative values being £90,684 and £105,929. Cutlery was fairly in demand for the United States during the whole of the first six months; but when the official figures are published for the last six months of 1883 it will be seen there was a serious decline in this industry as well. A singular item is the export of salted skins and grindstones. The former, which come from Lincolnshire, were exported to the States during the six months ending June last to the value of nearly £29,000, and the latter represent a value of some £1700; glue has also been sent from Sheffield during the same period to the value of £7000.

The London ivory sales have been unusually interesting, owing to the large supply of ivory on offer—no less than 178 tons, against 129 tons at the same time last year. The quantity included 53½ tons Zanzibar, Bombay, and Mozambique, 2½ tons Cape of Good Hope, 66½ tons Egyptian—58 tons from Alexandria, 8½ tons from Malta—42 tons West Coast African, 11 tons mammoth teeth, and 2½ tons cuttings, waste, &c.; also 1 ton sea-horse teeth, ½ ton rhinoceros horns, walrus teeth, &c. Of this, 13 tons East Indian, and 35 tons Egyptian—chiefly Alexandrian—and 7 tons mammoth teeth were withdrawn. Buyers were not very eager at first, but as soon as it became known that the holders of Egyptian and East Indian would not sell at a reduction, the bidding became brisk. East Indian was generally £2 to £3 lower; Cape realised about the average of last sales. With the exception of large soft teeth, Egyptian was generally £2 to £3 lower. West Coast African was also lower than the average of last sales. A portion of the mammoth teeth realised good rates; sea-horse teeth rather lower. The stock at 25th January, 1884, was 231 tons, against 160 tons at the same time last year. The reductions in Sheffield ivory are not sufficient to justify the ivory cutters in making any reduction in the prices of handles.

The Miners' Conference at Birmingham on the question of an advance of wages is watched with very languid interest in this district. The colliers in South Yorkshire generally see no prospect of obtaining 10 per cent. advance, and they therefore wisely abandon all efforts as a useless agitation.

All the London papers in reporting the launch of H.M.S. Warspite speak of the vessel being armoured with steel plates. This is equivalent to saying that our Government went all the way to France for Schneider's steel plates, for no steel armour plates are made in this country. There is not a ship in the British Navy coated with steel plates. The armour for the Warspite was made by Messrs. John Brown and Co., Limited, Atlas Steel and Iron Works, and Messrs. Charles Cammell and Co., Limited, Cyclops Steel and Ironworks, and they were on the compound "Ellis" and "Wilson" patents.

Mr. F. Brittain, president of the Sheffield Chamber of Commerce, an accomplished linguist and one of the ablest statisticians in the country, has been obliged to winter in the South of France in consequence of ill-health. Mr. J. Willis Dixon—Messrs. James Dixon and Sons, Cornish Place—has succeeded him as president. Mr. Dixon is an able and courteous gentleman who will admirably occupy the post.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

BUT little business has been done in Cleveland pig iron during the past week, but prices have been steady and fully maintained at the advanced rates. At the market held at Middlesbrough on Tuesday, the usual quotation for No. 3 g.m.b. for prompt delivery was 37s. per ton; but some makers would not take less than 37s. 6d. It was not easy to obtain grey forge iron at less than 35s. 6d. per ton, and it is thought that the difference between this grade and No. 3 will soon be reduced to 1s. per ton, as formerly. Makers are no longer pressing their iron on the market, and being well off for orders for early delivery, and believing that the effects of the restriction will become increasingly manifest as February advances, they hope soon to realise better prices.

The stock of Cleveland pig iron in Messrs. Connal's store at Middlesbrough shows an increase again this week. The quantity held on Monday last was 62,282 tons, or 101 tons more than on the previous Monday.

Shipments from the Tees have fallen off, owing, no doubt, to the stormy weather of the last few days. The quantity of pig iron sent away up to and including Monday last amounted to 57,162 tons, being nearly 4000 tons less than during the corresponding period of December.

Finished iron manufacturers have the greatest difficulty in keeping their mills going, as though prices are weaker orders are given out but slowly. Ship plates are now offered at £5 10s. per ton, shipbuilding angles at £5 to £5 5s., and common bars at £5 5s. to £5 10s., all free on trucks at makers' works, cash 10th, less 2½ per cent. discount.

Dr. R. S. Watson, arbitrator in the wages dispute in the North of England manufactured iron trade, gave his award on the 24th January. The points submitted were as follows:—"The claim of the employers for a reduction of 6d. and 5 per cent. respectively, and the claim of the operatives for a substantial advance." The award is to the effect "that the present rate of wages continue to be paid during the three months ending March 29th, subject to one month's notice from either side."

The annual meeting of the Board of Arbitration was held at Darlington on Monday last, when the standing committee's fifteenth annual report and statement of accounts was read and passed. The income for the year, including a balance of £34 17s. 3d., amounted to £1939 16s. 8d., and the expenditure was £1826 19s. 5d. Balance in hand at the close of the year, £112 17s. 3d. Mr. Wm. Whitwell was re-elected president, and Mr. D. Dale referee for the present year.

The whole of the men employed at Messrs. Bolckow, Vaughan, and Co.'s Eston Steel Works agreed at the end of last week to return to work at the full reduction of 10 per cent. asked by the firm. The works are, therefore, now in full operation.

The Bowesfield men are still out on strike, and it is not likely that any steps will be taken to settle the dispute until the men come to their senses and return to their work.

At a meeting of Cleveland mineowners and Cleveland miners, held at Middlesbrough on the 22nd, a new sliding scale for the regulation of wages was agreed upon. No alteration will be made in wages till April, when the scale comes into force and continues for eighteen months.

The Cleveland ironmasters have offered to renew their previous sliding scale for the regulation of blast-furnacemen's wages, but if the men do not accept this offer by the 30th January, notice for a reduction of wages will at once be given.

Judge Turner's decision as to the closing of the Fighting Cocks Ironworks is to be appealed against. A committee has been formed to carry the matter through, and a fund raised to defray legal expenses.

Owing to want of specifications, the plate mill at the works of Messrs. Jones Brothers, of Middlesbrough is idle this week. The Wear Rolling Mills, at Sunderland, are also idle, and have been so throughout January. The Witton Park Ironworks are working intermittently.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE Scotch iron market has exhibited much less animation this week than in the past fortnight, the upward movement in quotations having been arrested, and the inducements to speculation withdrawn. Operators are now pretty well aware of the probable effect that the curtailment of production in the North of England is likely to exert upon business, and unless there should be a further damping out of furnaces in Scotland, or a marked improvement in the demand for pigs, it is not likely that prices will advance much farther at present. The shipments of the past week were 6819 tons, against 9229 in the preceding week, and 8788 in the corresponding week of 1883. In addition to the small exports it should be noted that the demand from abroad for future deliveries has slackened considerably just at a time when it might have been expected to improve. This is ascribed to the advance in prices here, consumers abroad not being disposed to pay the higher rates, as long as they are not absolutely pressed for the raw material. The additions to stocks have been considerably larger in the past week.

Business was done in the warrant market on Friday at 43s. 8d. to 43s. 9½d. cash, and 43s. 11d. to 43s. 8½d. one month. The market was quiet on Monday and Tuesday, with business done down to 43s. 1½d. cash. On Wednesday business was done at 43s. 4d. to 43s. 4½d. cash, and 43s. 6½d. one month. To-day—Thursday—the market was quiet at 43s. 4d. to 43s. 3d., and back to 43s. 4d. cash, and 43s. 5d. one month.

While the prices of warrants have fluctuated, those of makers' iron have been well maintained, and whilst I write they are as follows:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 54s.; No. 3, 52s.; Coltness, 58s. and 52s.; Langloan, 55s. and 51s. 6d.; Summerlee, 53s. and 49s.; Calder, 54s. 6d. and 48s.; Carnbroe, 52s. 6d. and 48s. 6d.; Clyde, 48s. and 45s. 6d.; Monkland, 45s. 3d. and 43s. 3d.; Quarter, 44s. 9d. and 42s. 9d.; Govan, at Broomielaw, 45s. 3d. and 43s. 3d.; Shotts, at Leith, 54s. and 52s 6d.; Carron, at Grangemouth, 49s.—specially selected, 56s. 6d.—and 47s. 6d.; Kinneil, at Bo'ness, 46s. 6d. and 46s.; Glengarnock, at Ardrossan, 52s. 6d. and 46s. 6d.; Eglinton, 46s. 9d. and 44s.; Dalmellington, 49s. 6d. and 47s. 6d. The arrivals of Middlesbrough pigs at Grangemouth show a comparative increase this year to date of 3069 tons.

The imports of Cleveland pig iron into Scotland are fully as large as they were in the opening month of last year.

Owing to the prolonged nature of the strike in the steel trade, there has been only a quiet demand for hematite, which is quoted at 47s. per ton, f.o.b. Cumberland.

At the malleable works there is a fair amount of activity. The wages' question still remains unsettled, and in the meantime the men are understood to be interested in the award of the arbiter in the North of England, which is to the effect that present wages be paid for three months hence, subject to a month's notice on either side. In the Glasgow district the foundries are, for the most part, well supplied with work in the meantime, although merchants state that founders are purchasing the raw material in smaller quantities than they did a year ago. The iron and steel

manufactures shipped from Glasgow in the course of last week are valued at upwards of £80,000. Much less steel than usual is being dispatched, no doubt on account of the strike in the steel trade.

In most localities the coal trade is quiet, and the coalmasters, presuming that they will presently be obliged to accept somewhat lower prices, have intimated reductions of wages, these taking effect in some instances at once. The amount of the reduction is about 6d. a day, being the same which was given to the men in the autumn of last year. At Glasgow the shipping demand at the moment is quiet, and the very stormy weather just experienced has greatly disorganised the shipping arrangements. From the same cause there is rather more inquiry in the household department. The reduced wages will be felt as a greater deprivation in some districts of Ayrshire than elsewhere, because the miners there had no rise in their pay last year. In Fife and Clackmannan the reduction is 15 per cent., and along with it the masters intimate a slight decrease in the price of coals. The men's executive board have resolved to advise them that the reduction is uncalled for, as the prices of coals are 9d. per ton better than they were when wages were at the same level as that proposed. The process of reducing wages is spreading into numerous departments of industry throughout Scotland, and business is much disorganised in consequence, because in few cases are the workmen at once prepared to acquiesce in what they will all doubtless soon perceive to be inevitable.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

I am glad to find that the Cardiff and Monmouthshire Valleys Railway Bill has passed standing orders. The able engineer, Mr. Sutherland, has acquitted himself well, and now there can be the utmost confidence reposed in the Bill passing Committee. This railway will be a popular one, opening out a rich virgin coal track, which will be in its full development when the Rhondda begins to show signs of exhaustion.

The Rhondda and Bristol Channel line is yet in abeyance. Possibly this may require a bigger fight. The ulterior aims of the promoters are great ones, and if carried will render nugatory all attempts of the Barry promoters. The natural docks for Cardiff in addition to the existing are at the outfall of the Rhymney River. This would be a feature, I learn, of the Rhondda and Bristol Channel Bill.

We have had storms above and below ground of late. One on Sunday morning in Penygraig Naval pit destroyed eleven men and caused the death also of one of the most gallant survivors of Tynewydd. This was Daniel Thomas, Albert medallist, manager and lessee of Dinas Colliery, which he was working for Col. Hunt and Co. It was little short of madness to descend, as he did, the shaft from whence heavily laden gaseous air came even to the surface, and when the fan was rendered useless. The explosion, so far as one can learn at present, seems due to blasting operations on the Sunday, and thus only the officials of the pit were present. The inquiry will be one of the most important of late years.

The storms in the coal valleys have been very violent, and in consequence have interfered with that harmonious working of pit cage, train, and docks, which has been so conspicuous of late. This, however, is only a temporary evil. Little damage seems to have been caused by the gale at collieries or at ironworks, though the strength of plant must have been tried. An engineer of eminence, referring to some of our critical structures, notably Crumlin Viaduct and Severn Bridge, points out that if on crossing a bridge in a gale, the passengers open the windows, the wind cannot get such a grip of a train as it would otherwise. There are two cases in illustration. On one of the Welsh railways, during the gale, an empty train was blown off the line. On the Taff Vale, Saturday, in crossing Maker's Yard Viaduct, a passenger train was as nearly as possible thrown off the track. The violence of the wind for one moment overcame the impetus of the train, and the train was clearly lifted within a hair's breadth of the top of the rail. A slight increase—and one shudders at the possible calamity that must have ensued.

The Neath Harbour Bill has passed its first obstruction, and the future of that place naturally wears a better appearance. The Rhondda and Swansea Bay Railway is advancing; this will tend to the improvement also of Neath.

Another Bill, which has not advanced to the practical stage attained by the Swansea Bay Railway, is of a very promising character. I refer to the London and North-Western extension to the Mumbles, and its line of steamers and jutting pier for traffic with Devon.

If the agent of the Duke of Beaufort will now show as much interest in the development of the place as he has shown for the rights of his employer, a great amount of good will accrue to Swansea from this connection with the opposite coast.

There has been no change in the iron and steel trades. Inaction is the distinguishing feature, and turning out a few small rails and pig is about the best achievement. Dowlais and Ebbw Vale have still some orders to execute, but new business is coming in slowly, and if some of the colonies are going to be independent of English ironmasters, as they threaten, our prospects are not very bright.

There is a scope for improvement at some of our steel works. I have just seen the analysis of steel samples—carbon, only a trace; sulphur in preponderance. Cyfarthfa in starting will have the advantage of the shortcomings of others, and look upon the laboratory and its competent action as one of the essentials.

The demand for Welsh coal is as active as ever, and prices are very stiff. Various speculative colliery movements are on foot, and I expect every day to report a beginning in the Taff Valley, near Pontypridd. Some amount of care is necessary in selecting the spot for sinking; all other preliminaries are complete in this great venture in proving the various measures to the south.

The Ocean collieries scale did not justify an advance of wages at the last examination of books.

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.

22nd January, 1884.

1859. Raising, &c., Window Blinds, T. Trotman and J. Carter, Stroud.
1860. Cranes, W. B. Knapman, Salford.
1861. Fasteners for Gloves, &c., H. H. Lake.—(*E. J. Kraetzer, Boston, U.S.*)
1862. Attachment to Sewing Machines, E. W. Whitehall, Nottingham.
1863. Digging Potatoes, J. Holt, Dunham Massey.
1864. Mixing with Earthy Matter, &c., Petroleum, W. P. Thompson.—(*J. Leede, Washington, and G. H. Ouray, Florence.*)
1865. Harness Shaft Tugs, S. E. Davies, Liverpool.
1866. Fire-grates, H. T. Davis, Lewisham.
1867. Propelling Boats, H. H. Werninck, Plymouth.
1868. Navigation, F. Buchanan, Chatham.
1869. Instantaneously Connecting Pipes, &c., J. T. Mason, Tunbridge Wells.
1870. Tanning Hides, W. J. Grass.—(*W. Hasseler, Sweden.*)
1871. Miners' Safety Lamps, S. Hall and M. Rigby, Leeds.
1872. Fasteners for Buttons, W. Foxcroft and J. J. Perry, Birmingham.
1873. Boot and Shoe Protectors, J. Blakey, Leeds.
1874. Trenching, &c., Wood, J. Swindells, Stockport.
1875. Paddle-wheels, J. B. Ellison, Liverpool.
1876. Washing Machine, J. R. Taylor, Kingswinford.
1877. Cap Spinning, H. Jagger, Bradford.
1878. Steam Boiler Furnaces, L. Bregha, Dresden.
1879. Runner for Umbrellas, T. Widdowson, Sheffield.
1880. Producing, &c., Motion, J. Roots, London.
1881. Lock-up Luncheon Cabinet, T. Marsh, Birmingham.
1882. String Cover, T. Marsh, Birmingham.
1883. Boots and Shoes, J. T. Hotblack, Norwich.
1884. Portland Cement, J. H. Johnson.—(*R. W. Leslie and J. M. Willcox, Philadelphia, U.S.*)
1885. Maintaining Seats on Horseback, A. Payne, East Moulsey.
1886. Self-cleaning Furnace Grates, G. G. M. Hardingham.—(*J. C. Jones, Chicago, U.S.*)
1887. Fittings of Magnetic Compasses, W. J. Simpson, London.
1888. Beer Taps, H. Jones, Birmingham.
1889. Treating Cotton, &c., Waste, E. A. Bath, Sketty, near Swansea.
1890. Producing, &c., Carbonic Acid, J. Harrison, Battersea.
1891. Fumigating Hothouses, &c., T. Elcome, Upper Norwood.
1892. Filters, H. Harris and T. Faneway, London.
1893. Lamps, R. Gordon, Worthing.
1894. Dynamo-electric Machines, W. Ross, Glasgow.
1895. Pressure-reducing Valves, W. Key, Glasgow.
1896. Securing Covers, &c., to Stands, M. Chapman, London.
1897. Stockings, J. Spencer, Leicester.
1898. Photographic Cameras, C. Sands and J. J. Hunter, London.
1899. Washing Machines, F. Axam and G. Davies, London.
1900. Horseshoes, W. Body and S. J. Winton, Wittersham.
1901. Dwarf Window Blinds, W. Kay, London.
1902. Spreading Plaster of Paris Compounds, J. Hinton, London.
1903. "Tallboy" for Preventing Down Draughts, F. W. Smith, London.
1904. Nipple Shield for Infants' Feeding Bottles, J. H. Redman, Brighton.
1905. Spring Balances, A. A. Watkins, London.
1906. Shoe Laces, O. Hoppe, Barmen, Germany.
1907. Back Supporter for Persons Suffering from Spine Disease, &c., H. M. Tarratt, London.
1908. Relief Printing Surfaces, H. Rafter, Kent.
1909. Confectionery, J. L. Collier, Rochdale.
1910. Needles for Sewing Machines, J. Whiteley, Leeds.
1911. Compound Engines, &c., H. Dansey and O. Robinson, London.
1912. Gas, P. Everitt, London.
1913. Car Axle-boxes, &c., W. S. G. Baker, U.S.
1914. Knife Cleaner, J. F. Wiles, Old Charlton.
1915. Pigment Distributors, J. Imray.—(*J. P. Whipple, U.S.*)
1916. Preparing Brewers', &c., Worts, C. Arkcoll, Chatham.
1917. Portable Railways, J. G. Chapman, London.
1918. Driving Gear for Velocipedes, T. Millward and C. Leni, London.
1919. Holder for Fishing-rods, C. L. Mathews, Dulwich.
1920. India-rubber Bearing Springs, G. Spencer, London.
1921. Steam Traps, W. Rotton, Marsden.
1922. Accumulating, &c., Natural Forces, P. A. Dohis, Paris.
1923. Securing the Bills in Mill-bill Holders, E. B. Pearse, Exeter.
1924. Transmitting Motion, W. A. Rollins, Upper Norwood.
1925. Soles for Boots, &c., H. I. Livermore, London.
1926. Horseshoe Nails, &c., A. J. Boult.—(*G. J. Capewell, Cheshire.*)
1927. Signalling Devices, A. J. Boult.—(*T. B. Joseph, Pennsylvania, U.S.*)
1928. Hook for Fixing Slates, &c., A. J. Boult.—(*L. Leblond, France.*)
1929. Bicycles, &c., A. J. Carruthers and A. T. Smith, Nottingham.
1930. Wedges, J. Newman, London.
1931. Measuring, &c., Apparatus, W. Brown and H. Macdonnell, Stockton-on-Tees, and T. Thompson and R. Embleton, South Stockton.
1932. Books for Holding Bills, &c., W. R. Lake.—(*E. G. Thorp, Boston, U.S.*)
1933. Boots, W. R. Lake.—(*G. P. E. Lenormand-Carpentier, France.*)
1934. Pump Valves, T. Carter and W. Palmer, Sunderland.
1935. Coats, H. F. Ihlee, Wimbledon.

23rd January, 1884.

1936. Lawn Tennis Poles, F. Taylor, Chippenham.
1937. Preventing Corrosion in Steam Boilers, &c., W. Lester and W. R. Lester, Glasgow.
1938. Multitubular Boilers, I. Morris, Bloxwich.
1939. Indicating Low-water, &c., in Steam Boilers, H. Wilkinson, London.
1940. Capping Knife and Fork Handles, E. Barton, and C. H. and J. J. Hawksworth, Sheffield.
1941. Reading Stands, E. Behar, Leeds.
1942. Safety Appliances for Ships, &c., C. G. Clarke, Kingston-upon-Hull.
1943. Marmalade Frames, J. Mallol, Birmingham.
1944. Ensilage, D. B. Chatterton, Chester.
1945. Barometers, &c., E. J. Warmington, Maldon.
1946. Giving Motion to Hoists, Winches, &c., A. Higginson, Liverpool.
1947. Marking-out Wearing Apparel, &c., F. C. Noar, Manchester.
1948. Medicinal Liquids, F. W. Griffin, Bristol.
1949. Protecting Pipes and Cigar Tubes, L. B. Phillips, London.
1950. Washing Machines, J. Watson and G. Whalley, Keighley.
1951. Box-end Springs, S. Cook and J. Feilden, Bury.
1952. Purifying Coal Gas, M. Williams, Wigan.
1953. Utilising the Power Lost in Brakes, W. Bland, Shipley.
1954. Stopper for Bottles, C. Cockson, Wigan.
1955. Friction Joints, C. Miles and T. Ballard, Bristol.
1956. Fastening Boots, C. Miles & T. Ballard, Bristol.
1957. Boiler Flanging Machine, W. Murray, Glasgow.
1958. Watch Ring, &c., W. Burnett, Jarrow-on-Tyne.
1959. Preventing the Overflow of Oil in Lamps, R. Thorley, London.
1960. Water-closet Apparatus, S. Welman, Godalming.
1961. Preventing Coin from Rolling Away when Emptied from Bags, &c., J. Ormerod, Manchester.
1962. Heald Shafts, H. B. Barlow, Manchester.
1963. Picking Motion in Looms for Weaving, W. L. Hindley and J. Caldwell, Farnworth.
1964. Removing, &c., Sand or Mud Banks, &c., E. Foulger, Liverpool.
1965. Sheep-shears, T. Birkhead, Sheffield.
1966. Manufacturing Useful Products from Shale, &c., T. White Thorpe Hesley, and G. Dawson, Sheffield.
1967. Automatically and Instantaneously Coupling, &c., Carriages, &c., A. L. Daviess, Derby.
1968. Desk Bench, B. Hawerkamp, London.
1969. Reversing Paddle-wheel, J. Kirk, Dunfermline.
1970. Flower-pots, &c., R. G. Kirton, Ipswich.
1971. Tricycles, W. Spence, Surbiton, and R. C. Thompson, Brixton.
1972. Shutting for Etuis of Pap, A. Hermann, Berlin.
1973. Road Horse, S. F. Mason, Thrapstone.
1974. Jacketted Heating Stoves, L. A. Groth.—(*M. Schneider, Germany.*)
1975. Tricycles, A. F. Robinson, London.
1976. Ventilating Apparatus, W. P. Buchan, Glasgow.
1977. Curative Compound for Treating the Human Skin, F. Hancock, Edinburgh.
1978. Locking Devices, C. Kahn, London.
1979. Boilers, J. Stark, Glasgow.
1980. Gunstocks, J. Schulhof, Vienna, and I. Qurin, Dusseldorf.
1981. Floating Water Engines, T. J. Mortin, Woking.
1982. Carriage Bearings, W. Day, Leicester.
1983. Finishing Boot and Shoe Soles, &c., J. Keats, Frankfort-on-the-Maine, and O. Robinson, Kettering.
1984. Farinaceous Food, J. Schweitzer, Brixton.
1985. Filtering and Decolorising Sugar, &c., W. Fairweather.—(*F. Kleeman, Germany.*)
1986. Chimney Cowls, A. Thomson, Strathbungo, and R. Anderson, Glasgow.
1987. Spindle Tubes, S. R. Ogden, Blackburn.
1088. Removing Loose Fibre, &c., from Pile Fabrics, B. Thresh, Bradford.
1989. Box Irons, F. Stichbury, Leyton.
1990. Discharging Ashes, &c., from the Furnaces of Ships at Sea, W. Wasley, near Mold.
1991. Drift Anchor, G. R. King, Gorleston.
1992. Type-founding Machines, A. M. Clark.—(*A. A. Laval, Paris.*)
1993. Furnaces, W. A. M'I. Valon, Ramsgate.
1994. Recovering India-rubber from Waste Cardings, &c., A. Gutensohn, London, & A. Cox, Bristol.
1995. Motor Engines, J. I. Thornycroft, Chiswick.
1996. Dobby Apparatus, J. Ainsworth, Preston.
1997. Dobby Apparatus, H. Ainsworth, Preston.
1998. Decarbonating Carbonate of Strontia, J. Imray.—(*H. Leplay, Paris.*)
1999. Strontia Treatment of Saccharine Liquors, J. Imray.—(*H. Leplay, Paris.*)
2000. Water Meter, J. Imray.—(*K. Frager and La Société Michel et Compagnie, Paris.*)
2001. Seats, A. J. Bale, North Dulwich.
2002. Velocipede Treadles, H. Thresher, Brixton.
2003. Kilting Looms, J. F. R. Morris, London.

24th January, 1884.

2004. Shipping and Transferring Coal, &c., A. R. Large, Birkenhead.
2005. Heating Stoves, W. Scott, Glasgow.
2006. Dynamo-electric Machines, W. A. Carlyle, Birmingham.
2007. Bale Fastenings, H. Lindon, Liverpool.
2008. Iron Fencing, W. Gray, Ripon.
2009. Sewing Machines, T. Chadwick and T. Sugden, Oldbury.
2010. Collecting Sheets of Paper from Printing Presses, G. A. Wilson, Liverpool.
2011. Hatchway Covers of Barges, T. Turton, Liverpool.
2012. Sash Pulleys, W. J. Penny, Southend.
2013. Crank Shafts, H. B. Young, Sheffield.
2014. Clutch-motion, J. W. Adams and R. Bannister, Redditch.
2015. Withering Green Tea Leaf, E. Hunt.—(*J. A. R. Main, Calcutta.*)
2016. Cut-off Mechanism of Steam Engines, C. Bedford, Birstall.
2017. Looms for Weaving, C. Bedford and T. Kershaw, Birstall.
2018. Spring Raising Draught Preventer, B. Horton, Wolverhampton.
2019. Skein Holder, L. W. White, Birmingham.
2020. Spiral Laid Dandy Roll, J. Sinclair, Glasgow.
2021. Incubators, W. Muir, Thornliebank.
2022. Hoes, D. Smith, jun., Wolverhamgton.
2023. Metallic Barrels and Drums, W. H. and B. Jones, Wolverhampton.
2024. Scarborough Trunk Locks, J. Legge and W. Slater, Willenhall.
2025. Plough Heads, J. Scarby and I. Howe, Rotherham.
2026. Stoppering Bottles, A. B. McLean, Sheffield.
2027. Furniture Castors, E. W. Hughes, London.
2028. Rag Engines, J. R. Mayfield, Hemel Hempstead.
2029. Cooling Milk, N. Moës, Luxemburgh.
2030. Compressing, &c., Air, G. T. Harrap, London.
2031. Securing Stair Rods, J. Faulkner and J. H. Starling, Birmingham.
2032. Ornamenting Glass, W. T. Whitehead, Moseley.
2033. Mills for Rolling Wire Rods, &c., W. D. Houghton, Warrington.
2034. Fitting Window Sash Weights, W. J. Penny, Southend.
2035. Kettles, &c., J. Jones, London.
2036. Electric Alarm Attachments for Clocks, G. Moore, Lewisham.
2037. Inner Soles for Boots, T. H. Harrison, London.
2038. Safe Doors, G. E. Morgan, London.
2039. Facilitating the Acquirement of the Knowledge of Musical Scales, W. Nott, Cranleigh.
2040. Making Trunks, J. G. Carrick, Glasgow.
2041. Dynamo-electric Machines, E. Bright, London.
2042. Cutting Bread, J. M. Richards.—(*W. P. Ward, New York, U.S.*)
2043. Wigs, &c., F. Page, London.
2044. Fret Saw Frames, E. J. Beaumont, Reading.
2045. Fastening Doors, J. Lowley and J. Harold, Battersea.
2046. Separating Solid Impurities from Liquids, B. H. Remmers, Glasgow.
2047. Incandescent Electric Lamps, A. Thompson and L. R. R. W. Bishop, London.
2048. Lamp Burners, E. A. Rippingille, Birmingham.
2049. Distance Indicators, H. Loe, Brading, and E. R. Shipton, London.
2050. Tricycles, W. Blenheim, New Egham.
2051. Bottle Stoppers, J. T. Markham, Bury St. Edmunds.
2052. Instrument to Insert in the Human Ear, J. W. Cousins, Southsea.
2053. Heels for Boots, J. W. Jones and E. K. Bridger, London.
2054. Automatic Speculum, R. Blackbee, London.
2055. Heating Railway Carriages, H. J. Haddan.—(*A. Kraschovitz, Leipzig, Saxony.*)
2056. Brake Shoes, J. J. Lappin, Toronto, Canada.
2057. Vessels, W. R. Lake.—(*F. Folacci and P. Bertin, Paris.*)
2058. Horseshoes, C. Sheather, London.
2059. Arc Lamps, J. Brockie, London.
2060. Sheaf-binding Harvesting Machines, J. Howard and E. T. Bousfield, Bedford.
2061. Tricycles, W. T. Shaw, Surbiton, and W. Sydenham, London.
2062. Tricycles, W. Burgess, Battle.
2063. Domestic Fire-escapes, A. M. Clark.—(*W. Jensen, British Columbia.*)
2064. Flutes, &c., C. Binda, Bath.
2065. Securing Strings or Cords, F. H. Smith Winchmore-hill.
2066. Sewn-through Buttons made of Wood, &c., S. Bagnall, Birmingham.
2067. Secondary Batteries, T. J. Jones, London.
2068. Automatic Signalling Apparatus, H. Le Loutre, France.
2069. Cooling Liquids, E. G. Colton.—(*V. Wilhelmi, Paterson, U.S.*)
2070. Pulverising Cereals, E. G. Colton.—(*L. S. Chichester and C. M. F. Schroeder, Jersey, U.S.*)
2071. Pulverising Cereals, E. G. Colton.—(*L. S. Chichester and C. M. E. Schroeder, Jersey, U.S.*)
2072. Pack or Wrapper, S. Popplewell, Harpenden.
2073. Primary, &c., Batteries, A. Tribe, London.
2074. Permanent Way of Railways, A. M. Clark.—(*C. H. V. Orden, Catskill, U.S.*)
2075. Permanent Way of Railways, P. B. and J. Wilson, Accrington.
2076. Extracting the Metal Aluminium from its Ores, H. A. Gadsden.—(*E. Foote, New York, U.S.*)
2077. Duplex Fire-arm, R. Morris, Blackheath.
2078. Relay Apparatus for Electric Telegraphs, C. D Abel.—(*J. Kolzer, Duisburg, Germany.*)
2079. Pointing Pencils, T. Moore, London.
2080. Pianista or Automatic Action for Playing on Pianos, C. D. Abel.—(*L. E. Thibouville-Lamy, Paris.*)

25th January, 1884.

2081. Metallic Bedsteads, E. Fewtrell and J. A. Crane, Birmingham.
2082. Locks, A. Adam, Falkirk.
2083. Umbrellas, &c., D. Sheehy, Templemore.
2084. Wheels and Axles, W. Parsonage, Swansea.
2085. Jewellery Fastenings, H. Parker, Birmingham.
2086. Cruet Stands, &c., H. Parker, Birmingham.
2087. Locking Apparatus, H. Parker, Birmingham.
2088. Gas Motor Engines, W. Rodgerson, Gateshead.
2089. Gas Engine Cylinders, W. Ainsworth, Blackburn.
2090. Travelling Grates, J. Brentnall, Heaton Norris.
2091. Raising, &c., Weights, W. Clissold, Nailsworth.
2092. Door Locks, W. Wilkes, Bloxwich.
2093. Frillings, &c., M. Jackson, Nottingham.
2094. Bottles, W. Holt & H. Tongue, Bolton-le-Moors.
2095. Ships, &c., C. Ridealgh, Sunderland.
2096. Asphalte Apparatus, B. D. Healey, Brighouse.
2097. Letter Clips, &c., J. F. Williams, West Derby.
2098. Rivetting Machines, G. Edmeston, Cheetham
2099. Fastenings, S. H. Sutton, Birmingham.
2100. Removing Dust from Carpets, &c., P. Stubbs Liverpool.
2101. Lifting, &c., Apparatus, H. J. Johnstone, Paris.
2102. Spinning, &c., Fibres, R. Riley, Habbergham.
2103. Shavers, J. H. Pearce, Sheffield.
2104. Cooking Apparatus, T. H. Blamires, Huddersfield, and W. H. Bailey, Salford.
2105. Bungs, O. Blechschmidt, Berlin.
2106. Timepieces, O. Fleischhauer, Berlin.
2107. Ointment, C. Wilson, Manchester.
2108. Benzoline Lamps, W. Smith, Eastbourne.
2109. Folding, &c., Chair, E. Smith, West Dulwich.
2110. Sash-bars, A. Drummond, Edinburgh.
2111. Double Sounding Boards for Pianofortes, C. Marx, Dresden.
2112. Warves for Spinning, &c., Frames, S. Rowbottom, Glossop, and H. Illingworth, Bradford.
2113. Remedy for the Cure of Syphilitic, &c., Diseases, E. Lawton.—(*J. Carder and I. Parra, U.S.*)
2114. Looms, J. Bennett, Baildon.
2115. Steam Steering Apparatus, J. Duncan, London.
2116. Cabinets, G. Body, Aldershot.
2117. Hydrochloric Acid, E. Carey, H. Gaskell, jun., and F. Hurter, Widnes.
2118. Treating Sulphate of Ammonia, E. Carey, H. Gaskell, jun., and F. Hurter, Widnes.
2119. Tin, A. P. Price, London.
2120. Voltaic Battery, D. Piot and A. Levy, London.
2121. Ventilating Glazed Structures, A. Drummond, Edinburgh.
2122. Scribing Apparatus, J. Carter, Glasgow.
2123. Tool, G. Plumpton, Warrington.
2124. Checking Apparatus, J. M. Black, London.
2125. Washing Rubber, J. Ralph and J. A. Jordan, Bilston.
2126. Castors, S. Thorpe, and W. and A. Chamberlain, Wigston Magna.
2127. Setting and Bevelling Metal Bars, &c., N. Arthur, Leith.
2128. Buoys, R. Tindall, Fraserburgh.
2129. Flushing Apparatus, W. Bennett, Southampton.
2130. Perambulators, F. Plaister, Oxford.
2131. Driving Gear of Velocipedes, S. Rich, Croydon.
2132. Gas Heating Stoves, H. J. Davis, London.
2133. Joiners' Bench Knife, T. J. Syer, London.
2134. Uniting the Ends of Driving Belts, A. C. Henderson.—(*A. D. Lagrelle, Paris.*)
2145. Motor Engine, A. C. Henderson.—(*E. Etève and J. A. de Braam, Paris.*)
2136. Letter-boxes and Bags, F. Wirth.—(*F. Teller, T. Maynz, and C. O. Weber, Germany.*)
2137. Amalgam for Tooth Stopping, W. C. Davis, Bayswater.
2138. Preparing Knitted Fabrics, L. A. Groth.—(*W. Ziesch and Co., Berlin.*)
2139. Testing Apparatus, J. Jackson, London.
2140. Umbrellas, &c., H. J. Haddan.—(*Knauth and Co., and R. Geisler, Leipzig.*)
2141. Fastenings, T. Hayward, Leebotwood.
2142. Letter-boxes, C. Swinney, London.
2143. Explosive Cartridges, G. G. M. Hardingham.—(*T. Woolhouse, Paris.*)
2144. Treating Seeds or Grain, A. J. Boult.—(*Mhun, Tardie, and Courtois, Vierzon.*)
2145. Connecting Metallic Tubes, E. Phillips, jun., Moseley.
2146. Hydrated Oxide of Iron, J. G. Willans, London.
2147. Portable Forges, H. Moser, London.
2148. Firing Batteries, J. Mathieson, Stratford.
2149. Sliding Scales, L. G. Ram, London.
2150. Thrashing Machines, P. Gibbons and A. S. F. Robinson, Wantage.
2151. Locking Railway Points, &c., H. O. Fisher Cardiff.
2152. Spring Wheels, C. Burrell, jun., and T. Burall, Thetford.
2153. Invalid Couches, &c., A. H. Carter, London.
2154. Fireproof Plates, J. Nagel, Vienna.
2155. Spring Packing for Pistons, &c., W. Lockwood, Sheffield.
2156. Sewing Machines, J. H. Johnson.—(*A. Jacobs, Brussels.*)
2157. Treating Ores, J. H. Johnson.—(*E. Hermite, France.*)
2158. Engines, J. J. Miller and G. J. Tupp, London.
2159. Advertising Apparatus, H. B. Hyde, London.
2160. Effecting Combustion of Liquid Hydrocarbons, J. H. Selwyn, London.
2161. Pocket Knives, E. Jansen, A. Böntgen, and L. Sabin, Solingen, Germany.

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2162. Treating Substances, A. E. Scott, London.
2163. Shuttles for Looms, J. Earnshaw, Cornholme.
2164. Steam Boilers, F. D. Rose, Flixton.
2165. Steam Boilers, F. D. Rose, Flixton.
2166. Weavers' Tools, S. Nuttall, Walmersley.
2167. Cutting Paper, G. Black, Newcastle-on-Tyne.
2168. Cutting Hot Iron Blooms, &c., W. E. Kochs, Merthyr Tydfil.
2169. Differential Pulley Blocks, R. Priest, Cradley Heath.

2170. ORGAN PALLET ATTACHMENTS, P. Knott, Sharples.
2171. COLOURED LIGHTS or SIGNALS, W. W. Lavarack, Liverpool.
2172. HEEL COMBS, B. H. Fitton, Shelley.
2173. AFFIXING KNOBS to their SPINDLES, T. Atkins, Drayton.
2174. LOOMS for WEAVING, R. L. Hattersley, Keighley, and E. Hartley and A. Ellis, Bradford.
2175. RUBBER PROTECTOR, H. Dean, Wolstanton.
2176. VENTILATORS for SHIPS, &c., A. W. Kershaw, Lancaster.
2177. KEY-BLANKS, E. Phillips, Willenhall.
2178. LOCK-KNOB FASTENER, J. W. Sisson, London.
2179. LABELS for HAT TIPS, R. Turner, Hyde.
2180. VENTILATED WATERPROOF COATS, E. S. Helwitz, Cheetham.
2181. TABLE CUTLERY, T. H. Heard, Sheffield.
2182. FIRE-GRATES, W. St. J. Joyce, Dublin.
2183. APPLYING BICARBONATE of AMMONIA to the LEAVENING of DOUGH, R. A. Mossman and J. M. Mayelston, Elloughton.
2184. COLLECTING EXCRETA, &c., C. Scott, Belfast.
2185. DEPOLARISING SECONDARY BATTERIES, A. C. Henderson.—(*C. Philippart, Paris.*)
2186. PRINTING by RUBBER TYPE, &c., L. B. Bertram, London.
2187. HOLDERS for VALANCES, A. Woods, Northampton.
2188. VELOCIPEDES, J. L. Bramley, London.
2189. SHAFT COUPLINGS, T. L. Ellis, Coatbridge.
2190. PUDDLING and RE-HEATING FURNACES, T. L. Ellis, Coatbridge.
2191. TAKING UP MOTION for SIZING MACHINES, H. Livesey and T. Kenyon, Blackburn.
2192. BREAD, J. M. Abercromby, Glasgow.
2193. GLASS CHIMNEYS, E. J. Shaw, Walsall.
2194. SLIDING SASH FRAMES, W. B. Carne, Kingsand.
2195. FOLDING, &c., TABLE, A. M. Woolf, London.
2196. GENERATING ELECTRICITY, W. Fox, London.
2197. SHEEP SHEARS, D. Ward and A. Davy, Sheffield.
2198. PADLOCKS, G. Harrison, Walsall.
2199. TRICYCLES, J. C. Brawn, Leicester.
2200. CLINICAL THERMOMETERS, J. J. Hicks, London.
2201. ELECTRIC CONDUCTING WIRES, H. J. Haddan.—(*J. Manne, Bruxelles.*)
2202. FILLING BOTTLES with LIQUIDS, A. P. Scrase and W. Carter, Horsham.
2203. WATCHES, R. Squire, London.
2204. LOOMS for WEAVING, T. Wilkinson, Coventry.
2205. SADDLE BARS, G. Craddock, London.
2206. DYNAMO-ELECTRIC MACHINES, W. Fairweather, Glasgow.
2207. GAS PRODUCERS, G. R. Hislop, Paisley.
2208. STEAM BOILERS, &c., J. Clark, Paisley.
2209. FIRE-LIGHTERS, R. Fallnight and M. Behrend, Berlin.
2210. STEAM BOILERS, R. H. Ellacott, Plymouth.
2211. APPLYING ELECTRIC LIGHT to CAMERAS, A. F. Link.—(*M. Bauer, Paris.*)
2212. BREAKING ELECTRIC CIRCUITS, H. H. Leigh.—(*J. L. Huber, Hamburg.*)
2213. BREAKING DOWN COAL, W. Walker, Saltburn-by-the-Sea.
2214. GAS MOTOR ENGINES, F. H. Anderson, Openshaw.
2215. BRACES, G. C. Lidstone, Swansea.
2216. ELECTRIC LAMPS, G A. Tabourin, Marseille.
2217. BRACE BUCKLES, W. R. Lake.—(*F. Armstrong, Bridgeport, U.S.*)
2218. PRODUCING ALUMINIUM, G. B. de Overbeck.—(*H. Nieverth, Hanover.*)
2219. EXPLOSIVE COMPOUNDS, G. de Overbeck, London.
2220. PRINTING COPIES of DRAWINGS, &c., E. S. Chatterton, London.
2221. LAMPS, A. J. Boult.—(*L. Henkle, Rochester, U.S.*)
2222. PERMANENT WAY of RAILWAYS, A. J. Boult.—(*P. Dietrich, Berlin.*)
2223. CARD CLOTH, T. Sartorius, Germany.
2224. FRYING PANS, A. Perkins, London.
2225. LIQUID DIPPING COMPOUND, R. Hastie, Bristol.
2226. PONTOON DOCKS, R. Turnbull, R. Fell, jun., and A. M. Cohen, Newcastle-upon-Tyne.
2227. KAMPTULICON, &c., A. Wilkinson, Camberwell.
2228. EXTRACTING LEAD, &c., from ORES, A. P. Laurie, Duddingstone, Edinburgh.
2229. WASHING, &c., COAL GAS, F. Weck, Lilleshall.
2230. VALVES, F. Weck, Lilleshall.
2231. POWER LOOMS, J. Heaton and J. Bentley, Manningham, near Bradford.
2232. RING SPINDLE, T. Coulthard and J. Simpson, Preston.
2233. FUNNELS, B. A. Barczinski, London.
2234. EXCITANTS for GALVANIC BATTERIES, J. J. Lundy and W. F. Bottomley, London.

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2235. LOOMS, J. Thornton, Shipley.
2236. CLEANING CHIMNEY GLASSES, H. Hellier, London.
2237. FLOOR-CLEANING UTENSILS, J. Walsh, London.
2238. COUPLING RAILWAY CARRIAGES, J. Stephens and J. D. Smith, South Bank, York.
2239. INCREASING the ILLUMINATING POWER of ARTIFICIAL LIGHT, F. B. Lord, South Devon.
2240. HOLDERS for INCANDESCENT ELECTRIC LAMPS, E. H. Thompson, Liverpool.
2241. MACHINERY for ROAD TRAVELLING, M. Green, Smethwick, near Birmingham.
2242. PLACING COP TUBES on the SPINDLES of MULES, S. Morris, Dukinfield.
2243. SPRING-BACK BRUSH, G. Russon and A. Peake, Staffordshire.
2244. SECURING SCAFFOLDING, C. Jones, Derby.
2245. LOOMS for WEAVING, W. Fielding, Moses Gate, near Bolton.
2246. SUPPORTING, &c., WINDOW SASHES, T. Nield, Sandbach.
2247. ASPHALT COMPRIME, C. J. Lortzing, Russia.
2248. PERAMBULATORS, M. J. Redgate, Sheffield.
2249. RELEASING HORSES from VEHICLES, W. Corboud, Camberwell.
2240. FITTINGS for OARS, &c., L. Young, London.
2251. FEED-WATER HEATERS, J. McLachlan, Glasgow.
2252. SPRING PACKING for PISTONS, &c., R. H. Taylor, Sheffield.
2253. TREATING TIN, &c., PLATES, H. A. Morgan and R. Taylor, Llantrissant.
2254. LENTICULAR APPARATUS for LIGHTHOUSES, D. H. Brandon.—(*Messrs. Barbier and Fenestre, France.*)
2255. PERAMBULATORS, L. L'Hollier, Birmingham.
2256. LAMP WICKS, J. Shallis and T. Thomas, London.
2257. PERAMBULATORS, H. W. Twiggs, Bristol.
2258. CARRYING PARCELS, C. Halsey, London.
2259. CONNECTING ARTICLES of DRESS on the WEARER, W. A. F. Teffer, London.
2260. CASES for HOLDING TYPE, W. Simmons, London.
2261. BOOTS, &c., P. and G. Purdie, Glasgow.
2262. STRETCHING SKINS, &c., P. Jensen.—(*R. Spitta, sen., Germany.*)
2263. TIN and TERNE PLATES, J. D. Thomas, T. W. Evans, and J. Gravell, Swansea.
2264. ELECTRIC INCANDESCENT LAMPS, H. J. Haddan.—(*C. G. Perkins, New York.*)
2265. MAKING CHESSMEN, G. Cumberpatch and A. Mackie, London.
2266. REGULATING ELECTRO-DYNAMIC MOTORS, T. J. Handford.—(*F. J. Sprague, New York.*)
2267. CANE-SEATED CHAIRS, G. W. Fairhall, London.
2268. GRINDING PIGMENTS, G. J. Baseley, London.
2269. COLOURING MATTERS, Dr. O. Hoffmann, Mainkir, near Frankfort-on-the-Main, Germany.
2270. LAMPS, A. Martin, Birmingham.
2271. CASK TAPS, A. Martin, Birmingham.
2272. FLOWER STANDS, R. H. F. Behrens, Hamburg.
2273. FASTENER BUTTONS, E. G. Colton.—(*E. Wuerfel, Brooklyn, New York.*)
2274. DISCHARGING MECHANISM of FIRE-ARMS, J. Rigby, Dublin.
2275. CUTTING the LIFTS &c., of BOOTS, H. A. Oldershaw, Leicester.
2276. PRESERVING the TEMPERATURE of LEAD, &c., PIPES, J. Gill, Keighley.
2277. PENS, &c., J. Kaye, London.
2278. REGULATING, &c., ELECTRIC CURRENTS, J. H. Johnson.—(*E. Bertin, Paris.*)
2279. PURIFYING COAL GAS, W. T. Walker, London.
2280. DRESSING FLOUR, &c., H. H. Lake.—(*A. Brzesky, Austria.*)
2281. SECURING GLOVES, J. S. Letts, London.
2282. ADAPTING a VIOLIN or like CASE and a MUSIC SUPPORT as one ARTICLE, J. Boarder, London.
2283. DWARF SAFETY BICYCLE, J. Lee and E. Whittington, Brighton.
2284. MINERS' SAFETY LAMPS, J. Routledge and H. Johnson, Sunderland.
2285. HOLDERS for INCANDESCENT ELECTRIC LAMPS, C. Dornfeld, Cologne.
2286. EVAPORATING APPARATUS, H. H. Lake.—(*A. Vivien and A. D. R. Dujardin, France.*)
2287. TRANSMITTING MOTIVE-POWER, C. M. Parkinson and J. Walker, Doncaster.
2288. BENDING ANGLE IRONS, C. Wicksteed, Kettering.

ABSTRACTS OF SPECIFICATIONS.

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

1957. BOTTLES, AND STOPPERS FOR SAME, *J. Edwards, London.*—18*th April*, 1883.—(*Patent dated* 11*th June*, 1883.) 6*d.*

Relates to the construction of bottles with internal stoppers composed of a glass ball.

2485. ENGINES FOR TRAMWAYS OR ROAD TRACTION, *T. Hunt, Manchester.*—18*th May*, 1881.—(*Not proceeded with.*) 2*d.*

The inventor places the uptake on the side opposite to or farther from the fire door, and between them are arranged pendent tubes or a water space (or both tubes and water space), for the purpose of interrupting the direct current of air from the fire door, and assist in heating and mixing the said air with the gases in the fire-box before they arrive at the uptake.

2637. MANUFACTURE OF EXPLOSIVE MATERIALS, AND APPARATUS THEREFOR, *W. R. Lake, London.*—26*th May*, 1883.—(*A communication from J. Pichler and A. Fels, Vienna-Neustadt.*)—(*Not proceeded with.*) 4*d.*

Relates to the manufacture of gunpowder and other explosive materials by means of a process which is carried out in such a manner as to be entirely free from danger, and to apparatus therefor.

2638. SCREWS FOR WOOD, *H. J. G. Hallström, Koping, Sweden.*—28*th May*, 1883.—(*Void.*) 2*d.*

The inventor removes the whole or part of the superfluous and impeditive material from the unthreaded portion or neck of the screw situate between the thread and the head, thereby reducing the said portion or neck of the screw to about the same diameter as the root of the thread.

2640. APPARATUS FOR MAKING LASTS FOR BOOTS AND SHOES, *A. Stürmer, Elberfeld, Germany.*—28*th May*, 1883. 6*d.*

Consists in the method of giving to boot and shoe lasts such forms as will correspond to all irregularities of the feet.

2656. CARTRIDGE-HOLDERS, *P. W. D'Alton, Streatham, and F. W. Durham, Barnet.*—29*th May*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to a cartridge-holder to be worn on the person as a belt, or attached to a belt.

2660. CULINARY UTENSILS, BREWING AND EVAPORATING PANS, &c., *P. R. Bjorling, Wolverhampton.*—29*th May*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to increase the heating surface of the bottom of the utensils, &c., by making the bottom corrugated.

2676. MECHANISM FOR NUMBERING, PRINTING, AND CUTTING TICKETS, CHEQUES, &c., PROGRESSIVELY AND CONSECUTIVELY, *J. M. Black.*—30*th May*, 1883.—(*Not proceeded with.*) 4*d.*

This relates to the general construction of the machine.

2684. HARVESTING MACHINES FOR REAPING AND BINDING, *Rev. J. Wild, B.A., Tetney.*—30*th May*, 1883. 8*d.*

Consists in improvements in mechanism or apparatus chiefly designed to be attached to a reaping or harvesting machine, for automatically erecting the crop, and collecting it, as it is cut, into sheaves or bundles, and binding the same with a band or other suitable material.

2686. MANUFACTURE OF OIL PAINTS AND VARNISH, *A. F. Link, London.*—30*th May*, 1883.—(*A communication from E. Fischer and E. Cohn, Berlin.*)—(*Not proceeded with.*) 2*d.*

The paint and varnish consists chiefly of an intimate combination of oil and various resins with silicic acid, Guylaya bark, and alkalies, in which, by an addition of chromium, alum, and sulphuret of carbon, a palmitine is produced, that, after submitting it to the influence of light and air, is unaffected by external influences, and that on drying the varnish produces subliming sulphur, greatly increasing the durability of the paint and varnish.

2690. OIL CANS used for LUBRICATING MACHINERY, &c., *G. A. J. Schott, Bradford, and G. Robinson, Sheffield.*—30*th May*, 1883. 6*d.*

This relates, First, to the means of filling the can; Secondly, to the manner of working the spindle or lever, which operates the valve or valves; Thirdly, to the manner of affixing the spout to the can.

2697. DEVICES FOR LACING GLOVES, *A. M. Clark, London.*—30*th May*, 1883.—(*A communication from W. T. Foster, New York.*)—(*Not proceeded with.*) 2*d.*

This relates to the general construction of the lacing device.

2708. LATHE BACK HEADSTOCKS OR POPPETS, *T. B. Barker and J. Ewins, Birmingham.*—31*st May*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to combine, in one back centre poppet or machine, two machines or appliances admitting of exchange.

2714. TREATMENT OF LAGER BEER AND OTHER LIQUIDS, AND APPARATUS RELATING THERETO, *J. P. Jackson, Liverpool.*—31*st May*, 1883. 1*s.*

Relates chiefly to improvements in the bottling, dispensing, &c., of lager beer and other liquids.

2718. MINERS' SAFETY LAMPS, *D. Dodd, Intake.*—31*st May*, 1883.—(*Not proceeded with.*) 2*d.*

This consists, First in the construction of the wick tube with an external screw on which is fitted an adjusting tube with a corresponding internal screw; Secondly, in the construction of the safety lamp with two complete gauze cylinders with closed tops.

2720. WATER METERS, &c., *H. Frost, Manchester.*—31*st May*, 1883. 6*d.*

This relates to improvements on patent No. 1619, dated 7th May, 1874, and consists, First, in improvements in the valves for admitting and discharging the fluid to be measured; Secondly, the method of packing and guiding the piston-rod of the measuring cylinder.

2727. APPARATUS FOR RECEIVING AND DISCHARGING NIGHT SOIL IN CONNECTION WITH PNEUMATIC SYSTEM OF SEWERAGE, *A. M. Clark, London.*—1*st June*, 1883.—(*A communication from La Cie Générale de Salubrité, Paris, represented by J. B. Berlier.*) 1*s.*

This relates to patent No. 4800, dated 14th November, 1881, and consists in improvements in the construction and arrangement of the strainer within the receiver, as well as in the arrangement of the latter, and its combination with the discharging apparatus.

2728. LADIES' HAT AND BONNET RESTS FOR TRAVELLING, *A. Buckler, Coventry.*—1*st June*, 1883.—*Not proceeded with.*) 2*d.*

The object is to form a hat rest which can be folded up into a small space when not in use.

2731. MOTOR, *R. Anderson, Bermondsey.*—1*st June*, 1883. 6*d.*

The object is to utilise the floating power of bodies to obtain continuous rotary motion, and it consists in the use of an endless chain of buckets passing over top and bottom pulleys, the portion of the chain in which the buckets are in an inverted position being caused to rise through a column of liquid.

2732. STEAM BOILERS, *E. H. Nicholson and W. Mather, Newark-upon-Trent.*—1*st June*, 1883. 6*d.*

This consists, First, in connecting the fire-box of vertical boilers by means of one or more oblique or vertical flue pipes, with one or more transverse flue pipes which act as combustion chambers; Secondly, in constructing vertical boilers with a fire-box having a number of flue tubes of small diameter attached at their lower ends to the box crown, and at their upper ends to the shell of boiler below the water level.

2736. MANUFACTURE OF FABRICS FOR SURGICAL AND MEDICAL DRESSINGS AND OF SURGICAL SPLINTS AND SUPPORTS, *S. Gamgee, Birmingham.*—1*st June*, 1883. 4*d.*

The fabric is made from thoroughly bleached cotton, the fibre being then fed on to a series of carding engines, and the batts or fleeces accumulated upon a travelling apron, which leads them between two muslin fabrics, which are themselves of an open nature, thoroughly bleached and freed from dressing, and which feed the fleeces between pressing rollers, so as to form a compound fabric of an absorbed nature. The fabric can be dipped into a liquid mixture of plaster of Paris when required to form splints and surgical supports.

2739. APPARATUS FOR GENERATING AND UTILISING ELECTRIC ENERGY, *A. J. Boult, London.*—1*st June*, 1883.—(*A communication from B. Faquant, Springfield, Mass., U.S.*)—(*Not proceeded with.*) 4*d.*

This relates to the construction of such a motor "that being once set in motion, it will generate, or cause to be generated, sufficient electric force to keep the machine in motion, and supply power and electricity for other purposes."

2743. MECHANISM FOR REGULATING ELECTRIC ARC LAMPS, *F. L. Willard, London.*—2*nd June*, 1883. 6*d.*

Into the rack of the upper carbon a small pinion is geared, having upon its spindle a ratchet wheel, with pawl and catch, and also an escape wheel into which works a detent vibrated by a pendulum. A small piece of iron fixed to one arm of the detent acts as an armature to an electro-magnet; this, except when the lamp feeds, is in the main circuit and divides it with an iron wire resistance terminating in the bottom plate of the lamp. One end of this main magnet helix is fastened to a set screw terminating in two small set screws which press against two tongues fixed to a bar, the other end of which carries the armature of a shunt magnet bridging across the terminals. The bar with the two tongues is held against the set screws by a spring. To balance any increase of resistance caused by overheating in the shunt magnet the spindle of the escape wheel carries a nut, pivotted to which is a lever whose top engages with the spring as the carbon is consumed, and thus reduces its tension. A solenoid in the base of the lamp separates the carbons on the passage of the current.

2745. COMPOSITION FOR REMOVING INCRUSTATION FROM VESSELS AND APPARATUS EMPLOYED IN SUGAR MANUFACTURE, *R. de Martino, London.*—2*nd June*, 1883.—(*Not proceeded with.*) 2*d.*

A compound consisting of sal ammoniac with about 35 per cent. powdered gall nuts, and from 20 to 30 per cent. of sumach, is introduced with water into the vessel to be cleaned and kept boiling for about ten hours.

2747. COMPOSITION FOR REMOVING INCRUSTATION IN STEAM AND OTHER BOILERS, *S. Lattuada, Milan.*—2*nd June*, 1883.—(*Not proceeded with.*) 2*d.*

Seven parts sal ammoniac, 4 parts gambia or catechu, 1 part powdered gall nuts, and 1 to 2 parts soda are mixed together and applied with about 1000 times its weight of water.

2749. SHEET-DELIVERING APPARATUS FOR PRINTING MACHINES, *W. Conquest, London.*—2*nd June*, 1883.—(*A communication from Messrs. R. Hoe and Co., New York.*) 2*s.*

The improvements are especially designed for use in combination with web perfecting printing machines, and consist in the combination of longitudinal folding mechanism comprised of an internal guide, co-operating external turner, and moving tapes with drawing rollers or cylinders, or with transverse cutting and folding mechanism, and also with delivery mechanism and means for suspending the action of any or all of the cutting, folding, or gathering devices.

2751. APPARATUS FOR CUTTING SLATE-ROLLS, *O. Thomas, Bangor, and R. G. Thomas, Menai Bridge.*—2*nd June*, 1883. 6*d.*

The invention is designed to form a machine that will cut the rolls to a circular or cylindrical shape at one operation, and at a second cut the groove required in the one side before the stone is removed from the machine.

2754. TREATING COPPER PYRITES FOR THE EXTRACTION OF METALS AND APPARATUS THEREFOR, &c., *S. Pitt, Sutton.*—2*nd June*, 1883.—(*A communication from A. R. Gray, Montreal.*)—(*Not proceeded with.*) 2*d.*

This consists in drawing off, by means of a pump or pumps, the sulphurous gas and nitric oxides evolved during the different stages of the treatment of the pyrites (these gases being usually passed through a sulphuric acid chamber), and forcing them through a series of condensing vats, thus enabling a determined quantity of gas to be re-used repeatedly at very little cost.

2758. CAR COUPLERS, *E. T. Hughes, London.*—4*th June*, 1883.—(*A communication from G. A. Gage, R. F. Shreuder, and B. F. Read, Texas, U.S.*)—(*Not proceeded with.*) 4*d.*

The draw-head has a recess containing a sliding block pressed outwards by a spring, and the opening of which recess is bell-shaped to guide a coupling link into the recess and force back the block, when a sliding rod is drawn up out of a hole in the top of the cross-head. When this rod is lowered the coupling link is secured in position.

2760. PREPARING FLUID ISINGLASS FROM THE BLADDERS OF COD, HADDOCK, HERRING, AND OTHER FISH, *L. A. Groth, London.*—4*th June*, 1883.—(*A communication from C. A. Sahlström, Sweden.*)—(*Not proceeded with.*) 2*d.*

Relates to the general treatment of the bladders.

2762. SAILS FOR SHIPS, &c., *J. Capper, Liverpool.*—4*th June*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to enable a sail to be easily spread flat, and it consists in introducing into the sail near its foot a rope placed so as to approximately form the arc of a circle. Along the "tack" of the sail a band is placed in a position similar to that of the rope, and prevents stretching in that direction, and a similar band is placed along either side or edge.

2763. APPARATUS FOR GENERATING, DISTRIBUTING, REGULATING AND MEASURING ELECTRICITY, &c., *W. H. Scott, London.*—4*th June*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a generator, the distributing of currents, regulating apparatus in which a variable resistance is used, to a current meter, and to controlling the feed of arc lamps.

2764 PLAITING MACHINES, *J. and R. J. Foot, London.*—4*th June*, 1883.—(*Not proceeded with.*) 2*d.*

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

2766. CONSTRUCTION OF REVOLVING BACK COLLARS OR CAPS OF AXLES, &c., *E. Partridge, Smethwick.*—4*th June*, 1883. 6*d.*

The object is to construct revolving back collars or caps of axles with means of adapting and adjusting them, and securing axle-boxes in position without the usual long or short bolts, and it consists in notching, scoring, or recessing the edge or edges of the screw in collars or caps of axles for the reception of the head of a screw pin, whose stem is inserted in a projection on the head of an axle-box, the aperture which the screw pin fits serving also as an oil hole leading to the parts to be lubricated.

2767. APPARATUS FOR TREATING COAL OR OTHER ILLUMINATING OR HEATING GAS, *H. Symons, Totnes.*—4*th June*, 1883. 6*d.*

The apparatus consists of a purifier, a carburetter, and a regulator in combination.

2769. ELECTRIC LAMPS, &c., *W. R. Lake, London.*—4*th June*, 1883.—(*A communication from C. L. R. E. Menges, The Hague, Holland.*) 1*s.* 6*d.*

The two carbons are kept continually in contact under constant pressure, either or both carbons being fed through a clamp or abutment pole arrangement which may be provided with metallic rollers. Either the carbons may be fed through the clamps, or the carbons may be gripped by the clamps and these be fed forward by a flexible coupling. The carbons may be enclosed in a globe which is filled with a gas, or it may be exhausted, the exhausting device being described. The specification also relates to fittings and switches for incandescent lamps, and to a lead cut-out, in which a spring released by the fusing of the "plug" causes the circuit to be "widely broken."

2770. ELECTRO-MOTORS, *J. Imray, London.*—4*th June*, 1883.—(*A communication from H. T. Hillister, Vienna.*)—(*Not proceeded with.*) 2*d.*

Relates to the construction of a motor suitable for driving dental drills, engravers' tools, and the like.

2771. MANUFACTURE OF LIGNEOUS COMPOUNDS AND ARTICLES MOULDED THEREFROM IN IMITATION OF WOOD, *C. D. Abel, London.*—4*th June*, 1883.—(*A communication from B. Harrass, Germany.*) 4*d.*

The compound consists mainly of cellulose or ground linen rags, paper stuff, straw stuff, and the like, in suitable combination with wheat starch and wheat flour, or generally of cellulose and starch of any description.

2774. MACHINERY FOR TESTING THE STRENGTH OF MATERIALS, &c., *A. H. Emery, New York.*—5*th June*, 1883. 10*d.*

Two beams movable upon a main bed have between them platform levers or hydraulic supports, by which the pressure of a load on either is transmitted to the weighing apparatus. Stationary screws fixed to the bed pass through the coupled beams, and lock nuts, not moved in use, or fixed shoulders on the screw, afford to one beam a firm bearing, adapting it to serve as the fixed bed of the scale, while the other beam serves as the platform to receive the load produced by a strain of tension or compression on the specimen, as the case may be. To make either beam act as this fixed bed, it is forced against the fixed nuts by nuts interposed between them, and placed on the main screws or supplementary screws or rods. Openings are provided in the central part of the coupled beams to insert one end of the specimen, and its other end passes through an opening in the straining beam, which is moved on stationary screws. To apply heavy strains a double-acting hydraulic press is provided on the straining beam.

2775. WEIGHING MACHINERY, *A. H. Emery, New York.*—5*th June*, 1883. 10*d.*

This relates to scales in which the pressure is transmitted from the load platform or platforms, to the weigh beams through the medium of liquid contained in suitable chambers and pipes.

2779. MACHINERY FOR DECORTICATING OR SCOURING RICE, WHEAT, AND OTHER GRAIN AND SEEDS, *J. H. C. Martin, Walthamstow.*—5*th June*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the employment of an outer casing, consisting of a cylinder or truncated cone of wire-work or perforated metal, set in an angular position, and caused to revolve slowly. Within this casing is a drum or cylinder of corresponding shape, provided with a keen cutting surface mounted on a shaft, to which a rapid rotary motion is given.

2783. APPARATUS FOR SIGNALLING ON RAILWAYS, *W. Wise, Bristol.*—5*th June*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in means for sounding the whistle on the engine, or actuating other alarm apparatus by means of a projection or arm by the side of the line of railway, such projection or arm being raised into position when required.

2784. HORSE HOES AND TURNIP THINNERS, *F. Mote, Burnham Market.*—5*th June*, 1883. 4*d.*

This relates to the application and use with horse hoes and turnip thinners of adjustable wheels, skeeths, or discs.

2785. MANUFACTURE OF CIGARS, *C. Morris, London.*—5*th June*, 1883. 2*d.*

A tasteless gum or varnish is applied to the end of the cigar.

2788. PRIMARY VOLTAIC BATTERIES, *G. G. André, London.*—5*th June*, 1883. 6*d.*

The copper or other negative electrode, together with a soluble carbonate, as carbonate of soda, in combination with sulphate of copper, is contained in a porous cell, which is placed in the vessel containing the positive electrode and its saline solution of sulphate of zinc and sulphate of soda. To prevent the sulphate of copper depositing copper on the zinc electrode, an isolated shield is placed between the porous cell and the zinc electrode.

2791. BENDING ANGLE IRON, *C. Wicksteed, Kettering, Northampton.*—5*th June*, 1883. 6*d.*

Relates to the employment of conical rolls.

2795. ELECTRIC BELL APPARATUS, *W. R. Lake, London.*—5*th June*, 1883.—(*A communication from La Société Dany et Lapage, Paris.*)—(*Not proceeded with.*) 4*d.*

This relates to the combination in a single apparatus of batteries, bell, and all the necessary electrical conductors.

2796. TREATING COTTON AND WOOLLEN RAGS AND FIBRES, *J. Illingworth, Batley.*—5*th June*, 1883. 8*d.*

The inventor claims, First, the employment of a rotary cage working within a heated flue or chamber of a steam boiler; Secondly, in combination with the machinery the application of an alkali solution composed of whiting, chalk, or lime combined with steam for neutralising the acids left in the animal fibre after the extracting process; Thirdly, the employment of an exhaust fan working in combination with the drying machine.

2797. MEASURING TAPES used by SURVEYORS AND OTHERS, *L. P. Casella, London.*—5*th June*, 1883. 6*d.*

The object is to improve and facilitate the attachment of the tape to its winding spindle, or its re-attachment in case of breakage at this point.

2798. EXTRACTING GLYCERINE FROM FATTY SUBSTANCES, *W. R. Lake, London.*—5*th June*, 1883.—(*A communication from E. O. Bawjard, France.*) 4*d.*

The process is based, First, on the action produced on all fatty neutral substances by oxygen and hydrogen when in the primitive state; Secondly, on the property possessed by metallic zinc, when in a condition of proper division to decompose the water under the influence of heat.

2799. APPARATUS TO BE USED IN THE PREPARATION OF METAL SURFACES FOR ETCHING, ENGRAVING, &c., *J. J. Sachs, London.*—5*th June*, 1883. 6*d.*

This relates to an apparatus for applying the sand blast in the preparation of metal printing and embossing surfaces.

2800. ELECTRICAL MOTOR, *W. Peek, London.*—5*th June*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the arrangement of electro-magnets in a rotary motor, in which actual contact of the magnets is made.

2801. CALORIC ENGINES, *C. Ingrey, Fulham.*—6*th June*, 1883. 8*d.*

This relates to improvements of the kind wherein compressed air is forced into a closed vessel, retort, or generator, containing fuel, and after being used therein,

to promote combustion of such fuel, is employed to operate the piston of the engine.

2803. SAFETY APPARATUS FOR GAS-BURNERS, *The Hon. J. W. Plunkett, Dunstall Priory, and J. C. Hart, Stratford.*—*6th June*, 1883. 6*d.*

This relates to improvements on patent No. 643, dated 10th February, 1883, and has for its object to provide means whereby the necessity for holding the gas tap in position until the bar or rod or its equivalent has expanded is obviated.

2807. JACQUARD APPARATUS, *J., A., and T. J. Crossley, near Manchester.*—*6th June*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to weave with the jacquard apparatus alone Yorkshire or linen damask, or any damask or other fabric that requires a separate ground, and at the same time to maintain the figure the same size as the machine; and further to weave the above fabrics with a single or double lift machine with one or more cylinders, and to dispense with heald shafts or "banisters."

2809. ENVELOPES OR WRAPPERS USED IN EXTRACTING OIL FROM SEEDS, *C. Eskrett and W. H. Searle, Hull.*—*6th June*, 1883. 6*d.*

The inventors employ, in combination with vulcanised fibre a facing of corrugated wood, corrugated paper, or leather, or they face the fibre with transverse spaced rope of hemp, flax, manilla, cotton, wool, or cocoa-nut fibre. The space or interval between the roping forms an equivalent of the grooves or recessed part of the facing, and actual contact between the hot seed bag and the vulcanised fibre is avoided.

2810. TIPS OF CUES FOR BILLIARDS, BAGATELLE, &c., *T. Hyde, Oldbury.*—*6th June*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the means of fitting an india-rubber tip.

2811. MANUFACTURE OF OILCLOTH, *J. Wolfendale, Lancaster.*—*6th June*, 1883.—(*Not proceeded with.*) 2*d.*

This consists principally in the use or employment of prepared gas tar or coal tar mixed with other materials, for the preparation of the canvas or other fabric employed for the manufacture of such oilcloths.

2812. RAILWAY SWITCHES, *E. N. Molesworth-Hepworth, Manchester.*—*6th June*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to means for dispensing entirely with the hinged or jointed tongue rails.

2813. BREECH-LOADING SMALL FIRE-ARMS, *J. Woodward and F. Beesley, London.*—*6th June*, 1883. 6*d.*

This refers especially to self-cocking lock actions of break-down guns of the hammerless class.

2814. LOOMS FOR WEAVING CLOTH, *H. J. Haddan, London.*—*6th June*, 1883.—(*A communication from J. MacFarlane, New Hampshire, U.S.*) 6*d.*

This relates to several improvements in the general construction and details of the machine.

2816. MANUFACTURE OF SOLUBLE BLACK, *T. W., jun., and W. K. Appleyard, Leeds, and J. Longshaw, Manchester.*—*6th June*, 1883. 4*d.*

This relates to the process of manufacturing a finely divided or soluble black, which consists in treating waste tan liquor or other substance rich in gallic acid or gallates, with alkali, separating the insoluble residue, concentrating, and adding a soluble salt of iron.

2817. ELECTRICAL SIGNALLING AND INTERLOCKING APPARATUS FOR RAILWAYS, *C. Hodgson, London.*—*6th June*, 1883. 8*d.*

The inventor refers to four previous specifications, and in this specification describes means of rendering the ordinary needle telegraph instruments available for interlocking with and controlling the joint and signal levers, and arrangements for simplifying the operation of levers electrically controlled from a distance.

2818. APPARATUS FOR MOULDING OR BLOCKING CORSETS, *A. Grant, Landport.*—*6th June*, 1883. 6*d.*

This consists in the combination of a movable finger with the forms or blocks on which corsets are moulded, the said finger being so arranged that whilst the corset is upon the form or block it can be caused to press on the same, and compel it to conform to the re-entering curvature of the block, and thereby ensure the proper moulding of the bosoms or breasts of the corset.

2819. FASTENERS FOR BUTTONS AND APPARATUS FOR SECURING THE SAME IN LEATHER, &c., *W. R. Lake, London.*—*6th June*, 1883.—(*A communication from S. L. Pratt, Hingham, U.S.*) 6*d.*

This relates to the means of attaching hook buttons.

2820. MANUFACTURE OR TREATMENT OF BEET SUGAR, *W. S. Wise, London.*—*6th June*, 1883.—(*A communication from G. A. Hagemann, Copenhagen.*) 2*d.*

This relates to the treatment of sugar by removal of the film or coating of beet syrup, and substitution therefor of other syrup, such as sugar-cane juice or other syrup having an agreeable smell and taste.

2821. SHADE-HOLDERS OR FRAMES FOR GAS AND OTHER LAMPS, *J. H. Stone, Birmingham.*—*6th June*, 1883.—(*Not proceeded with.*) 2*d.*

The holders or frames are made collapsible.

2823. SPINNING SPINDLES AND THEIR BEARINGS, *A. M. Clark, London.*—*6th June*, 1883.—(*A communication from G. Jaquith, Maysville, U.S.*) 6*d.*

This relates partly to the novel construction of the whirl by which the live spindle or bobbin spindle proper is driven.

2824. APPARATUS FOR COOKING EGGS, &c., *J. Darling, Glasgow.*—*7th June*, 1883. 8*d.*

This relates to an apparatus for automatically stopping the cooking operation at any exact instant of time, and the tray or carrier of which apparatus is released so as to raise the eggs or other articles of food up out of the water or liquid in which they are, or have been, heated or boiled.

2825. MACHINES FOR PARING OR SKIVING LEATHER, *W. Douglas, Kingswood.*—*7th June*, 1883. 6*d.*

This relates, First, to the method of adjusting the lower feed roller relatively to the knife; Secondly, to the guide, by which the leather is guided to the knife and enabled to turn as required; Thirdly, to the method whereby undue cutting of leather, when of a thickness greater than that for which the knife is adjusted, is obviated, the degree of the inclination of the knife being capable of alteration as the thickness requires.

2826. LOCK-CATCH PLATES FOR FIXING STEREO PLATES IN POSITION FOR PRINTING PURPOSES, *T. T. Hodgson, London.*—*7th June*, 1883. 4*d.*

This relates to a means of securing stereotype plates upon metal or other blocks by means of catches or jaws.

2827. SEAL TRAPS FOR WASH-BASINS, WATER-CLOSETS, &c., *W. P. Thompson, Liverpool.*—*7th January*, 1883.—(*A communication from A. Edwards, New Jersey, U.S.*)—(*Not proceeded with.*) 4*d.*

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

2829. MANUFACTURE OF CAST METAL WHEELS FOR WAGONS, TRUCKS, TROLLIES, &c., *R. H. Hyde, Newhulls, Derby.*—*7th June*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the manufacture of cast iron wagon or other wheels chilled both on the rim and on the boss.

2832. APPARATUS FOR CONNECTING AND DISCONNECTING ELECTRICAL CIRCUITS AND LIMITING AND MEASURING CURRENTS PASSING THROUGH THEM, *H. H. Cunyinghame, O. E. Woodhouse, and F. L. Rawson, London.*—*7th June*, 1883. 8*d.*

To automatically break the circuit an electro-magnet placed in the circuit has its armature so mounted as to pass to either side of the magnet and be held in either position by a spring. When the strength of the electro-magnet overcomes the spring the armature is drawn from its contact and opens the circuit. To measure the current strength an electro-magnet has a loose iron core, and in front of this is poised an armature needle mounted on a torsion spring and carrying an index. Contact screws are made by cutting a longitudinal or oblique notch in a screw bolt; into this the wire is placed and a nut is screwed upon the bolt and wire.

2831. PNEUMATIC BREECH-LOADING GUNS, &c., *T. N. Palmer, London.*—*7th June*, 1883.—(*A communication from D. M. Mefford, Toledo, U.S.*) 6*d.*

This relates to guns for discharging shells or projectiles charged with dynamite or other powerful detonating powder, and to projectiles for use with the said guns.

2835. CARTRIDGES, *T. Nordenfelt, London.*—*7th June*, 1883. 6*d.*

This consists in fitting or bushing the base of a cartridge capsule or case with a priming tube fitting a recess on the base of the metal capsule or case, and capable, after firing, of being driven out or removed, together with the other primary parts, to prepare the capsule or case to be reloaded.

2836. PRODUCTION OF SUBSTITUTE FOR LITHOGRAPHIC STONES, *H. J. Haddan, London.*—*7th June*, 1883.—(*A communication from P. C. Möller, Leipzig.*) 2*d.*

Consists in producing on a metallic surface a calcareous deposit, by repeated moistening with a solution of bicarbonate of lime, and evaporating by heat.

2837. APPARATUS FOR FORMING STARCH OR YEAST INTO BLOCKS OR CAKES, *H. J. Haddan, London.*—*7th June*, 1883.—(*A communication from W. H. Uhland, Leipzig, and V. Machovsky, Prag.*) 6*d.*

This relates to apparatus for the manufacture of starch or yeast cakes or blocks by means of compressed air, comprising in its construction a fixed stand or underframe, carrying fixed or movable straining plates, an upper frame containing one or more fixed or movable moulds, and a hermetically closing lid.

2839. EXHAUSTING FOUL OR IMPURE AIR OR GASES, *T. Clayton, Ashton-on-Mersey.*—*7th June*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a system of an endless chain of revolving buckets passing through water.

2840. APPARATUS FOR SEPARATING AND SORTING GRAIN, SEED, &c., *J. H. Gatward, Hitchin.*—*7th June*, 1883. 6*d.*

This relates to the combination with a revolving cylinder of an adjustable trough, provided with a spiral creeper.

2842. REGENERATIVE FURNACES, *W. Spence, London.*—*7th June*, 1883.—(*A communication from G. Stumpf, Berlin.*) 6*d.*

This consists partly of a central receptacle or vessel, with a hearth at each end, on to which the material is fed, such hearths being separated from the central vessel by a bridge, over which the material has to pass in a molten state into the central vessel, the material under operation being acted upon by heated gases and a blast, in order to raise the temperature and increase the effect.

2843. MANUFACTURE OF COKE AND CONSTRUCTION OF COKE OVENS, &c., *H. Hutchinson, London.*—*7th June*, 1883. 8*d.*

The inventor claims, First, the construction of coke ovens by the system of flues, and the injecting of hot air through the coal during carbonisation, so as to effect a rapid coking with the production of tar of the benzine series and hard coke; Secondly, the novel construction of the gas mains designated the chemical zone, wherein he places pipes for the conveyance of cold air to be heated by the regenerative chambers, and pipes to convey steam to be superheated, as well as the use of air pipes to return the non-oxidising gases to stop the carbonisation when the coking is complete. Other improvements are claimed.

2844. MACHINERY FOR ROLLING TUBES, COLUMNS, SHAFTS, &c., *C. Kellogy, Buffalo, U.S.*—*7th June*, 1883. 6*d.*

This relates to the manufacture and use of a mandril for rolling and forming the inner surface of metal tubes, columns, shafts, and other hollow cylindrical work, consisting of a mandril rod having two chambers, in each of which is a pair of rolls, which pairs are arranged at right angles to each other.

2845. METALLIC CEMENT, *J. McConnell, Ballymena.*—*7th June*, 1883.—(*Not proceeded with.*) 2*d.*

This is composed of brimstone, black powdered antimony, and fine ground plumbago melted together.

2847. MANUFACTURE OF TUMBLERS, GOBLETS, WINE GLASSES, LAMP CHIMNEYS, &c., *J. T. H. Richardson, Hatton.*—*7th June*, 1883. 6*d.*

The object is to give to the edges of the articles a smooth and even rounded surface.

2849. MANUFACTURE OF ORNAMENTAL TABLETS FOR ADVERTISING PURPOSES, *J. Brand and H. Fermor, London.*—*7th June*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to produce imitation painted glass tablets.

2854. SECURING BAGS, POUCHES OR WRAPPERS, *E. Hawker, Lee.*—*7th June*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to a means for fastening by cords.

2859. APPARATUS FOR THE MANUFACTURE OF GLASS, *J. Reynolds, Gateshead.*—*8th June*, 1883. 6*d.*

This relates particularly to the construction of the tank.

2861. LOOMS FOR WEAVING, *M. Sowden, Bradford.*—*8th June*, 1883. 6*d.*

Relates to improvements in apparatus for operating the healds in looms, and for regulating the shuttle drop boxes at each end of the loom.

2863. VALVES AND TAPS, *A. H. Bateman, London.*—*8th June*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in valves and taps in which a conical, a disc, or other spindle valve is adapted to close or open at pleasure a passage through a diaphragm or partition in the body or case of the valve or tap.

2867. QUARTZ CRUSHER, &c., *H. Sutherland, London.*—*8th June*, 1883. 6*d.*

The crusher consists of two main parts, one a cast metal block with a cavity in it in form like a mortar, and the other another cast block like a pestle.

2870. APPARATUS FOR PLAYING PUZZLE OR EDUCATIONAL GAMES, *T. H. Ward, Tipton.*—*8th June*, 1883. 6*d.*

Consists of a number of pyramidal pieces, which are placed upon a tray, table, or holder, to be arranged in any desired order by tipping from one position to another.

2875. BABY JUMPERS, *A. M. Clark, London.*—*8th June*, 1883.—(*A communication from M. M. Raymond and D. Barton, Corry, U.S.*) 6*d.*

Relates to the general construction of a spring baby jumper.

2877. TIES OR BUCKLES FOR BINDING COTTON, HAY, WOOL, &c., *E. Ascherson, London.*—*9th June*, 1883.—(*A communication from W. M. Freeman, Meridian, U.S.*) 6*d.*

Relates to improvements in the form of buckle.

2879. CONSTRUCTION OF PROPELLERS, *J. Betteley, London.*—*9th June*, 1883. 6*d.*

The inventor claims making and employing half blades, whose surfaces are greater in length from point to point than in width from the boss to the top of the periphery of the diameter, the ends of said half blades projecting beyond the ends of the boss or bosses, and with the points in line, or nearly so, with the axial line of the shaft.

2883. STOPPERING BOTTLES FOR CONTAINING AERATED OR GASEOUS LIQUIDS, *R. J. Sankey, Ashford.*—*9th June*, 1883. 6*d.*

Relates to the construction of the india-rubber seating.

2897. HEELS OF BOOTS AND SHOES, *F. Cutlan, Leicester.*—*9th June*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the employment of a metallic plate.

2898. WATER-WASTE PREVENTERS, *S. and J. Chandler, London.*—*11th June*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the arrangement of valves.

2950. FASTENERS FOR ATTACHING BUTTONS, MEDALS, JEWELLERY, &c., TO CLOTHING, &c., *G. H. Jepson, London.*—*13th June*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the construction of a bar which passes through the shank of the article to be attached.

2967. STENCH TRAPS, *J. E. Manock, Heywood.*—*14th June*, 1883. 6*d.*

This relates to casting or forming the "box" in parts, so that the top or upper portion thereof carrying the "grid" may be separate or apart from the lower portion carrying the trap.

2968. SPANNERS, &c., *J. C. Bauer, London.*—*14th June*, 1883. 6*d.*

This relates to a spanner formed in two parts connected together linkwise, or by a link arrangement, in such a manner that the act of grasping the spanner in the hand closes and adjusts the jaws thereof against the screw nut or other article to be turned.

2985. GENERATING, PRODUCING, AND APPLYING CHEMICAL SOLUTIONS FOR EXTINGUISHING FIRES, &c., *A. F. Spawn, Oakland, U.S.*—*15th June*, 1883. 6*d.*

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

2993. GALVANIC ELEMENTS, *F. Wirth, Frankfort-on-the-Main.*—*15th June*, 1883.—(*A communication from C. Pabst, Stettin.*) 4*d.*

The electrolytic liquid preferred is the aqueous solution of ferric chloride or stannic chloride, the electrode suitable for which is made of tin or iron, the other electrode being of carbon.

2996. BLANK CARTRIDGE, *C. D. Abel, London.*—*16th June*, 1883.—(*A communication from W. Lorenz, Baden.*) 4*d.*

This relates to the construction of blank cartridges with projectiles having a deep recess at the rear end, and formed of a friable or easily breakable material.

3029. APPARATUS FOR COUPLING OR CONNECTING AND SUPPORTING OR HANGING SHAFTING, *A. G. Brookes, London.*—*19th June*, 1883.—(*A communication from R. Whitehill, New York.*) 6*d.*

One of the objects is the construction of an adjustable shaft hanger in which the box is so supported as to be able to oscillate both vertically and horizontally, in order that the box may readily adapt or allign itself to the shafting or its vibrations.

3125. MANUFACTURE OF SPADES AND SHOVELS, *J. Sidaway, Halesowen.*—*23rd June*, 1883. 8*d.*

Relates to means for making the blade, tang, and socket from one piece of iron and steel.

3136. LACING GLOVES AND BOOTS, *A. C. Mather, Chicago.*—*25th June*, 1883.—(*Patent dated 17th July*, 1883.) 6*d.*

Relates to a cord passing through eyelets and the employment of a slide.

3603. FIRE-ESCAPES, *G. S. Prindle, Washington.*—*23rd July*, 1883.—(*Patent dated 31st July*, 1883.)—(*A communication from G. H. Thompson, Plattsmouth, and S. O. Ryder, New York, U.S.*)—(*Complete.*) 6*d.*

Consists of a series of thimbles set into the wall of a building at a suitable distance apart, and provided with transverse bars, so that a permanent ladder will be formed thereby.

4337. APPARATUS FOR THE MANUFACTURE OF SULPHUROUS ACID, *C. A. Allison, London.*—*11th September*, 1883.—(*A communication from the National Chemical Machine and Manufacturing Company Incorporated, Newark, U.S.*)—(*Complete.*) 6*d.*

This relates to an improved construction for the condenser, and the furnace employed in such machines as are provided with a series of shelves, over which water flows in contact with the sulphurous acid fumes.

4346. SELF-LEVELLING BERTHS, *B. F. Merrill, Boston, U.S.*—*11th September*, 1883.—(*Complete.*) 8*d.*

This relates to a ship's berth, supported at each end upon co-acting rocks, the one attached to the berth, and the other to the bulkhead, in combination with a pendulum guided vertically upon a stud attached to the bulkhead, and oscillating upon the same about an axis parallel to the longitudinal axis of the berth and connected to the end of the berth by links, whereby the motion of the pendulum under the action of gravity is communicated to the berth, so that the berth shall assume a horizontal position when the pendulum is vertical.

4431. PRODUCING ICE FLOWER-LIKE FIGURES ON GLASS, *C. Pieper, Berlin.*—*17th September*, 1883.—(*A communication from Dunkel and Co., Aachen, Prussia.*)—(*Complete.*) 2*d.*

This relates to the method of producing irregular ornamental figures on glass by spreading out thereon a layer of a suitable glutinous substance adhering to the glass and adapted to become hard by desiccation, such as glue or gum arabic, by drying the same, at first slowly, and thereafter exposing it to a moderate heat.

4629. MANUFACTURE OF BUCKLES, *H. J. Haddan, London.*—*28th September*, 1883.—(*A communication from H. Kimball, Cleveland.*)—(*Complete.*) 6*d.*

This consists essentially in forming the sockets or ends of the turn buckles by means of dies in which the metal to be operated upon is entirely enclosed, and the forging of the metal is done by pressure of a die or plunger entering an aperture in the enclosing dies and acting longitudinally on the ends of the metal, so as to force it into the form of cavities made in the dies for the purpose.

4632. TRAPS FOR RABBITS, &c., *W. Burgess, Malvern Wells.*—*28th September*, 1883.—(*Complete.*) 4*d.*

This relates to a trap in which the arch or bow forming one gripping jaw is hinged so as to lay down out of the way when the trap is set, and be raised when it is released, and in which the operative spring is located to one side of, and not centrally in line with the mechanism of the trap.

4633. ANIMAL AND MAN TRAPS, *W. Burgess, Malvern Wells.*—*28th September*, 1883.—(*Complete.*) 4*d.*

A pair of curved shear-like gripping jaws are combined with a spring and setting and releasing devices, the latter actuated by the animal stepping on a platform.

4669. TELEPHONIC APPARATUS, *E. George, F. Pocock, J. S. Muir, and J. S. Muir, jun., London.*—*2nd October*, 1883. 6*d.*

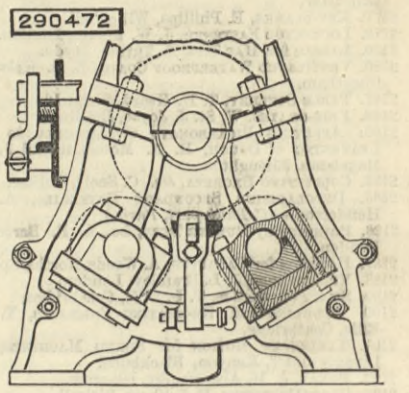
To overcome the retardation and induction relays with the necessary batteries are placed at suitable intervals along the line. Various forms of relay and methods of making the connections are described and illustrated.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

290,472. CANE MILL, *William S. Reeder, St. Louis, Mo.*—*Filed September 4th*, 1883.

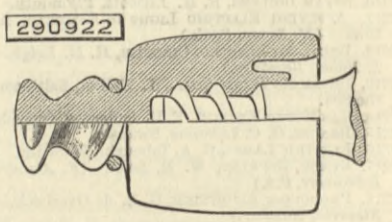
Claim.—(1) In a cane mill, the combination of two end pieces, lower rollers having bearings therein, upper roller having bearings thereon, a top piece forming the upper halves of the upper roller bearings, means to secure the top piece to the end pieces, and means to tie the end pieces together, as set forth. (2) In a cane mill, the combination of two end pieces, lower rollers mounted therein, upper roller mounted thereon, top pieces to secure the gudgeons on the upper roller and the end pieces together and having a vertical post, master gear wheel to turn on the post, and gear wheels connecting the roller with the maste wheel, as set forth. (3) The combination, with the lower rollers having gudgeons, of the end pieces having recesses, journal boxes having feathers to fit the recesses and removable by lowering them from the gudgeons, and plates to fit beneath the boxes to hold them against the gudgeons, as set forth. (4) The combination, with the lower rollers, of the end pieces in



which the rollers are journalled, arms pivotted to the end pieces, a scraper secured to the arms between the rollers, lugs on the end pieces, set screws working in the lugs through the lower ends of the arms, and springs between the heads of the set screws and arms to form cushions, as set forth.

290,922. INSULATOR FOR ELECTRICAL CONDUCTORS, *Frank L. Pope, Elmora, N.J.*—*Filed May 23rd*, 1883.

Claim.—(1) A supporting insulator for telegraphic line wires or other electrical conductors, having upon its exterior a conical or expanding screw thread, and provided with a socket having an interior spiral groove winding in the reverse direction to that of the exterior screw, substantially as and for the purpose set forth. (2) The combination, substantially as hereinbefore set forth, with a shackle or horseshoe formed with hooked ends, as described, for grasping a telegraphic line wire or other conductors, and



thereby forming a stirrup or ring, of a supporting insulator having a conical expanding screw thread or spiral groove formed upon its exterior surface and a reverse hollow screw formed upon its interior surface, whereby it may be secured to a supporting pin. (3) The combination, substantially as hereinbefore set forth, with a supporting pin having a screw thread formed upon one end thereof, of an insulator constructed with a corresponding screw groove formed within a socket for receiving said pin, and a conical expanding screw thread or spiral groove formed upon its exterior.

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