DIAGRAMS OF CONTINUOUS GIRDERS.

(*For description see page 478.*)

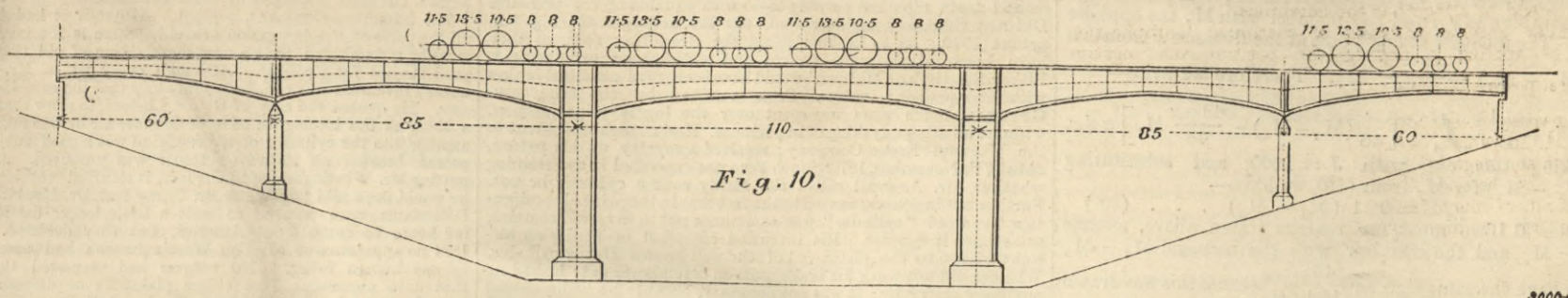


Fig. 10.

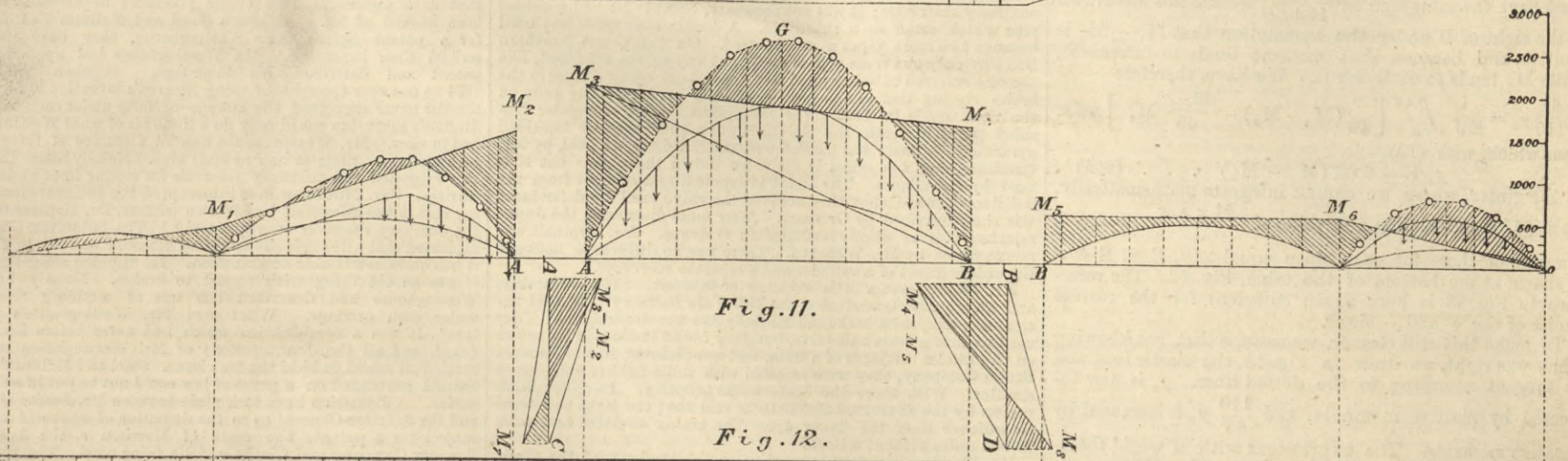


Fig. 11.

Fig. 12.

J	500	600	750	1000	1600	2600	2600	1600	1000	800	1000	1400	2000	3000	8750	3750	3000	2400	1900	1500	1250	1250	1500	1900	2400	3000	2750	2000	3750	3000	2000	1400	1000	800	1000	1600	2600	2600	1600	1000	750	600	500	J
Moments	60	160	210	210	160	60	170	455	700	980	1100	1100	880	540	150	270	840	1560	2050	2400	2530	2550	2380	2010	1490	790	250	50	170	300	400	450	430	370	240	100	230	600	760	730	560	220	Moments
Δx	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5	5	10	10	10	10	10	10	10	10	10	10	5	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	Δx
x	5	15	25	35	45	55	60	51	40	30	20	10	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155	165	175	185	195	205	215	225	235	245	255	265	275	285	295	305	x
$\frac{M x \Delta x}{J}$	0·00	0·52	0·88	0·88	0·28	0·21	0·32	0·44	0·50	0·62	0·40	0·21	0·1	0·25	0·11	0·14	0·33	0·88	0·42	0·47	0·43	0·40	0·27	0·16	0·08	0·03	0·01	0·11	0·25	0·1	0·32	0·44	0·50	0·62	0·40	0·21	0·1	0·25	0·11	0·14	0·33	0·88	0·42	$\frac{M x \Delta x}{J}$

Equations

$$\Sigma \frac{M x \Delta x}{J}$$

$$\frac{85}{60} Ey_1 = 0{\cdot}21\{170 + \tfrac{16}{17}M_1 + \tfrac{14}{17}M_1 + \tfrac{12}{17}M_1 + \tfrac{10}{17}M_1 + \tfrac{8}{17}M_1 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}44\{455 + \tfrac{15}{17}M_1 + \tfrac{13}{17}M_1 + \tfrac{11}{17}M_1 + \tfrac{9}{17}M_1 + \tfrac{7}{17}M_1 + \tfrac{5}{17}M_1 + \tfrac{3}{17}M_1 + \tfrac{1}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}62\{700 + \tfrac{12}{17}M_1 + \tfrac{10}{17}M_1 + \tfrac{8}{17}M_1 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}40\{1100 + \tfrac{8}{17}M_1 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}21\{1100 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}1\{880 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}25\{540 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}11\{150 + \tfrac{1}{34}M_2\}$$

$$\frac{85}{60} Ey_1 = 0{\cdot}21\{170 + \tfrac{16}{17}M_1 + \tfrac{14}{17}M_1 + \tfrac{12}{17}M_1 + \tfrac{10}{17}M_1 + \tfrac{8}{17}M_1 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}44\{455 + \tfrac{15}{17}M_1 + \tfrac{13}{17}M_1 + \tfrac{11}{17}M_1 + \tfrac{9}{17}M_1 + \tfrac{7}{17}M_1 + \tfrac{5}{17}M_1 + \tfrac{3}{17}M_1 + \tfrac{1}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}62\{700 + \tfrac{12}{17}M_1 + \tfrac{10}{17}M_1 + \tfrac{8}{17}M_1 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}40\{1100 + \tfrac{8}{17}M_1 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}21\{1100 + \tfrac{6}{17}M_1 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}1\{880 + \tfrac{4}{17}M_1 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}25\{540 + \tfrac{2}{17}M_1 + \tfrac{1}{34}M_2\}$$
$$+ 0{\cdot}11\{150 + \tfrac{1}{34}M_2\}$$

$$\frac{85}{60} Ey_1 = 0{\cdot}21\{170 + \tfrac{11}{12}M_1\}$$
$$+ 0{\cdot}44\{455 + \tfrac{9}{12}M_1\}$$
$$+ 0{\cdot}62\{700 + \tfrac{7}{12}M_1\}$$
$$+ 0{\cdot}40\{1100 + \tfrac{5}{12}M_1\}$$
$$+ 0{\cdot}21\{1100 + \tfrac{3}{12}M_1\}$$
$$+ 0{\cdot}1\{880 + \tfrac{2}{12}M_1\}$$
$$+ 0{\cdot}25\{540 + \tfrac{1}{12}M_1\}$$
$$+ 0{\cdot}11\{150 + \tfrac{1}{24}M_2\}$$

$$\frac{85}{60} Ey_1 = -2{\cdot}028 + 0{\cdot}985M_1 + 0{\cdot}89M_2$$

$$Ey_1 = -0{\cdot}246 + 0{\cdot}815\,M_1$$

$$\frac{85}{110} Ey_2 = 0{\cdot}14\{270 + \tfrac{15}{17}M_2 + \tfrac{13}{17}M_2\}$$
$$+ 0{\cdot}33\{840 + \tfrac{11}{17}M_2 + \tfrac{9}{17}M_2 + \tfrac{7}{17}M_2\}$$
$$+ 0{\cdot}88\{1560 + \tfrac{5}{17}M_2 + \tfrac{3}{17}M_2 + \tfrac{1}{17}M_2\}$$
$$+ 0{\cdot}42\{2050 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2\}$$
$$+ 0{\cdot}47\{2400 + \tfrac{5}{11}M_2 + \tfrac{3}{11}M_2 + \tfrac{1}{11}M_2\}$$
$$+ 0{\cdot}43\{2530 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}40\{2550 + \tfrac{7}{11}M_2 + \tfrac{5}{11}M_2 + \tfrac{3}{11}M_2\}$$
$$+ 0{\cdot}27\{2380 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}16\{2010 + \tfrac{9}{11}M_2 + \tfrac{7}{11}M_2 + \tfrac{5}{11}M_2 + \tfrac{3}{11}M_2\}$$
$$+ 0{\cdot}08\{1490 + \tfrac{10}{11}M_2 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}03\{790 + \tfrac{10}{11}M_2 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}01\{250 + \tfrac{10}{11}M_2 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$

$$\frac{85}{110} Ey_2 = 0{\cdot}14\{270 + \tfrac{13}{17}M_2 + \tfrac{11}{17}M_2\}$$
$$+ 0{\cdot}33\{840 + \tfrac{9}{17}M_2 + \tfrac{7}{17}M_2 + \tfrac{5}{17}M_2\}$$
$$+ 0{\cdot}88\{1560 + \tfrac{3}{17}M_2 + \tfrac{1}{17}M_2\}$$
$$+ 0{\cdot}42\{2050 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2\}$$
$$+ 0{\cdot}47\{2400 + \tfrac{3}{11}M_2 + \tfrac{1}{11}M_2\}$$
$$+ 0{\cdot}43\{2530 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}40\{2550 + \tfrac{5}{11}M_2 + \tfrac{3}{11}M_2\}$$
$$+ 0{\cdot}27\{2380 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}16\{2010 + \tfrac{7}{11}M_2 + \tfrac{5}{11}M_2 + \tfrac{3}{11}M_2\}$$
$$+ 0{\cdot}08\{1490 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}03\{790 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$
$$+ 0{\cdot}01\{250 + \tfrac{8}{11}M_2 + \tfrac{6}{11}M_2 + \tfrac{4}{11}M_2 + \tfrac{2}{11}M_2\}$$

$$\frac{85}{110} Ey_2 = -0{\cdot}1829 + 0{\cdot}985M_1 + 1{\cdot}89M_2$$

$$Ey_2 = -0{\cdot}1\{60 + \tfrac{M_1}{34} + \tfrac{8}{17}M_2\}$$
$$+ 0{\cdot}25\{540 + \tfrac{2}{17}M_1 + \tfrac{15}{17}M_2\}$$
$$+ 0{\cdot}82\{980 + \tfrac{13}{17}M_1 + \tfrac{13}{17}M_2\}$$
$$+ 0{\cdot}89\{1100 + \tfrac{11}{17}M_1 + \tfrac{11}{17}M_2\}$$
$$+ 0{\cdot}45\{1100 + \tfrac{9}{17}M_1 + \tfrac{9}{17}M_2\}$$
$$+ 0{\cdot}44\{880 + \tfrac{7}{17}M_1 + \tfrac{7}{17}M_2\}$$
$$+ 0{\cdot}25\{600 + \tfrac{12}{17}M_1 + \tfrac{5}{17}M_2\}$$
$$+ 0{\cdot}09\{455 + \tfrac{14}{17}M_1 + \tfrac{3}{17}M_2\}$$
$$+ 0{\cdot}02\{270 + \tfrac{16}{17}M_1 + \tfrac{1}{17}M_2\}$$

$$Ey_2 = -0{\cdot}1\{60 + \tfrac{11}{12}M_1\}$$
$$+ 0{\cdot}28\{160 + \tfrac{9}{12}M_1\}$$
$$+ 0{\cdot}35\{270 + \tfrac{7}{12}M_1\}$$
$$+ 0{\cdot}28\{210 + \tfrac{5}{12}M_1\}$$
$$+ 0{\cdot}25\{160 + \tfrac{3}{12}M_1\}$$
$$+ 0{\cdot}10\{60 + \tfrac{1}{12}M_1\}$$

$$\frac{85}{60} Ey_3 = 0{\cdot}11\{50 + \tfrac{3}{34}M_2 + \tfrac{M_3}{6}\}$$
$$+ 0{\cdot}25\{470 + \tfrac{2}{17}M_2 + \tfrac{2}{17}M_3\}$$
$$+ 0{\cdot}33\{800 + \tfrac{1}{17}M_2 + \tfrac{3}{17}M_3\}$$
$$+ 0{\cdot}39\{1400 + \tfrac{11}{17}M_3\}$$
$$+ 0{\cdot}45\{1450 + \tfrac{9}{17}M_3 + \tfrac{M_4}{6}\}$$
$$+ 0{\cdot}44\{1430 + \tfrac{7}{17}M_3 + \tfrac{2}{17}M_4\}$$
$$+ 0{\cdot}25\{870 + \tfrac{5}{17}M_3 + \tfrac{12}{17}M_4\}$$
$$+ 0{\cdot}09\{240 + \tfrac{3}{17}M_3 + \tfrac{14}{17}M_4\}$$
$$+ 0{\cdot}02\{100 + \tfrac{1}{17}M_3 + \tfrac{16}{17}M_4\}$$

$$\frac{85}{110} Ey_3 = 0{\cdot}11\{50 + \tfrac{3}{34}M_2 + \tfrac{M_3}{6}\}$$
$$+ 0{\cdot}25\{470 + \tfrac{2}{17}M_2 + \tfrac{2}{17}M_3\}$$
$$+ 0{\cdot}33\{800 + \tfrac{1}{17}M_2 + \tfrac{3}{17}M_3\}$$
$$+ 0{\cdot}39\{1400 + \tfrac{11}{17}M_3\}$$
$$+ 0{\cdot}45\{1450 + \tfrac{9}{17}M_3 + \tfrac{M_4}{6}\}$$
$$+ 0{\cdot}44\{1430 + \tfrac{7}{17}M_3 + \tfrac{2}{17}M_4\}$$
$$+ 0{\cdot}25\{870 + \tfrac{5}{17}M_3 + \tfrac{12}{17}M_4\}$$
$$+ 0{\cdot}09\{240 + \tfrac{3}{17}M_3 + \tfrac{14}{17}M_4\}$$
$$+ 0{\cdot}02\{100 + \tfrac{1}{17}M_3 + \tfrac{16}{17}M_4\}$$

$$\frac{85}{110} Ey_3 = 0{\cdot}18\{50 + \tfrac{11}{12}M_3 + \tfrac{M_4}{6}\}$$
$$+ 0{\cdot}28\{600 + \tfrac{9}{12}M_3 + \tfrac{M_4}{6}\}$$
$$+ 0{\cdot}35\{780 + \tfrac{7}{12}M_3 + \tfrac{M_4}{6}\}$$
$$+ 0{\cdot}33\{730 + \tfrac{5}{12}M_3 + \tfrac{M_4}{6}\}$$
$$+ 0{\cdot}25\{560 + \tfrac{3}{12}M_3 + \tfrac{M_4}{6}\}$$
$$+ 0{\cdot}10\{220 + \tfrac{1}{12}M_3 + \tfrac{M_4}{6}\}$$

$$\frac{85}{110} Ey_3 = -0{\cdot}385 - 0{\cdot}185M_3 + 0{\cdot}89M_4$$

$$Ey_3 = -0{\cdot}1\{60 + \tfrac{M_2}{34} + \tfrac{8}{17}M_3\}$$
$$+ 0{\cdot}25\{540 + \tfrac{2}{17}M_2 + \tfrac{15}{17}M_3\}$$
$$+ 0{\cdot}82\{980 + \tfrac{13}{17}M_2 + \tfrac{13}{17}M_3\}$$
$$+ 0{\cdot}89\{1100 + \tfrac{11}{17}M_2 + \tfrac{11}{17}M_3\}$$
$$+ 0{\cdot}45\{1100 + \tfrac{9}{17}M_2 + \tfrac{9}{17}M_3\}$$
$$+ 0{\cdot}44\{880 + \tfrac{7}{17}M_2 + \tfrac{7}{17}M_3\}$$
$$+ 0{\cdot}25\{600 + \tfrac{12}{17}M_2 + \tfrac{5}{17}M_3\}$$
$$+ 0{\cdot}09\{455 + \tfrac{14}{17}M_2 + \tfrac{3}{17}M_3\}$$
$$+ 0{\cdot}02\{270 + \tfrac{16}{17}M_2 + \tfrac{1}{17}M_3\}$$

$$Ey_3 = -0{\cdot}1\{60 + \tfrac{11}{12}M_2\}$$
$$+ 0{\cdot}28\{160 + \tfrac{9}{12}M_2\}$$
$$+ 0{\cdot}35\{270 + \tfrac{7}{12}M_2\}$$
$$+ 0{\cdot}28\{210 + \tfrac{5}{12}M_2\}$$
$$+ 0{\cdot}25\{160 + \tfrac{3}{12}M_2\}$$
$$+ 0{\cdot}10\{60 + \tfrac{1}{12}M_2\}$$

$$\frac{85}{60} Ey_4 = 0{\cdot}81\{100 + \tfrac{M_5}{17}\}$$
$$+ 0{\cdot}44\{240 + \tfrac{8}{17}M_5 + \tfrac{M_6}{17}\}$$
$$+ 0{\cdot}60\{370 + \tfrac{5}{17}M_5 + \tfrac{2}{17}M_6\}$$
$$+ 0{\cdot}62\{480 + \tfrac{2}{17}M_5 + \tfrac{3}{17}M_6\}$$
$$+ 0{\cdot}40\{460 + \tfrac{M_5}{17} + \tfrac{4}{17}M_6\}$$
$$+ 0{\cdot}21\{400 + \tfrac{1}{17}M_5 + \tfrac{5}{17}M_6\}$$
$$+ 0{\cdot}1\{300 + \tfrac{6}{17}M_5 + \tfrac{6}{17}M_6\}$$
$$+ 0{\cdot}25\{150 + \tfrac{4}{17}M_5 + \tfrac{7}{17}M_6\}$$
$$+ 0{\cdot}08\{50 + \tfrac{3}{17}M_5 + \tfrac{8}{17}M_6\}$$

$$\frac{85}{110} Ey_4 = 924 + 981M_5 + 1{\cdot}98M_6$$

$$Ey_4 = 0{\cdot}81\{100 + \tfrac{M_5}{17}\}$$
$$+ 0{\cdot}44\{240 + \tfrac{8}{17}M_5 + \tfrac{M_6}{17}\}$$
$$+ 0{\cdot}60\{370 + \tfrac{5}{17}M_5 + \tfrac{2}{17}M_6\}$$
$$+ 0{\cdot}62\{480 + \tfrac{2}{17}M_5 + \tfrac{3}{17}M_6\}$$
$$+ 0{\cdot}40\{460 + \tfrac{M_5}{17} + \tfrac{4}{17}M_6\}$$
$$+ 0{\cdot}21\{400 + \tfrac{1}{17}M_5 + \tfrac{5}{17}M_6\}$$
$$+ 0{\cdot}1\{300 + \tfrac{6}{17}M_5 + \tfrac{6}{17}M_6\}$$
$$+ 0{\cdot}25\{150 + \tfrac{4}{17}M_5 + \tfrac{7}{17}M_6\}$$
$$+ 0{\cdot}08\{50 + \tfrac{3}{17}M_5 + \tfrac{8}{17}M_6\}$$

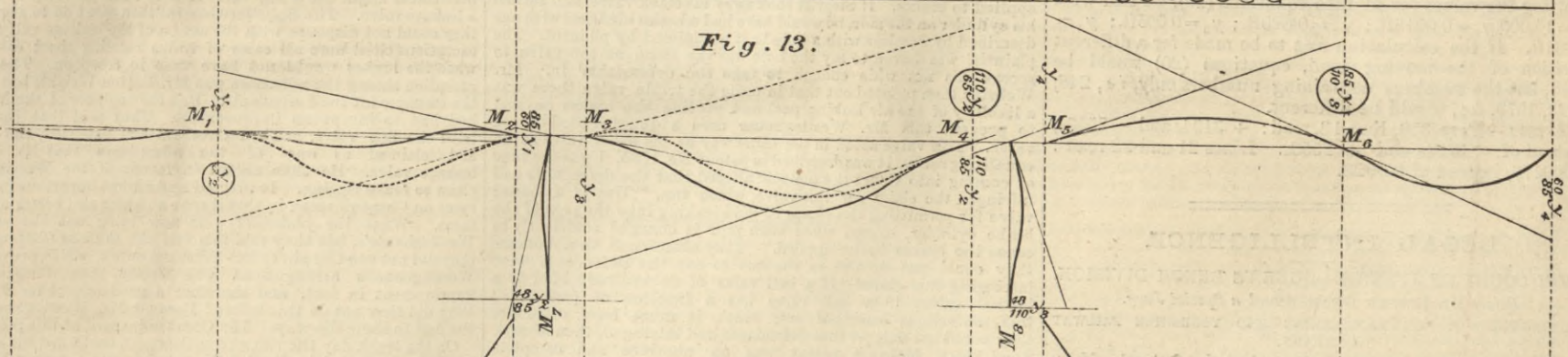


Fig. 13.

Fig. 14.

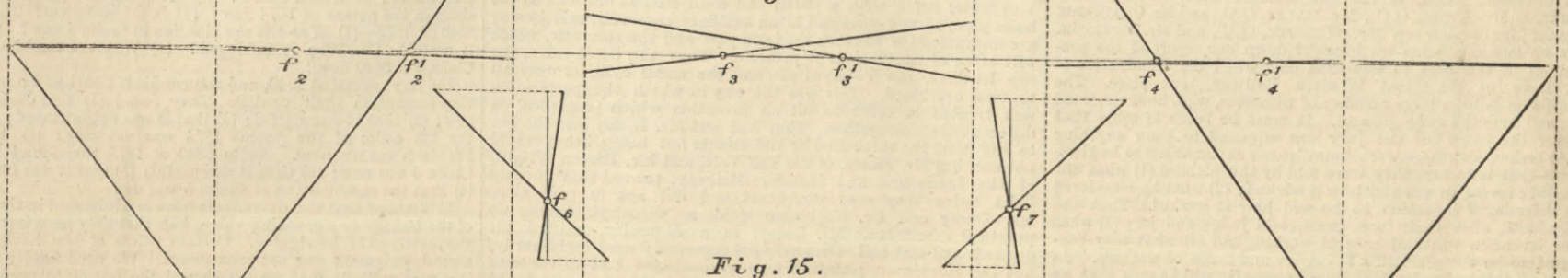
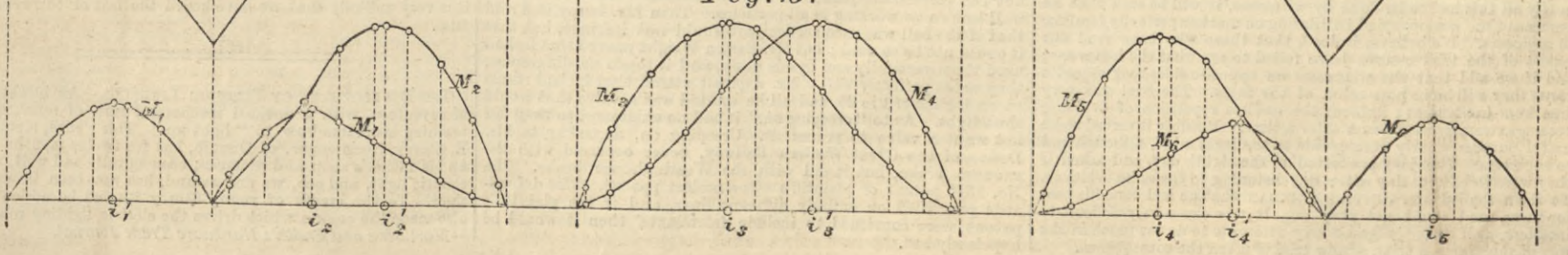


Fig. 15.



projects from A; M_3 was assumed $> M_2$, in Fig. 11, and in accordance therewith the piece cut off by the tangent at A lies to the left of C in Fig. 13. A positive $M_3 - M_2$ therefore tends to increase this piece, while a positive M_7, which acts in the opposite sense, tends to diminish it. In the following equation, therefore, the member with $M_3 - M_2$ must have the same sign as y_2, and the member with M_7 the opposite sign. The moment at any point at the distance x from C is $\frac{x}{48}(M_3 - M_2) - \frac{48 - x}{48} M_7$. Therefore we write—

$$+\frac{48}{85} y_2 = \frac{1}{E J} \int_0^{48} \left[\frac{x}{48}(M_3 - M_2) - \frac{48-x}{48} M_7 \right] x\,dx.$$

Working this out with J = 2000, and substituting $\frac{1}{2}(M_3 - M_2)$ for M_7 from (19), we have—

$$y_2 E = 0{\cdot}51\ (M_3 - M_2) \quad . \quad . \quad . \quad (20e)$$

In pier B D we must, for reasons stated above, assume $M_4 > M_5$, and the member with the moment $M_4 - M_5$ must have the same sign as $\frac{48}{110} y_3$, because this was drawn to the right of D under the assumption that $M_4 - M_5$ is positive, and because that moment tends to increase it, while M_8 tends to diminish it. We have, therefore—

$$+\frac{48}{110} y_3 = \frac{1}{E J} \int_0^{48} \left[\frac{x}{48}(M_4 - M_5) - \frac{48-x}{48} M_8 \right] x\,dx.$$

from which, with (19)—

$$y_3 E = 0{\cdot}66\ (M_4 - M_5) \quad . \quad . \quad . \quad (20h)$$

In the girder, where we cannot integrate mathematically, we state for each lamina the value of $\frac{M x \triangle x}{J}$, and put the sum of those for each span equal to y_1 E, y_2 E, &c., as shown at the bottom of the table, Fig. 12. The reference to Fig. 13 is here again sufficient for the correct choice of the + and − signs.

To make this still clearer, we assume that, not knowing what was right, we draw in Fig. 13 the elastic line, and its tangent according to the dotted lines. y_2 is now increased by positive moments, and $\frac{110}{85} y_2$ is increased by negative moments. The expressions with M would therefore now appear with their signs reversed, and the result would be that y_2 and $\frac{110}{85} y_2$ have now signs contrary to those they had before; if the − sign, the assumption was wrong; if the + sign, it was right.

The equations already stated in the table are as follows:—

$$\left.\begin{array}{rll}
y_1 E = & -246 + 0{\cdot}815\ M_1 \ldots\ \ldots\ \ldots\ \ldots & a \\
\frac{85}{60} y_1 E = & +2023 - 1{\cdot}732\ M_1 - 0{\cdot}981\ M_2 \quad \ldots & b \\
y_2 E = & -1979 + 0{\cdot}985\ M_1 + 1{\cdot}334\ M_2 \quad \ldots & c \\
\frac{110}{85} y_2 E = & +6239 - 1{\cdot}955\ M_3 - 1{\cdot}208\ M_4 \quad \ldots & d \\
y_2 E = & 0{\cdot}51\ (M_3 - M_2) \ \ldots\ \ldots\ \ldots\ \ldots & e \\
y_3 E = & +6187 - 1{\cdot}208\ M_3 - 1{\cdot}955\ M_4 \quad \ldots & f \\
\frac{85}{110} y_3 E = & -808 + 1{\cdot}334\ M_3 + 0{\cdot}985\ M_6 \quad \ldots & g \\
y_3 E = & 0{\cdot}66\ (M_4 - M_5) \ \ldots\ \ldots\ \ldots\ \ldots & h \\
y_4 E = & -924 + 0{\cdot}981\ M_3 + 1{\cdot}732\ M_6 \quad \ldots & i \\
\frac{60}{85} y_4 E = & +885 - 0{\cdot}815\ M_6 \ldots\ \ldots\ \ldots\ \ldots & k
\end{array}\right\} \ldots (20)$$

Eliminating y_1, y_2, y_3, and y_4, we obtain six equations containing the six M, and from these the following results:—

$$M_1 = 325;\ M_2 = 1461;\ M_3 = 2028;\ M_4 = 1573;$$
$$M_5 = 569;\ M_6 = 562;$$

and with equations (19) $M_7 = 283$; $M_8 = 502$.

These values have been plotted in Fig. 11, and all the moments are now determined by drawing the closing lines. Putting the values for M into equations (20), we find with E = 10,000 $y_1 = 0{\cdot}0018$ft.; $y_2 = 0{\cdot}029$ft.; $y_3 = 0{\cdot}065$ft.; $y_4 = 0{\cdot}061$ft. If the calculation has to be made for a different position of the moving load, equations (20) would be used, but the members containing numbers only, *i.e.*, 246, 2023, 1979, &c., would be different.

Errata.—Page 356, line 18, read: + 3194*e* and − 2553*e*, instead of − 3194*e* and + 2553*e*. Lines 21 and 22 read: 0·000176, instead of 0·0023.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Before Mr. Justice Denman *and a Special Jury.*

WESTINGHOUSE *v.* THE LANCASHIRE AND YORKSHIRE RAILWAY COMPANY.

This great case has reached the end of the first act. Many days have been spent in the examination of witnesses and the speeches of counsel, and upwards of forty models have been put in and discussed. Counsel for the plaintiff were the Solicitor-General, Mr. Aston, Q.C., Mr. Davey, Q.C., and Mr. Chadwyck Healey; for the defence, Mr. Webster, Q.C., and Mr. Moulton.

In our last impression we brought down our report of the proceedings in this case to the fifth day, when the examination of Mr. Dean, of the Great Western Railway, took place. The defendants called a large number of witnesses, who, however, went over and over the same ground. It must be borne in mind that neither the judge nor the jury was supposed to know anything about brakes, and there were four distinct explanations to be given them—that is to say, they were told by the plaintiff (1) what the plaintiff's invention was and how it worked; (2) what he considered the defendants' invention to be and how it worked. Then the defendants, when their turn came, told judge and jury (3) what their invention was and how it worked, and (4) what they considered to be the plaintiff's invention and mode of working. As nearly all this had to be done by witnesses, it will be seen that an immense time was occupied in dilating on matters perfectly familiar to engineers. We believe, indeed, that those who have read our report of the trial cannot have failed to see what the issues are; and if we add that the witnesses on opposite sides took opposite views they will be in possession of the facts. The trial was very free from excitement; indeed, the endless repetition of evidence became extremely wearisome after a time. Possibly it served some useful purpose clearly perceptible to the legal mind, although not to engineers. The jury protested on the eighth day, and asked if they were to be kept day after day listening to the same evidence. To them replied Mr. Justice Denman that he had done his best for them, and could not stop it. It was excessively difficult to interfere, as if either judge or jury attempts to do too much in the way of shortening a trial, a new trial is often the consequence.

We reproduce the substance of Mr. Aspinall's evidence, as he is the inventor of a portion of the defendants' brake. He is locomotive-superintendent of the Great Southern and Western Railway of Ireland, where he uses the apparatus in question, but with two train pipes instead of one. Instead of a ball valve he uses a flap valve, lying at an angle of 45 deg., so that it always remains closed by gravity. Has had no difficulty whatever from the brakes creeping on. The second train pipe has nothing to do with equalising the pressure. Did not think any engineer would use the arrangement Fig. 3 in patent 1540. As to brake rigging, the straddling rods, as they have been called, made an old and well-known arrangement. Either Siegrist's or McInnes' would have been good practical brakes without equalising valves. Cross-examined by the Solicitor-General, much time was spent over the toggle joint question, without eliciting anything of importance. Had not sold his patent to the Vacuum Brake Company; received a royalty on his patent, dated 7th November, 1878. Much time was expended in ascertaining whether Mr. Aspinall called the Hardy sack a cylinder or not. Further confusion was caused by the fact that in the printed specification the word "cylinder" was sometimes put in inverted commas, sometimes it was not. His invention consisted in fitting an air-tight sleeve to the piston-rod of the well-known Hardy cylinder. Witness did not work his brake quite as defendants did; he had no auxiliary reservoirs; it was not necessary, because he had a second pipe which acted as a substitute. A double-beat valve was used because two train pipes were employed. On the Great Northern Railway only one train pipe is used; but flap valves are fitted, like the one referred to before; had seen brackets to carry a lever in the brake rigging tied to the bottom of vans by straddling rods on the vans made in 1863. The arrangement was a triangular lop-sided pyramid, while the plaintiff's was a quadrangular lop-sided pyramid. Witness was handed a patent No. 4583, of 1880, by Mr. Gresham, and was asked if the valve shown there was not that used by defendants. The Judge interposed, and elicited from the Solicitor-General that they believed the valve used by defendants was that described by Gresham. After some discussion the Judge rejected this as wholly inadmissible evidence. Mr. Aspinall was re-examined by Mr. Webster. There was no difference between the enlargement of a cylinder and a separate reservoir.

Mr. Fisher gave a little evidence of interest. He is carriage and wagon superintendent of the Taff Vale Railway. In 1881 the company adopted a brake substantially like the defendants. They used at first a brass ball valve, but they found it slow in its action on the hinder carriages of a train, and complaining to the Vacuum Brake Company, they were supplied with india-rubber balls much smaller. With these the brake works properly. In cross-examination by the Solicitor-Genebal he said that the light ball went on quicker than the heavy one. The trains so fitted had made 70,000 miles without a hitch.

Mr. Shotton, assistant locomotive superintendent of the Great Northern Railway, said that they had a complete train of twelve coaches and an engine fitted with the brake. They used a flap valve. The ejector on the engine kept it off its seat. If the ejector ceased to suck it closed at once, and the brakes went on. They had used a separate reservoir, and also a "cylinder" with an enlarged top, which worked very well indeed.

We believe that we have now given all the evidence worth reproducing.

On the ninth day, Mr. Webster, Q.C., began his reply for the defendants. He began by explaining the law concerning combination patents. If a man patents a combination of old parts, his claim is confined to the combination of old parts, unless he tells the public: "I claim parts A, B, and C put together, all of which are old, and to that combination, and, in addition, I claim parts A and B, because I believe that combination to be new." If a patentee simply says to the public, I claim the combination of A, B, and C, all of which are old, in order to infringe you must take all the parts, and you do not infringe unless you take those three parts. The question was did Mr. Westinghouse claim that which he was entitled to in the years 1873 and 1874. Counsel then turned to Siegrist's patent of 1863. Nobody had attempted to say that the drawing which they had put in was not a correct representation of what Siegrist described. He pointed out that if Siegrist's cylinder—see page 466—was put on its side, then the flap valve in the piston would act as an equalising valve, for it would not shut until a strong current of air came in. Siegrist's, without any alteration save turning it on its side, would fulfil all the conditions which counsel's learned friends, the Solicitor-General and Mr. Aston, contended for. Furthermore, supposing Siegrist had been minded to put a small hole instead of a valve—an arrangement well known in 1873 and 1874—the operation of the brake would be identical with that claimed by the plaintiff. Bolitho in 1872 worked a brake with compressed air, with a piston having a differential area on the two sides. He then went on to consider Sanders' patent—see page 466. Sanders, it is true, only gave a drawing of the application of his piston to a whistle, but he explained that the same action might be applied to brakes. If Siegrist took away his clack valve, and turned his cylinder on the side, he would have had a brake identical with one described by Sanders with a hole in it as claimed by plaintiff. The plaintiff was driven to say the hole was the same as the valve to spread his net wide enough to take the defendants' in. Mr. Webster then pointed out that in using the triple valve there was a liability of the air leaking past and putting the brakes on, and to prevent this Mr. Westinghouse used a double-ended check valve. This valve acted in the same way as his other valve as an equalising valve. It was described in patent No. 1735. Up to the time of coming into Court the plaintiff alleged that the defendants had infringed the claim for this valve, which ran, "Use of a loaded valve for permitting the escape of fluid leaking into the pipe of the brake cylinder, except when such pipe is charged sufficiently to cause the brakes to be applied." They abandoned this, because they could put no one in the box to say the defendants were infringing this claim. If a ball valve of an ordinary kind is a loaded valve, if a ball valve has a function of performing this marvellous beneficial act, which it must have, otherwise they could not suggest that defendants had infringed, then Messrs. Steel and McInnes patent was an absolute and complete anticipation of the plaintiff's. Counsel then traced the similarity between the two brakes at great length. Mr. Imray had stated that the essential features of the plaintiff's invention were a cylinder fitted with a piston and connected at one end to the train pipe, at the other end to an auxiliary reservoir, and having a communication between the train pipe and the reservoir, which will allow of fluctuations of pressure. Thus the triple valve, the cup leathers, the V-shaped rib, and the small cylinder were all thrown overboard. This was the way in which the specification was treated in order to hit an invention which proceeded on different lines altogether. They had put Mr. Imray into the box to say that the valve used by defendants not being heavy would not act, but Mr. Fisher, of the Taff Vale, and Mr. Barton Wright, of the Lancashire and Yorkshire Railway, proved that the only light valve they used would act and did act to perfection. Mr. Imray and Dr. Hopkinson spoke as theorists, having no practical experience. Mr. Imray, in a difficulty, shifted his ground, and said ball valves were not commonly used horizontally; but Dr. Hopkinson, plaintiff's own witness, said ball valves were well known as working in all positions. Then Mr. Imray had said that if the ball was used vertically it would not infringe, but that it could not be so used; but Mr. Barton Wright proved that he had used them vertically and upside down, and it made no difference; they acted perfectly well. Mr. Aspinall stated that he had run it on an incline of 1 in 45, and all he wanted was a valve that would shut tight. As to "creeping on," it had no existence, so they did not want a valve to prevent it. Creeping on, according to Mr. Dean, of the Great Western Railway, never occurred with the vacuum brake, but it did with the Westinghouse brake. The No. 1540 patent of plaintiff's was a useless patent. The defendants proceeded on entirely different lines, and if the plaintiff's patent were construed to include defendants' then it would be hopelessly bad.

Mr. Webster next proceeded to consider the question of brake rigging. He reviewed the evidence at great length. We do not think it necessary to follow counsel here, because our readers are already in possession of the diagrams and drawings of the rigging made by the plaintiff and by Chapin. He concluded, after an able speech of two hours, by asking the jury to say that properly construed and giving the plaintiff the full benefit of his rights, neither of the two patents had been infringed by the defendants.

The Solicitor-General replied. Although it had been said all the parts of the invention are old, where is the invention? it must be remembered that a new combination of old things was a good subject for a patent. Although every part of Mr. Westinghouse's invention was old, he would show that the combination was new. He quoted the case of Otto *v.* Linford, to show that so small a thing as the letting in of a little more air by one man than by another into the cylinder of a gas engine was a good subject for a patent, because an improved result was produced. As to not putting Mr. Westinghouse in the box, it signified nothing, because he would have said just what Mr. Imray and Dr. Hopkinson said. Defendants were wanted to wait a little longer for Mr. Westing house to come from America, but they declined. Before 1874 no apparatus at all like Westinghouse's had been worked by any human being. No witness had suggested that before that date apparatus like either plaintiff's or defendants' had been worked at all. Although Steel and McInnes had applied for a patent before Mr. Westinghouse, they have not described their invention. Mr. Westinghouse had applied for a patent and described his invention. Between 1863 and 1874 no one ever thought of using Siegrist's invention in any way. Siegrist never suggested the storage of force under each carriage. Siegrist's invention could only do a little bit of what Westinghouse had in view. Mr. Westinghouse wanted a storage of force under each carriage. Siegrist had no such idea. Nobody before 1874 had ever suggested the auxiliary reservoir for storing force under each carriage. [Mr. Moulton here interrupted the Solicitor-General to say that it was admitted by his own witness, Dr. Hopkinson, that the auxiliary reservoir was quite old.] The Solicitor-General explained that although the auxiliary reservoir was old, in a sense, it was quite new in this combination. He disputed altogether that it was an old thing with regard to brakes. Nobody but Mr. Westinghouse had described the use of auxiliary reservoirs under each carriage. What was Mr. Westinghouse's invention? It was a combination which had never before been produced, and all the denunciations of Mr. Westinghouse were so much dust raised to hide the true issue. Steel and McInnes' brake, counsel contended on a point of law could not be put in as anticipation. A discussion here took place between Mr. Justice Denman and the Solicitor-General as to the definition of what was a proper subject for a patent, the cases of Harrison *v.* the Andersten Foundry Company and Clarke *v.* Adie being cited. The pith and marrow of the plaintiff's invention was patentable, contended Mr. Webster, and this was the working of the apparatus by means of the auxiliary reservoir in communication with the brake cylinder, and with an equalising apparatus so that the brakes should not be put on when they were not wanted. He then pointed out that it was nothing to the purpose to say that Westinghouse had never used the patent which he alleged was infringed. If the patent was good it did not signify whether it was used or not. It was not used only because Mr. Westinghouse had invented a better thing. The leakage valve in connection with the triple valve referred to by Mr. Webster was quite different from the leakage valve in other patents, it acted in an entirely different way. He then went on to consider what it was the defendants did. They had the equivalent of a cylinder and piston and a pipe communicating with the auxiliary reservoir. They had the train pipe; all these they had, same as the plaintiff. They had in this pipe, through which they exhausted the air, a branch communication, which he said was similar. They had a valve as the plaintiff had. Now, what kind of valve was that? Was it a valve so arranged that it would serve the equalising purpose which the plaintiff's valve served, because, if so, they inevitably had his combination. Their own witnesses admitted that it was a ball, resting normally away from its seat; that being so light currents would pass round it, no matter for what purpose defendants used it. That was the way it acted. If it was so arranged that, besides serving other purposes, it served that one, that did not the less make it an infringement. He cited the case of Cannington *v.* Nuttall to prove this. The defence was that this was not a loaded valve. This looked like quibbling. All that was meant by the witnesses was that the valve kept off its seat by its own weight till brought up by a strong current of air. A valve, no matter what size, say, a pin's head, if it had a load on it, was a loaded valve. To say this was a ball valve and not a loaded valve was a mere play upon words. As for Steel and McInnes, it was all very well to say that it was the same thing if turned on the side. Steel and McInnes did not turn it on the side, and no one else did. They said it was not to be done. But the defendants might use a flap valve if they liked provided it was not a leakage valve. The Solicitor-General then went on to argue that they could not dispense with the action of the leakage valve. The exceptions cited were all cases of trains running short distances, when the brakes would not have time to creep on. The single exception among the witnesses was Mr. Barton Wright, but he was the manager for the defendants. But the engineer of the Midland had had to invent an improvement. They said that they had tried the flap valve. Then Gresham had patented the valve, and claimed as one of the advantages that it was a leakage valve. He then argued in favour of the Westinghouse claim to brake rigging. It effected a small but important improvement on Chapin's ideas in that it gave a lighter and better arrangement. What the plaintiffs were now using was the same as Westinghouse's, but they said this was the same as Chapin's; but they did not use Chapin's, but Westinghouse's, which proved that Westinghouse's arrangement was better than Chapin's; an improvement in fact, and therefore a good subject for a patent. Why did they not do this before? Because Mr. Westinghouse was the first to show the way. The Court adjourned at this point.

On the tenth day the Solicitor-General continued his address, which he concluded in about half-an-hour. Mr. Justice Denman then summed up, and put the following questions to the jury:—As to patent No. 1540. (1) Is the plaintiff's invention as regards the combination of Claim 2 new? (2) Is it useful? (3) Is the fourth claim in the patent of 1874 new? (4) Is the fifth ditto? Then as to 3840 of 1873—(1) Was the combination in Claim 4 new? (2) Was it useful? (3) Was it infringed? (4) Was the combination in Claim 5 of 3840 new?

The jury retired at 2.40, and returned into Court at 6 p.m., when they handed in their verdict. They found (1) that Claim 2 was new; (2) that it was useful; (3) that it was not infringed; (4) that the 4th claim of the patent 1874 was not new; (5) that the 5th claim was not new. As to 3840 of 1873, they found (1) that Claim 4 was new; (2) that it was useful; (3) that it was infringed; (4) that the combination of Claim 5 was new.

This means that the defendants have not infringed in the matter of the leakage or equalising valve, but that they have infringed in the matter of brake rigging. Certain points of law having to be argued, judgment was not pronounced. We need hardly say that it is very unlikely that we have heard the last of this remarkable trial.

The Development of Electric Lighting.—An intelligent lad of seventeen, with a decided mechanical turn of mind, has been teaching his elders how to "light up." This youth, a son of Mr. E. Storey, ironmonger, of Oundle, has for twelve months past lit up his father's shop and premises, economically and well, with the electric light, and gas, we understand, has not been in use there since. To the credit of young Storey it must be added that he also made the engine which drives the electric lighting machinery. —*Martineau and Smith's Hardware Trade Journal.*

RAILWAY MATTERS.

THE largest locomotive ever built in America is now being made in Sacramento by the Central Pacific Railroad. The engine and tender will weigh 105 tons, and will be 65ft. 5in. long.

THE South Australian Government have agreed to pay Messrs. Walker and Swan £5000 in settlement of the claim made by that firm of £10,000 for widening the cuttings on the Nairne Railway.

THE nine o'clock train from London to Manchester on Saturday came in collision at Stockport with a train of empty carriages which were being shunted out of the way of the express. Six new carriages and one new engine will be wanted.

THE South Australian Ministry are seeking to pass a Bill to authorise the construction of a railway from Adelaide to Willunga. The length of permanent way which will have to be constructed is 27½ miles, and the estimated cost is set down at £378,800.

THE Tasmania Legislative Council has passed the Bill authorising the construction of the railway from the main line to Oatlands—four miles. This will be a very light line. The railway policy of the Government seems now to be generally accepted by the Council.

TWO passenger trains are now running daily between Semlin and Pesth, leaving Semlin at 8.25 a.m. and 2 in the afternoon. Trains arrive at Semlin at 1.40 and 7.14 p.m. The express train covers the distance in eleven hours. The Belgrade and Semlin ferryboats run in connection with all the trains.

TWO engineers of the Paris, Lyons, and Mediterranean Railway have made the discovery that the rails on the line between Marseilles and Rognac have become strongly magnetised by the friction exerted by the passing trains. The magnetisation is not appreciable until the fish-plates are removed and leaves the rails soon after they are taken up.

ON Tuesday the Cirencester section of the Swindon and Cheltenham Extension Railway was opened for passenger traffic amid great rejoicing. This new line connects directly with Southampton and the south coast a very large district of country, from which previously there was either no railway communication or railway communication only by very circuitous routes.

A BLOCK occurred shortly before one o'clock on Saturday afternoon on the Metropolitan District Railway, through the side rod of an engine snapping in two just as a train was leaving Charing-cross station for the Mansion House. It became so twisted that it was fifty minutes before it could be taken off and the train proceed, thus causing an annoying delay at the busiest part of the day.

THE New York correspondent of the *Times* says: "The steamer Alaska, from New York, yesterday carried to England seventy British ironworkers recently discharged from the Paterson Locomotive Works owing to the want of orders. They intend to go to the Clyde shipyards, returning because the prospect of any American employment is but slender. This case has aroused some comment, but it is believed to be an exceptional one."

IN New South Wales the tender of Messrs. Proudfoot and Logan, for constructing the Coal Cliff to Wollongong Railway extension, is the lowest, and has been accepted, the amount being £318,526. There is one tunnel 1056 yards in length. The contract commences 34 miles from Sydney, and ends at 60 miles 15 chains, being a length of 26 miles 15 chains. The amount of the contract is exclusive of the cost of permanent way, materials, station buildings, water supply, and compensation for land.

THE chairman of the Stockton and Darlington Steam Tramways Company, at the annual meeting held at Stockton on the 15th inst., reported that the average running cost of the Merryweather tramway locomotives working their Stockton lines amounted to the very small sum of 3¼d. per mile. These results, we believe, surpass those obtained on any other tramway line, either in the United Kingdom or abroad. The Merryweather tramway engine on the Dewsbury, Batley, and Birstal lines are also, we are informed, giving excellent results.

LOUD complaints are being made in Queensland at the delays in the conveyance of produce on the Southern and Western Railway. The rolling stock is quite inadequate for the traffic, nor are there sufficient goods trains to keep the stations from being blocked up with goods. Below the range special goods trains have been put on, but even with this the receiving stores are crammed. It is evident that a single line of rails is not nearly sufficient for the traffic at that end of the colony, and, as a second cannot be laid down on the present track without widening the bridges and tunnels—an enormous and very costly undertaking—the absolute necessity of connecting the Killarney and Fassifern lines should force itself upon the authorities as a work which must soon be undertaken.

THE Patent Shaft and Axletree Company, of Wednesbury, who has obtained a large sale in Canada for its steel tired elastic wrought iron railway wheel, claims that its wheels, which are taking the place of cast iron wheels in America for passenger traffic, although high in first cost, possess superior merits to the cast iron chilled railway wheels in general use in the States. These latter are cheaper, but are inferior in wearing power. Mr. Herbert Wallis, mechanical superintendent of the Grand Trunk line, reports that the average mileage of 828 wheels for the first turning has been 73,566 miles, and these are still running. The highest mileage obtained from the first turning has been 228,643 miles, and the highest total for any wheels now in the service 474,311 miles. Since numbers of railway engineers in the States are now preferring the steel-tired wheel to the chilled wheel for passenger service, there is good reason to expect that the patent wheels will be used on the States lines; but chilled wheels still hold their own in the States for freight car service.

ON Monday the French Chamber took up the Public Works, or special Budget. The vote of 3,300,000f. for the Senegal Railway was sharply criticised. It was argued that in four years 33 kilometres of line had cost 35 millions; that the rails were rusting in the sand; that 2000 lives had been sacrificed; that 100 kilometres had still to be constructed in a hostile region; and that there would never be the smallest traffic. M. Rouvier replied that a considerable portion of the outlay had been upon forts, of which four out of five were already erected; that 100 kilometres of railway out of 125 were completed; that the mortality had only been 350; that a staff of Europeans and Moors had been engaged for the coming season; and that France would be discredited by the abandonment of the enterprise. The proposal was rejected by 234 votes to 197. This decision marks a reaction from the colonial extension mania, which a few years ago led to the Flatters Expedition for surveying a railway from Algeria to Senegal, *vid* Timbuctoo—an expedition massacred almost to a man.

"YES, this is a pretty lively place, I admit," said the station agent of the Pennsylvania Railroad at Elizabeth, N.J., to a reporter of the *National Car Builder*, as the Pacific Express went thundering by. "Take such a spot as this, where two roads like the Jersey Central and the Pennsylvania cross each other, and things can't be very sleepy. How many trains pass here in twenty-four hours? Well, on ordinary days we have about 380, but there have been times when the number has reached 400. These are express trains, way freights, through freights, excursion trains, and coal trains, rushing by at all hours of the day and night. That flagman out there has no 'soft thing.' It would be a great convenience to him if he was cross-eyed; for he has to look in four directions at once in order to keep out of the way of the trains. He can't do, as I've known them do at some junctions—attend dog fights, or go round the corner for a drink. He must be right there every moment while on duty, or lose his position. Not only are the lives of the passengers in his hands, but also the lives of hundreds of people who are obliged to cross the track in passing from one part of the city to another."

NOTES AND MEMORANDA.

IT is stated that the sea weed *Zostera marina*, or "wrack," can be made to yield by treatment with mineral acids, a substance resembling horn, capable of being manufactured into forms, and of receiving colour from pigments. This substance is called "algin," from *algæ*, the generic name of one common species of sea weed. The crude material can be obtained in large quantities on all exposed shores, and, the *Scientific American* says, its preparation for ultimate manufacture is a cheap process.

THE coal-fields of New South Wales are among the richest and most extensive in the whole world. In 1829 the quantity of coal raised was 780 tons; in 1882 it was 2,102,281 tons. The value of the coal obtained in 1829 was £394; in 1882 it was £944,415 12s. 8d. The total quantity of coal raised during the period, from 1829 to the end of 1882, was 25,978,132 tons; yet the real stores of coal have scarcely been touched, and there are many miles of valuable coal land awaiting the capital and labour.

AT a recent meeting of the Royal Society of Dublin, Professor G. F. Fitzgerald, F.R.S., read a paper on the quantity of energy communicated to the ether by a variable current. The author shows that an alternating electric current, if it produces radiations of the nature of light—as it would do upon the most probable interpretations of Maxwell's electro-magnetic theory of light—would radiate energy equal to $m^2 \times N^4 \times 10^{-29}$ ergs per second, where m is the magnetic moment of the current, and N is the number of its alternations per second.

NOTWITHSTANDING the abundance and richness of the iron ores of New South Wales, the only works in operation are those at Eskbank, in the Hartley district, at the base of the western side of the Blue Mountains. The last published return shows that during 1882 the Eskbank Iron Company made 4320 tons of pig iron, valued at £15,120, against 2737 tons 12 cwt., valued at £10,950 8s., in 1881; finished iron, 2139 tons 9 cwt. 2 qr. 20 lb., valued at £23,330 19s. 6d., against 3351 tons, valued at £31,056 12s. 6d., in 1881; and castings, 1016 tons 16 cwt. 3 qr. 22 lb., valued at £1773 3s. 3d., against 220 tons, valued at £4011 11s. 8d., for 1881.

M. JACQUELAIN has endeavoured to procure a pure carbon for electric purposes that should be as hard and as conductive as gas carbon. He first takes gas carbon, which he submits to four processes:—(1) Treatment with dry chlorine at a red heat for thirty hours; (2) treatment with hot alkali for about three hours; (3) immersion in hydrofluoric acid—one to two of water—at a temperature of 15 deg. to 25 deg.; (4) carbonised by heating strongly in the vapour of a high boiling hydrocarbon, for commercial purposes gas tar will do well. All these operations may be performed after the carbon has been cut into sticks. By these processes, which do not seem to be new in any particular, the *Scientific American* says, the impurities have been reduced to a minimum, and a good, pure carbon is obtained.

A REPORT on the tensile strength of a Vertongen-Goens cast steel wire rope, as shown by test made by Mr. D. Kirkaldy for Messrs. Cowdy and Co., New-street, E.C., gives the ultimate strength of a rope 4·625in. in circumference, having six strands, and consisting of twelve outer wires and seven inner ones 0·0963in. diameter, making in all 114 wires on a central hemp core, as 138,870 lb., or 62 tons. The rope weighed 19·75 lb. per fathom, or 3·29 lb. per foot, or a little less than the weight of square bar steel 1in. square. The sectional area of the wires is 0·728, and of the 114 wires 0·8299, which does not seem to agree with the weight, and the discrepancy is, no doubt, due to very minute error in measuring the diameter of the wire, this measure being squared, and multiplied by 114. Taking the area as 0·83, the ultimate strength comes out at 74·7 tons per square inch.

A USEFUL rheostat has been devised by M. Trouvé, the well-known Parisian inventor. It consists of a German silver spring inclosed in a nickel-plated tube, the spirals not being allowed to touch each other, and insulated from the tube by a pasteboard sheathing. Inside the spring is a rubbing contact formed of a metal rod split into four parts, like the split plugs of a resistance box. This rod is graduated in divisions. The current enters at one end of the spring, traverses it, the rubbing contact, and the graduated rod. When the rod is deeply inserted into the spiral coil, the current only traverses a few turns, and the resistance in circuit is very small; but when the rod is pulled out, the number of turns inserted is considerable. The divisions on the scale tell the number of turns in circuit. The device is employed by Trouvé in connection with his polyscopes to regulate the strength of current supplied by a small Planté accumulator.

SOME idea of the size of the colony of New South Wales may be obtained by contrasting it with the areas of other countries which are more largely known. It contains an estimated area of over 310,700 miles, which is more than the whole of the United Kingdom, France, Belgium, Denmark, and Sweden. If the Netherlands were added to the list, the whole of these countries combined would be only about 4923 miles larger than New South Wales, which occupies but little more than one-tenth of the Australian island-continent. Yet while the population of these countries is 86,954,625, that of New South Wales at the end of 1882 was only 817,468, or less than quarter the population of London. Belgium, with its limited area of 11,373 miles, contains a population of 5,519,844, or about six times as many inhabitants as are to be be found in New South Wales, with a territory fifteen times as large. Everything that is naturally grown or produced in these countries is also grown or produced, often in greater abundance, in New South Wales, which is practically a repetition of South-western Europe in the Southern Hemisphere.

THE weight of a cylindrical iron wire one mile in length and giving one ohm resistance at 60 deg. Fah., is called an ohm-mile. While the first iron telegraph wire was specified to give an ohm-mile of 5500 lb., it is now obtained as low as 4520 lb., and the maximum resistance specified at 4800 lb. The ordinary best puddled iron is at present used only for fencing purposes, but a mild English Bessemer steel is largely used for railway telegraphs and for stays; however, the resistance is very high, owing to the presence of manganese. The wire used by the Post-office is made from Swedish charcoal iron, with an ohm-mile resistance of about 4520 lb. Swedish Bessemer, or a specially prepared low-carbon English Bessemer, is adopted by the Indian Government, with an ohm-mile resistance of about 5000 lb. Cast steel wire, with a breaking weight of about 80 tons to the square inch, has been adopted on the Continent for telephone currents, with an ohm-mile resistance of 8000 lb., while in England, where speed of working is the prime consideration, and length of span negligible, electricians are satisfied with a breaking strain of 22 tons on the square inch; in the Colonies, where long spans are essential and speed of working not so important, the specification was 30 tons on the square inch.

THE following are the heights of a few of the tallest steeples:—Pisa, leaning tower, 179ft.; Baltimore, Washington Monument, 210ft.; Montreal, Notre Dame Cathedral, 220ft.; Boston, Bunker Hill Monument, 221ft.; Montreal, English Cathedral, 224ft.; Paris, Notre Dame, 224ft.; Bologna, leaning tower, 272ft.; Cairo, minaret of Mosque of Sultan Hassan, highest Mohammedan minaret in the world, 282ft.; New York, Trinity Church, 284ft.; Florence, Campanile, or Glotto's Tower, 292ft.; Lincoln, Cathedral, 300ft.; Washington, Capitol, 307ft.; Venice, Campanile, 322ft.; New York, St. Patrick's Cathedral—to be when completed—330ft.; Utrecht, Cathedral—formerly 364ft.—338ft.; Florence, Cathedral, 352ft.; Milan, Cathedral, 355ft.; London, St. Paul's, 365ft.; Brussels, Hotel de Ville, 370ft.; Lubeck, Cathedral, 395ft.; Antwerp, Cathedral, 402ft.; Amiens, Cathedral, 422ft.; Hamburg, St. Michael's, 428ft.; Landshut, St. Martin's, 435ft.; Cairo, Pyramid of Chefren, 446ft.; Vienna, St. Stephen's, 449ft.; Cairo, Pyramid of Cheops—original height, 480ft.—450ft.; Rome, St. Peter's, 455ft.; Rouen, Notre Dame, 465ft.; Strassburg, Cathedral, 468ft.; Hamburg, St. Nicholas, 473ft.; Cologne, Cathedral, 511ft.; Washington Monument—intended height as given by the *Scientific American*—555ft.

MISCELLANEA.

SOME workmen have discovered a splendid grotto, containing marvellous stalactites, at Roisin, near Mons.

THE Eastern Telegraph Company has concluded an arrangement with the Government to establish communication with Suakin.

THE whole of the network of the Belgian telegraphs will be appropriated for telephonic communication within a period of four months.

THE new gunboats Dolphin and Wanderer, built by Messrs. Raylton Dixon and Co., of Middlesbrough, left the Tees for Sheerness on the 11th inst.

THE gasworks at Clayton, near Bradford, were entirely demolished during the gale last week, over 200,000 cubic feet of gas being liberated and ignited.

MESSRS. E. WHITBY AND CO., of West Hartlepool, have this year built twelve vessels with an aggregate tonnage of 21,199 tons. This is about 700 tons less than they turned out last year.

THE depressed state of trade has made it necessary to close all the coal pits along the Monongahela River, near Pittsburg. This week work will be suspended in 75 pits, and 6000 men will be rendered idle.

M. G. TROUVE has fitted small incandescent lamps to the jewelled heads of canes and other objects, supplied by a bichromate of potash battery carried in the pocket. It is said that the light thrown by a large diamond is sufficient to read by.

A FIRE, which soon assumed great proportions, broke out in the night of the 17th inst. at the Royal Dockyard, Lisbon. The training brig Camoens, a new vessel just about to be launched, was totally destroyed, and several depôts were burnt to the ground. There was no loss of life, and none of the dockyard staff sustained any injury. The damages are placed at £100,000.

THE bore hole put down on the north side of the Tees by Messrs. Atkinsen and Co. in search of salt has now been definitely discontinued, after having penetrated to a depth of 1200ft. without success. It is believed, however, by certain experienced geologists that another 200ft. might lead to the discovery of coal, and an attempt is being made to form a syndicate to provide the means of testing the validity of this belief.

THE January number of the *English Illustrated Magazine* contains among a number of beautifully illustrated articles, one of interest on Rivers and River Gorges of the old world and the new, by Professor Archibald Geikie. It is of much interest to geologists as well as engineers, the formation of the great gorges and canons of the Colorado being here described with much clearness, and showing what enormous forces were at play in their production.

THE seaport of Aber, Cardigan Bay, has been offered for sale by auction. The population of the town is 2000, and the estate put up for sale comprises 400 houses, four chapels, two schoolrooms, a townhall, and market place, together with harbour and dues. The manorial rights of Llyswen, having a sea frontage of seven miles, and the rights of shooting and fishing, were also put up in a lot, together with a large quantity of building land. Colonel Lewis offered £24,000, but the estate was withdrawn.

A NEW type-writer has been brought out by Mr. F. W. Ticehurst, of Colmore-row, Birmingham, which he claims possesses several points of improvement upon the American Remington machine. In Mr. Ticehurst's invention the letters are india-rubber types arranged on the edge of a portion of a wheel, the position of which is changed by the key-levers, so as to present the required letter opposite a slot in a protecting shield in front of a roller on which the paper rests. The pressing down of a key both turns the wheel and then presses it on the paper, which receives the impress of the letter opposite to the slot.

IT is reported that the extensive premises recently erected on the Tyne by the North-Eastern Marine Engineering Company, Limited, and which were fully described in THE ENGINEER, have been acquired by a syndicate for the purpose of forming a company for the manufacture of engines and boilers on an extremely large scale. It is also intended to provide graving docks capable of admitting the largest class of steamers. The title of the new company will be the River Tyne Dry Docks, Engineering, and Boiler-making Company, Limited, and it will probably be the largest concern of the kind on the North-East coast.

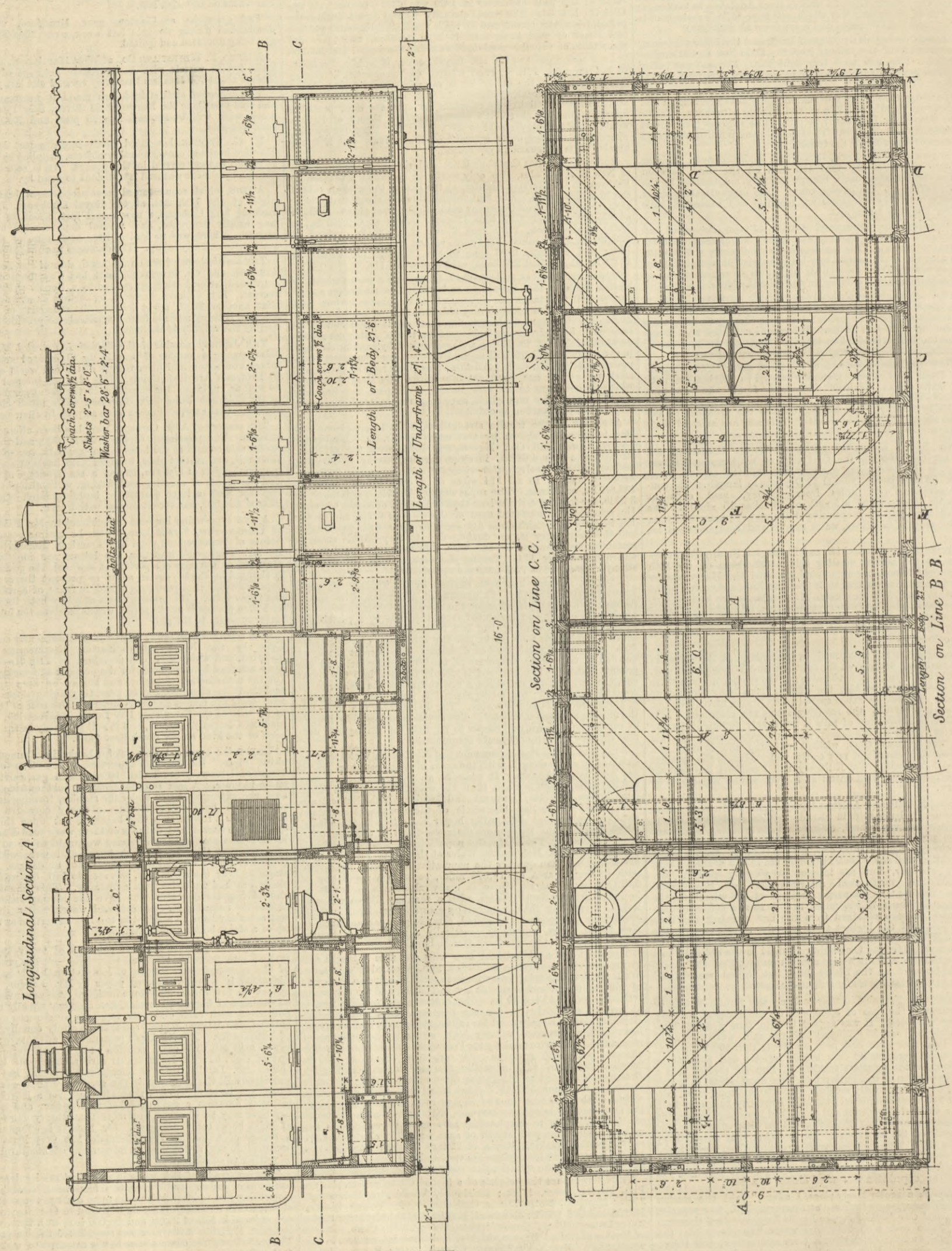
UNDER the heading "Look out for Leaks in Ammonia Ice Machine Pipes," the *Scientific American* says:—The cellars of a Cincinnati brewery are cooled by ammonia gas, carried through them in pipes. A leak recently occurred just outside the cellars, and the gas was set free under the stables, forming in the moist atmosphere hydrated ammonia, intensely corrosive to animal tissues. In a few seconds this began to act upon the lungs and eyes of the horses, and sixty-six of them were soon dead or dying. Even some street car horses passing were said to be so powerfully affected that they fell to their knees, and were with difficulty roused to drag a car and its passengers out of danger. One man, standing near the stable door, was seen to fall, but was rescued by those who had noticed it from a distance. This singular accident should impress upon those who have the management of ice machines the necessity for great care and watchfulness, that we may not some day have an accident in this line as serious as the blowing up of a steam boiler can sometimes be.

THE following, taken from our columns of twelve years ago, is now of interest to bicyclists and tricyclists:—"The practical value of the velocipede as a means of locomotion has been thoroughly discussed in a well-considered paper by Mr. Lauder, C.E., read before the Liverpool Polytechnic Society. As advantages and disadvantages of bicycles, tricycles, &c., are very equally balanced as compared with each other, Mr. Lauder's conclusions may be considered, the *Mining Journal* remarks, to apply equally to all kinds of velocipedes. The velocipede possesses no advantage; that is to say, a man can with equal exertion walk or run quite as far in a day of eight hours as he can travel with a velocipede in the same time. Mr. Lauder, being a velocipedist himself, has given the velocipede all the advantage in the argument that was at all possible, yet he can only show that, although for a journey of a few minutes' duration a good speed of twenty-four and a-half miles per hour may be obtained, not more than thirty miles in the day of eight hours can be traversed. Mr. Lauder is of opinion that, as a means of travelling, the velocipede has very little chance of coming into use, although as an instrument of healthful exercise it is worthy of consideration."

THE iron trade of Belgium is in an exceptionally depressed state for want of orders; and ironmasters have been casting about for something just to keep their works open during the winter. They observe that iron sleepers are largely used in Germany, where they are ordered in lots of 20,000 and 30,000 tons at a time, whereas in Belgium the trials made were not considered to give good results. They attribute this circumstance to the attempt to make iron permanent way for the same price as one with timber sleepers. The economy due to the use of the iron results from the greater duration and the reduction in labour for renewals, while the old iron is always worth something for working up again. M. Sadoine, of the Cockerill Works, convened a meeting of ironmasters at the Grand Hotel, Brussels, when it was agreed to petition the Minister of Public Works to institute on the State railway a fresh series of experiments with iron sleepers, and to entrust a trial order of 1500 to 2000 tons to each of the principal ironworks, one-third of the price to be spread over five years at the rate of interest to be agreed upon. M. Victor Gilliaux, president of the Association de Maitres de Forges de Charleroi, undertook to hand the petition to the Minister. The ironmasters rely upon the Minister's well-known solicitude for the welfare of the working class to give this proposition a favourable consideration.

CONTRACTS OPEN—INTERMEDIATE CLASS CARRIAGE, INDIAN STATE RAILWAYS.

(For description see page 489.)



AIR-COMPRESSOR AND TURBINE, YANAGASE TUNNEL WORKS, JAPAN.

Fig. 1.

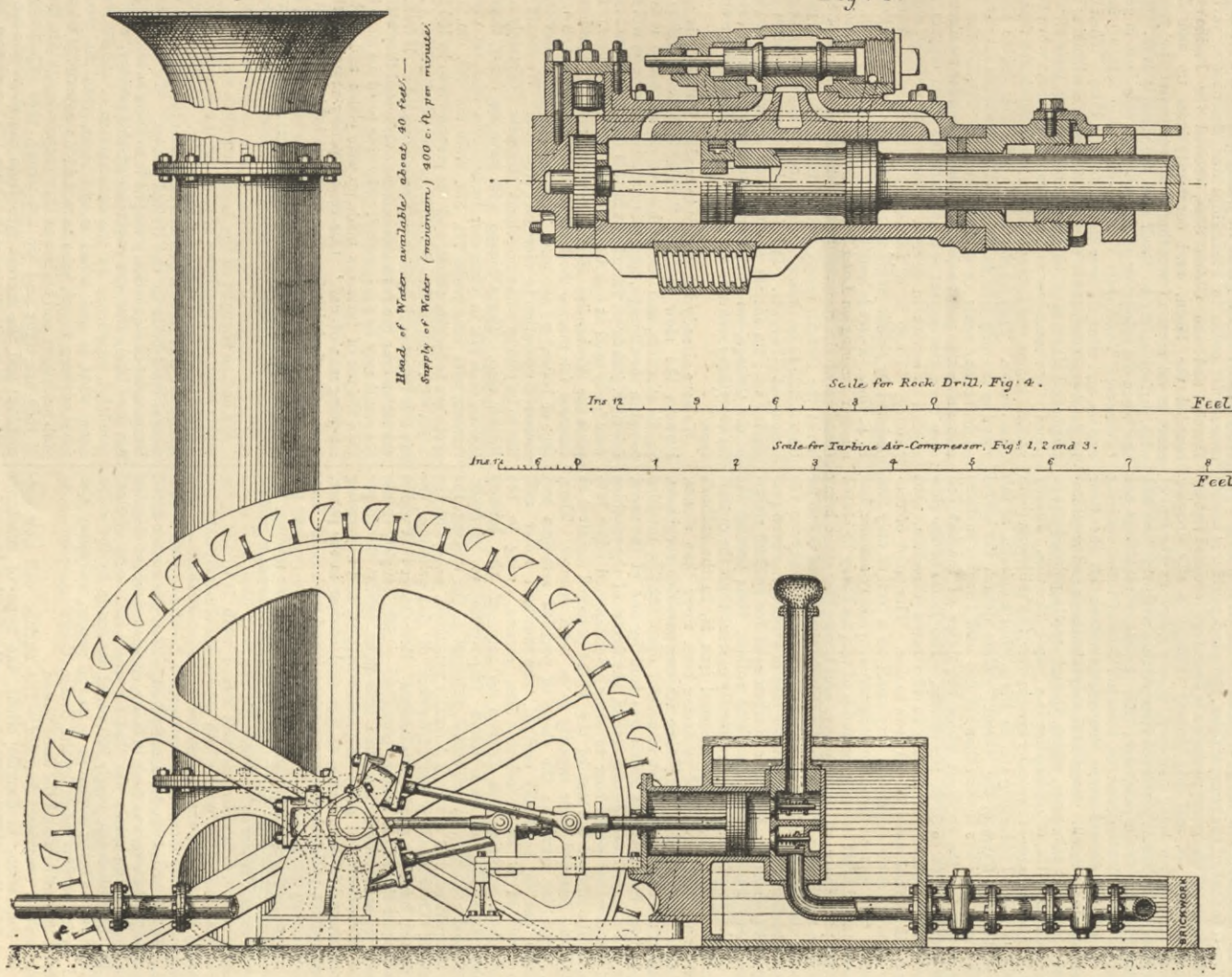


Fig. 4.

Fig. 2.

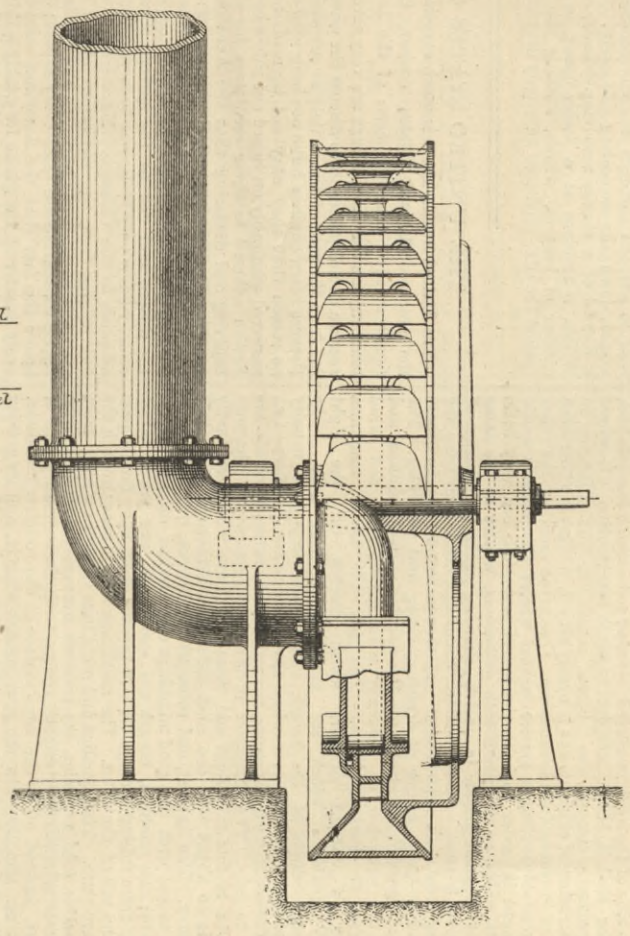
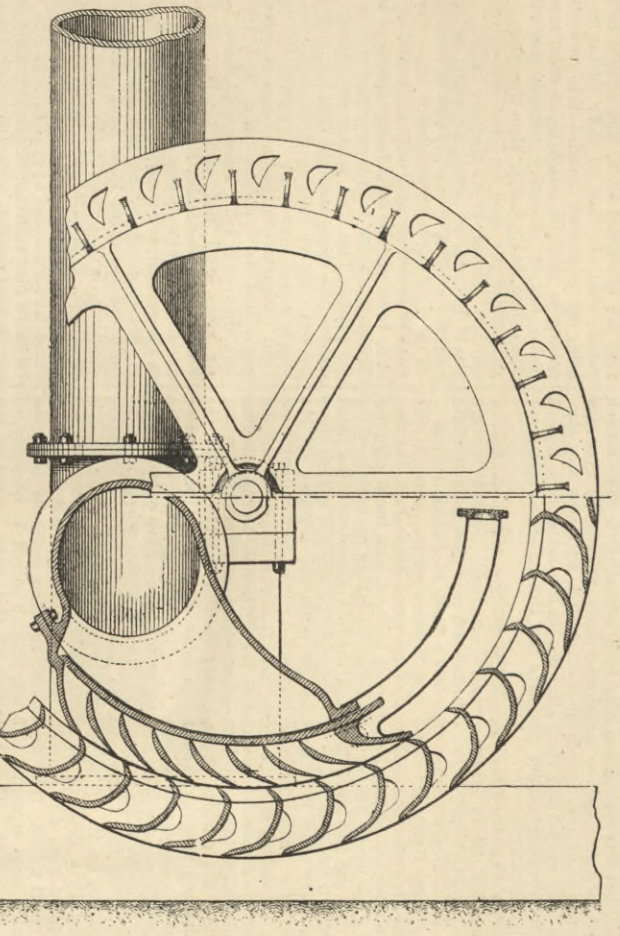


Fig. 3.



AIR-COMPRESSOR AND TURBINE FOR WORKING ROCK DRILLS AND VENTILATING YANAGASE TUNNEL, JAPAN.*

By BENJAMIN F. WRIGHT, M. Inst. C.E.

THE Yanagase Tunnel is situated on the Tsuruga-Nagahama section of the Imperial Government Railways of Japan, which line with its proposed extensions will connect the western and eastern coasts of the island of Niphon. The tunnel, when completed, will be 67 chains in length. with a gradient throughout of 1 in 40. It pierces a hill 800ft. high from formation level. One face only is being worked at present, and a length of 680 yards has been completed and lined with bricks. The works at the Tsuruga end were commenced on the 11th of June, 1880. The material at first was soft decomposed granite, gravel, and detached boulders, through which progress was made at the rate of 3 or 4 lineal feet per day for about 100 yards; nearly all the remainder of the stuff to be excavated consisted of hard Trappean rock, with veins of water and clay. The ventilation became defective, and the air vitiated to such an extent that the miners' lamps would not burn, and the only means of boring the hard rock for dynamite charges was by hammer and chisel. An ordinary fan worked by a waterwheel, the wind being conducted to the headings by tin pipes, was tried, but found not to give sufficient ventilation. The work in the headings was, therefore, suspended in August, 1882, until a new air-compressor, driven by a turbine designed for the purpose, was completed. This was erected in October, 1882. The original designs for both turbine and compressor were made by Mr. E. G. Holtham, M. Inst. C.E., late Principal Engineer of the Southern section of the Imperial Government Railways of Japan. The details and working drawings were got out in the drawing-office of the locomotive department, by native draughtsmen under the supervision of the author; and the whole of the work, patterns, castings, and forgings, were made and fitted in Kobe locomotive works by native workmen, under the supervision of a European foreman and the author. No European artisan was engaged on any part of the work. The compressor consists of three cylinders, is simple in action, and has few parts, Fig. 4. This was necessary, as the tunnel is 120 miles from Kobe, and communication beyond Kiyoto, fifty miles, is difficult and slow, the only means of carriage being across Lake Biwa, fifty miles, then by a mountain road, steep, narrow, and rough. Further, complicated and intricate machinery was undesirable, as the entire works are in charge of native engineers and workmen, no Europeans being permanently employed on this section, which is only visited periodically by the author and the resident engineer stationed at Kobe. The middle portion of each cylinder is cast with a flange on each side, and when all are bolted together these form the front of the cooling tank. The air chambers answer admirably; the valves are perfectly tight, and the piston rings fit so well that no air passes them. Stop cocks are provided for cutting off either one of the cylinders or all of them. The cooling tank is supplied with water from the bottom, and a constant circulation is kept up. The turbine wheel has thirty-six buckets; it was cast in one piece, and weighed 1 ton 17 cwt. when finished and bored. This casting proved a difficult one, as there were no less than ninety-six cores, and it required great care to place them all in proper positions; the result was a perfect success without a flaw. The bend pipe forms a support and a bearing for the shaft of the wheel; the guides, eight in number, are covered by a sluice, which can be regulated by a rack-and-pinion working in a water-tight box. The supply pipes were made in lengths of 6ft. for convenience of transport; the inside diameter is 1ft. 8in.; they are put together with flanged joints. The head of water is 40ft. The water is collected from two valleys, and conducted to the mouth of the supply pipe by wooden troughs of the following dimensions:—From main valley, 1ft. 5in. by 11in.; from branch valley, 1ft. 5in. by 9in.; incline of troughs, 1 in 250. The average supply of water in dry weather is about 400 cubic feet per minute; in the wet season it is much more. With 400 cubic feet of water per minute the supply pipe can be kept full by opening only three guides by means of the sluice. The number of revolutions, up to a pressure of 20 lb. per square inch in the receiver, varies from seventy to seventy-five; as the pressure increases the speed is reduced until 60 lb., the maximum pressure, is attained, when forty revolutions per minute is the usual speed. This it will maintain, and supply sufficient air to work two rock drills and ventilate the tunnel at the same time. The air receiver was made in the Kobe works. It is cylindrical, with flat ends, and is stayed longitudinally. The plates are $\frac{5}{16}$in. Lowmoor iron. It is 9ft. 6in. by 3ft. 2in., butt jointed and double rivetted. It was tested to a pressure 90 lb. per square inch, but is not required to work at over 60 lb. pressure. A safety valve, pressure gauge, cocks, and unions for screwing on flexible hose pipes, are provided. The receiver is placed 1300ft. from the entrance of the tunnel, and the air is conveyed to it from the compressor in cast iron pipes, and from the receiver to the rock drills in the headings in flexible india-rubber pipes. The rock drills used in the tunnel were made in the Akabane Works, Tokio, by native workmen, and act efficaciously. It is not the author's intention to claim anything original or novel in the design of the turbine or compressor, but to record the fact that the whole work has been made and erected by, and is now in entire charge of, men who eleven years ago had not seen a railway or machinery used for making them. The line was surveyed by Japanese engineers, and all the works were under their superintendence; and, with the exception of the tunnel, the railway has been completed.

* From the 'Proceedings," Institution of Civil Engineers.

INSTITUTION OF CIVIL ENGINEERS OF IRELAND.—At the annual meeting of the Institution of Civil Engineers of Ireland, held in Trinity College last week, the Mallins' medal was presented to Mr. J. Angelo Fahie, C.E., for his paper on "Magneto and Dynamo-electric Machines," read during the past session.

METEOROLOGY.—The second of a course of lectures on "Meteorology," by Mr. W. Marriott, F.R.M.S., was delivered on December 13th, in the reading room of the Society of Engineers, Victoria-street, Westminster, Mr. Charles Gandon, vice-president of the Society, in the chair. Mr. Marriott described the method of constructing isothermal charts, and by the aid of such charts for January and July, he showed the distribution of winter and summer temperature over the globe. The range of temperature is much greater over the land than over the sea. The highest monthly average temperature known is that of May for Massowah, 99 deg.; and the lowest is −56 deg. at Werchojansk in January, thus giving an extreme difference of 155 deg. The lecturer gave some interesting particulars of extremes of temperature, and of the great frosts that have occurred in this country. The lowest temperature of the air which has been registered in these islands was −23 deg. at Blackadder, Berwickshire, on December 4th, 1879. After pointing out the importance to the engineer of a knowledge of the temperature of the soil, especially in relation to the laying down of water mains, the lecturer gave an account of the distribution of the currents and surface temperature of the sea. The instruments used for measuring the effects of solar radiation having been explained, the sunshine recorder was described, and some of the results obtained from it were given. The lecturer concluded by referring to terrestrial radiation, and giving an account of the practical use which is made of nocturnal radiation in India in the preparation of ice.

THE SOCIETY OF ENGINEERS.

ROLLER MILLING MACHINERY.

At the meeting of the Society of Engineers, held on December 3rd, at the Westminster Town Hall, Mr. Jabez Church, president, in the chair, the following paper on "Roller Milling Machinery," by Mr. J. Harrison Carter, was read:—

The object of this paper is to describe the manufacture of pure flour by the roller milling system—which is superseding the millstone system, and revolutionising the milling industry of this and other countries. It is generally thought that the manufacture of flour requires little care and skill, and that the most primitive machinery is sufficient for its successful accomplishment; and doubtless this is partly owing to the long continued pre-eminence of the millstone, which is mentioned in the earliest Biblical and other historical records. As a matter of fact, however, the production of pure flour is a task of great delicacy and intricacy. The author proposes to treat the subject of his paper under the following heads:—(1) The extensive character of the British milling industry; (2) the importance of excelling in the quality of our own flour, in order to secure the benefits of its manufacture for our own country; (3) the merits of pure flour; (4) the formation of the wheat-berry the miller's difficulty; (5) millstone milling and its defects; (6) the manufacture of pure flour by the roller milling system; (7) roller milling machinery described.

The British milling industry.—Mr. H. Kains Jackson, the eminent authority on grain statistics, estimates the consumption of flour in the United Kingdom and Ireland for the present cereal year, which commenced on the 1st September, as 36,000,000 sacks. Taking the average price per sack at 33s., this gives a total value of £59,400,000.

Importance of excelling in our flour.—Mr. Jackson, when sending the author the above information, added, that out of the above quantity of flour, not less than 5, or more than 6 million sacks will be imported in the manufactured form. Though this shows that the greater proportion of flour is still manufactured here, he states that great and rapid inroads are being made by foreigners, *e.g.*, in 1879-71 the flour imports were 1,921,564 sacks—in 1881-82, 5,600,000. This rise in the decade is much larger, *pro rata*, than in wheat; the proportions put roughly being flour 250 per cent. increase, wheat 75 per cent. increase. This is a strong argument for the more general use of better machinery in England. It is well known and acknowledged that until comparatively recent years French millers were far in advance of ours and those of other countries, and that, therefore, when they in turn were superseded by the Hungarians and Americans, they, not being so far behind as ourselves, suffered less. Mr. Jackson illustrates this very clearly. He says:—"The United Kingdom imports about 15,000,000 quarters of wheat, France imports 5,000,000, therefore France should also import one-third as much flour as the United Kingdom, but she does not, taking less than one-tenth." Mr. J. H. Chatterton, the secretary to the National Association of British and Irish Millers, who is entrusted by millers in all parts of the kingdom with the insurance of their mills, and who, therefore, has special means of arriving at the cost of the machinery at present in use, estimates it at 7½ millions, there being, he says, 10,000 mills in the United Kingdom. This amount does not include engines and boilers, or water-wheels. The supplying of this machinery should be kept, first in the interests of our common country, and next of our profession, as much as possible in our own hands.

The merits of pure flour.—With regard to the merits of pure flour, Dr. Charles Graham, Professor of Technology at the University College, London, in his series of Cantor Lectures, in the winter of 1879 and 1880, says: "Practice proves that a labourer who has work to do demands white bread, and any addition he makes is in the form of meat or fat." Other authorities, such as Professors Church, Graham, Allen, Voit, Schenck, &c., are of similar opinion; and only last month Mr. Jago, F.C.P., chief of the Brighton School of Science and Art, in a paper on Bread-baking, read before the National Association of Millers, propounded the same views, viz., that the germ and bran of wheat should be removed from the flour. He reasons: "Firstly, that their retention does not add to the nutritive value of the flour, as, although they contain nitrogenous or flesh-forming compounds, yet their removal only lessens the percentage of these bodies from 11·0 to 10·5 per cent., while, as they contain a large quantity of cellulose, the residual flour, after their removal, is richer in starch by over 4 per cent. Secondly, the bran and germ contain bodies which, in the presence of moisture and warmth, act rapidly on the starch, converting it into sugar and dextrine, and thereby lowering the quality of the flour and the loaf of bread." But following the example of Dr. Graham, and using our own common observation, what do we find? That, as he says, labouring men who have to work demand white bread. The author is well acquainted with all parts of the kingdom, and can testify that the purest bread is to be found, either in the chief manufacturing districts, or where—as in Ireland—the labouring classes depend to a very great extent on bread as their daily food. Again, if the offal of wheat contain so abundantly the bone and sinew and power-producing properties claimed for it, why does it not secure an exceptionally high price, and become a chief article of food for our labouring horses?

The formation of the berry.—The constitution and formation of the wheat berry has made the perfect separation of the flour from the offal most difficult of accomplishment. By kiln drying oats and then passing them through a millstone set rigidly at a correct distance apart, the husks come off quite easily, leaving the kernel to a great extent intact. The same applies to peas when dried; the then brittle bran comes freely away with a slight touch of the stone. The skin of the oat, bean, pea, &c., separate from the kernel by being dried. The bran of wheat, though rendered more brittle by the same means, does not become detached. The unequal shape of the wheat berry also prevents the bran being removed by outside application. Decortication has long been attempted, but has failed. When most perfectly done so much of the ends of the wheat containing good flour has been rubbed away with the bran, that the loss from its being mixed would be ruin to the miller. Even were it not so, and all the bran rubbed at last off the grain at its smallest diameter, leaving merely a round ball—like pearl barley—remaining, the branny crease would be found still left untouched, nearly dividing the ball, and thus proving decortication imperfect. Having shown that the bran cannot be taken from the kernel, the author will now proceed to explain why the millstone is being superseded by the roller mill for taking the kernel from the bran.

Millstone milling and its defects.—Millstone milling, as nearly universally practised here, has been as follows:—The wheat, after passing through the usual wheat-cleaning machines, is ground between a pair of millstones, and the latter are set sufficiently close together to practically remove all the flour from the bran. The meal, as it is then called, goes into the silk reels, or wire cylinders, or cloth bolters, and is dressed. The stones are usually from 4ft. to 4ft. 6in. diameter, and travel at from 100 to 120 revolutions per minute, according to the diameter and the fancy of the miller. It has never been conclusively proved what surface of stone the wheat is caused to traverse before it escapes, but it is believed to be at least 3ft. or 4ft. Those who know what French burr stone is like—so finely porous and so rasping, and, when made into a millstone, so flat on the surface—will understand that this ordeal of grinding, this extreme of frictional treatment over so large a surface—and a smaller surface with the flat face of a stone does not answer—is enough to rasp off the bran an excessive quantity of bran flour; and so it is, spoiling the flour and spoiling the loaf. It cannot be argued that we should in this country adopt the gradual reduction by millstone system so long practised on the Continent. Even in experienced hands, it had to be abandoned in favour of rollers. "But," said the Americans, "these Hungarians and Germans were always careless with their stone-dressing," and so with their lately developed attention to stone-dressing they thought to avert the reconstruction of the machinery of their gigantic mills, and they introduced what they called the "new process," but this system has also been superseded. The French excelled for a long time as millstone millers, principally by means of dressing their flour very finely through silk, and now they also, though late, are turning their attention to the roller mill, finding that fine dressing cannot eliminate the bad coloured bran flour made by the stones.

Roller milling and its merits.—Roller milling was first successfully carried out in Hungary, and it gradually spread through Austria and Germany. It was introduced into this country about 1874. In 1877 the author organised a party of British millers to visit Austro-Hungary; forty gentlemen went, were kindly received by the leading millers of Vienna and Buda-Pest, the best mills in these towns were thrown open to them, and knowledge was gained then which has been of service—speaking personally—ever since. It was not until 1880 that the first complete roller plant was started in America, but so enterprising are the millers there that already most of their principal mills are working on the roller system. The author has distinguished the new milling from the old by calling one the roller, the other the stone system, and this conveys a correct impression of the difference, as the semolina and middlings made in both cases, when worked by gradual reduction, are purified through very similar purifiers, and the flour dressed through exactly the same description of dressing machines. The machines used in a modern gradual reduction roller plant are, roughly speaking, as follows:—Five or six successive fluted roller mills to detach the kernel of the wheat from the bran, leaving the latter with no flour—commercially speaking—remaining on it. The broken wheat from each roller mill is followed by a dressing or sifting cylinder, which removes the flour, middlings, and semolina, and sends the overtails in its turn to the next roller. The flour from the first cylinder is almost invariably kept separate, it being, though small in quantity, of very bad quality. The abstraction of this flour is one of the advantages claimed for gradual reduction milling. The bran from the last fluted roller goes straight to the bran sack, and if examined by the side of the millstone brand, is found to be much less polished, showing that it has been subject to much less friction. If wheat be imperfectly cleaned, the "beard" is left on, but millstones in the operation of grinding rub it nearly all off, whilst in roller bran much of it can be found remaining. One great merit of the roller mill gradual reduction system is, that whilst the bran is under treatment in order to have the kernel removed, but very little flour is made, as compared with millstones, whilst at the same time it is much better in quality, showing again the absence of excessive friction. The semolina, middlings, and flour from the various breaks are next treated—together in some cases, in others separately—to a course of dressing, sizing and purifying. The largest pieces of the kernel are in this country called semolina, and these are operated on generally with gravitation and wind purifiers of various kinds. The fan of these machines creates a current of air, which carries off the light branny particles which are mixed with the pure. The smaller products of the kernel, called middlings, are usually by preference treated over what are called sieve purifiers—*i.e.*, sifters covered with silk gauze, through which currents of air are made to pass. The difference in the specific gravity of the pure particles of fine middlings and those which are wholly or partly offal is so slight that the most delicate treatment is absolutely necessary. The lightest, and consequently lowest, quality of particles mixed with the good middlings are carried off by the air currents; the medium, though not carried off, are prevented by the air from falling through the silk meshes, and they finally pass over the tail of the sifter. The middlings which pass through the sieve are pure. The semolina and middlings being now freed from all possible offal particles, the pressure necessary to reduce them into flour is applied by smooth rollers, with their small points of contact, instead of by the large surface of the rougher millstone. The larger semolina has the germ present with it, and its gravity being equal to that of the pure particles, the wind purifier is unable to separate it. This germy semolina is therefore crushed lightly through smooth rolls, and then dressed through a silk dressing machine. The germ being flattened, passes away at the end of the dresser, and thus is prevented from mixing with the flour and lessening its value to the purchaser. All the other middlings are dressed through silk after crushing, some portions of them requiring to be rolled and dressed more than once, before all the flour they contain is procured. Many little amplifications and modifications of treatment take place, which, though easily pointed out in a mill, are impossible of explanation in a paper like this. Briefly stated, the advantages of the roller system over the millstone (both working by gradual reduction) are, in the author's opinion, as follows:—The sharp flutes of the "break" rollers detach the kernel from the bran with less friction than the flat and rougher surfaces of the stone, *e.g.*, the speed at which the flutes of the fast roll travels is from 450ft. to 550ft. per minute. The flutes of the slow run at 180ft. to 200ft. per minute in the same direction, thus giving a differential speed of only two to one. The point of contact or grinding surface is clearly very small on a roll of only 9in. diameter. The approved speed for millstones, we may assume, has been ascertained after its many centuries of use, and may be stated at 1500ft. per minute at its periphery, and the nether stone being motionless, much more friction results than in the case of the roller mill, with the differential speed of only two to one between the operating surfaces. The latter, in the case of stones, has been previously put at from 3ft. to 4ft., and when used for gradual reduction, as many breaks are required with rollers, thus proving the shape of the fluted roll more scientifically correct than the operating portion of the stone. The material iron is, in the author's opinion, much less capable of producing bran flour than stones. The latter retains for a long time its comparative roughness, whereas in the case of the most successful decorticating machine that has been invented, the author was told by one of the users, that in order to produce the best results, the drive of the machine should be reversed every hour to bring re-sharpened edges into action, as the silica in the bran of the wheat polished the steel so quickly, and lessened their capacity as a bran scourer. Then, again, when the kernel in the shape of purified semolina and middlings has to be finally crushed, the smooth roller mill makes flour of a better colour than stones, owing to the fact of their applying less friction to any of the branny particles that it has been found impossible to separate. The gradual reduction by millstones, referred to in making the above comparison, has not been generally practised, except on the Continent. Over the old English system of flat grinding, the roller system has even greater advantages. Remember that whilst by the former the 75 per cent. of pure flour which, roughly speaking, good wheat contains, is ground into flour, whilst the 25 per cent. of offal—bran and germ—is present with it, and undergoing the pressure and friction, which, as was said earlier in the paper, produced such a polished appearance as compared with roller bran. In polishing anything, the rough surface removed to produce the polish can usually be seen in dust as it comes off. In milling, the immense quantity of bran flour which, it is now known, is rubbed off by the stones, is lost sight of amongst the pure flour, and much of it being as fine, is thus irretrievably mixed with it to the great injury of its quality. A point which proves conclusively that the rolls apply less friction than the stones, is the remarkable one that though considerably more machines are used, far less power is consumed. In the mill of Mr. Moss, of Salford, which the author fitted up, no change whatever was made in boiler, engine, or wheat-cleaning machinery, and the result was that for every 550 sacks of flour made by the millstones, nearly 900 could be made by the roller plant, the engine being worked up to its full power, and being also proved by indications taken by the Steam Users' Association, to have been indicating about the same power.

Roller milling machinery described.—The author will now proceed, in conclusion, to describe briefly the type of machines employed in roller milling. The fluted roller mill taken as an illustration is fitted with two pairs of rolls, the wheat passing to them in thin, even streams, through two feed rolls. All fluted rolls are of chilled iron, and should be made as hard as is compatible with the fact of their having to be fluted. The wheat being by preference graded into two sizes, preparatory to its passing to the first machine, in order that the larger and smaller grains can be similarly treated, necessitates one pair of rolls being more finely fluted than the other. The author usually cuts eight flutes per inch and ten respectively, the flutes being cut spirally. Fluted, or as they are called "brake," rolls are used in sets of five, six, or seven, according to the ideas of the maker or user, there being generally two or three additional flutes per inch on the rollers of each successive set. The bearings of roller mills must be accurately and well made, and adjustable in all directions, so as to ensure the rolls being capable of setting perfectly parallel. The smooth roller mill is constructed with three rollers, one above the other. The feed passes out through one feed roll, and is divided by a sharp straight edge into two equal streams, one being crushed between the top and middle roll, the other between the middle and bottom rolls. The gears in this mill are encased in an oil-tight compartment, to save loss of power by the friction of dry gears, and to prevent wear and tear. The bearings contain their own oil. These rolls have been in use for the last six years, and not one bearing, so far as the author has been able to ascertain, has yet worn sufficiently to require repair or refitting, and only one set of gears has worn out. The gear case in this set had evidently not been supplied with oil. Some of the earliest machines made, and which have been working day and night continuously, have been examined lately, and have no shoulders, even on the teeth. The sieve purifier is used to purify middlings. The latter are made to pass in an even stream across the whole width of a vibrating sieve covered with silk. The fan causes an air current to pass through the silk meshes, which carry off into a dust collector the light branny particles. These machines require very delicate adjustments of vibration of sieve and strength of air current. Centrifugal dressing machines are now very largely used instead of the old hexagonal reels, which simply allowed the flour to sift out through the silk meshes as it rolled, of its own weight, down the ascending silk cover. The centrifugal machine is formed of a slowly revolving cylinder covered with silk gauze. Within it revolves at a faster speed, in the same direction, a number of beaters, which, striking the material being dressed against the silk, produces an evenly dressed flour.

THE UNITED STATES CRUISERS.

The United States Press is much exercised by our criticisms on the proposed United States cruiser, Chicago. The *Nautical Gazette* says:—"The criticisms of the London Engineer on the beam engines for the Chicago are very severe. Not being an engineer we do not presume to discuss the correctness of the criticism; but from the tone of the article we are satisfied with its unfairness. Because beam engines have not been used on board British ships is no reason that they may not be made to work well. They have answered admirably on board our side-wheel river boats; while the British adhered to their oscillators for the same class of boats, believing and declaring that the American beam engine was inferior." The *Mechanical Engineer* says:—"Elsewhere we print two criticisms upon the engines of the new cruiser, Chicago, recently illustrated in this paper. These criticisms refer solely to the design, and not to the system, which, as engineers in this country know very well, has been sufficiently tested to warrant its adoption in the Chicago. Marine beam engines are no novelty; but, judging from the utterances of the London Engineer, they are quite new. That paper, in a recent issue, condemns the beam engine for marine use from every aspect; but it seems to wholly ignore the fact that the American beam engine has been in use in every quarter of the globe for nearly a third of a century. It has crossed the ocean in steamships and steamboats, navigated the Danube and the China Seas, crossed the Pacific to Japan, rounded the Horn, and constantly goes up and down this coast in all sorts of weather at all seasons of the year; all this with perfect safety to itself and the vessel it is in. Many years ago, when the side-lever engine was the only form in general use, Commodore Vanderbilt fitted a steamship with a pair of beam engines, and went all over the world with them. When he reached England engineers there were unanimous in condemning them, and prophesied all sorts of things regarding them, none of which happened. The same hue and cry was raised abroad when the present vertical engine was introduced, for the English are nothing if not conservative. They clung to the side-lever engine and paddle-wheel as the only true faith, and did not abandon it until the logic of dollars and cents compelled them to. The London Engineer makes a specific point against beam engines for tw n screws. But even from this aspect it is at fault, for beam engines have been applied to screws in several instances successfully, and are now running. There is a twin-screw steamer with beam engines, designed by Frank Stevens, now in daily use in the Pennsylvania R. R. line. There is another pair in the Metropolitan, a coasting steamer running on Long Island Sound, and still another in the Louisiana of the Cromwell Line. This vessel is one of the fastest, if not the fastest, vessel out of this port, and her performance leaves little to be desired. So far as the type of engine goes, there is none, at all events. It is too late to decry the beam engine for marine use; its merits are too well known, but as regards those in the Chicago, we think our contemporary's strictures merited, for everything seems to have been done to throw discredit upon the type."

We have already taken care to explain that there is no analogy between the slow running "walking beam" engines of large paddle steamers, and the high speed engines which it is proposed to put in the Chicago, and this American engineers will find out in due time, just as we found out in this country, where beam engines were freely used at one time to drive screw propellers. In another place the *Mechanical Engineer* writes:—"In regard to firebrick furnaces for marine boilers, the London Engineer says: 'The type of boiler,' we are told, 'is new to the naval service, but is in successful operation in merchant steamers.' We should very much like to be told in what merchant steamers. Certainly not in any British ship. The Chicago will have no fewer than fourteen boilers, each 9ft. in diameter by 9ft. 10in. long, set over a single furnace, with one grate 7ft. 8in. wide and 7ft. 6in. long. The shells are to be §in. thick, and the pressure is to be 100 lb. To go to sea with such boilers is simply to court destruction. If the fires are ever urged such boilers will prime furiously. If from any cause the plates over the furnaces become overheated they will crack, and the result may be anticipated. Nothing could be more injudicious than the use of furnaces made up with plates and firebricks in a sea-going man-of-war.' Our contemporary argues in the face of facts. The firebrick furnaces were put in the Louisiana as a temporary device, and with the expectation that they would give out in a short time. They did so well that they were retained, and have now been some two years in service, with such satisfactory results that they will be applied to new boilers in the future."

We had no thought of the Louisiana when we wrote. What we said is based on experience acquired in this country. We are quite content to let facts speak for themselves. If the Chicago is not a failure she will form a glorious exception to the rest of the experimental craft built in the United States. We would ask our contemporaries one question; we put it to them as sensible men—Is it not more likely that the engineers of this country, with their unparalleled experience in the construction of ships-of-war, should know what is and what is not right, than the members of a naval advisory board, who have had no experience whatever with such machinery and boilers as they propose to put into the Chicago? If they are right and we are wrong, then experience is worth nothing; and the merest tyro from the shops who can design an engine is as good as the man whose life experiences have taught him what it is and what it is not expedient to use at sea.

THE EXPORTS OF STEEL RAILS AND IRON RAILS.

The subjoined statement is designed to show the details respecting British exports of steel rails and iron rails under separate heads. It will be remembered that until the year 1876 no information was available in respect to the relative exports of steel or iron. The quantities and the values of either description were placed under one head without explanation. The inconvenience felt under the pressure of this system was a cause of complaint on all sides. The subsequent years, 1877 to 1882, have brought about considerable changes in the situation of steel *v.* iron. The first-named year stood as follows: 1877, export of iron rails, 190,054 tons; export of steel rails, 173,750 tons; total summing up together of iron and steel, 363,804 tons. The year 1882, as will be seen from the table given below, shows the following comparison: Steel rails exported, 733,915 tons; iron rails, 46,532 tons. It is tolerably clear that under these circumstances the iron trade is entitled to be supplied with reliable information as to the correct proportion of steel shipments, as well as to that obtaining in iron rails. The authorities published the warning which is here reproduced: "In accordance with the wish of the iron and steel trade, an attempt has been made in this return to distinguish the quantities of iron and steel rails exported from the United Kingdom; but as much difficulty has been experienced in obtaining accurate information from exporters and their agents, in consequence of the indiscriminate use of the terms 'iron' and 'steel' for the same article, the figures cannot be relied upon." We give the preceding figures with some hesitation, as it is not considered sufficiently trustworthy to indicate the export trade in those articles under the two separate heads; the total quantity of rails, however, may be accepted as correct. The same anomaly has been carried monthly during six years through the printed statement offered to the trading community of Great Britain. The question forces itself on the mind of every rail shipper, namely, whether no means can be found to put the matter in a more convenient shape and render further publication unnecessary. If for no other purpose, British returns would bear fair comparison with the exports of neighbouring competitors.

Six Years' Results of Shipments of Railroad Iron to Foreign Countries and British Colonies.

IRON RAILS TO EUROPEAN COUNTRIES.

	1877.	1878.	1879.	1880.	1881.	1882.
	tons.	tons.	tons.	tons.	tons.	tons.
Russia	12,625	4,238	454	557	77	24
Sweden and Norway.	34,448	40,338	457	738	2,222	2,435
Germany	303	476	1,227	72	195	28
Spain	10,723	6,657	1,295	2,198	525	116
Italy	15,019	2,447	4,900	5,328	840	19
	73,118	54,156	8,333	8,893	3,859	2,642
AMERICAN CONTINENT.						
U.S. of America	161	1,708	20 955	106,061	96,139	21,135
Brazil	16,029	19,894	2,323	3,051	1,968	2,369
Chili	958	366	112	90	209	293
	17,148	21,968	23,390	109,212	98,316	23,777
BRITISH COLONIES.						
British N. America..	21,839	6,734	2,215	2,157	1,260	338
British India	30,404	21,203	5,718	3,371	4,493	5,119
Australasia	13,946	45,772	5,796	3,573	5,219	3,663
	66,189	73,709	13,729	9,101	10,972	9,120
OTHER COUNTRIES.						
Not enumerated	33,599	6,240	9,659	7,697	7,074	10,993
Total shipment of iron rails	190,054	176,229	55,071	144,903	120,221	46,532
Proportion of distribution:—						
Colonies	66,189	73,709	13,729	135,802	109,249	37,412
All other countries..	123,865	122,522	32,342	9,101	10,972	9,120

Six Years' Results of Shipments of Railroad Steel to Foreign Countries and British Possessions.

	1877.	1878.	1879.	1880.	1881.	1882.
	tons.	tons.	tons.	tons.	tons.	tons.
Russia	66,029	75,098	35,300	7,677	10,116	2,626
Sweden and Norway.	3,928	17,220	12,610	5,797	4,416	6,952
Germany	12,943	21,365	1,758	411	—	52
Spain	6.279	12,929	11,710	7,689	11,486	11,786
Italy	2,027	4,600	31,310	19,137	24,222	71,114
Total Europe	91,206	131,212	92,688	40,711	50,240	92,530
AMERICAN CONTINENT.						
U.S. of America	—	404	23,681	113,214	194,001	173,876
Brazil	896	12,119	25,680	11,943	32,184	43,270
Chili	2,088	520	610	4,541	933	3,931
	2,984	13,043	49,871	129,698	227,118	221,077
BRITISH COLONIES.						
British N. America..	36,247	28,041	58,220	80,184	103,477	89,647
British India	10,130	32,772	44,317	76 932	42,112	82,392
Australasia	10,442	27,909	40,144	72,844	83,387	72,267
	56,819	88,722	142,681	239,960	228,976	244,303
ALL OTHER COUNTRIES.						
Not enumerated	19,545	11,511	46,807	59,208	89,575	171,096
Total shipment of steel rails	173,750	234,480	322,145	459,187	595,911	733,919
Totals of steel and iron rails	363,808	460,710	387,216	604,090	716,132	780,451

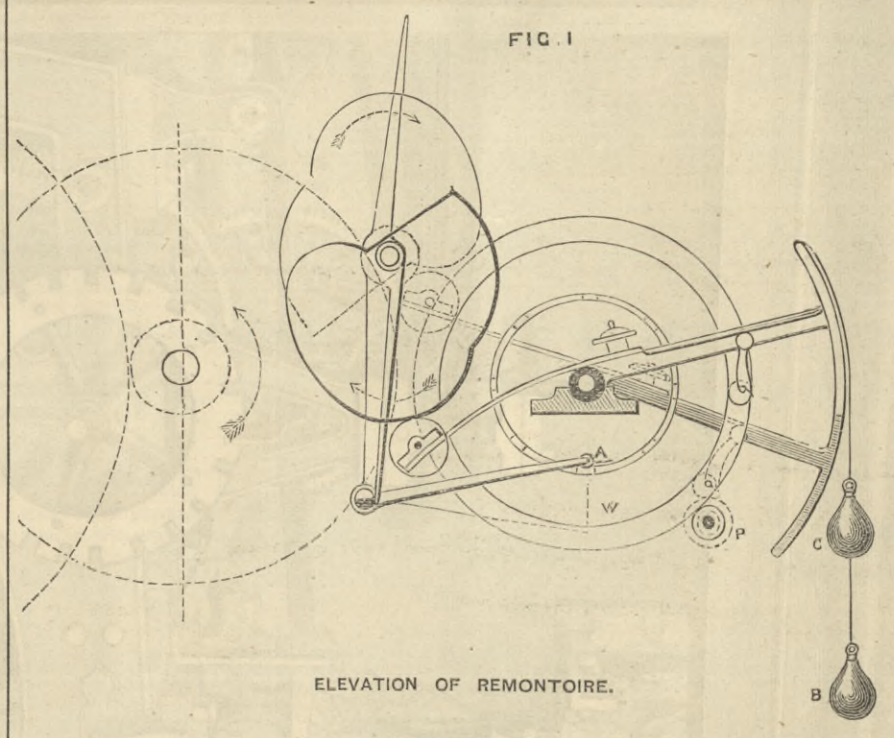
THE CLOCK AT THE ROYAL COURTS OF JUSTICE.

THE want of a really good public clock in mid-London has long been experienced, and has at last been satisfied. In no modern city of importance is it more difficult to ascertain true time than in London. Westminster has the great clock, which is one of the best timekeepers in the world, and the City has the Royal Exchange clock, so placed that it can be seen with difficulty. There are no other public clocks in London which are really accurate timekeepers; and anyone who possesses and wishes to rate a good watch, has no resource, save to resort to the shop windows of a few first-class watchmakers, and there consult a chronometer, whose time fast or slow of Greenwich in seconds is affixed. That there is a demand for a means of timing good watches is proved by the crowd to be found round the inconveniently situated regulator in the entrance to Messrs. Lund's shop in Cornhill, for this regulator is connected by wire with Greenwich, and is always right within less than a second.

The new clock in the Law Courts tower, constructed by Messrs. Gillett and Co., of Croydon, was formally handed over to the authorities on Tuesday. The clock has been going for some time, the external hands not being attached, however, and has been keeping time with a maximum error of two seconds per week, which is an admirable performance for a perfectly new clock, and will no doubt be reduced by about one-half as the machinery settles down to its work. We illustrate the clock as seen with its case open in the room just under the clock dials. These are carried on a heavy stone corbel, which corbel goes right through the wall, and to it by leavis bolts is secured a large cast iron cock plate from which is suspended the pendulum 15ft. long, beating in two seconds, compensated zinc and iron, and with a cast iron bob weighing 3 cwt. This plate is seen in the middle of the engraving, page 486, the round rod below passing through an oblong hole in the floor is the tubular pendulum rod suspended by a flat spring from the cock plate above. The clock presents several peculiarities, to make the nature of which intelligible a little preliminary explanation is necessary.

Public clocks are exposed to the disturbing influence of the wind on the hands and the variation in the oil, caused by freezing or arbor thinning, as the weather is cold or hot. When the force driving a pendulum varies the clock gains or loses. To get over this difficulty, what is known as the *remontoire* was invented more than half a century ago. Under this system the scape wheel, which propels the pendulum, is itself driven by a small weight or a spring, which weight or spring is wound up every half minute. As this spring or weight generally acts directly on the scape wheel, oil little affects its action. The main clock works only move every half-minute, and they have only to drive the hands and to wind up the *remontoire*. The escapement is thus practically independent of variations in force in the main clock train. The introduction of the *remontoire* at once permitted an accuracy to be obtained previously believed to be quite unattainable. Subsequently the system was carried a step further, and the scape wheel, without a *remontoire*, at each tick lifted a heavy pallet, which was held up until the pendulum in its swing touched a detent and released the pallet, which then, by its own weight, impelled the pendulum; thus the driving force on the pendulum became absolutely constant.

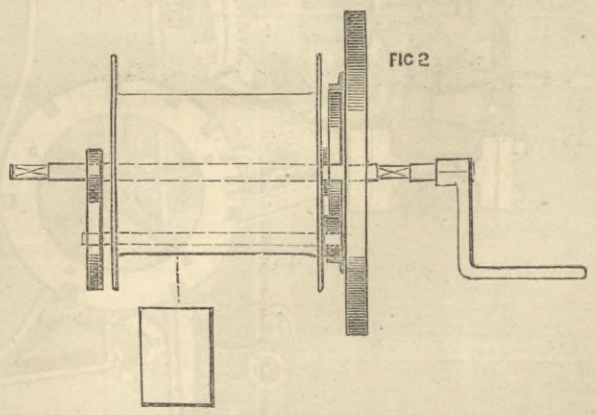
FIG. 1



ELEVATION OF REMONTOIRE.

In the New Law Courts' clock Messrs. Gillett have combined both systems. The escapement is that known as Dennison's "double three-legged gravity," and an entirely novel continuous action *remontoire* is put in the train, so that the least chance of disturbance of the pendulum is obviated, and the taking of the time is facilitated by the jumping of the minute hand every half-minute. The dials, filled in with opal glass, are 8ft. 6in. in diameter, and the minute circles are divided into alternate bars and spaces, each half the width of a minute, or 2½in.

FIG 2



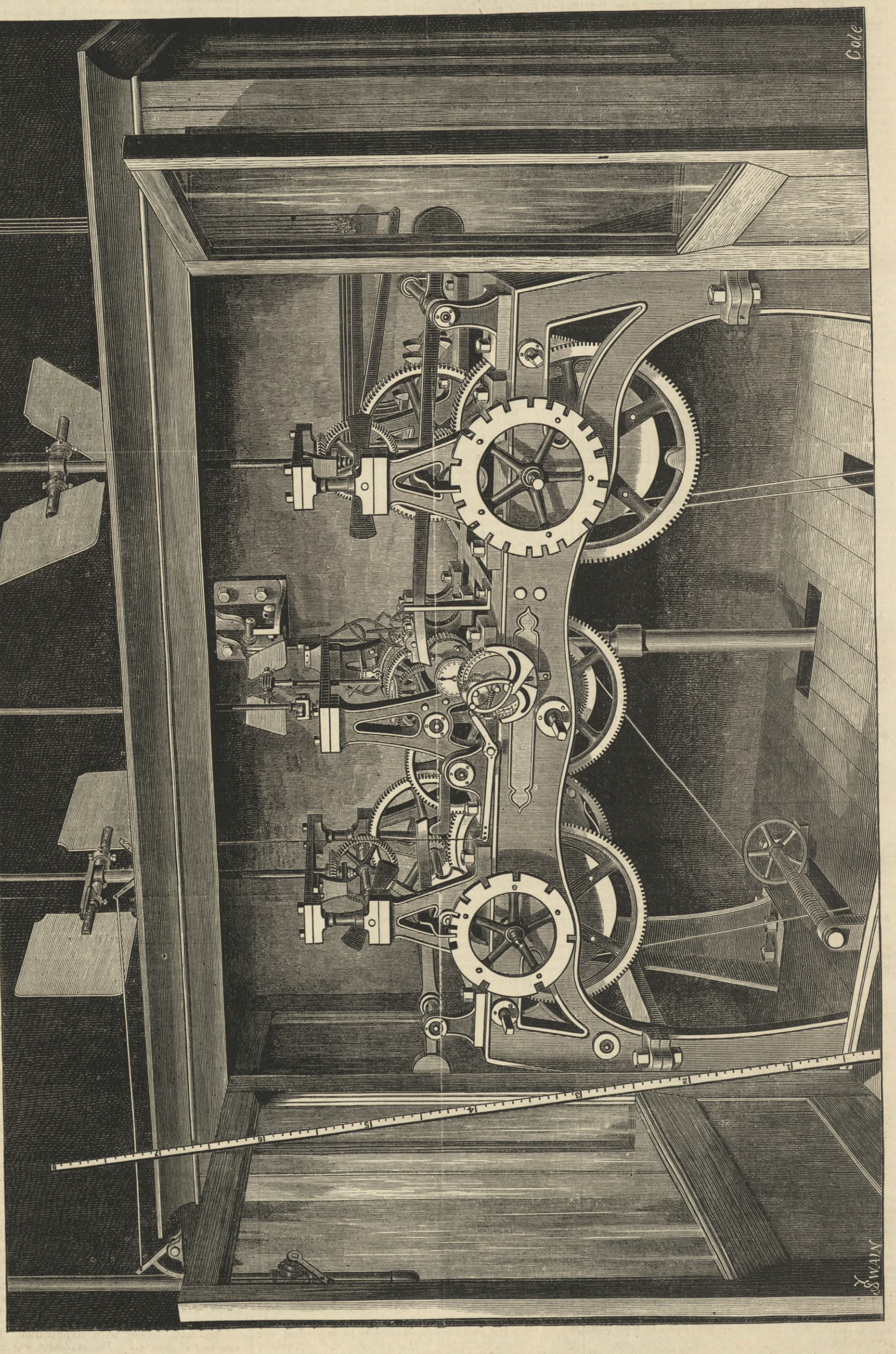
GOING BARREL.

The clock movement is arranged in a cast iron frame 7ft. 6in. long and 2ft. 6in. wide. All the wheels are of gun-metal, and the pinions have been cut out of solid cast steel. It may be worth while to state that Mr. Gillett has found that brass will not last in a London atmosphere, though copper and gun-metal will to perfection. The going part of the clock is on the left-hand side of the engraving near the scale rod leaning against the case. The locking plate for the hours with its notches is the most prominent object. Right in the centre are seen two cams, and two levers combined in a heart-shape which act as a perpetual regulator of the gas, turning it up and down at sunset and sunrise automatically. At the right-hand side is seen the quarter bell striking gear, driven by wipers on the surface of a drum. A few of these are seen under the four quarter bell levers in the background. The fans on top of the case are to regulate the rate of striking. The *remontoire* and winding gear are shown by Figs. 1 and 2. In these figures it will be seen that W is a toothed wheel driving P the escape pinion. The remainder of the train shown on the left hand of the figure is locked by an arm of a two-armed lever on the arbour of the last pinion of the train pressing against a rocking shaft. Every half minute this shaft is rocked, one arm of the lever is allowed to escape through a notch in the shaft; the arbor makes half a rotation, and the other arm is caught on the rocking shaft. It will be observed that there are two cams on the arbour of the last pinion in the train. These cams lift the weights C B, which, in falling, supply the power to drive the escapement. On the arbor of the wheel W are two weighted levers, one of which is sufficient to drive the escapement. By means of a loose claw, each lever as it falls presses on one of several pins sticking out of the face of the wheel W. The weights are suspended from the ends of the levers by cords passing over segmental guides, so that the weight is always the same distance from the centre of motion. One point of advantage displayed is in securing that the pressure on the pins sticking out from the wheel W shall always be exactly equal to one lever and weight during the period when one lever is taking the place of the other. The levers have spring tails terminating in rollers where contact is made with the cams, and the cams are shaped to secure the uniformity of pressure indicated. Attached to the wheel W is a brass ring, in which a little roller at the end of a light arm fixed to the rocking shaft rests. Every half minute a break in the ring is brought underneath this little roller, and the arm is suffered to drop, thereby rocking the shaft and allowing the train to escape. The light arm is instantly brought up again by a segment attached to the two-armed lever, and is held there while the train is running, by which time the break in the ring has travelled past the little roller and it can again rest on the ring. This instantaneous action is produced by a spring which throws the lever forward before the cams, and this spring also serves to break the concussion in stopping. This arrangement entirely removes the objectionable and varying stop pressure and friction from the escapement portion, there being no friction on the rocking shaft except when it rocks, at which time it is entirely detached from the ring and escapement portion. A projection on the cams at once brings the rocking shaft back by pushing another arm, as may be seen by examining the drawing. Another feature worth notice is the maintaining power and winding work, a sketch of which is given in Fig. 2. The barrel and great wheel both ride loose on the barrel arbor. On one end of the latter is the winding handle, and on the other a small pinion is fixed. This gears with a wheel on the end of an arbor running right through the barrel near its circumference. A small pinion on this last-named arbor takes into an internal ring of teeth fixed to the great wheel, as shown in the centre, page 486. There are no ratchet wheels or clicks at all; the sole connection between the barrel and the great wheel is that made by the small pinion gearing into the internal teeth. At first sight it may appear that after winding the weight would run down again without a ratchet and click on the winding arbor, and under ordinary circumstances such a train would run down, and with great speed if the weight is increased; but by a very simple method and a judicious arrangement of the different parts, the friction is equalised and so proportioned with regard to the weight that the tendency to run down is less with a heavy weight than with a light one. It must be remembered that the power gained in winding, by making the pinion on the winding arbour less than the wheel with which it gears, renders it proportionately difficult for the barrel to turn the winding arbour, and the barrel and weight being placed on this arbour, brings the principal friction to where it has the greatest effect, while the power in winding being applied direct easily overcomes it. Theoretically a portion of the weight would be taken off the clock during the operation of the winding; but this is counteracted by friction in other parts of the machinery. The *Horological Journal*, an authority of no mean weight, says:—"This maintaining and winding work, which is, we believe, the invention of Mr. Gillett, is in our judgment by far the cleverest thing of the kind yet introduced, and is an improvement on the old style of turret clock-making, second only to Sir E. Beckett's double three-legged gravity escapement. With it no preliminary action is required on the part of the operator before proceeding to wind. Practically the force on the train during winding is neither more nor less than at other times. No matter how long the winding takes, it may continue uninterruptedly. However heavy the weight, there is always ample power for every winding, because with clocks of increased size larger barrels would be used, and the larger the barrel the greater number of times may the pinion on the winding arbour be contained in the wheel with which it gears. The winding wheels are not in operation during the going of the clock. This last is an important advantage, for, independent of the power absorbed in constantly turning one or two winding wheels, inaccuracies of construction in these wheels often exert an injurious influence on the clock by varying the power applied to the train." The bells are carried on massive timbers in the room above the clock. The B bell weighs about 12 cwt., the A 15 cwt., the G 1 ton 1 cwt., and the D 2 tons 7 cwt. The great hour bell—C in note—weighs 3 tons 8 cwt., and rings out its deep sounds in perfect tune. A mistake was made in building the tower, the lower holes in the fireproof floors, providing for hoisting up the bells, were larger than the upper holes, and a good deal of cutting had to be done to make room. The clock weights have a fall of about 100ft. No place was provided for them by the architect, and they have to work in boarded trunks in the corners of the staircase, holes being cut for them in the stone landings. The whole of the work was done by Messrs. Gillett and Co.'s own staff. The workmanship and design of the clock and the tone of the bells leave nothing to be desired, and reflect great credit on the firm.

WATER SUPPLY AND IRRIGATION WORKS, SOUTH AFRICA.—The first great irrigation work in South Africa is now in course of construction at Van Wyk's Vlei. The Parliament granted £20,000 for the work. The contractor is Mr. Gillet. The water dammed in will cover an area of 19 square miles, with an average depth of 10ft., and for two miles and a-half the depth will be 27ft. This great artificial lake will be as large as Loch Katrine, in the Highlands of Scotland, and will, when at the depths given, be a sheet of water equal to 350,000,000,000 gallons, and capable of irrigating for many months thousands of acres. One rainfall such as Mr. Gillet experienced in April last he asserts would have kept the dam going for the purpose for which it was constructed for a whole year. The *Colonies and India* says:—"If Parliament were to vote half a million for the construction of similar dams in other parts of the country, we should hear very little of depression."

THE GREAT CLOCK IN THE ROYAL COURTS OF JUSTICE.

(For description see page 485.)



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J. W. H.—*We believe the original patent has expired, but we are not quite certain. So far as we can see, your method of manufacture would be an infringement.*

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NAUTICUS.—*The utilisation of wave power has often been proposed, and ships' pumps have been worked by it. It is altogether too irregular, and the mechanism necessary to the required end too cumbrous and too much exposed to injury, to be of any commercial value.*

COLONIAL BORN.—*Friction is, within ordinary limits of speed and load, independent of velocity, consequently the resistances of your shafts will so far be the same. But the leverage to overcome the resistance is obviously twice as great with the small as it is with the large shaft, and the small shaft will therefore be driven, other things being equal, with one-half the power required to turn the large shaft.*

J. P. S. (1).—*You may take the strength of leather used in belts at about* 3000 *lb per square inch of section Spliced leather made up into belts will not have more than about half this, and your square leather not more than about* 1800 *lb. Taking as the working stress one-third of this, or* 600 *lb. per square inch, then your belt* 2*in. square will transmit* 2400 *lb. at whatever speed within limits is required. Suppose the belt moves at* 4000*ft per minute, then it will transmit* $\frac{2400 \times 4000}{3300} = 290$*-horse power.* (2) *Water at* 0 *deg. Cent. increases in volume when it becomes ice at* 0 *deg Cent. by* 1·03125 *times its volume* (3) *Ice contracts in volume with loss of temperature* (4) *At the moment of solidification air is released, and the water itself expands between* 4 *deg. Cent and* 0 *deg Cent.; from* 1 *to* 1·000122. (5) *In freezing, the water in a pipe will solidify at the outsides first and the liquid part will be forced along the pipe towards the part where there is any freedom, as, for instance, where the air has collected, as already explained The general body of the pipe will thus be freed from elastic or from liquid pressure as it is filled with a rigid core which does not further expand. The part under pressure of accumulated air is, however, strained for some time, and a few repetitions thinnens the pipe and strength is lost.*

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DEATH.

On the 16th inst, at 9, Motcomb-street, JAMES RENNIE, F.R.S., youngest son of the late John Rennie, C.E. and F.R.S., in his 78th year.

THE ENGINEER.

DECEMBER 21, 1883.

LOSSES AT SEA.

WE have placed before our readers at considerable length some of Mr. Chamberlain's thoughts on merchant shipping, and we propose here to consider certain questions, concerning which we have said little or nothing, and about which Mr. Chamberlain has been practically silent. The theory on which he is acting is that losses at sea are preventible. We do not mean to say that he holds that ships are never lost save through the fault of the shipowner or the shipbuilder; but it is impossible to read his memoranda and not to arrive at the conclusion that the President of the Board of Trade is of opinion that there would be very few ships lost if only men did their duty all round. After giving a list of the losses of coal, timber, and grain-laden ships, Mr. Chamberlain goes on to say that something must be attempted to prevent the enormous sacrifice of life and property to which his figures refer. We have already shown what his views are, and we need not set them forth again. The question with which we have now to deal is this—Are the wrecks about which he speaks preventible by legal means or not? The answer to this must be, we regret to say, that as far as can be seen they are not preventible in any full sense of the term. The history of ships is a history of disaster. Storms and wrecks have always gone together, and it is only necessary to look at any wreck chart to see how little the quality of the ship and how much the nature of the coast on which she happens to be caught have to do with wrecks. The Goodwin Sands supply a case in point. Every winter scores of ships are wrecked on these sands, the nature of which is not, perhaps, as well understood by landsmen as it ought to be. The so called sands are really a great area of shallow water traversed by more or less deep-water reaches, through which ships can thread their way under the guidance of good pilots. If a ship is caught in a heavy gale while on the Goodwins or to windward of them her chances of safety are extremely small; and it is impossible to see under the circumstances what legislation can do. The whole east coast of England is badly provided with harbours, and a ship caught in a north-easterly gale must have a bad time of it. Not unfrequently sailing ships have been blown from the north for a couple of hundred miles only to bring up on the Goodwins, and become a total loss at the last. The number of ships lost at sea is comparatively small. The number of those actually wrecked, that is to say, blown on shore and broken up, is very large—so large that we do not think Mr. Chamberlain has realised what a wreck chart means. Legislation is no doubt intended by him to prevent losses at sea, but it cannot prevent all losses, nor, we fear, even a very large number of them. But there can be no doubt that an increase in the number of harbours of refuge would do good.

All that the President of the Board of Trade has written is of limited application. There are gales and seas through which no merchant steamer can live, and there are coasts to be caught off which in a gale means destruction. Against such contingencies the shipping owners are absolutely powerless. They can do nothing. It may be quite true that a well-found ship will often be able to get through a gale which would cause the total loss of a weaker or worse craft. Thus, for example, if it comes to riding out a storm at anchor, the ship with good ground tackle may live, while the ship with bad is lost. But conceding all this, there still remain cases in which the well found and the badly found ships are alike at the mercy of the sea and the wind, and good and bad are lost alike. "The loss of life," says Mr. Chamberlain, "was in 1881-2 greater than ever. No doubt a large part of this loss was immediately caused by the violent gales of that autumn, when, as has been said, the Bay of Biscay was strewed with the wrecks of foundered ships. But well found ships ought not to strew the ocean in every heavy gale." This is quite true, but it is also true that every heavy gale does not strew the ocean with wrecks. If Mr. Chamberlain could but see how some of the ships which he regards as bad, weather Atlantic gales he would probably change his mind concerning their qualities. Mr. Chamberlain, like many other men who see but one side of a case, draws a curious comparison between first-class passenger ships and cargo boats. "Emigrant ships and passenger steamers have long been subject to a Government survey, and the system has worked with little difficulty. The principal reason probably is that these ships are among the best on the ocean; no expense and no skill is spared by the owners; and amongst them are many which are not insured." Such ships as these are not lost. Why should any ship be lost? Now, no true comparison between, let us say, the Cunard steamer and the cargo boat is admissible. If we take the life of one of the former ships, we shall find that she goes backward and forward steadily over the same route—we had almost said week after week; that she is fitted with full-powered engines, and that she rises so high out of the water that her being swamped is almost an impossibility. The cargo steamer has, on the contrary, to go everywhere. At one time she is in Bombay, another in Singapore. This voyage she makes to New York, the next to Cronstadt. A great deal of her work is done in crowded and dangerous waters. The risks she incurs are out of all proportion to those run by the Cunarder, and these risks are unavoidable. The value of great power cannot be over-estimated. It will enable a vessel, for example, to keep head to wind, and even to make some progress when the low-powered vessel is almost helpless. A cargo steamer carrying 3000 tons of dead weight will have engines indicating 600 to 750-horse power. Such a vessel will be nearly as large as a passenger steamer indicating 3500-horse power. The speed of the first will be 9 knots, that of the latter 15 knots. It does not require much knowledge of the sea to understand which will be best off in a heavy gale. The cargo steamer cannot be high out of the water for the same reason that she cannot have full power—it would cost too much. In many instances engines are taken out of steamers and replaced by others of less power to make the ship pay. The tonnage laws interfere and prevent the adoption of the hurricane decks which would do so much to render ocean cargo steamers safe—will Mr. Chamberlain have a change made in the system of levying tonnage dues? In one word, the cargo steamer must be less safe than the passenger steamer, because she must be cheaper; and this question of cost goes after all to the root of the whole problem.

If the President of the Board of Trade is to do good he must set forth in very plain terms what are and what are not preventible losses at sea. As regards wrecks caused by heavy gales, he will be able to prove very little on his side; his strong point will be the number of vessels which go to sea and are never heard of afterwards. We concede with pleasure that a strong, well-found ship ought to be safe in the open sea, and that the majority of English ships are safe is proved by the fact that losses at sea are comparatively few and far between. The clipper sailing ship of the present day is, for example, the safest craft afloat. In order that Mr. Chamberlain may make the ground sure under his feet, he must be prepared to prove that the losses at sea, so much to be deprecated, are due to unseaworthiness. His statistics are sufficiently appaling; but when we have subtracted wrecks proper and losses by collision, it will be found that we shall have comparatively little left. As we have said before, we have no desire to hinder the good work which Mr. Chamberlain would undertake; but exaggeration due to misconception of facts can do no good, but rather harm. The President of the Board of Trade has not yet mastered his subject, but he must do this before he can legislate, or even write with advantage concerning it.

THE BOARD OF TRADE ON BOILER EXPLOSIONS.

WE briefly referred in our last impression to the report on boiler explosions presented by Mr. Thomas Gray to the President of the Board of Trade. Last year an Act of Parliament was passed, one of the clauses in which provided for inquiries by the Board of Trade into the circumstances under which boiler explosions take place in the United Kingdom. These inquiries are conducted by Board of Trade engineers, and their reports are printed and published. They are fully and exhaustively illustrated, and, we are informed, are much sought after. We have before now commented on these reports. They are prepared with sufficient care, but they are in other respects open to criticism. Many manifest more or less a lack of appreciation of the necessities and difficulties of steam users. Thus, for example, we find in one of them a general deprecation of the use of small vertical boilers. No substitute is recommended, nor, indeed, is it possible to find one. Vertical boilers are used by thousands for working cranes, and few steamships are without one or more donkey boilers of this class. It would, indeed, be waste of time to point out that the type cannot be done without. Again, we are told that a particular boiler of the locomotive type was worked at about double the pressure which Board of Trade rules would allow; the writer of the report in question failing to see that if the Board of Trade rules applied generally, locomotives, traction, and many portable engines would cease to exist. Mr. Gray's report manifests in several respects a similar lack of intelligence. To him all failures of boilers are "explosions." If he possessed a competent knowledge of the subject, he would see that the coming down of furnace crowns is a matter of daily occurrence, and that these events are not necessarily accompanied by any explosion whatever, and the collapses referred to in his report, as will be seen further on, scarcely, we think, deserve to be classed as they are.

We are told in the report with which we are now dealing that the terms "inevitable accident" and "accident" are entirely inapplicable to boiler explosions. The reports show that so far from the explosions being accidental, the only accidental thing about many of them is that the explosions should have been so long deferred." With this statement we cordially agree. The total loss of life and injury reported on amounts to 35 killed and 33 injured during the twelve months ending on the 12th of last July. In all, 45 cases have been reported on. Of these, 14 were due to corrosion, 5 to bad design, 4 to overheating from shortness of water, 4 to defective safety valves, 3 to undue pressure, 3 to neglect or ignorance of the attendant, and 12 come under the vague head "Miscellaneous." "As in three cases only," says Mr. Gray, "can the explosion be attributed to neglect or ignorance of management on the part of the boiler attendants, there is no reason for yet assuming that any material diminution in the number of explosions may be expected to result from the systematic examination of and granting certificates to the men employed in working the boilers." With this also we agree; but we hold all the same that some advantage would be gained by employing men whose competence was ascertained in some way before they were put in charge of dangerous and expensive appliances like steam boilers. Beyond question, too much has been expected from the granting of certificates. As a matter of fact, no one is really put in charge of a boiler who is not able to furnish some guarantee that he is competent to perform the duties he seeks to undertake; and these are, after all, very simple and easy of performance. They demand incessant vigilance more than anything else; and it is not easy to see how this could be secured by any examination better than by certificates from past employers. It does appear, however, that some explosions do occur through the fault of attendants—many more, we are disposed to assert, than Mr. Gray seems to think. We cannot see, however, that any amount of education would have obviated these. A knowledge of the laws of heat and steam will not keep a man awake, or compel him to be careful that water does not get too low. Vigilance is more a matter of personal idiosyncracy than anything else. While we are of one mind with Mr. Gray concerning examinations and granting certificates, our reasons are different from his reasons.

Four explosions, causing the loss of ten lives, were due, we are told, to shortness of water; but this is the *prima facie* evidence of neglect on the part of the attendant. There is a table attached to the report, giving particulars of the explosions; and to say the least this does not bear out Mr. Gray's conclusions. In the first place, many of the explosions were not boiler explosions at all, in the proper sense of the word. Thus, for example, in case 2 the lid of a steamer for steaming woollen goods was blown off. In case 6 the lid of a naphtha still was blown off, "the pitch having solidified at the cock through which the tar was being drawn off, a red hot rod was inserted to clear the obstruction, and thus ignited the gas left in the still." This was certainly not a boiler explosion. In case 10 a fusible plug was blown out; no damage done. In case 17 the cylinders of a steam drying machine gave way, either through soldering becoming defective, or by the application of too great steam pressure. The machine was not fitted with a safety valve. In the next case the cap was blown off a tube in a fuel economiser, because a nut was screwed up too hard. In case 22 a naphtha still burst owing to accumulation of pressure, the worm of the still becoming choked with naphthaline. In case 38 a naphtha still gave way. The explosion was caused by the accidental ignition of vapour left in the still after the

pitch had been drawn off. The vapour became ignited through an open cock. We have here six cases out of forty-five which ought not to be classed at all with the rest. As regards shortness of water, the evidence of the report is extremely vague. We find four cases mentioned, and in only three of these it is certainly known that the water was short.

We have already commented on the statement that "inspection by insurers of boilers does not insure safety, for we find that one-fifth of the explosions which happened during the year happened from boilers not only inspected by, but insured in boiler insurance companies." The cases cited are Nos. 10, 13, 23, 25, 29, 35, 39, 41, and 43. We have pointed out that these are not explosions proper, or that they occurred from causes quite beyond the control of the insurers. We may now examine them a little more in detail. No. 10 took place at a dye works; a fusible plug was blown out, no one hurt. In No. 13 an internal flue, wasted by corrosion, collapsed; three persons were killed. The boiler was under the inspection of the Boiler Insurance and Steam Power Company, but not insured. This seems to indicate that the company had refused to take the boiler, and had probably warned the owner. It is difficult to see where the responsibility of the inspecting company comes in. Case 23 was a vertical donkey boiler insured by Newcastle-on-Tyne Boiler Insurance Company, one man was killed; case 25 was a locomotive thirteen years old, insured and inspected by the Scottish Boiler Insurance Company; case 27 is strictly anomalous. A Lancashire boiler was insured by the Mutual Boiler Insurance Company, of Manchester, and we are told that collapse and rupture of the crown of the right-hand furnace took place because of the "sudden contraction of the top of the furnace in consequence of furnace door being left open for a period of from five to ten minutes. Similar contractions on previous occasions had perhaps injured the boiler." We never heard of such a case as this, and we venture to doubt the accuracy of the statement. No one was hurt. In case 35, also a Lancashire boiler, insured with the Boiler Insurance and Steam Power Company, Manchester, the right-hand flue collapsed because of "overheating of the flue consequent on shortness of water, but the cause of the latter could not be ascertained with certainty." The insurers cannot be held responsible here. In case 39, also a Lancashire boiler, insured with the Mutual Boiler Insurance Company, we have:—"Collapse and rupture of right hand furnace. Top of left-hand furnace also collapsed; due to overheating of furnace crowns, caused by the collection of a deposit from a boiler composition used to soften scale. Working pressure also excessive at time of explosion." This also seems to be a case where the insurers are blameless. The last case is that of the S.S. Esther. No one was hurt. Both furnace crowns came down, owing to a deposit of salt scale. The boiler was inspected by the surveyor for the Red Cross Club of Newport, which club was obviously not responsible. No one, so far as we are aware—least of all the boiler insurance companies—asserts that insurance and inspection give absolutely immunity, and we have no fault to find with Mr. Gray for saying so much; but we think it is greatly to be regretted that he should have said it in a way which conveys the idea that he depreciates the services rendered by these companies, which are undoubtedly very great. Possibly Mr. Gray does not mean this. It is a pity, if this be so, that he has not expressed himself more felicitously.

IRON SHIPBUILDING.

Commercial men must have their jokes although the air is full of rumours of serious complications. One of the latest is that iron shipbuilders will be found advertising ready-made ships early next spring, the sinister meaning being that the ships now in course of construction will not be claimed by the too sanguine individuals who have commenced the trade of managing owners too late in the day. However that may be, it is very certain that ships are at a discount, and that the hearts of those who have contracted for new ships which are now building are very heavy. A year or so ago a man would give £500 for a turn before his neighbour. The sale of a "berth" was much more profitable than Esau's transaction, and in ports on the north-east coast especially scarcely a clerk existed who did not imagine that the mantle of a shipowner belonged to him. The intrinsic value of a merchant steamer was not deemed to have any relation to the price charged for it. The inflation of prices meant high wages for operative shipbuilders—indeed, some "ironmen" have earned sums which would make some professional men very envious—and almost fabulous wealth for master shipbuilders. The only other industry which profitted by this abnormal state of things was the marine engineworks. No benefit accrued to the plate-maker or to the departments of the iron trade. Now, the time has arrived when the ships already afloat are so numerous that merchants are playing them off against each other in a way which may conduce to the profit of the merchant, but will certainly not make the shipowner rich. As a natural consequence the investor who has just discovered that instead of an inexhaustible gold mine the shipping trade is poor and profitless, does not desire to expend further capital in the purchase of sixty-fourths, and so the shipbuilder finds that no more orders are coming in. The pinch will not be severely felt till the spring of next year, because of the multitude of old contracts; but in the meantime shipbuilders in the North of England have given their workmen notice of a reduction which is equivalent to 20 per cent. on the wages of the higher paid men, and 10 per cent. on the wages of the ordinary workmen. The object, apparently, is to cheapen the production of vessels so as to tempt buyers. Winter weather deals unkindly with iron merchant steamers, and it is not unsafe to expect that 5 per cent. of the ships registered in every port will disappear between now and next April. But it is hardly likely that the confidence of investors will have returned so soon, more especially if Mr. Chamberlain's notions of limited insurance are carried into effect. There must be a period of stagnation in shipbuilding—how long it will continue depends altogether upon circumstances. If legislation is not too exacting, the shipping trade is only fettered by such restrictions as all honest men are willing to submit to; it will not be of many months' duration.

GAS TESTING

The journal which is generally recognised as representing the gas companies continues to be exceedingly angry with us for supporting the action of the Metropolitan Board in seeking further guarantees for the statutory character of the London gas supply. In our second article on this subject we brought forward precise facts in support of our previous statements, and on these facts we rely, whatever amount of hostility we may have to endure at the hands of our contemporary. We have simply discharged a public duty, and have no *animus* in the matter. It cannot be disproved that a large quantity of gas consumed in London has for some time past escaped the ordeal of the existing testing stations, and it is also an assured fact that when a test has been applied to this portion of the gas supply, a serious deficiency in the lighting power has been discovered. That is to say, the illuminating power of the gas so tested has proved to be "frequently under 16 candles, and on several occasions even below 14 candles." It would be far better for our contemporary to explain these results than to attack The Engineer. If explanation cannot be offered, it might be well to remember that sometimes "silence is golden."

THE WHITE STAR LINE.

It is worthy of remark that, although commenced some twelve years ago, the White Star fleet is still the first on the Atlantic in point of speed and regularity. The commodore ship, the Britannic, has illustrated this in a singular manner, having just completed her seventh consecutive voyage from New York to Queenstown in less than eight days, the longest of these voyages being 7 days 21 hours 23 min., and the shortest 7 days 17 hours, making an average of 7 days 19 hours 53 min., the best which she has yet attained. This record becomes the more remarkable when it is remembered that the homeward route which the company has adopted for the sake of securing greater safety for its ships is more southerly, and therefore considerably longer than that generally adopted. Regularity, when it is, as in the present instance, combined with comfort, speed, and safety, should be a strong recommendation to public favour.

LITERATURE.

Life of Sir William E. Logan, Kt., LL.D., F.R.S., F.G.S., and First Director of the Geological Survey of Canada, chiefly compiled from his Letters, Journals, and Reports. By Bernard J. Harrington, B.A., Ph.D., Professor of Mining in M'Gill University; late Chemist and Mineralogist to the Geological Survey of Canada. London: Sampson Low, Marston, Searle, and Rivington. 1883.

This book contains a record of a career in some respects probably unique. Here is the life of a man certainly not educated for scientific pursuits and spending his time up to the age of thirty-three in the counting house of a London merchant. From the firm with which he was connected having entered into speculations connected with copper mining, we read of him, as if touched by the fairy wand, transformed into an efficient metallurgist and miner, and a really eminent geologist. In one way, therefore, his career may prove a bad lesson, as supporting the common delusion that a man may, if he needs it, get up any branch of science at any time. If Logan succeeded by dint of a rare capacity, both of body and mind, for hard work, how many would under precisely similar circumstances have failed completely? Nor is it difficult to perceive that if he had enjoyed a good chemical education the undertaking would have been more remunerative. One part of the speculation consisted in a patent for the extraction of copper from slags, which were to be worked over again. This process came to nothing, so that the money sunk in the purchase of this invention, and of some millions of tons of old slags, was to a great extent sacrificed. But that part of the undertaking which consisted in smelting copper according to the ordinary Welsh process, and in coal mining, proved successful. From seeking after coal he was led to inquire into the origin of this mineral, and to study the structure of the Glamorgan coal-fields. So indefatigably did he work on this subject, that by the time he had resided two years in Swansea he had completed a geological map of the neighbouring area, which was adopted by Sir H. de la Beche for the Government Survey with the highest praise. He was the first to demonstrate that the coal beds had been formed *in situ*, and were not accumulations of drift wood, &c. He came to this conclusion after observing the invariable presence under each seam of coal of a bed which the local miners call "the under clay." In 1837 he was elected a Fellow of the Geological Society, before which he read an account of his conclusions respecting the coal-beds. He took an active interest in the management of the Royal Institution of South Wales, in which he filled the office of geological orator. When he left Wales and returned to Canada, his native country, he had already been widely and favourably known to the leading geologists of the day as an earnest and accurate observer and worker. In 1842 the project of a geological survey of Canada, which had already on several occasions been brought forward, at last took a definite shape, and on the warm recommendation of such men as De la Beche, Sedgwick, Sir Roderick Murchison, and others, Logan was appointed the director.

The work contains many sketches of Canadian landscapes, especially of rivers, and of some fossils, and the style, fresh and rough, of the drawings of Sir W. Logan especially commend themselves to notice—such as: view on the Lower St. Lawrence (p. 187), and view at Cape Maquereau (p. 169). Some of the stories of mining are interesting, especially those about the Canadian coal miners. It is stated that a real *practical* miner had discovered coal near Bowmanville, in Upper Canada. Mr. B——, the owner of the farm, was easily persuaded that boring operations should be undertaken, and bore-rods and tools were soon provided. Sections of strata, supposed to be passed through, were daily heralded in several of the papers, and great was the excitement throughout the country, and great the indignation against unfortunate geologists who ventured to doubt the occurrence of coal in this district. Logan had declared from the first that there was no coal there, and refused to visit the spot. A certain sheriff, a great friend of Logan's, went to Bowmanville, was convinced that it was all right, and proceeded to Montreal to Logan with some fragments of coal. "I saw it taken out with my own eyes," said the sheriff. "Ah," replied Logan, "you should have been there earlier, and looked more sharply, and then you might have seen it put in." The possibility of such a proceeding had never occurred to the worthy sheriff. Some other visitor, while witnessing the extraction of the coal from the same bore-hole, observed that the coal was mixed with bread and cheese, which had accidentally got into the hole during the preliminary operation. So ended the Bowmanville excitement. Eventually it turned out that the bore-rod had never reached the solid rock at all. In 1855, while acting as juror to the Canadian section of the Paris Exhibition, a respectable Frenchman said to him: "Le Canada est en Peru, n'est-ce pas?" He seems to have been singularly alive to the tricks of "prospectors" in mines. A number of other tales are told in illustration of this. During the time of the gold excitement in the province of Quebec he was not infrequently urged to give his opinion on gold-bearing quartz. Sir William was asked whether the glittering metal visible at the bottom of little cavities in the quartz was really gold. "No doubt of it," said the unmoved critic, after eyeing it closely with a pocket lens—"no doubt of it, and with this glass you can see the marks of the punch perfectly." On another occasion, when pestered to give an opinion on a copper-bearing area, after reiterating without avail that he was a geologist, but not a mining engineer, he was pressed for an answer to the question whether there was not an enormous quantity of copper within the area described. He satisfied both the intending seller and contemplating purchaser by the reply: "There is an enormous quantity of copper—an enormous quantity; and it is my opinion that it will cost just a little more than it is worth to get it out."

He died in 1875, after a long, well-spent, and most honourable life.

DR. JAMES LAWRENCE SMITH.

By the death of Dr. Smith the scientific world of America has sustained a severe loss—one of the greatest which she possibly could, for there are few men living in the United States who have done so much for inorganic chemistry as Dr. Lawrence Smith. He was born near Charleston, South Carolina, on the 16th December, 1818, and was therefore in his sixty-fifth year. He graduated in the University of Virginia, and in the Medical College of Charleston. After leaving the latter institute he spent three years in Europe, and mostly in Paris, pursuing studies in physics, chemistry, geology, and mineralogy. While in Paris he commenced his publications in chemistry by a paper on the means of detecting arsenic in the human body, which was reprinted in Silliman's *American Journal of Science* in 1841. After his return to Charleston in 1844, he was made Assayer to the State, studied its marls, ores, and cotton-bearing soils; and his able report on cotton-growing led to his appointment under the Turkish Government, with reference to instruction on the subject in that country. The emery mines of Turkey, near Smyrna and Ephesus, and adjoining districts and islands, gave him a new subject for research; and his report on them to the Academy of Sciences of the French Institute in 1850 is the first full description of the geological character and mineralogy of the emery region that had appeared. Besides a careful chemical study of the emery, in the course of which he devised the mode of attack of this refractory mineral by sodium bisulphate, he investigated its effective hardness by a new method, and extended his determinations to the emery of other localities. His memoir was published in the *Mémoires des Savants étrangers*. He also studied the emery of Chester, Massachussetts, in which he confirmed and extended his previous observations of the mineral and its mode of occurrence, and mineral associates. He also published a report on the thermal waters of Asia Minor.

American mineralogy owes very much to Dr. Smith for his careful chemical investigations, the earlier of which were carried on conjointly with Professor Brush, and the science of chemistry in many ways, and especially for the method proposed by him, and since adopted generally, for the determination of alkalies in silicates. Many ingenious appliances were proposed by Dr. Smith in the department of chemistry and physics. One of the most important is that of the inverted microscope. Meteorites were with him a subject of great interest and thorough study. His papers giving descriptions and the results of chemical and physical investigations of different meteoric stones and irons are very numerous, and have greatly advanced this department of science. It formed the topic of his last paper. In 1873 he collected in one volume the chief of his papers, and out of 400 pages which it contains, 100 are devoted to papers on meteorites. He noticed the invariable presence of cobalt in meteoric iron; a new mineral occurring in meteorites, a chromic sesquichloride; and noticed a few years since the occurrence of three falls of meteorites within a month or thirty-two days in a very narrow area of the United States.

Dr. Smith held for some years the professorship of chemistry in the University of Virginia, and during the later years of his life that of chemistry in the University of Louisville. His large collection of meteorites and minerals he gave to the Polytechnic Society of Louisville two years ago. He was a member of various scientific academies, both foreign and American, and was recently elected to a foreign membership of the Academy of Science of Paris. A most kindly and appreciative eulogy has been spoken there about him by M. Daubrée. One who well knew him in his adopted city says justly of him:—"Eminent in his profession, he was more than eminent in his home. He was a gentleman, truly; but he was a man of affairs, a man of convictions, a man among men, who, though absorbed in scientific pursuits, took a sincere and profound interest in public questions and events. He had not an enemy on earth, despite the positivity and transparency of his opinions, and he goes to his last rest leaving the people with whom he was so long identified to mourn the loss of a citizen of whom all were proud and whom everybody loved and honoured."

Harbours of Refuge and Breakwaters round the British Coasts.—On Wednesday evening, at the monthly *conversazione* of the London Literary and Artistic Society, held at St. James's Hall, a lecture was given by E. C. Greenway Thomas, Esq., late Judge of the Civil and Session Courts of Vizagapatam, on a novel and economical method of constructing harbours of refuge every fifty miles around the coast for saving life and property. Mr. Thomas proposes the use of a form of floating breakwater, which is of his invention, and is known as the Greenway breakwater, and of a modification of this formed partly of concrete. The essential feature of the invention is that, while the sea is not stopped by the floating and independent sections, it is checked, the waves meeting the floating buoys being split up and their motion of translation destroyed by their meeting between the buoys. In some situations masonry and concrete fixed breakwaters would be used, each part having a cross section similar to that of the floating buoys, namely, hollowed sea faces. There is no doubt these might be advantageously used at many places.

THE DOCKISING OF RIVERS.

No. III.

ON receiving Mr. Rawlinson's reports, the Council made up their mind to spend a sum of £1500 on further inquiry, and put the matter again in the hands of the committee. They proceeded in the first place to obtain Mr. Howard's opinion on certain supplementary points, with the following results. First, with regard to land required for wharves, it appears that there is a large acreage lying on both sides of the river, which is at present merely grazing land or salt marsh, but which could at once be utilised for quays. The total length of frontage of this land is about six miles, and the breadth is from 300ft. to 500ft. Assuming the area to be about 280 acres, it was estimated that it might be purchased under Parliamentary powers for £56,000. Secondly, as to the increased cost of the working staff, it is obvious that two dock masters, with a sufficient number of assistants, would have to be maintained at Kingroad. On the other hand, the staff at the present floating harbour could be reduced, as the work of locking, &c., would then be much lessened. On the whole, there might be expected an increased annual cost of about £1000. Thirdly, as to the increased cost of dredging, most of that which is now required is due to the muddy tidal water which flows for some days during each spring tide over the dam at Netham, and which also enters at every tide into the junction locks and half-tide basins between the floating harbour and the New Cut. This is evidenced by the fact that the present dredgers are occupied for much the greater part of their time either just within the entrance to the floating harbour or in the Avon above Netham dam. There might no doubt be a certain amount of deposit from flood waters in the great float; but Mr. Howard does not consider this a serious item, and even according to his estimate it is probably overrated. Very many rivers, the Avon amongst them, are practically dockised or converted into canals for large portions of their course, and the amount of dredging thereby rendered necessary is generally insignificant. Moreover, the velocity, even in the great float, would be usually sufficient to carry the greater part of the suspended water down to its lower end, and so into the Severn. Fourthly, as to the comparative cost of towing before and after dockising, it might be expected that this would be largely increased by the new works, inasmuch as vessels are now able to take advantage of the ebb and flow of the tide; but, as a matter of fact, only the very lightest vessels can venture to come up by the tide alone. All vessels worth considering must have a tug with them for the purpose of regulating their course, if not of actual haulage; and the cost for towage by tugs is naturally far smaller in still water than in a dangerous tidal channel, such as that of the Avon. Mr. Howard proves this by comparing the charges actually made for towing in the river Avon and in the Berkeley Canal, by which vessels of considerable size are conveyed from Sharpness docks to Gloucester. He estimates that the saving in cost of towing by the new works might be taken as 50 per cent. Fifthly, with regard to the size of vessels that could come up to Bristol, the depth of water in the present float limits the draught there to about 22ft. There is, however, width for vessels 300ft. long to swing within the present harbour, whilst in the great float there would be a swing of 350ft. to 400ft. at Rownham, and room for vessels of almost any length to swing in the lower parts near the dam. Here, of course, vessels of any draught could always be accommodated. Even with the channel in its present form there would be space for two vessels 300ft. to 320ft. long to pass each other deeply laden at the very worst point, where there is a curve of 600ft. radius. Sixthly, as to the cost of wharf walls, Mr. Howard estimates that many railway companies, &c., would be willing to take wharves on easy terms with the condition of building the walls. He suggests that the Corporation should begin with 4000ft. to 5000ft. length of quay wall, which would cost about £100,000.

Having obtained this opinion, the committee went on to carry out their instructions, which were to consult an eminent engineer on the whole question. They selected Sir John Coode, and asked him to advise whether there was a good *primâ facie* case to warrant the expense of a further survey, borings, &c.; or whether, after looking into and considering the general nature of the scheme, he judged it to be one that he could not see his way to support. On these instructions, Sir John Coode went into the question, and furnished an important report, dated 8th March in the present year. He begins by saying that he had made an inspection of the river and docks in company with Mr. Howard, and had obtained from him a number of documents bearing on the question. He then proceeds to deal with what he calls the cardinal question of the maintenance of the depth of water in Kingroad and at the new entrance, in the event of a dam being placed across the Avon channel. He quotes the view of Mr. Page: "That such an interference with the tidal action of the Avon would, in fact, deprive the river of that power which maintains any depth of water at its mouth;" and also that of Sir John Hawkshaw, which was practically to the effect that he was unable to arrive at any conclusion at all. He observes that the matter appeared to him to be one which should be settled rather upon hydrological than geological considerations; in other words, by studying the tides in the Severn rather than the strata underlying the Avon. His object was to ascertain whether the tides in the locality might be regarded as being in any degree the cause of deep water at Kingroad, and of the curved indent in that part of the Severn shore which lies about a mile and a-half on either side of Avonmouth. He confined his examination to the tidal currents in the Severn, for since the volume of water flowing into the Avon is somewhat less than 1 per cent. of the tidal current flowing up the Bristol Channel, the exclusion of the tidal waters may, in his opinion, be safely dismissed as being an altogether unimportant factor in the case. It will be seen that Sir John Coode, who is a man pre-eminently cautious in adopting new ideas, here directly contradicts the opinion of Mr. Page, and lays, it may be hoped for ever, the ghost of tidal obstruction, which had prevented the dockising of the river when first mooted.

The results of his examination are very striking. It has been shown, chiefly by the observations of Admiral Beechey, that at the time the stream from the Scilly Islands is setting to the northward, that from the Irish Channel will be found setting from the southward, and that both of these turn into the Bristol Channel; the offing tide from the Atlantic at the same time contributing its share to the central portion of the channel. It is the combined action of these three streams, coupled with the gradually converging form of the estuary, which causes the exceptional rise of tide in the Severn, and the local phenomenon known as the bore. On studying the directions of the tidal currents, it appears that the principal set between Clevedon and Portishead is to the southern or Somersetshire side, and that it hugs this side closer as it gets further up the river. The result is that the lift of tide on the southern side is actually greater than on the northern, the water being, as it were, banked up against that shore. Studying the question further, it appears that in the lower parts of the channel the opposite is the case. Between Watchet and Barry Island there is a greater range by 1ft. 6in. on the Welsh than on the English shore. Again, between Penarth, near Cardiff, and Brean Down, near Weston, the lift on the two shores is about the same, showing that the currents are here fair in the middle of the river. But on a line drawn from Gold Cliff, three miles east of the Usk, to Walton Bay, near Clevedon, the range is greater by 1ft. 9in. on the English shore. Lastly, at the mouth of the Avon the difference in range is as great as 2ft.

From these facts the conclusion is drawn that "the preponderance of the sweep or momentum of the Severn tides is so distinctly along that portion of the Somersetshire side of the Channel, near Kingroad and Avonmouth, that the configuration of this section of the Severn shore is independent of the passage of the relatively small volume of tidal water passing in and out of the Avon, and the continuance of the deep water along the shore and through Kingroad would be permanently assured by the momentum of the Severn tide streams if the whole of the tidal waters of the Avon were excluded by the erection of a dam."

Not merely is the passage of tidal water into the Avon thus shown to be of no advantage to the depth outside, but it is even suggested that it may be a positive evil. The deposition of mud which is found on the Flatness Ledge, near Avonmouth, may probably be attributed to the stilling effects of the confluence of the two rivers, and it is not unlikely that the result of dockising would be to sweep it away.

Passing on now to the engineering conditions of the problem, Sir John Coode observes that the geological conditions at Avonmouth appear to be favourable to the construction of the necessary works; although, of course, careful examination would be necessary before they were carried out. The depth of the sills at the entrance would require special consideration. Having regard to the growing size of modern steamships, the sills of at least one entrance should be little if at all above the level of low water at the lowest equinoctial spring tides; for if dockising is to be carried out, it must be so devised as to insure the entrance and exit of the largest class of steamers on every tide throughout the year. On the other points requiring special consideration—namely, the carrying off of flood water and the disposal of the sewage—Sir John Coode is content to refer to the reports which we have already dealt with; and he concludes by observing that there is, is his opinion, a sufficient *primâ facie* case to warrant the expense of the new survey, and a thorough investigation of all the physical conditions requisite for an exhaustive consideration of the question in all its bearings.

In presenting this report to the Council the Committee annexed to it a memorandum upon the financial aspect of the question. This, in its details, is, of course, chiefly of local interest; nevertheless it is of importance as showing the general questions which arise for consideration when the economic aspects of such a scheme have to be dealt with. In the first place they give statistics showing that the registered tonnage arriving with cargoes from abroad has been practically stationary during the last five years, and that whilst the value of the exports has increased enormously since the opening of the docks at the mouth of the river, yet this is of no advantage, because the charges imposed on this trade, owing to competition, are merely nominal. Hence they conclude that with the present trade no margin of profit can be looked for, such as to meet the interest on a large expenditure of capital. It remains, therefore, to consider whether the dockising of the river would lead to new traffic, such as the Atlantic passenger trade, and also to such an expansion in local industries and shipments of exports as would give a corresponding increase of revenue. Now with regard to the American trade, Bristol has two well marked and special advantages. In the first place it is the nearest English city to New York; as a port it is nearer by 50 miles than Liverpool; and the route to London and the Continent *viâ* Bristol is shorter than that *viâ* Liverpool by no less than 150 miles. But by the dockisation scheme vessels of any size would be able on any tide to enter the harbour and come up to a berth alongside the railway, so that in three or four hours after passing through Kingroad her passengers would be in London. The saving of several hours between New York and London is to business men a serious consideration, and offers an advantage whose importance can hardly be over-rated.

Secondly, Bristol lies close to the important coal-fields of South Wales, from which comes the steam coal used almost exclusively by the vessels now plying between England and America. At present this coal has to be taken by rail or steamer to Liverpool; in both cases with serious expense both of transit and handling. On the completion of the dockising scheme, the coal would be brought by truck through the Severn Tunnel, now nearly complete, direct to the wharves on the new floating harbour, and discharged at once into the vessels. The saving in cost, especially to the shipowner, would be something like 5s. per ton; and when the importance of fuel to a swift passenger steamer is considered, it will be seen that we have here a very strong inducement to choose Bristol as the port of embarkation. The opening of the tunnel will also produce greatly increased trade of all kinds between South Wales and Bristol, and will stimulate both imports and exports there. The tendency now existing to shift industries, such as iron and steel, to the coast, is also pointed out as likely to enhance the manufacturing prosperity of Bristol. Making a moderate estimate on this basis, the committee see their way to an additional revenue of about £88,000. On the other hand, the works to be carried out would probably involve an additional yearly expenditure of £85,000; so that it appears that the scheme would just pay its way directly, while indirectly its advantages can hardly be underrated. On these grounds the committee recommend the Council to authorise a further expenditure —say £3000—for the new survey and investigation approved by Sir John Coode.

We have now placed our readers in possession of the leading facts of the case, and enabled them, we hope, to appreciate the importance of the question which has to be decided by the citizens of Bristol. Whether it will be decided aright we do not venture to prophesy. It is hard to augur well from the history of the past. There can be little doubt that if Bristol had retained something more of the spirit which built and launched the Great Western—if she had resolved that, *coute qui coute*, she would retain the command of that ocean steam trade with America which she had herself created—she would be to-day the formidable rival, if not the acknowledged superior, of Liverpool. But she let her opportunities slip. Years went by, and she did nothing; and when she woke from her sleep to see her trade slipping from her, she wasted her energies on two or three different and competing schemes, not one of which was really abreast of the wants and necessities of the times. Much, very much, has been lost thereby. But is everything lost? Is it altogether too late? and is Bristol destined to sink into the quiet repose of an interesting cathedral town? We believe that it is not too late; but only provided that her citizens of this generation are both wiser and bolder than those of the last—are more worthy descendants of those old "merchant venturers" whose places they fill and whose traditions they profess to inherit. The motto of a merchant venturer was union in enterprise; but in modern Bristol the two have been fatally dissociated. Where there was enterprise there was no union; and where there was union there was no enterprise. But it may be hoped that better counsels are beginning to prevail, and that the present rulers of Bristol will venture what seems, but only seems, a bold stroke to revive the commercial greatness which is slipping away from them like melting snow. They have plenty of examples to spur them on. Preston, for instance, with a population below 100,000, is about to spend half a million in improving the river Ribble. Or let them look no further than their own great rival, Liverpool. One hundred years ago she was little more than a fishing village: she has spent eighteen millions of hard money in dock works, and she is—Liverpool. On the other hand, Chester, once the emporium of trade for the north-western coast, was content to keep her money in her pocket, and is now a reputable town, frequently visited for the sake of its cathedral and its antiquities. Which shall be the destiny of Bristol?

It may be said that the matter is one of local interest only; but it is not so. The observations made at the commencement of these articles show how important is the general question of dockising to all countries possessing navigable rivers by which traffic may, under proper conditions, be led from the coast to the interior. To Belgium, to France, to Spain, to America the problem may ere long appear in its true importance. But it is in Bristol, owing to local circumstances, that it has been longest and most deeply studied; nowhere else can it be carried out with brighter prospects or under more favourable conditions. Success achieved there—and it would be achieved—could not but react elsewhere; the same process would be applied to larger and more important rivers, and a great stride would be taken in that process of cheapening transport, which seems, after all, the most weighty factor in the material prosperity of nations.

B.

CONTRACTS OPEN.

INDIAN STATE RAILWAYS.

TENDERS are asked for the underframe and body ironwork, roofing, iron and brass fittings, lavatory fittings, trimmings, and window glass for intermediate-class carriages, with bodies 27ft. 6in. long, as set forth in the accompanying drawing, page 482, for the Indus Valley Railway—5ft. 6in. gauge. These carriages are intended for native use in accordance with caste prejudices.

The work required under this specification comprises the construction, supply, and delivery in England, at one or more of the ports named in the conditions and tender, of iron underframes, underframe and body ironwork, roofing, iron, gun-metal, and brass fittings, lavatory fittings, trimmings, and window-glass, with all requisite bolts and nuts, rivets, washers, panel pins, coach and wood screws, both iron and brass, and brass work, for putting the work together in India, and fixing the bodies to the underframes, for twenty intermediate-class carriages.

All fastenings, screws, &c., are to be supplied in quantities sufficient for securing the ironwork and fittings to the bodies and underframes, and for putting the bodies and underframes together, together with an allowance of 20 per cent. extra for waste. The contract does not include wheels and axles, bearing and draw and buffer springs, india-rubber window cushions, Attock's blocks, lamps, and axle-boxes. All these parts will form the subjects of separate contracts. No woodwork is required to be sent to India. The conditions of the contract are those usual with the Indian Government. Tenders must be sent in on or before January 1st, to the Secretary of State for India, India-office, Westminster.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Dec. 15th, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 7515; mercantile marine, Indian section, and other collections, 2639. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 4 p.m., Museum, 1534; mercantile marine, Indian section, and other collections, 588. Total, 12,276. Average of corresponding week in former years, 11,990. Total from the opening of the Museum, 22,629,728.

THE CONDITION IN WHICH CARBON EXISTS IN STEEL.

An inquiry into the condition in which carbon is present in steel as it is left by the cold-rolling—as well as in its hardened, annealed, and intermediate states—has been made by Sir F. Abel and Mr. Deering for the Committee on Steel of the Institution of Mechanical Engineers. Two series of experiments were made, the earlier ones showing difference in the behaviour of the hardened steel as compared with the cold-rolled and annealed steel, and in the amount of carbide of iron left by the oxidising solution; and the second series were devoted to ascertaining the limits of strength of the chromic solution, within which the same percentage of carbide of iron would be obtained.

First series.—Discs of steel, weighing about 6·5 grammes, were employed, about 2 5in. diameter and 0·01in. thick. Twelve were used, all of which were cut from the same strip of metal, the odd-numbered discs—1, 3, 5, &c.—being cut from one side of the axis of the strip, and the others—2, 4, 6, &c.—from the other side. The discs 1, 4, 7, and 10 were as received for the cold-rolling; Nos. 2, 5, 8, and 11 were annealed; and Nos. 3, 6, 9, and 12 were hardened. The discs to be hardened were placed between two cast iron blocks, one being recessed to receive the plates, the other being quite flat. These blocks were equally heated to a bright red; a disc was then placed between them and allowed to remain till thoroughly heated; it was then instantaneously removed, and as quickly as possible caught and pressed between two cast iron surface plates. The discs to be annealed were bolted between wrought iron plates, ⅜in. thick, and so enclosed in a thin sheet iron box, 5in. square and 2in. deep. This was enclosed in a cast iron box about 15in. by 6in., and the intervening space filled up with flue dust—thoroughly burnt soot—and the whole was then raised in an annealing furnace to a bright red heat, sufficient to scale but not peal the iron of the box. The fire was then slackened off, banked up with ashes, and the box left undisturbed in the furnace for twenty-four hours. From certain estimations made, the steel discs in contact with the wrought iron plates appear to lose carbon during the annealing. Of the annealed discs Nos. 2 and 11 were those which were in contact with the wrought iron plates. Disc No. 6 was used for estimation of silicon, which was found to amount to 0·2 per cent. Total carbon was estimated in one disc of each kind, but an inside disc of the annealed series was examined to compare with those which had been annealed in immediate contact with the wrought iron. Total carbon was, as usual, estimated by decomposing the metal with cupric chloride containing sodium chloride. The filtration was conducted in the combustion tube itself, so that no loss could ensue from transferring the filtering bed and the carbonaceous matter. The discs were in all cases rubbed with fine emery and cleaned with ether before being used. The total carbon was found to be:—

Disc No. 1	(cold-rolled)	gave	1·103	per cent. carbon.
,, 3	(hardened)	,,	1·128	,, ,,
,, 5	(annealed, inside disc)	,,	0·921	,, ,,
,, 11	(annealed, outside disc)	,,	0·860	,, ,,

An estimation of the so-called uncombined carbon in three of the discs was made by generally heating them with hydrochloric acid of specific gravity 1·10. The annealed and cold-rolled discs dissolved much more rapidly than the hardened disc, the cold-rolled disc furnishing the largest amount of dark-coloured residue. The residue, collected on asbestos in combustion tubes, washed successively with water, alcohol, ether, and water, were dried, and the carbon estimated by combustion:—

Disc No. 7	(cold-rolled)	gave	0·096	per cent. carbon.
,, 8	(annealed, inside disc)	,,	0·052	,, ,,
,, 9	(hardened)	,,	0·035	,, ,,

Of the remaining four discs, three were submitted to the action of an oxidising solution—potassium bichromate with sulphuric acid—made by adding to cold concentrated solution of bichromate one-twentieth of its volume of concentrated sulphuric acid. The discs were placed on sieves of platinum gauze in the centre of 500 cubic cm. of the liquid with the following result:—No. 4 disc (cold-rolled) solution of metal began at once with rise of temperature, and a very slight evolution of gas. Black particles in small quantity remained at the end of five days on the sieve, they were attracted by the magnet and appeared spangly under the microscope. No. 2 disc—annealed—solution did not commence till after the lapse of five hours; afterwards solution proceeded slowly; scaly residue left on the sieve; resembled the above. No. 12 disc—hardened—metal at once attacked with considerable evolution of gas. At the end of five days a little buff-coloured matter remained on the sieve, as well as spangles; the light-coloured matter was probably silica. The residues which remained on the sieve were placed in the liquid for a further thirteen days. Finally collected and washed, dried, and burnt in oxygen as usual; the iron estimated after the experiment. The following quantities, calculated on 100 parts of the discs, were found:—

	Carbon.	Iron.
No. 4 (cold rolled)	1·039 per cent.	5·87 per cent
No. 2 (annealed, outside disc)	0·30 ,,	4·74 ,,
No. 12 (hardened)	0 178 ,,	0 70 ,,

It will be seen that very nearly the whole of the carbon for the cold-rolled disc is left in the form of a carbon-iron compound; and from the annealed disc still more nearly the whole of the carbon. Thus:—

	Total Carbon.	Carbon in residue from chromic treatment.
No. 1 disc (cold rolled)	1·103 per cent.	— per cent.
No. 4 ,, ,,	— ,,	1 039 ,,
No. 11 (annealed, outside disc)	0 860 ,,	— ,,
No. 2 ,, ,,	— ,,	0·880 ,,

On the other hand only about one-sixth of the total carbon of the hardened disc was left in the solid residue of the chromic treatment. In the latter case, too, the ratio of carbon to iron in the residue was greater than in the residue for the other two discs, thus:—

	Carbon.		Iron.
No. 4 (cold rolled)	1	:	5·64
No. 2 (annealed)	1	:	5·72
No. 12 (hardened)	1	:	3 93

It is interesting to observe that in the case of the annealed and cold-rolled discs the ratios correspond very closely; they also correspond closely with the proportion of the elements of the iron carbide having the formula $Fe_6 C_5$. The last disc was used to see whether the iron carbide would resist the action of a chromic acid solution containing a large excess of sulphuric acid. There was left 0·84 per cent. of carbon and 1·104 per cent. of iron per 100 of disc. With this large excess of acid the carbide broke down.

Second series.—The strength of the solution of chromic acid and the amount of sulphuric mixed with it was varied, and the different kinds are described as Preparations 1, 2, 3 and 4. From these points it was desired to ascertain whether its composition is independent, with rather wide limits, of the strength of the chromic solution employed; whether, within these limits, a constant quantity of carbide is obtained per 100 of steel; and how much of the carbon of this carbide, upon treatment with hot hydrochloric acid, would remain unconverted into hydrocarbons. The chromic acid solution used may be conveniently referred to that used for Preparation 2, containing 99 grammes of salt per 1000 cub. cent. solution, sulphuric acid being added in the proportion of 0·9 gramme of acid to 1 gramme of the bichromate. The solution used in obtaining Preparation 1 was a little weaker, being 0·8th strength of the solution of Preparation 2. Preparation 3 was produced with a much weaker chromic solution, its strength being 0·44. For Preparation 4 a hot solution of bichromate was mixed with the requisite quality of sulphuric acid, and the strength aimed at was double that of Preparation 2. The mode of treatment with the chromic solution was in all instances alike, and the experiments were made at ordinary laboratory temperatures.

Preparation 1.—Four pieces of the steel—from 7 to 7·5 grammes each—were exposed in separate vessels to the chromic acid solution; 1000 cub. cent. to each piece of steel. At the end of two days there only remained small quantities of a black grey powder, which was worked off into the liquid and exposed for several days to the action of the chromic solution, and were then collected together and treated with some fresh chromic acid. In a similar manner other portions of steel were treated with Preparations 2, 3 and 4, which led to the following results:—

	Preparation 1	Preparation 2.	Preparation 3.	Preparation 4.
Carbide obtained per 100 of steel	13·25	14·16	153·4	4·66 where 4 00 is $Fe_3 C$.
Composition per 100 of carbide				
Carbon	7·31	7·21	6·84	11·77
Iron	{0·42	90·64	91 50	80·57
Water	2·37	2·27	1·63	5·57
Atomic ratio	$Fe_{2\ 65} C_1$	$Fe_{2\ 694} C_1$	$Fe_{2\cdot 867} C_1$	—
Parts of carbon obtained in form of carbide per 100 of steel	0·959	1·021	1 049	0·266
Parts of carbon unconverted into hydrocarbons by treatment of carbide with H Cl:—				
Per 100 of carbide	{1·410 / 1·234}	1·269	0·836	
Per 100 of carbon in carbide	{20·87 / 16 93}	17 60	12·22	

An examination of the foregoing results suggests the following conclusions:—

1. The two chromic solutions used for Preparations 1 and 2 gave very similar results both in respect of the percentage of product obtained from the steel and of the percentage composition of the product. The third, a much weaker solution, furnishes results which, allowance being made for the smaller quantities of substance dealt with and inherent analytical difficulties, must be regarded as closely resembling those obtained with the other two solutions.

2. The results obtained with Preparation 4, the strongest chromic solution, indicate that the limit of concentration of the oxidising solution which the separated carbide is capable of resisting has here been exceeded. Not only has there been in this case a very considerable loss of carbon as hydrocarbons—or possibly as a soluble product of oxidation—but the iron in the separated carbide has also been to a considerable extent attacked, and only a relatively small proportion of the carbide remains, together with separated carbon, the latter partly in a hydrated form, and possibly also in some partially oxidised insoluble form.

3. The small amounts of water obtained by the combustion of Preparations 1, 2, and 3 may indicate that, in these also, small quantities of carbohydrate are present with the iron carbide. This may result from the action of the chromic solutions on the carbide first separated, and may account for the not very definite, though on the whole uniform, atomic ratio of iron to carbon in the products of Preparations 1, 2, and 3.

4. If the carbon unconverted into hydrocarbons by treatment of the products with hydrochloric acid be deducted from the percentage of total carbon in the products of Preparations 1, 2, and 3, the results exhibit a uniformity which, if accidental, is somewhat remarkable. Thus:—

	Preparation 1.	Preparation 2.	Preparation 3.
Percentage of total carbon	7·31	7·21	6·84
Less carbon unconverted into hydrocarbons	1·38	1·27	0·84
There remains of carbon per cent.	5·93	5 94	6·00

The atomic ratio of this residual percentage of carbon to iron is as 1 to 3.270 of iron.

5. The carbon separated in the solid form as carbide and carbohydrate more nearly approaches the total amount (1·144 per cent.) of carbon contained in the steel in the case of No. 3, when the weakest chromic solution was employed—a result which was anticipated.

These results serve to confirm the view that the carbon of cold-rolled steel exists, not simply diffused mechanically through the mass of the steel, but in the form of an iron carbide, a definite product capable of resisting the oxidising effect of an agent which exerts a rapid solvent action upon the iron through which the carbide is distributed. It is to be hoped that opportunity may be found to continue these experiments with unfused cementation steel, and with other ingot steels in the same and in different conditions of temper, using the weakest chromic solution which gave the most favourable results.

FOREIGN NOTES.

A steel bridge is to be built across the South Saskatchewan, at Medicine Hat, this coming winter. It is to be 900ft. long and 36ft. above water-mark. It is to rest upon six piers and two abutments, and is to contain a swing between the first and third piers from the east side. The piers, which will commence 5ft. below low-water mark, are to rest on piles. About 1000 car loads of stone will be required for the piers. Cost 250,000 dols.

It appears from recent returns that each engine on the Pennsylvanian Road cost last year 26s. for repairs, 27s. for fuel, and 3·44s. for stores for each 100 miles. The consumption per mile was 82 lb. of coal, 5·3 quarts of oil, and 3·8 lb. of tallow. It would be interesting to know the percentage connected with the repairs and running of locomotives in Canada during the winter months. It is somewhat surprising that means are not taken to cover in the whole length of the engine by carrying the cab forward to the smoke stack, thereby preventing the contact of an atmosphere often 40 deg. to 50 deg. below zero, with the boiler, injector, pumps, &c. A number of engines were frozen up last year, and so rendered useless.

There are at present along the line of the Canadian Pacific Railway, or being erected, elevators and warehouses having sufficient capacity to store 1,544,700 bushels of grain, flour and grist mills having a grinding capacity of 1505 bls. per day, and saw mills capable of cutting 972,000ft. per day. The above does not by any means include the grain warehouses, grist, and saw mills scattered throughout the provinces.

The leading German shipbuilders are well supplied with work for some months to come, especially the Flensburg Company and the Vulcan Company of Stettin. On the 1st inst., a powerful cruiser, built to the order of the Chinese Government, was launched from the yard of the latter firm. This vessel was named the Tchi Yuen by the Chinese Ambassador to the Court of Berlin. She is 236ft. 3in. long, 34ft. 5in. wide, draws 15ft. 9in. of water, and has a displacement of 2355 tons. The hull is constructed entirely of steel, and the vital parts, such as engines, boilers, magazines, &c., are protected by a turtle-back armoured deck, extending several feet below the water line. It is estimated that the twin-screw engines of 2800 indicated horse-power, manufactured by the Vulcan Company, will be capable of propelling the vessel at a mean speed of 15 knots per hour. The Tchi Yuen will be supplied with tubes for discharging Whitehead torpedoes, besides which she will carry an armament of two 8¼in. and one 5¾in. Krupp guns, which will be mounted in two machine gun-proof steel turrets. This is the third Chinese ship-of-war now lying in the Oder, near Stettin. It is rumoured that the Vulcan Company is about to receive an order from the Portuguese Government for the construction of two large vessels-of-war. On December 1st the Germania Company, of Kiel, launched from their yard at Gaarden a steamer of 650 tons register, built for Messrs. Paulsen and Ivers, the dimensions of which are—164ft. by 24ft. 6in. by 13ft. The vessel was named the Commercial, and is intended for the Baltic trade. The Reiherstag Company, of Hamburg, has been entrusted by Messrs. Woermann and Co. with the construction of a spar-deck steamer of 1450 tons burden. The hull of this vessel will be built entirely of steel. Messrs. Koch and Co., of Luebeck, have just completed an iron cargo steamer of 1100 tons for the Toenning Steamship Company. The speed of this vessel, on a draught of 15ft. 3in., is eight knots per hour, and her cost is £13,750.

A Newcastle firm of marine engine builders have ordered of Herr Krupp, of Essen, two heavy hollow-forged steel crank shafts, each of which is upwards of 50ft in length. It is supposed that they are intended for a powerful Italian cruiser, the engines of which are being manufactured in England.

In the State Railway Estimates for the financial year 1884 to 1885, the sum of 1,600,000 marks is asked for as a first instalment for the purpose of carrying out the suggestions of the Safety Conference, which met in Berlin in the spring of the present year. Of the above amount, 600,000 marks will be devoted to a more extensive application of automatic brakes, and 200,000 marks are required for acquiring electric contact apparatus. The object of this apparatus is to ascertain the exact whereabouts of a train, and the speed at which it is travelling, by means of electric wires, which connect various portions of the line with the nearest stations. The remainder of the grant will be devoted to improvements in signalling apparatus switches, &c.

The late trial of chilled iron armour at Buckau-Magdeburg has given rise to an animated newspaper controversy between the partisans of Herr Krupp, whose gun was used for the test, and those of Herr Gruson, who supplied the armoured turret. The arguments brought forward by both parties are generally illogical, but so much is certain, viz., that after the third round the turret was incapable of further resistance. The Gruson party, however, deny the assertion that the Krupp steel shells penetrated the chilled iron plate to a considerable depth, but, on the contrary, maintain that the shells left but a slight mark at the point of impact, and that they were broken up. Minor questions, such as the above, however, alter nothing of the fact that the fourth—and last—shot drove the greater portion of the test plate into the centre of the turret.

The prices lately quoted by certain firms for 9656 tons of steel rails for an Italian railway have again drawn general attention to the fact that German Government railways, and therefore the taxpayers, have to purchase their railway material at a far higher price than is paid in any other European country. The lowest quotations for the rails in question were:—Rheinische Stahlwerke, 125.50f.; Bochumer Verein, 127.24f.; Société Cockerill, 133.17f.; and Bolckow, Vaughan, and Co., 133.50f. The German Government have found to their cost that in imposing so heavy an impost, or rather a preventive duty on railway material, they have placed themselves at the mercy of a few large manufacturers. It is reported that this question will be brought prominently before Parliament early in the present session.

The Society of Engineers.—The twenty-ninth annual general meeting of the members of the Society of Engineers was held on Monday evening, the 10th inst., in the reading room of the Society, Victoria-street, Westminster. The chair was occupied by Mr. Jabez Church, M. Inst. C.E., F.G.S., president. The following gentlemen were balloted for and duly elected as the council and officers for the ensuing year, viz.:—As president, Mr. Arthur Rigg; as vice-presidents, Mr. F. E. Duckham, Mr. Charles Gandon, and Mr. Perry F. Nursey; as ordinary members of council, Mr. Robert Berridge, Mr. T. H. Hovenden, Mr. A. F. Phillips, Mr. Henry Robinson, Mr. W. Schönheyder, Mr. John Waddington, Mr. A. T. Walmisley, and Mr. M. Ogle Tarbotton, the last-named gentleman being a new member of the council; as honorary secretary and treasurer, Mr. Alfred Williams; and as auditor, Mr. Alfred Lass. The proceedings terminated by a general vote of thanks to the council and officers for 1883, which was duly acknowledged by the chairman.

Gunboat for the Italian Navy.—On Saturday last Sir Wm. Armstrong, Mitchell, and Co., Low Walker, launched the Giovanni Bausan, a torpedo gunboat, constructed and armed for the Italian Government. The name of the Giovanni Bausan has been given to the ship in honour of the memory of the famous Italian buccaneer bearing that designation, who rendered signal service to the Parthenopeian Republic, and who became subsequently an admiral renowned for glorious deeds afloat. The present vessel offers a singularly fine and smart appearance, and has been built on a plan devised by Mr. George Rendel. The length of the Giovanni Bausan is 296ft. between each extremity, and between the two perpendiculars 276ft. Her breadth is 42ft., and her tonnage about 3020 tons. She will be, when in a complete state, propelled by two compound engines of about 2750-horse power each, making altogether 5500 specified horse-power, which will give to the vessel a speed of rather more than 17 knots an hour. She will carry two guns of 25 tons each, of the new Elswick pattern and "ribbon coil" system, capable of throwing projectiles of 450 lb. weight, with charges of powder of 230 lb. She will also be further furnished with six guns of the new Elswick pattern, throwing projectiles of 80 lb. weight, with charges of powder of 34 lb.; and to these will be added two more guns—pounders—with four *mitrailleuses*. The launch of the Giovanni Bausan was effected in the presence of a numerous and distinguished assembly. Lady Armstrong undertook the task of christening the vessel, and was supported by Sir William Armstrong and Rear Admiral Commendatoré Raffaele Noce, together with Signora Noce and the Admiral's son. The Italian navy numbers—ships in the course of construction being included—fifteen men-of-war of the 1st class, twelve men-of-war of the 2nd class, and fourteen of the 3rd class. The Giovanni Bausan will form one of the 2nd class. This computation does not, however, comprise a number of transport ships and vessels devoted to local and *laguna* service.

LETTERS TO THE EDITOR.

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

EFFICIENCY OF FANS.

SIR,—I think you are mistaken as to your formula for calculating the efficiency of fans. What you say about the work done by a fan "consisting in putting a body of air previously at rest into motion" is no doubt true, but it would be equally true to say of a pump that the work done consisted in putting a body of water previously at rest into motion without taking into account whether it was lifting the water 20 fathoms or 200. The chief difficulty with regard to comparing two fans, is that under ordinary circumstances the greater part of the work done is spent, not in putting the air into motion, but in overcoming the friction of passing through the fan itself and the passages leading to it. In order to get proper data for comparison there must be a standard resistance fixed. This has been done by M. Murgue, who compares the resistance in the passages and the fan to the resistance of the air to passing through an orifice in a thin plate. Thus the area of the hole in a thin plate which would offer the same resistance to the passage of air as the fan, is the "equivalent orifice" of the fan, and the area which gives the same resistance as the passages is the "equivalent orifice" of the passages, so that in order to make a comparison the observations are reduced to unit equivalent orifice. The formula for finding this is derived from the usual formula for the quantity of air which will pass through an orifice in a thin plate, making allowance for the "vena contracta," and is $a = \frac{\cdot 403\, v}{\sqrt{h}}$, where a = equivalent orifice; v = volume of air in thousands of feet per minute; h = inches of water gauge. Having got the equivalent orifice of the fan and passages the velocity of the air through it is taken, the formula $E = \frac{m\, v^2}{2\, g}$ will apply

With regard to your comparison of a fan with a turbine, or rather a centrifugal pump, with a centrifugal pump raising water, the pressure to be overcome is, as in a fan, the head to which the water has to be raised and the friction of the water in passing through the pump and pipes. As with properly proportioned pipes the friction is small, the pressure to be overcome is practically constant, and a much greater efficiency can be got by increasing the velocity of the pump, so as to have it very great in proportion to the head which it has to lift; and, within certain limits, the faster the pump is driven the better efficiency is got.

In a fan, however, as the larger proportion of the power is expended in overcoming friction, the water-gauge caused by the resistance of the passages increases in the same proportion as the water-gauge caused by the fan, and no increased efficiency is got by increasing the speed. This, however, is only true within certain limits, as the power shown in a diagram is expended, first, in turning the engine and fan on their bearings. This is a constant per revolution, no matter what is the velocity; secondly, in churning the air in the fan; and thirdly, in driving the air through the passages. As the two latter increase in proportion to the square of the number of revolutions, and the first is a constant, higher results will be got with higher speeds of the fan. This also explains the reason why such apparently contradictory results are got with different fans. When there is a small quantity of air passed, the useful work done is small in proportion to the passive resistances, and so a smaller useful effect is got than would be the case were a larger quantity of air being driven.

I think with Mr. Steavenson, that the extraordinary results given by Mr. Capell's fan must be the result of inaccuracies of observation. It is not well, however, to dogmatise on matters of this sort, and it will, perhaps, be the most satisfactory way, as you suggest, to have the matter settled by experiments made by a competent engineer. Possibly Mr. Capell has found out some way of utilising some of the water-gauge not taken out of the air by the *evasée* chimney of the Guibal fan.

In the preface to his translation of M. Murgue's book, Mr. Steavenson says:—"If then, as is clearly demonstrated, the covered Guibal with *evasée* chimney most nearly meets theoretical requirements, how can its acknowledged defects in points of size, structural weakness, and heavy cost, be best met, so as to produce a machine perfect in every respect? The answer is to be found in a ventilator I have recently designed, and which will be at work at Pagebank Colliery by the time this issues from the press. It is 20ft. diameter, built with, and from, a central wrought iron diaphragm, like the Rammel and Schiele fans. It has the vanes in shape according to M. Murgue's demonstrations made of iron, and rivetted to the diaphragm with angle irons, the sheet iron cover, *evasée* chimney, and sliding shutter of Guibal type with air admitted on both sides. The fan is driven by ropes, and will run about 110 revolutions, and much more if needed.

I have not yet seen a description of the results of this fan, and it would be most interesting if Mr. Steavenson would give us a note of the results got from it. R. T. M.

December 17th.

SIR,—I am induced to extend my remarks on this subject, so that I may be able to explain why I still venture to differ from you on one or two points, and why I took such strong objection to the fan of the Rev. Mr. Capell, who has kindly sent me some further information and a photograph of his fan, at the same time expressing his opinion that I had been "rather hard on him for a civil engineer." I trust the hardness of my remarks did not amount to a want of civility. I am very sorry if they really exceeded fair criticism, but it is very difficult to be patient, and see one fan after another brought forward, as they always are, capable of beating the best work on record. This very morning I have had supplied to me results of experiments on a new fan at Wigan giving 74·7 per cent. of useful effect.

The theoretical depression in a perfect—ideal—ventilator where the speed of the air at the top of the *evasée* or gradually expanding chimney is supposed to be reduced to nothing, is $H_0 = \frac{u^2}{g}$, where u equals speed of the tip of the fan blades. I have not space here to show how this is arrived at, but those interested will find it in Murgue's "Theories and Practice of Centrifugal Ventilating Machines," published by E. and F. N. Spon, and I will presently allude to this in practice.

But, in the first place, I must point out that there are really two water gauges to be considered. Mr. John Cooke, of this city, the inventor of an ingenious, but too cumbersome displacement fan, was the first to call attention to the fact that in the immediate proximity of the centrifugal fan we get what he called a pseudo w.g., and that as we go back from it, it falls rapidly in proportion to the suitability of the fan and its dimensions to its work until at a point, say, 60ft. away, we get a virtually permanent depression which is the w.g. the fan actually puts upon the mine. You see the fan, however small, gives a vacuum depending upon the speed of its tips. Now, if the fan is too small for the volume of air which the mine naturally would afford under that depression, the effect of that vacuum is lost upon the mine, the fan, in fact, at once exhausts and obstructs the ventilation.

I have frequently proved this by lowering pipes in the upcast shaft and registering the water-gauge as each length was added, and at a given point the depression becomes permanent. Thus we have one water-gauge on the doors at bank and quite another on the doors at the pit bottom. I will give you one or two actual cases:—

	Water-gauge at bank. Inches.	Water-gauge at pit bottom.
A mine	1·288	0·70
B ,,	1·300	1·16
C ,,	1·210	0·830
D ,,	1 150	0·600

The mine shafts are all of a good size; that of A mine, in particular, is 13ft. in diameter, with no obstructions, and 120ft. deep. This is discussed by M. Murgue as "the orifice of passage." Now, as to efficiency in water-gauge:—

		Inches.				Actual.
No. 1.	Open fan	$\frac{u^2}{g}$	=	2·46	– 1·13	= 45 per cent.
,, 2.	,, ,,	,,	=	3·69	– 1·04	= 28 ,,
,, 3.	Guibal	,,	=	2·35	– 1·47	= 62·5 ,,
,, 4.	,,	,,	=	4·05	– 2·60	= 69·0 ,,

The above are a few of my own observations. This manometrical efficiency is somewhat affected by conditions of working; but the highest result I have got from an open fan for manometrical efficiency is 48 per cent., and when a mine is altered purposely to four or five different conditions, and the water-gauge combined in a diagram with the equivalent orifice of the mine, we get what M. Murgue has termed the "characteristic curve of the ventilator." This "equivalent orifice" is that which would represent an area in a thin plate equivalent to a passage of the quantity of air such as passes through a given mine under a stated water gauge.

I give two instances showing how much easier it is to ventilate some mines than others. Thus:—

	Ins.	E. O. sq. ft.
No. 1	43,200 c. ft. p. m. w.g.	2·58 = 10·85
No. 2	132,000 c. ft. p. m. w.g.	0 90 = 56·40

This is got by the formula for "vena contracta," allowing for density of flowing medium, and enables us to compare how the work done by a fan on one mine compares with the work of a different fan on another.

Perhaps the greatest source of error in all fan investigations arises from the measurement of air. A passage of uniform area and of sufficient length to prevent eddies should be divided equally by strings, and the anemometer held on a rod an equal time, say half a minute in each space, and moved without stopping to read it, and the total reading divided by total time. The inner end of the water-gauge should be protected from the rush of air past it by a loose roll of felt.

The anemometer should be tested on a whirling machine, and the indicator by weights. Then, with the reading of the water-gauge accurately checked and averaged, and the speed of fan by a counter, true results may be got, such as are supplied in a recent report of a committee of the Northern Mining Institute. Under these circumstances, I say, it has been impossible to make a test of the Capell fan which would give the least idea of the effect such a fan would exert upon a mine. A small short pipe upon a small fan is quite useless. Let us have a reasonable sized machine upon a mine, keeping the fan at one speed, make alterations in the mine by opening doors and closing air-ways, and we shall then know what it can do. The equivalent orifice of the fan, or "orifice of passage," may also be deduced, showing the amount of obstruction it offers to the air passing through it. I fear I have already exceeded reasonable limits, but I have shown how to obtain a measure of the relationship between pressure and quantity.

Durham, December 8th. A. L. STEAVENSON.

SIR,—In reply to Mr. Capell's remarks respecting the water-gauge level in connection with the testing of his fan at Birmingham on the 1st inst., I think Mr. Capell must know I did not take any measurement. The readings were given me by a gentleman who thoroughly understood such matters, and were certainly correct. It is rather singular Mr. Capell did not raise the objection when all the particulars were read at the discussion. I am aware the water-gauge pressures and the air current do not agree; and it seems unquestionably to point to the fact that the data of the air supposed to have been passing through the fan was not correct; and this was referred to at the discussion. At first I was at a loss why Mr. Capell so completely ignored the tests of the 1st inst. Allowing it to be possible for all the particulars to have been correct, the results would give 90 per cent.; but perhaps nothing less than doubling the water-gauge and showing 180 per cent. would be satisfactory to Mr. Capell.

From your article in last week's paper you still seem to infer the South Staffordshire engineers ought to have scattered Mr. Capell's statistics to the winds, and undertaken to have set him right. However, the course we pursued we believe to be the right one. It is to be hoped Mr. Capell will accept an offer to fix one of his fans at a colliery. Its real value would then be proved. The number of trials spoken of by Mr. Capell and the conclusions remind one of "Confusion worse confounded." C. H. TREGLOWN.

Handsworth, Birmingham, December 12th.

SIR,—In your article on the "Efficiency of Fans" in last week's ENGINEER, you say that "there is no fixed and invariable relation between the pressure and the quantity." This must come as a paradox to mining engineers, and those conversant with the testing and practical working of fans. I refer to such colliery centrifugal ventilating machines as the "Guibal," "Waddle," or "Schiele," the two former having been constructed up to diameters of 50ft., and weighing upwards of 50 tons. The velocity at the tips of the vanes of such machines will sometimes exceed 100 miles per hour.

Now I say that the relations between pressure—*i.e.*, water-gauge—and volumes of air per minute, are as fixed and as well determined as the relations existing between the strengths of different scantlings of timber or iron, and that in any fan working on any particular mine the volumes vary exactly as the square root of the water-gauge or pressure per square foot, provided always that the conditions under which the fan is working remain unaltered. As an illustration and proof of this I give the following figures, taken from a careful series of experiments with a large colliery ventilator:—

Number of experiment.	Revolutions of fan per minute.	Quantity of air in cubic feet per minute. Actual A.	Observed water-gauge on fan drift doors in inches.	Actual H.P. in air. $\frac{Q \times h \times 5{\cdot}2}{33{,}000}$ = H.P.
1	39·9	92,180	1·03	14·9
2	50·0	105,427	1·46	24·2
3	59·8	116,519	1·99	38·5

Then, taking experiment No. 1 as a standard or basis of calculation with the relation expressed above, we have—

B calculated.

$\sqrt{1{\cdot}03} : \sqrt{1{\cdot}46} :: 92{,}180 : 104{,}160$ cubic feet per minute.

$\sqrt{1{\cdot}03} : \sqrt{1{\cdot}99} :: 92{,}180 : 128{,}647$,, ,, ,,

Comparing columns A and B, the actual and calculated results respectively, I think all will admit that the discrepancies occurring are only those due to unavoidable error of observation, and that there is "a fixed and invariable relation between the pressure and the quantity."

Next you say that "if we double the velocity we double the quantity or volume; but the power required will be, other things being equal, not double, but quadruple." I must take exception to this, as it is a rule long ago established that "the quantity of air varies as the cube root of the power and of the quantity of coals burnt to produce it," so that eight times the coals only double the quantity of air circulating in a mine, whether the ventilation is produced by furnace action, ventilating machines, or otherwise, so long as the airways remain in the same unaltered state, and therefore if we double the velocity and therefore the quantity circulating in any given time, we shall have a $(2 \times 2 \times 2)$, or eight times the power, instead of "quadruple," as in your article.

The following, taken from the figures already given, in which the horse-power is obtained by the formula given in last week's ENGINEER by Mr. Steavenson, will go to prove the accuracy of the above rule, and, taking again No. 1 as a basis of calculation—

						Calculated H.P.	Actual H.P.
$92{,}180^3$	:	$105{,}427^3$	::	14·9	:	22·0	24·2
$105{,}427^3$	:	$116{,}519^3$	::	14·9	:	29·8	38·5

This again is sufficiently near to prove the accuracy of the rule, though no doubt in the latter case some error has been made in the observations.

The efficiency of the different fans at present in use has been severely tested lately by a committee appointed by the North of England Institute of Mining and Mechanical Engineers. The results show Struvé's displacement machine to have the highest percentage of useful effect, but the quantity of air is small and the water gauge high, while the Guibal, Waddle, and Schiele all run about equal, none giving so much as 60 per cent. useful effect, whereas 40 to 50 per cent. is nearer the results usually obtained. It is, however, impossible to ascertain correctly the relative efficiencies of the different fans at present in use, unless they are each set to work separately under exactly similar conditions as to depths and areas of shafts, lengths, areas, temperatures, &c., of roadways. This is obviously a most laborious and costly method of obtaining the wished-for results, and will, perhaps, never be satisfactorily accomplished. A. CRAWHALL CHAPMAN.

Silksworth Hall, Sunderland, Dec. 12th.

SIR,—Since I first saw your article *re* the Rev. J. M. Capell's fan, I have followed with much interest all correspondence or information in reference thereto, because I cannot see anything in its principle of construction to account for its great efficiency. This, of course, may be my fault.

But Mr. Capell, in his letter in your last issue, gives what he calls his theory as follows:—"If the outer fan is disconnected from the inner fan and port holes, the blast from the inner fan drives the outer fan at great speed. Thus, as the air velocity increases the speed of the outer fan increases. If I suddenly, with a spring stop, connect the two fans, then, like your apt illustration of the train and wheat, the energy put into the outer is imparted to the whole machine. Thus the inner fan is the prime motor; the outer fan picks up the energy which would otherwise be lost in the air thrown off." I fail to see anything in this but what might be obtained in an ordinary fan made in two parts, the vanes being separated so as to form an inner and outer fan. Before the stop is applied, the energy which propels the outer fan acts as an obstruction to the free passage of the air, and if the outer fan was removed better results would be obtained. When the stop is applied the energy is picked up by the outer fan, in the same way that the outer part of the vanes of an ordinary fan continues the energy imparted by the inner part of the vanes.

Early in the year some correspondence was going on in your paper, and extraordinary results were claimed for this fan, and as I had an opportunity of comparing Mr. Capell's fan with one of Mr. Charles D. Phillips' fans, of Emlyn Works, Newport, I give you the results. Mr. Capell's fan was what is called a hand-power fan, 14in. diameter, geared so that for one turn of handle there was 35 revolutions of fan, or 123ft. travel of periphery; the diameter of suction pipe was 6⅝in. Mr. Phillips' fan was 15in. diameter, geared so that one turn of handle was equal to 27 revolutions of fan, or a travel of periphery equal to 100ft.; the diameter of suction was 7¼in.

My first trials were with suctions closed, and water gauge only, my object being to get as near as possible in both cases the same velocity of the periphery of the fans. The results were as follows:

	No. of turns of handle.	Velocity of periphery.	Head of water.	Travel of periphery per lin. head.
No. 1, Capell's fan	50	6150ft.	2in.	3078ft.
Mo. 2, Capell's fan	60	7380ft.	2¾in.	2671ft.
No. 3, Phillips' fan	78	7800ft.	3in.	2600ft.

The second trial in the above of the Capell fan was taken, because the results did not compare favourably in the first, but it required extra effort of the man turning to produce the result, and more power than in Phillips' fan. The second trials were with the suction closed, an opening being left, into which was inserted a 3in. diameter anemometer. The results measured by the anemometer were as follows:—

	No. of turns of handle.	Velocity of periphery.	Velocity of air through the anemometer.	No. of feet travel of periphery per foot travel of air.
No. 1, Capell's fan	51	6273ft.	5300ft.	1·18ft.
No. 2, Capell's fan	49	6027ft.	5100ft.	1·18ft.
No. 3, Phillips' fan	60	6000ft.	5100ft.	1·17ft.
No. 4, Phillips' fan	58	5800ft.	4852ft.	1·19ft.

The next trials were with the suctions full open, the anemometer being held steadily just inside the suction, so as to measure the velocity of the inlet. This velocity multiplied by the area gives following results:—

	Number of turns of handle.	Velocity of periphery of fan.	Velocity of air at inlet of suction.	Cubic feet of air passed per minute.	Cubic feet of air per 100ft. travel of periphery of the fan.
Capell's fan	56	6888	3245ft.	845	12·1
Phillips' fan	48	4800	3593ft.	1029	21 0

I give the data for what it is worth. The trials were made with the desire to see something of what was claimed for the fan. The results show for themselves, and in each case the Capell fan took more power than Phillips' fan. I am not prepared to say this was due to the principle of the fan, or was caused by the method of gearing.

As I have already said, I have watched with some interest all correspondence and information in connection with the Capell fan, and I follow Mr. Capell in his theory, but I fail to see its application. JNO. HODGSON.

Hydraulic and General Engineering Depôt,
118, Commercial-street, Newport,
Mon., December 18th.

SIR,—I think the South Staffordshire mining engineers have after all very little to say for themselves in the matter of the Capell fan. I have read the defence set up for their action with some amusement. These gentlemen all assert that Mr. Capell is wrong, but none of them seem to know where he is wrong, and their only resource is to suggest more experiments. Why is it that they cannot say with the data they have where Mr. Capell is wrong? I do not know Mr. Capell, nor have I the smallest interest in him or his fan; but I want to find out why his fan has excited so much interest if there is nothing in it.

Mr. Capell asserts that he has got certain results. The South Staffordshire engineers say he has not, but they give no reason for this. Mr. Steavenson goes away altogether from the fan as a fan, and treats your readers to a dissertation on the performance of fans and mines combined, which is quite another affair. I ask him to say definitely, does the Capell fan give the water gauge stated? Does it pass the volume of air stated? If it does not, why not? If the water gauge is right, why should not the quantity passed be right? Does water gauge, all other things being equal, save the shape of the fan blades—always represent the same velocity? If not, why not? Suppose, for example, I take a Lloyd's fan and a Capell fan, both same diameter, driven at same speed, and with same outlet and inlet orifices, will the water gauges be the same for both? If not, will the quantity of air passed bear the same relation to the water gauge in both fans? I want to know where Mr. Capell is wrong. It seems strange that no one can say precisely.

London, December 18th. BOREAS.

THE NEW PATENT ACT.

SIR,—The Government regard Mr. Chamberlain's Patents Bill as one of the most valuable measures passed last session, and the

public generally are under the impression that a boon has been secured. According to the memorandum attached to the Bill, its object was to consolidate in a single measure the twenty-three statutes in existence relating to patents, designs, and trade marks, and to "simplify procedure, lessen its cost, and increase the protection afforded." The new Act comes into operation on the 1st of January, and reduces the total fees for a fourteen years' patent from £175 to £154. The Act is drawn up on the lines of American patent laws, more particularly clause 33, which provides that "every patent shall be granted for one invention only." The whole Act hinges on the words "one invention only," notwithstanding that clause 33 also states that "every patent may not contain more than one claim." Every patentee knows that "claims" are not mentioned in the "Letters Patent," but are inserted in the "complete specification," which does not require to be lodged until nine months after the patent is protected.

While the new Act reduces the cost of a patent for an invention capable of being constructed in only one way, such is not the case when the invention can be constructed in a variety of ways. For instance, some years ago I patented a mechanical contrivance, drawings were lodged, showing the particular construction I preferred, but as I clearly saw that my apparatus could be constructed in at least two or three ways, the words, "or the equivalent thereof," were added to the description given in my "provisional specification," and these words guarded my patent against infringement.

I was somewhat startled recently on being told by a leading authority on patent law, that whilst the various possible constructions of my apparatus were effectually covered by one patent—at a cost of £175—under the present law, which expires this month, equal protection under the new Act could only be secured by obtaining a separate patent for each possible construction, and that my patent would therefore cost under the new Act two or three times £154, instead of £175 as formerly. Thus the new Act reduces the cost of a patent £21, but the protection afforded against infringement is decreased instead of increased, as stated in the memorandum attached to the Bill.

Some lawyers may differ, even the Comptroller of Patents himself may differ, from the opinion I have received, but all must admit that it is at least an open question what meaning Courts will take out of the words "one invention only" in Clause 33. Such a phrase has not been used before in any of our Patent Laws. These words must be considered entirely apart from the meaning put upon them by the promoters of the bill in their speeches, and must be read as they will be construed and twisted a hundred years hence. Judges and juries must be guided by the law as written, however hard or unjust.

Will our Courts be guided by American decisions? In the United States each patent covers one distinct invention only, and a number of patents are therefore frequently necessary to protect one invention against infringement. For example, one of our leading electricians is at present patenting an invention there—which required only one patent to protect it in England—and as it can be applied to forty-five different instruments, he is taking out forty-five patents in the United States. Although the American Government fees are only about seven guineas for a patent, it will thus be seen that effectual protection in some instances is not so cheap as some persons suppose.

As many of the most valuable improvements in machines have originated with mechanics and operatives who tend machinery, and as it was well known that working men took considerable interest in this new measure, one would have supposed that when altering laws—which have puzzled many a Court—our legislators would have endeavoured to express their meaning in language within the reach of an ordinary education. The "definition" of the term "invention" is, however, perplexing to an untutored mind. According to Clause 46, "'invention' means any manner of new manufacture, the subject of letters patent and grant of privilege within Section 6 of the Statute of Monopolies—that is, the Act of the twenty-first year of the reign of King James the First, Chapter 3, intitled 'An Act concerning Monopolies and Dispensations, with Penal Laws and the Forfeiture thereof'—and includes an alleged invention."

By Clause 106 a penalty of £20 is to be inflicted upon any person using "the Royal Arms, or arms so nearly resembling the same as to be calculated to deceive," without the authority of any member of the Royal Family or of any Government Department.

The Royal Arms have hitherto been regarded as the emblem of the United Kingdom, and although it was well known that the Royal Arms could not be registered as a trade mark, many manufacturers put the Royal Arms on their goods, and when shipped abroad that device indicated the country from which they came, and English manufacturers and merchants have as loyal a pride in exhibiting the British lion as Americans have in showing the eagle. Some newspapers print the Royal Arms on their title page, shopkeepers and tradesmen throughout the country display the Royal Arms, not with the view of leading the public to imagine that they are under Royal patronage, but rather to show their loyalty to the Throne. All these emblems of monarchy, according to Mr. Chamberlain's fiat, must be on and after 1st January swept into oblivion unless the persons using the same can show their special authority. Holders of patents frequently use the Royal Arms. They are not permitted to continue doing so.

The Government did not attempt to prove that any person was ever induced to buy a newspaper, a hat, or indeed any article, because it had the Royal Arms impressed upon it. The object of legislation is to remove grievances; but such changes are wholly unnecessary, and do not deserve the name of legislation.

The Act is silent as to how Government Departments are to be guided in granting authority to use the Royal Arms, but unless they act reasonably this aimless change of law will involve many merchants and manufacturers in considerable loss, not only of expensive dies for stamps, stocks of printed wrapping papers, and stocks of goods having to be re-made up, but it may inflict a permanent injury on their shipping trade by upsetting the marks by which their goods have been known in foreign lands for perhaps half a century.

Talking politicians reap the glory, but manufacturers and merchants who carry on the real work of the country have to pay for it.

ARCHIBALD W. FINLAYSON.

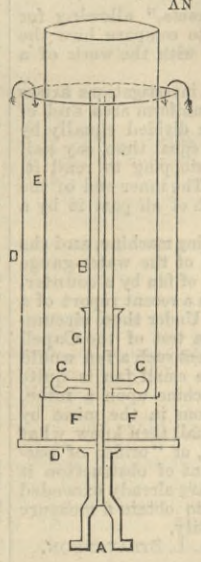
Flax Mills, Johnstone, near Glasgow,
December 3rd.

SIR,—We are now within three weeks of the commencement of the new Patent Law, and yet the rules and regulations for the guidance of applicants for patents are not yet published. Late as it is, it is to be hoped that they are not even definitely settled, if it be true, as rumoured, that they contain requirements which are apparently not contemplated by the Act, and which will materially increase the trouble and cost of obtaining patents. One such is the requirement which it is rumoured is in contemplation, that the applicant shall file with his application an abstract or brief of his invention, accompanied by a drawing illustrating the main features of the invention, and suitable for insertion in the illustrated journal which it is intended shall correspond in some measure with the United States "Official Gazette." Vigorous protests will be made against this provision, and it is to be hoped that the authorities may not enforce it. The absurdity of such a provision is evident on the face of it; for, on the one hand, to prepare a proper abstract of a specification requires special skill and a complete mastery of the subject; while, on the other hand, to determine whether an abstract is sufficient requires an equal acquaintance with the invention. So that while an applicant would be put to considerable expense for agency fees in preparing the abstract, the examiner or other controlling official would have to devote much time to ascertaining that a correct abstract was filed. It is easy to see what would take place—there would be a repetition of the practice that prevailed some few years ago, when the Patent-office required abridgments to be filed; that is to say, some applicants would file a so-called abstract, being merely an extension of the title, while others would lodge a copy of the entire specification.

It is also rumoured that it will be endeavoured to make this illustrated journal take the place, to a great extent, of the printed copies of the specifications, on the ground that although about fifty copies of each specification are struck off, in some cases not a single copy is sold. We can hardly credit such a monstrous proceeding, more especially after the authoritative statements that have appeared from time to time, and the protests that were made not long ago when it was proposed to destroy a quantity of the printed specifications because of the room they occupied. Another objectionable requirement is that the applicant should be required to sign the provisional specifications and drawings himself. If this is so a great deal of unnecessary inconvenience, delay, and trouble will be caused to inventors and their agents. Whatever may be the intention of the authorities on these matters, it is evident that their action must be jealously watched to see that the benefits that were to be conferred by the Act are not rendered nugatory by the action of the Patent-office officials. New blood is about to be transfused into the Patent-office, and it is possible that so-called improvements will be the order of the day. It is, however, hoped that Mr. Chamberlain will not consent to see the measure which was hailed with a chorus of approval by the "toilers and spinners" rendered abortive by official blunderings. X.

December 13th.

AN IMPROVED GAS-BURNER.



SIR,—I send you a sketch of an improved gas-burner. A is the gas inlet and small tube continued nearly to the top of the larger tube B, which tube communicates with the ring burner C C. The outer glass chimney D rests upon the plate D¹; the inner glass chimney B rests upon a perforated base F F. G is a small cylinder of pipe-clay surrounding the lower part of the tube B. The gas being lighted at the ring-burner C C, heats the tube B, causing the gas in the annular space between the tubes A and B to become heated, and also causes the air passing in at the top of the glass chimney D to pass down the annular space between D and E to become heated; also this heated air passes through the perforations at F F and comes in contact with the flame, which causes much more perfect combustion. The cylinder of pipe-clay G both assists combustion and prevents injury to the heating tube B.

R. ALLISON.

Stoke, Ipswich, December 11th.

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

(From our own Correspondent.)

UPON 'Change in Wolverhampton yesterday, and in Birmingham this—Thursday—afternoon, manufacturing ironmasters were eagerly seeking specifications under contracts already secured, upon which to commence operations after the holidays. They were, however, unable to get all the specifications they would have liked, since consumers are not generally desirous to begin the new year with large deliveries.

Proprietors who have been able to secure pretty well of specifications, and who have not extensive repairs to make to machinery, will try to limit the holidays to the first three days of next week. The best thin sheet makers are in this category, for they are experiencing very good home and foreign demand. The bulk of the works will, however, appropriate all the Christmas week to stocktaking and repairs, and will not resume operations until the 31st inst.

Upon the finishing up of the old orders the works have this week been very active, and this activity will continue up to Saturday night.

Prices are in consumers' favour. Small rounds and squares of ordinary make were this afternoon £6 10s. to £6 5s., and occasionally £6 2s. 6d. per ton. Superior bars were £6 15s. to £7, and marked ditto £7 10s. to £8 2s. 6d. Hoops are in steady demand at £6 10s. to £6 15s. and £7. Gas and rail strip sells freely at £6 7s. 6d. to £6 5s. per ton.

Black sheets for merchant and galvanising purposes were £7 15s. and on for singles, and £9 5s. for lattens. In the galvanised corrugated state, the general quotation for 22 g. to 24 g. was £13 delivered at outports. Morewood's "Red Star" quality was quoted £12 10s. for 18 g. and 20 g., £13 10s. for 24 g., £15 10s. for 26 g., and £17 10s. for 28 g. The "Lion" brand was £13, £14, £16, and £18, according to gauge. Best close annealed sheets of the "Anchor" brand were quoted £18 10s. for 20 g., £20 10s. for 24 g., £22 for 26 g., and £24 for 28 g. Galvanised flat sheets of the "Woodford Crown" brand were £16, £18, £19 10s., and £21 10s. respectively, according to gauge.

Pig iron rules dull, whether native or imported sorts are referred to. Current orders are confined mostly to lots of from 100 to 200 tons. When 1884 comes in, some fair buying may take place in anticipation of the January quarterly meetings; but it will not be a great lot. The demand for all-mines is so inactive that an important firm was mentioned on 'Change this afternoon as having determined to shortly blow out their furnaces. They will then sell from stock.

Prices of all-mines are nominally 65s., but 62s. 6d. to 60s. is nearer the real figure. Hematites are competing severely at 60s. to 61s., delivered hereabouts. Native part-mines are 52s. 6d. to 45s.; and common pigs, 42s. 6d. to 39s. Derbyshires cannot command business at 46s., and Northampton vendors are little better off at 45s. Coal is abundant and cheap. Best deep house sorts are 11s. per ton at the pits; furnace sorts, 10s. to 9s. 6d.; forge sorts, 7s. 6d. to 6s. 3d., long weight.

The Cannock Chase miners have resolved to withdraw their notices for an advance in wages until after the Manchester conference on the 27th inst. They have also empowered their agent to vote at that conference in favour of any uniform action that may be taken by the whole of the Midland Counties to obtain an advance.

The German competition in the wire trade is of increasing seriousness to the Shropshire wire rod makers. It was a subject of less importance when the Germans were content to send us the rods, but now that the Germans are sending us the drawn wire in great quantities, and, materially aided by the preferential freights quoted by our railway companies for the carriage of the foreign commodity, are offering it at much under native prices, the position of our rod makers is most unenviable.

Mr. Thomas Morris, manager of the Pearson and Knowles Coal and Iron Company, Limited, Warrington, in a paper read before the Institute of Ironworks' Managers at Dudley on Saturday, stated that the cheapness of the German rods was due mainly to the "starvation" wages paid to the ironworkers and to the advantage of Sunday labour. Yet the question might be satisfactorily solved. The cost to the English wire drawer on each ton of 19½ w.g. wire from the No. 4 wire rod was £8. In Westphalia the cost was £7. This £1 difference in cost would also apply to nails and similar classes of imported goods. More than this 20s. could be saved if some improved machinery were put down by our wire drawers, if manufacturers were content with a little less profit, and if each wire drawer minded two blocks with an assistant, and the difference in wages given to the employer. A few years ago Mr. Morris inspected the Westphalia works.

I looked in this week at the works of the Wolverhampton Electric Light, Storage, and Engineering Company, and I find that they are increasing their output, and getting together a promising connection. They are particularly successful with their patent accumulator, which they claim is one of the cheapest and most reliable upon the market. The company has now orders which will occupy it for the next seven months. Some of these are accumulators for use with the Swan and Edison lamps. Certain of their batteries have had more than twelve months' regular work, and continue to work perfectly. The company's high-speed engine is meeting with considerable favour, and has proved itself adaptable to all high-speed purposes. Its chief features are its thorough working and economical properties, combined with its low price. These engines are being built up to 50-horse power, and do not occupy a space more than 3ft. square by 4ft. high. The company has, after much experiment, arrived at an earthenware composition which renders their battery impervious to moisture, and at the same time acts as a perfect insulator. They intend to make this discovery the matter of another patent.

The South Staffordshire Electric Lighting Company, Limited, intends, it is understood, to employ the Consolidated Electric Lighting Company, Limited, London, to carry out the works in connection with the introduction of the new light into any of the towns in the Midlands where it is adopted, and concerning which the South Staffordshire Company has obtained provisional orders. The Consolidated Company has lighted Colchester with electricity. The largest conductor which has been laid down in the streets of Colchester is only about ⅜in. diameter, and the junctions are made by the simple means of a socket and nut.

Dudley is one of the Midland towns which propose to adopt electricity, and, upon the invitation of the corporation, Mr. George Offor, the general manager of the Consolidated Company has just delivered a lecture there. The Public Hall was lighted by four lamps upon the Brush system, but there was some flickering during the whole proceedings. Dudley, he said, could be lighted with electricity for no more than they were now paying for gas, and the attendant advantages would be many. At present £2000 a year is charged for lighting the town.

Another extensive galvanised sheet iron or roofing works is about to be established at Wolverhampton. The exact locality is at Wednesfield on land covering an area of some 2 acres. By reason of some of the proprietary being connected with Messrs. Robey and Co., of Lincoln, a report has got abroad that the company is the proprietor, and is going to establish a branch agricultural engineering works. I am authoritatively informed, however, that this is not correct.

Amongst the heavier ironfounding and engineering branches which are just now active, the cable and anchor firms stand up with conspicuousness. Steel is now more than ever being utilised as a material for anchors, and splendid specimens of this class have lately been sent out from the works of the Patent Shaft and Axletree Company. Some of these steel anchors weighed five tons each, and the company are able to produce castings of this class and size by reason of the advantages which they possess in having in operation the Thomas-Gilchrist process for making steel from common Staffordshire pigs.

The new works which are being put down at Spring Vale, Bilston, by Mr. Alfred Hickman and others, for the carrying on of the basic steel process, are steadily progressing, and are likely to confer a great benefit upon the district.

Hardware manufacturers who hold stocks are this week beginning to see that they are not likely to be so much affected by the Patent Act as they had at first feared. They have come to view the matter more in the light of your leading columns last week, and the anxiety is subsiding. They believe that it would be impossible for the prosecution to prove that no part of a given article had never been made the subject of a patent. Further it is discovered that equally severe clauses dealing with this matter were in the old Act. Yet a deputation is likely to seek an interview with the President of the Board of Trade, representing Birmingham, Wolverhampton, and Walsall.

The Local Board of Willenhall are desirous of purchasing the gasworks there, now owned by a joint-stock company. The company has offered to sell their property at £37,000, but the Board at present decline to tender more than £30,000.

The telephone is making steady progress in Birmingham. Three years ago the National Telephone Company established an Exchange here. Now they have some 350 subscribers, whose interchange of conversation goes on through 415 miles of wire. The company has also subscribers at Wednesbury and Wolverhampton. Birmingham is of itself a "centre" of four miles radius. In the heart of the town the wires are laid underground, protected by 3in. iron pipes. A good deal of the danger which attends the use of overhead wires is removed, however, when they are made of phosphor bronze, and wires of that metal are now being substituted for those hitherto hung. Though the wires are but one-tenth as heavy as the existing ones, they are quite as strong.

NOTES FROM LANCASHIRE.

(From our own Correspondents.)

Manchester.—There is the general absence of animation in the market whish usually precedes the immediate close of the year. In many cases stock-taking operates against buying beyond what is absolutely required for present wants, and generally there is a disposition to hold over any large transactions until after the holidays, and there are some indications as to the prospects of the ensuing year's trade. The downward movement in the Glasgow and Middlesbrough markets, although it has had no appreciable effect upon local and district brands of pig iron, is also a further inducement to buyers not to purchase largely at present, and with so many causes operating against business, it is only a natural result that trade has been very flat during the week. There is, however, no actual pressure to sell, so far as local and district brands of pig iron are concerned, and several of the large Lincolnshire houses are so fully sold over the next three or four months that they are quite indifferent about booking further orders at present.

At the Manchester market on Tuesday there was very little doing. For forge pig iron there were moderate inquiries in the market, but as offers by buyers were generally at about 6d. under the quoted rates, they did not lead to much actual business being done. For foundry iron there is little or no inquiry. Quoted prices for local and district were without change, Lancashire makers holding to 45s. as their minimum, and Lincolnshire makers being firm at 44s. 10d. to 45s. 10d., less 2½ for forge and foundry qualities delivered equal to Manchester. Although any weight of business would seem only to be practicable at about 6d. under these figures, it is only in exceptional cases that buyers are able to place orders at less than the quoted rates. In Middlesbrough iron g.m.b.'s are now being offered at about 44s. 10d. net cash, delivered equal to Manchester, and Scotch continues to be pushed at under makers' prices.

The price of hematite iron continues very low, and foundry brands could be bought at from 56s. to 57s. less 2½ delivered here. Even at these low figures I do not hear of any orders of importance being given out, but with hematites so close upon the price of Scotch iron, there would seem to be an inducement to bring buyers into the market.

In the manufactured iron trade orders are coming forward very slowly, and the market may be said to be weak. There are a few makers who are still asking £6 5s. for bars, but where there is any weight of business done the average basis of prices is about £6 to £6 2s. 6d. for bars, £6 7s. 6d. for hoops, and £7 15s. for sheets delivered into the Manchester district.

Ironfounders as a rule report trade to be quiet, and in builders'

work especially there is very little doing, with prices cut extremely low.

Brassfounders report rather more orders stirring; these, however, would seem to be largely on account of jobs that are being finished off before the holidays, and there is no improvement in the prices obtained for engineers' fittings.

With regard to the engineering trades, the reports as to the actual weight of work doing and the state of employment with the close of the year are by no means of an unsatisfactory character. It is practically only in the large shipbuilding centres that there is any really serious decreasing activity. In the important engineering districts of Lancashire, with the exception that machinists in many cases continue only indifferently employed, there are very few complaints of scarcity of work. Locomotive and railway carriage builders continue well supplied with work; tool makers in most cases are being kept busy; boiler makers and the large engineering firms are also as a rule well employed, and new orders appear to be coming forward very fairly as the old ones work off. This is the general tenour of what I hear in reports from the works themselves. The returns as to employment just issued by the various engineering trades' union societies are also satisfactory. The returns issued by the Amalgamated Society of Engineers for the past month, it is true, show an increased number of men out of employment throughout the country, especially in the shipbuilding districts, where there is evidently a tendency to discharge men, but the increase of unemployed is not serious, only amounting to about 1 per cent., and practically does not apply to Lancashire. In the Manchester and Salford district there is really no appreciable increase at all, and the number of unemployed on the books of the society at present is considerably less than it was at the close of last year. The better class of men who can take charge of jobs are in good demand, and pattern-makers and smiths have no difficulty in finding full work. The report of the Steam Engine Makers' Society issued this week shows a general improvement in the demand for men, and in this respect the returns are of a more favourable character than they have been for several months past. The returns for this month show only 1 per cent. of the members in receipt of out-of-work support as compared with about 2 per cent. in November, and generally throughout Lancashire the men are reported to be in full work. The Manchester and Salford districts return trade as good, and similar reports are also received from Bolton, Bury, Preston, and Blackburn. The secretary of the Ironfounders' Society also reports a decrease, although only slight, in the number of members in receipt of out-of-work support, notwithstanding that about sixty men have been thrown on the funds in consequence of a dispute with reference to an extension of piecework. The number of members on donation this month is 480, as compared with 499 last month, out of a total membership of 11,721. As the condition of the ironfounding trade is a fair indication of the weight of work which is passing into the shops of the engineers, it may be of interest to quote the branch reports of the above society with regard to the state of trade in the more important centres of industry. These do not return trade as actually bad in very many of the large centres. In Liverpool, Heywood, Oldham, Cardiff, Chatham, and Retford trade is returned as good; generally, however, the reports do not go beyond "moderate," and this is the case at London, Manchester, Wigan, St. Helens, Bury, Blackburn, Sheffield, Wakefield, Hull, Worcester, Chester, Stockport, Northampton, Greenwich, Ipswich, Barnsley, Exeter, Stockton, Devonport, Woolwich, Leeds, Bolton, Rotherham, Grantham, Darlington, Portsmouth, Hyde, Widnes, and Swansea. At Sunderland it is returned as "very bad," and either as declining or bad at Preston, Warrington, Burnley, Staleybridge, Lancaster, Bradford, York, Birmingham, Middlesbrough, Newcastle, Southampton, Maidstone, Dewsbury, and Darwen.

In the coal trade there is now none of the pressure for supplies which prevailed in the market a few weeks back, but there is generally a steady business doing, which is taking away the present output of the pits. The better classes of round coal are going away freely for house fire purposes, and common round coals, suitable for iron-making and furnace purposes, are in good demand. Engine fuel is, however, only moving off moderately, which may be partly due to the strike and threatened short time in the cotton trade, whilst, in addition, consumers, in anticipation of a possible stoppage of the collieries, got in large supplies of stock, and in many cases will still be working on with stock. With the exception of the slight giving way on the advance in pit prices after the collapse of the threatened strike, prices are being fairly maintained, and at the pit mouth average about as under:—Best coal, 10s. 6d.; seconds, 8s. 6d.; common house coals, 7s. to 7s. 6d.; steam and forge coals, 6s. to 6s. 6d.; burgy, 4s. 6d. to 5s.; good slack, 4s. to 4s. 3d.; and inferior sorts, 3s. to 3s. 6d. per ton.

In the shipping trade there has been a moderate amount of activity, and there has been a fair weight of Lancashire steam coal shipped at about 8s. 6d. per ton, delivered at the high level, Liverpool, or the Garston Docks.

Barrow.—I notice that the position of the hematite pig iron trade shows no marked improvement during the last week. The business that is being done on both home and foreign account is exceedingly quiet, and the orders received from America are practically *nil*. It is very difficult to say when a revival will take place. The present aspect of the trade is anything but cheerful, and there are no signs of an early change. Most makers, however, seem to think that in the new year the market will alter for the better. Lately they have shown a more decided tendency to sell, and their offers have been accepted. Stocks now kept at makers' are heavy, but they are being slightly reduced, as since the movement was commenced of blowing out several furnaces the output of metal more nearly represents the deliveries. Prices ruling this week are same as last, No. 1 Bessemer selling at 47s. 6d. per ton net at works, prompt delivery; No. 2, 47s.; and No. 3, 46s. 6d. per ton. Steel makers are rather quiet, but this can only be expected at this time of the year. They have, however, business enough in hand to keep all departments steadily employed. £4 15s. per ton net at works represents about the average value of rails. Steel shipbuilders are dull, and the dispute between masters and men existing in many yards is not yet settled. Iron ore is in limited request at unchanged prices. Large banks of ore are stocked at mines. Coal and coke steady. Shipping dull.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THE miners have resolved, through their delegates, to renew the agitation for an advance of wages. At a meeting held at Barnsley on Saturday last it was decided to take this step, limiting the amount to 10 per cent., "although believing we are justly entitled to an advance of 15 per cent." Each colliery and pitshead of men are to send deputations to their managers and owners, asking for the 10 per cent. advance, "between now and the next Conference, to be held immediately after the Manchester Conference." As the Manchester Conference is fixed for the 27th inst., we shall soon hear how far this action on the part of Yorkshire will be responded to by Lancashire. The general impression is that the fiery spirits who are again rushing to the front will find it hard to extend the agitation over the whole district, so soon after the collapse of a few weeks ago.

Another meeting of the coalowners of South Yorkshire, West Yorkshire, and North Derbyshire was held at Sheffield on Monday, when it was decided that in case any further steps to secure an advance of wages are taken by the colliers in any one of these districts, no action shall be taken without conferring with the other districts. This means that the coalowners are determined to grant no advance, and that they will continue their union for defensive purposes so long as Messrs. B. Pickard and Co. threaten trouble.

The export season may be said to have closed for the Baltic and neighbouring ports. During the eleven months from January to November 1,247,732 tons of coal were sent from the Yorkshire collieries to Hull, against 1,225,654 tons in the corresponding period of last year. This is an increase of 22,078 tons. During November the quantity sent was 115,816 tons, or an increase of 9267 tons as compared with November, 1882. The exports amounted to 62,109 tons, against 56,561 tons in November, 1882, or 575,348 tons in the eleven months, against 622,181 tons in 1882. Denaby Main again heads the list with 15,856 tons—last year 9304 tons. Twelve leading South Yorkshire firms supplied 35,336 tons, and twelve West Riding collieries sent 36,328 tons. Allerton Main supplied 9688 tons, and Featherstone 8128 tons.

The Board of Trade returns for November bring out some interesting facts in regard to industries in which Sheffield is interested. The quantity of iron and steel exported in November was 342,051 tons, being over 8000 tons more than last year and about 33,000 tons more than in November, 1881. On the other hand, the value was only £2,313,674, or £245,000 less than a year ago, and only £17,000 in excess of 1881. Pig iron has increased by 9000 tons; rails and railway iron by 12,000 tons; tinned plates, 1000 tons; and cast and wrought iron, 4000 tons. Steel rails and tinned plates to the United States show an increase, but there is a serious falling off in other descriptions of iron and steel to that market. India, Australia, and Canada show a decided improvement. During November steel was exported to the value of 5211 tons, as compared with 7779 tons and 16,004 tons in November of 1882 and 1881 respectively. France keeps its demand about the same, but the United States show a heavy decline. Last November the steel sent to the States was only 865 tons, while in November, 1882, it was 3973 tons, and in November, 1881, 13,311 tons. Though this decline is chiefly traceable to the collapse of Bessemer and other billets, there is a perceptible falling-off in the demand for crucible steel.

Hardware and cutlery statistics are also discouraging. Last November the value was only £317,013, being £23,000 less than last year. Australia shows an increase of £7000, and Holland an increase of about £2000. To all other markets, however, exports were smaller, the United States taking only £29,830, against £38,552 in November, 1882.

A tabulated list of thirty-nine companies whose affairs have been placed in liquidation under the Winding-up Act, will be published in the *Sheffield and Rotherham Red Book*. Advance sheets have been supplied to me, from which I gather that the loss sustained by shareholders and creditors in these companies, taking the shares at the par value, is upwards of £2,600,000. This, however, does not represent the entire loss, for in the inflated period of 1871-2-3, the shares of many of these defunct companies were bought and sold at high premiums. Of fifty limited companies, the shares of fifteen show an increase in value of £1,759,625 above the capital paid up, and thirty-five show a depreciation of nearly £3,500,000, of which amount nearly £3,000,000 arise upon twelve of the fifteen companies entered under the head of coal and iron.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE Cleveland pig iron trade is in a dull and inanimate condition, and there is no likelihood of improvement until the holidays are over. At the market held at Middlesbrough on Tuesday last there was but little inquiry for iron of any sort, and the little business actually done was at lower rates than were obtainable last week. No. 3. g.m.b. was sold by merchants at 36s. 6d. per ton for prompt delivery, but makers asked 36s. 9d. to 37s. These figures were, however, only obtainable where special brands were specified. No. 4 forge iron was 34s. 9d. to 35s. per ton.

The demand for warrants does not improve, the nominal value now being 36s. 9d. per ton.

Messrs. Connal and Co.'s stock of pig iron at Middlesbrough was reduced 540 tons during the week ending Monday last, the quantity then held being 62,856 tons. On the same date they had in their Glasgow store 583,447 tons.

The exports continue at a very insignificant rate compared with last month; but are better than in December, 1882. The quantities are as follows, viz.:—To the 17th December, 1883, 35,600 tons; over the same period of last month, 65,540 tons; to December 17th, 1882, 30,166 tons.

Consumers of manufactured iron are still holding back their inquiries, and prices are consequently easier than they were. Ship plates are now offered at £5 15s. per ton, common bars at £5 12s. 6d., and shipbuilding angles at £5 10s.; all free on trucks at makers' works, cash 10th, less 2½ per cent. Small lots for quick delivery are worth 5s. per ton more than the prices named. Most of the mills and forges will be closed during Christmas week.

Mr. R. Dixon, of the firm of R. Dixon and Co., Middlesbrough, speaking at a meeting on the 13th inst., stated that it had been decided to carry on business at the Cleveland shipyard for three years more at least. The firm have nothing on hand at present but a small vessel, but they are about to lay down a new keel and build on speculation in order to keep the men together.

A meeting of the Cleveland Mineowners' Association was held at Middlesbrough on the 13th inst, when a deputation from the Cleveland Miners' Association was present, and the question of revising the sliding scale was discussed. The deputation suggested considerable alterations, but the employers stated that only slight modifications could be sanctioned. A joint committee was appointed to further consider the question, and the result will be placed before the men shortly.

Another meeting of the Board of Arbitration and Conciliation was held at Darlington on Monday last to discuss the wages' question. It was found that no compromise was possible, and it was, therefore, decided to send the matters in dispute for settlement by an arbitrator. Dr. Spence Watson, of Newcastle, was unanimously chosen for that office. In case of his refusal to act either Mr. J. Cowan, M.P., or Mr. J. Morley, M.P., will be asked. The case to be referred will be simply what shall the wages be for the next three months; that is, whether lower than the present rates, and how much, up to the 5 per cent. claimed by the employers; or whether any or a substantial advance shall be given as claimed by the operatives. The duration of the award is only to be three months, and the present wages rates are to continue until it is given. The sliding scale is to be entirely suspended for the present.

A meeting was held at Middlesbrough on the 18th inst., presided over by the Mayor, to consider a letter from the Elder Brethren of Trinity House, agreeing to place a lightship off Redcar provided shipowners would pay a toll of one-sixteenth of a penny per ton on coasting vessels, and one-eighth of a penny per ton on foreign bound vessels. After some discussion the following resolutions were passed, viz.:—"(1) That a light is desirable in the position named, but that a lighthouse would be better than a lightship. (2) That the light in question ought to be provided without additional toll, considering how heavily burdened the local shipping already was."

NOTES FROM SCOTLAND.

(From our own Correspondent.)

IN the Glasgow iron market this week there has not been much animation, although the demand for warrants was very considerable. The past week's shipments were very good, having been enlarged somewhat, however, by quantities that might have been despatched in the preceding week but for the very stormy weather which then prevailed. Rumours of the curtailment of production abroad were being circulated this week in our market, but they had scarcely any effect upon the course of business. There has been a good inquiry for No. 3 makers' iron. Stocks this week in Messrs. Connal and Co.'s stores show a smaller reduction than usual.

Business was done in the warrant market on Friday at 44s. cash. On Monday transactions occurred at 43s. 11d. to 43s. 10½d. cash, and 44s. one month. Business was done on Tuesday down to 43s. 8½d. cash. Business was done on Wednesday at 43s. 9d. to 43s. 6d. cash; and to-day—Thursday—transactions occurred between 43s. 7d. and 43s. 6d. cash.

The values of makers' iron are without much change, as follows:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 51s. 6d.; No. 3, 49s.; Coltness, 55s. 6d. and 51s.; Langloan, 54s. and 50s. 6d.; Summerlee, 53s. and 48s. 6d.; Calder, 55s. and 48s.; Carnbroe, 52s. 6d. and 47s. 6d.; Clyde, 48s. and 46s.; Monkland, 45s. 6d. and 43s. 6d.; Quarter, 44s. 6d. and 43s.; Govan, at Broomielaw, 45s. 6d. and 43s. 6d.; Shotts, at Leith, 55s. and 52s. 6d.; Carron, at Grangemouth, 49s. (specially selected, 56s. 6d.) and 47s. 6d.; Kinneil, at Bo'ness, 47s. and 46s.; Glengarnock, at Ardrossan, 52s. 6d. and 45s. 6d.; Eglinton, 46s. 3d. and 43s. 6d.; Dalmellington, 48s. and 46s. 6d.

There is little change in the hematite market. Nos. 1, 2, and 3 Bessemer are changing hands at 47s. a ton.

Five steamers arrived at Glasgow from Bilbao in the course of the past week, bringing cargoes of iron ore amounting in the aggregate to 6962 tons.

In the malleable department there is still constant employment, although a duller time is predicted for the beginning of the new year. In the past week there has been shipped from Glasgow machinery to the value of £35,400; sewing machines, £2500; steel manufactures, £2360; iron ditto, 46,700. There is a brisk trade in most of the engineering branches, if we except that of pipe-making, which is at present in a very unsatisfactory state. Some Glasgow engineers have of late been booking heavy contracts both for home and foreign work.

Additional numbers of workmen have been paid off in the Clyde shipbuilding trade, but notwithstanding this, if the men quietly submit to a reduction of wages after the holidays, the coming year may not be the least productive in this most important industry.

A strike has been threatened in the building trade of Glasgow, owing to an attempt on the part of some of the master joiners to reduce wages, but the probability is that a general collision of this description will be averted.

The coal trade has been active this week in most districts, in consequence partly of the anxiety of those concerned to have contracts fully implemented by the close of the year. Shipments were considerably delayed in consequence of last week's storm; but this branch of the trade has again got into its normal state, and is doing very well for the season. During the past week the foreign shipments from Glasgow amounted to about 14,000 tons; Grangemouth, 3356 tons; Troon, 4408 tons; and Ayr, 5097 tons.

There is no dispute of any consequence pending in the mining trade. After the employers of Fife and Clackmannan had agreed to the principle of a sliding scale for the regulation of wages, and putting an end to the chronic state of dissatisfaction that mars the relations of employers and workmen in these counties, the men have interposed impossible conditions in the way of its adoption.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

I HAVE been favoured with an early information concerning a new railway scheme which is to open out the virgin coal treasures of the Sirhowy Valley, and other rich spots lying in that direction. The line will be called the Cardiff and Monmouthshire Valleys Railway. It is formed of five sections. Its first length of five miles unites the Rhymney Railway to the London and North-Western. Its second is a spur near Caerphilly. Its third a spur to join the Caerphilly branch of the Brecon and Merthyr Railway, near Machen. Its fourth from nine mile point to Risca, and its fifth from North Risca to junction with the Great Western, near Cross Keys. The distance from Tredegar Works to docks at Cardiff is now over twenty-eight miles. This line, by way of example, will reduce it to twenty-three miles. The connection between the Hill Collieries and Newport will also be altered considerably, as shown in one instance. From the London and South Wales Collieries at present the route is *vid* Newport, ssventeen miles twenty chains; by proposed, eleven miles forty chains. The extent of coalfield governed by the proposed line is eighty square miles, and the confident opinion is that it will be a second Taff Vale.

Some of the discontents in the Taff Vale, principally young hands, I hear, continue their clamour for sixty hours and six days per week. The arrangements with regard to the new offices, &c., are, however, approaching completion, and will soon enable the directors to carry out their changes as regards time. The management has been exceedingly moderate and forbearing, though overwhelmed almost by the vast traffic. The new sidings are answering admirably as a relief, and others at Penarth Junction are approaching completion.

The advance in mechanical science has been well illustrated of late at Plymouth Works, where a clearance of old plant is taking place. Engines of the old style have been unceremoniously broken up as old iron.

The iron trade is dull. Home and foreign trade is quiet. There are fortunately prospects ahead, and the new year is expected to bring a revival in bulk of orders even if not in price. The quantity of rejected rails now being sought shows that there is still a demand. As for best qualities, perfect, very few rivals can surpass the Welsh steel rail, either in quality or price.

The coal trade continues very brisk. Some little hitch has taken place between the tippers and the dock authorities, but it is expected that terms will be arranged. Anything that obstructs the present animated character of the coal trade is to be deprecated, especially where, as in the present case, the terms offered by the dock officials are so reasonable. Excellent coal has been struck at Resolven, Neath, which is welcomed heartily by Swansea port. But Swansea is looking forward to the nine months' interregnum which must take place before it can be connected with the Rhondda Valley. This will be as important to Swansea as the new line now completed from the Rhondda to Newport is to Newport. This latter is known as Sir George Elliott's line, and is creditable to his energy and financial capacity. Another line under his fostering hand is talked of, and still greater schemes loom ahead which I shall note in due time.

The export this week from the three principal ports has not been so large as in past weeks, chiefly owing to the weather. Prices are unchanged, and the best steam commands 11s. 6d. freely.

Small steam coal is quiet, but patent fuel is brisk, and both at Swansea and Cardiff a good deal of trade is being done. The tin-plate works are all tolerably busy, and have work for some time to come. Fresh orders promise slowly, and prices are slightly drooping.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—S. J. Robins, engineer, to the Forward, vice Stanlake; W. Rumble, chief engineer, to the Indus, additional, for service in the Black Prince, vice Lodge.

COAL IN NEW SOUTH WALES.—The coal measures of the colony cover about 23,950 square miles. The seams worked vary from 3ft. to 25ft. in thickness, are nearly horizontal, and are in some localities considerably above sea-level. There are at the present time forty-one collieries at work, employing in the aggregate above and below ground 4125 miners and others. In addition to the foregoing there are two mines at which very valuable seams of petroleum oil, cannel coal, or kerosene shale are being worked. The number of men employed at these mines above and below ground is 231. Since 1865, when the working of these seams commenced, the output has been 241,284 tons, valued at £581,046. There are three principal coal mining districts—the Hunter River and Newcastle Coal-field, situated to the north of Sydney; the Southern of Illawarra Coal-field; and the Western or Lithgow Coal-field, upon the Great Western Railway line, about 95 miles west from the metropolis. Coal is also being worked near Berrima, between Illawarra and Lithgow; and some seams are known to occur in the country lying between Lithgow and the Hunter River. Sydney, therefore, occupies an almost central position with regard to the coal mining districts.

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.

11th December, 1883.

5697. Lighting Mechanism, G. P. Ganster, Reading.
5698. Producing Heat, V. W. Blanchard, New York.
5699. Steam Generators, H. J. Allison.—(*J. E. Culver, Jersey, U.S.*)
5700. Feeding Apparatus, R. R. Holben, Barton, and S. Wilkerson, jun., Bassingbourn.
5701. Engines, T. E. Craven—(*G. W. Price, Baltimore.*)
5702. Food Compound, E. J. T. Digby, London.
5703. Hose or Flexible Pipes, Blodner and Vierschrodt, Gotha, Germany.
5704. Alarm Watches, C. Masmejan, Arogno.
5705. Pulping Turnips, &c., C. P. Davison, Swinton.
5706. Shears, D. Ward and P. Ashberry, Sheffield.
5707. Heeling, &c., Boots, J. Keats, Bagnal.
5708. Insulating Electric Conductors, A. J. Boult.—(*J. B. Hyde, Brooklyn, U.S.*)
5709. Hydrogen Gas, S. Pitt.—(*E. J. Jerzmanowski, New York, U.S.*)
5710. Shields, R. H. Brandon.—(*W. de Rohan, Paris.*)
5711. Sewing Machines, H. Birch, Bristol.
5712. Soda, &c., E. Carey and F. Hunter, Widnes.
5713. Roundabouts and Toys, J. C. Fell.—(*Comte de Vaussay, Paris.*)
5714. Electric Lighting Apparatus, A. M. Clark.—(*G. Trouvé, Paris*)
5715. Paper, F. Bardo, London.

12th December, 1883.

5716. Pumps, F. P. Preston, J. T. Prestige, and E. J. Preston, Deptford.
5717. Electric Low-water Alarms for Steam Boilers, A. M. Clark.—(*T. M'Kenna and H. Carley, U.S.*)
5718. Working, &c., Railway Signals, S. C. C. Currie and I. A. Timmis, London.
5719. Forging Bolts, &c., W. Horsfall, Leeds.
5720. Furnaces, J. Lones, C. Vernon, E. Holden, and R. Bennett, Smethwick.
5721. Gas Motor Engines, E. C. Mills, Barnes-green.
5722. Cartridge Cases, C. D. Abel.—(*P. Boca, Paris.*)
5723. Treating Timber with Preservative Fluids, S. B. Boulton, London.

13th December, 1883.

5724. Distilling Coal, &c., P. Couper, Edinburgh, and M. Rae, Linlithgow.
5725. Lamps, A. Rincklake, Brunswick.
5726. Automatic Ironing Machine, M. Heslop and J. Martin, London.
5727. Measuring Apparatus, W. H. Tooth, London.
5728. Seats and Sleeping Berths of Railway Carriages, J. L. and F. H. W. Livesey, London.
5729. Working Ingots of Steel, B. Walker, Leeds.
5730. Producing Brown Colours or Dyes, J. C. Mewburn, London.—(*La Société P. Monnet et Compagnie, France.*)
5731. Mechanical Excavators, A. J. Boult.—(*G. Kervern, France.*)
5732. Water Filters, W. L. Barstow, Pontefract.
5733. Obtaining Electric Force, F. Gossage, Widnes.
5734. Door-handles, H. H. Lake.—(*C. E. Lacey, Calais.*)
5735. Explosives, W. A. Barlow.—(*A. Gacón, Paris.*)
5736. Dynamo-electric Machines, P. W. Williams, Thames Ditton.

14th December, 1883.

5737. Electric Batteries, A. C. Henderson.—(*B. G. Vauzelle, Paris.*)
5738. Clocks, G. W. von Nawrocki.—(*P. Vielmetter, Berlin.*)
5739. Carding Machines, W. Gawthorp, J. Reddihough, and S. Wade, Bradford.
5740. Carding Engines, W. Richardson, Oldham.
5741. Secondary Batteries, J. S. Sellon, London.
5742. Burning Oils, &c., for Heating Purposes, L. Lefferts, New York, U.S.
5743. Treating Peat, &c., for Making Paper, &c., A. J. Boult.—(*A. Ubbelohde, Hanover.*)

15th December, 1883.

5744. Flour, T. N. Robinson, Rochdale.
5745. Umbrella Fasteners, A. C. Henderson.—(*J. Roy, Paris.*)
5746. Placing Cop Tubes upon Spindles, J. B., G., and J. B. Swailes, Oldham.
5747. Anchors, G. Tyzack, South Shields.
5748. Music Sheets, C. Pieper.—(*P. Ehrlich, Gohlis.*)
5749. Carbons, C. H. F. Müller, Hamburg.
5750. Velocipedes, J. White and J. Asbury, Coventry.
5751. Crushing Apparatus, W. H. Thompson, London.
5752. Stern Frame for Screw Steamers, C. J. D. Christie, Tynemouth.
5753. Packing Articles, J. T. Staniland, London.
5754. Cast Metal Pipes, &c, W. R. Lake.—(*F. Shickle, St. Louis, U.S.*)
5755. Permanent Way, F. Schauman, Copenhagen.
5756. Aluminium, G. B. de Overbeck.—(*H. Nieverth, Hanover.*)

17th December, 1883.

5757. Lithographic Printing Machines, A. Paton, Leeds.
5758. Raising Heavy Bodies, D. W. Sargent, Brixton.
5759. Secondary Electric Batteries, A. C. Henderson.—(*N. Basset, Paris.*)
5760. Winding Apparatus, C. Pieper.—(*A. Lindenberg, Dortmund.*)
5761. Carbonate of Ammonia, W. E. Gedge.—(*F. C. Glaser, Berlin.*)
5762. Cyclometers, J. Butcher, Boston, U.S.
5763. Packing Frilling, J. MacCallum, Manchester.
5764. Packing Cases, &c., A. J. Boult.—(*E. Kricker, Essen-on-the-Rhine.*)
5765. Engines, &c, T. H. Blamires, Huddersfield.
5766. Cabriolets, C. A. Floyd, Eastbourne.
5767. Colouring Matters, C. D. Abel.—(*The Farbwerke vormals Meister, Lucius, & Brüning, Germany.*)
5768. Spinning Machinery, T. Coulthard, Preston.
5769. Pianofortes, R. Howson, Middlesbrough.
5770. Mincing Machines, A. M. Clark.—(*Collin et Cie., Paris.*)
5771. Regulating the Flow of Gas, H. H. Lake.—(*M. E. Braundbeck, Stockholm*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

5698. Producing Heat, &c, V. W. Blanchard, New York, U.S.—11*th December*, 1883.
5699. Steam Generators, H. J. Allison, London.—A communication from J. E. Culver, Jersey, U.S.—11*th December*, 1883.
5701. Engines, T. E. Craven, Leeds.—Com. from G. W. Price, Baltimore, U.S.—11*th December*, 1883.
5709. Hydrogen Gas, S. Pitt, Sutton.—Com. from E. J. Jerzmanowski, New York.—11*th December*, 1883.
5717. Electric Low-water Alarms, A. M. Clark, London.—A communication from T. M'Kenna and H. Carley, New Jersey, U.S.—12*th December*, 1883.

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

5163. Letting-off Motion for Looms, J. Williamson and J. and C. Swindells, Lancaster.—10*th December*, 1880.
5168. Refining Iron and Steel, G. Ellinor, Sheffield.—10*th December*, 1880.
5171. Railway Vehicles, W. R. Lake, London.—10*th December*, 1880.
5173. Artificial Manures, &c, F. J. Bolton and J. A. Wanklyn, London.—10*th December*, 1880.
5266. Ventilating Apparatus, W. and B. Verity, London.—15*th December*, 1880.
5282. Vanilline, G. de Laire, Paris.—16*th December*, 1880.
5265. Covering Metal Busks, W. R. Lake, London.—15*th December*, 1880.
5228. Scouring and Fleshing Leather, &c, E. Wilson, Exeter.—14*th December*, 1880.
5234. Sectional Warping, &c., Machines, J. C. Sewell, E. Hulton, and J. Bethel, Manchester.—14*th December*, 1880.
5264. Bottles, F. Trotman, London.—15*th December*, 1880.
5279. Drying, &c, Yarn or Thread, T. P. Miller, Lanark.—16*th December*, 1880.
5318. Heel Paring Machine for Boots, &c., F. Cutlan, Cardiff.—18*th December*, 1880.
5278. Dredging Apparatus, J. Standfield and J. L. Clark, London.—16*th December*, 1880.
5237. Braiding, &c., Machinery, W. T. Glover and G. F. James, Salford.—14*th December*, 1880.
5283. Pulley Blocks, W. R. Lake, London.—16*th December*, 1880.
5288. Iron, P. S. Justice London.—17*th December*, 1880.
5381. Barrels, W. Morgan-Brown, London.—22*nd December*, 1880.
5397. Horizontal Saw Frames, T. N. Robinson, Rochdale.—23*rd December*, 1880.
5447. Purifying Steam, &c., J. F. Belleville, Paris.—28*th December*, 1880.
5484. Pumping Apparatus, E. H. Greeven, London.—30*th December*, 1880.
5281. Working Traffic on Inclined Planes, &c, J. S. Hughes, Portmadoc.—16*th December*, 1880.
5300. Iron and Steel, S. Pitt, Sutton.—17*th December*, 1880.
5303. Ventilating Sewers and Drains, T. Rowan, Ryde.—17*th December*, 1880.
5320. Cleaning Imitation Carving on Wood, A. Guattari, Paris.—18*th December*, 1880.
5472. Glazing, C. F. Elliott, Liverpool.—29*th December*, 1880.
5516. Producing Designs or Figures on Wood, A. Guattari, Paris.—31*st December*, 1880.

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

4876. Mariners' Compass, Sir W. Thomson, Glasgow.—18*th December*, 1876.
4805. Electric Lighting Apparatus, R. Werdermann, London.—12*th December*, 1876.
4835. Combing Cotton, &c., E. J. J. Lecœur, Manchester.—14*th December*, 1876.
4836. Egg-boiler, J. A. de Macedo, Leeds.—14*th December*, 1876.
235. Looms, S. Pitt, Sutton.—18*th January*, 1877.
4884. Rail Joints for Railways, A. J. Acaster, Sheffield.—18*th December*, 1876.
4985. Buckles and Keepers, J. S. Crowley, Manchester.—23*rd December*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition, 4th January*, 1884.)

3865. Speaking Tubes, T. W. Redfern and R. Wilkinson, Derby.—9*th August*, 1883.
3883. Incandescent Lamps, T. T. Smith, London.—10*th August*, 1883.
3899. Looms for Weaving, J. and W. Youngjohns, Kidderminster.—11*th August*, 1883.
3900. Scoring Lawn Tennis, &c., E. R. Kesterton, London.—11*th August*, 1883.
3901. Electric Switch, J. Lea, London.—11*th August*, 1883.
3903. Reproduction of Writings, &c., J. H. Johnson, London.—Com. from I. Camarasa.—11*th August*, 1883.
3910. Incandescent Electric Lamps, A. Swan, Gateshead.—13*th August*, 1883.
3927. Disintegrating, &c., Machinery, T. G. Bowick, Bedford.—13*th August*, 1883.
3932. Fibres, P. M. Justice, London.—A communication from J. G. Stephens.—14*th August*, 1883.
3943. Sporting Knives, T. Crookes, Sheffield.—14*th August*, 1883.
3961. Treating Calcareous and Dolomite Marl, R. Bowman, C. R. Cowens, and W. J. Smith, Durham.—15*th August*, 1883.
3987. Waterproof Garments, H. L. Rothband, G. and S. Mandleberg, Manchester.—17*th August*, 1883.
4002. Grinding Ores, &c., J. Wood, West Stockwith.—17*th August*, 1883.
4042. Furnaces, J. West, Manchester.—21*st August*, 1883.
4049. Safety Appliances for Elevators, A. W. L. Reddie, London.—A communication from R. A. Chesebrough.—21*st August*, 1883.
4162. Catting Ships' Anchors, A. M. Clark, London.—Com. from J. N. Purdy.—28*th August*, 1883.
4175. Connecting the Pipes used on Railway Trains for Communicating Fluid Pressure to Work Brakes or Signals, J. Imray, London.—A communication from G. Westinghouse, jun.—29*th August*, 1883.
4205. Pipe Couplings for Railway Brake Apparatus, J. Imray, London.—A communication from L. B. Regray.—31*st August*, 1883.
4236. Driving Gear, D. Carter, Stratford-on-Avon.—3*rd September*, 1883.
4279. Construction of Tiles, J. L. Edward, London.—6*th September*, 1883.
4701. Making Bread, A. McDonald, Glasgow.—3*rd October*, 1883.
4910. Motive-power Apparatus, W. Fletcher, Faversham.—16*th October*, 1883.
5023. Binding Sheaves, J. Howard, Bedford.—Partly a com. from J. W. Twentyman.—22*nd October*, 1883.
5088. Circuits, &c., J. S. Beeman, London.—26*th October*, 1883.
5126. Clarification of Beer, H. H. Lake, London.—A communication from H. Kunheim and W. Raydt.—29*th October*, 1883.
5133. Steam Pumps, F. and S. Pearn and T. Addyman, Manchester.—30*th October*, 1883.
5306. Paper Stock, G. B. Walker, London.—9*th November*, 1883.
5340. Refining, &c., Oils, E. S. Wilson, Camberwell.—12*th November*, 1883.
5358. Wool Oiling Machines, J. L. Mathews, West Troy, U.S.—13*th November*, 1883.
5698. Generating Steam, V. W. Blanchard, New York, U.S.—11*th December*, 1883.
5699. Steam Generators, H. J. Allison, London.—Com. J. E. Culver.—11*th December*, 1883.

(*Last day for filing opposition, 8th January*, 1883.)

3908. Explosive Cartridges, S. Trivick, Clapham, and J. Macnab, London.—13*th August*, 1883.
3911. Actions for Pianofortes, &c., E. A. Brydges, Berlin.—Com. from A. Lexow.—13*th August*, 1883.
3918. Locks, J. H. Ross, Dublin.—13*th August*, 1883.
3928. Treating Hops, W. Linden, Streatham-common.—13*th August*, 1883.
3934. Dynamo-electric Machines, W. P. Thompson, Liverpool.—A communication from R. J. Sheehy.—14*th August*, 1883.
3935. Paper, W. P. Thompson, London.—A communication from M. W. Brown.—14*th August*, 1883.
3941. Artificial Stoneware, H. J. Haddan, London.—Com. from J. Hemmerling.—14*th August*, 1883.
3948. Pliable Plates, &c., as a Substitute for Glass, J. J. Sachs, London.—A communication from Fickeissen and Becker.—14*th August*, 1883.
3962. Bale-hoop Fastenings, J. W. Allen, Manchester.—15*th August*, 1883.
3969. Transferring Designs to Fabrics, T. J. Warwick, London.—16*th August*, 1883.
3973. Carrying, Lowering, &c., Ships' Boats, J. H. Barry, London.—10*th August*, 1883.
3975. Fire-lighters, J. Templeman, Glasgow.—16*th August*, 1883.
3992. Gas or Lamp Shades, &c., H. E. A. Wallis, London.—17*th August*, 1883.
4007. Internally-fired High-pressure Steam Generators, F. Livet, London.—18*th August*, 1883.
4011. Packing for Piston-rods, &c., R. H. Harper, London. and J. H. Chapman, Forest-gate.—18*th August*, 1883.
4052. Marine Night Signals, H. J. Allison, London.—A communication from R. J. Baker and J. P. Roberts.—21*st August*, 1883.
4073. Paper Boxes, T. Bishop, Birmingham.—22*nd August*, 1883.
4084. Sugar, G. Fry, London.—A communication from W. B. Espeut.—23*rd August*, 1883.
4087. Slide-valves for Steam Engines, T. Thom, Barrow-in-Furness.—23*rd August*, 1883.
4165. Utilising Gas Engines for Locomotion, T. F. M'Nay and F. Harrison, London.—29*th August*, 1883.
4229. Steam Boilers, &c., S. Fox, Leeds.—3*rd September*, 1883.
4252. Signalling by Semaphore, W. F. Larkins, London.—4*th September*, 1883.
4260. Gas Engines, A. M. Clark, London.—Com. from the Economic Motor Company.—4*th September*, 1883.
4548. Making-up, &c., Bodies and Linings of Trousers, J. Baxter and W. Gould, Bristol.—24*th September*, 1883.
4771. Artificial Fuel, E. Marriott, Highgate.—8*th October*, 1883.
4816. Gas Motor Engines, T. Williamson, J. Malam, and W. Ireland, Southport.—10*th October*, 1883.
5012 Fixing Metallic Letters, &c., J. H. Hollinghurst, London.—22*nd October*, 1883.
5022. Hinges, F. and W. Parker, London.—22*nd October*, 1883.
5292. Breech-loading Fire-arms, D. Bentley, Aston, and W. Baker, Handsworth.—8*th November*, 1883.
5349. Connecting Pipes, C. D. Abel, London.—Com. from G. Westinghouse, jun.—13*th November*, 1883.
5363. Treating Calcareous Phosphorites or Ores, W. R. Lake, London.—A communication from J. Cox.—13*th November*, 1883.
5412. Mounts or Holders for Glasses, &c., J. Dawson, Kilburn, and T. Heap, London.—16*th November*, 1883.
5450. Dye Stuffs, J. H. Johnson, London.—A communication from A. Kern.—19*th November*, 1883.
5453. Housing, &c., Electrical Wires, H. J. Allison, London.—A communication from C. C. Gilman.—20*th November*, 1883.
5709. Hydrogen Gas, S. Pitt, Sutton.—A communication from E. J. Jermanowski.—11*th December*, 1883.
5717. Electric Low-water Alarms, A. M. Clark, London.—A communication from T. M'Kenna and H. Carley.—12*th December*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 14th December*, 1883.)

2880. Gas or Tube Hooks, T. Ashford, Birmingham.—9*th June*, 1883.
2984. Electric Wire Conductors, J. Greenwood, Bacup.—15*th June*, 1883.
3002. Life-saving Dresses, A. W. Ward, Kilburn.—16*th June*, 1883.
3008. Galvanic Batteries, J. Oliphant, E. B. Burr, and J. Gowan, London.—16*th June*, 1883.
3012. Protecting Corns, &c., E. Holliday, London.—18*th June*, 1883.
3033. Annealing Chilled Castings, W. R. Lake, London.—19*th June*, 1883.
3057. Spring Beds, &c., F. Ellisdon, Liverpool.—20*th June*, 1883.
3070. Gas Motor Engines, J. Fielding, Gloucester.—20*th June*, 1883.
3072. Casting Iron, T. and J. Robinson, Widnes.—21*st June*, 1883.
3221. Corkscrew, R. W. Bradnock, Moseley.—29*th June*, 1883.
3276. Clocks, A. M. Clark, London.—2*nd July*, 1883.
3320. Anti-fouling Paints, A. M. Clark, London.—4*th July*, 1883.
3393. Gaseous Hydrochloric Acid, C. D. Abel, London.—9*th July*, 1883.
3435. Bleaching Ozokerit, &c, J. Imray, London.—12*th July*, 1883.
3477. Fastenings for Purses, A. M. Clark, London.—14*th July*, 1883.
3635. Indicating Weights, &c., T. H. Ward, Tipton.—24*th July*, 1883.
3842. Circuit Closers, H. W. Ferris, Merton.—7*th August*, 1883.
3891. Combustible Gases, W. S. Sutherland, Birmingham.—11*th August*, 1883.
4468. Obtaining Benzol, &c., G. E. Davis, Manchester.—18*th September*, 1883.
4584. Separating Oil from Metal Turnings, A. G. Brookes, London.—26*th September*, 1883.
4589. Ornamentation of Glass, V. Blüthgen, Prussia.—26*th September*, 1883.
4635. Beds, J. S. Hill, Clifton.—28*th September*, 1883.
4651. Regulating Valves, W. H. Bailey and W. Lawson, Salford.—29*th September*, 1883.
4671. Alarm Bells for Bicycles, H. Serrell, Plainfield, U.S.—2*nd October*, 1883.
5049. Setting Buttons upon Boots, &c., R. H. Brandon, Paris.—24*th October*, 1883.

(*List of Letters Patent which passed the Great Seal on the 18th December*, 1883.)

1957 Bottles and Stoppers, J. Edwards, Holloway.—11*th June*, 1883.
2500. Ambulance Carriages, R. A. Westhorp, London.—19*th May*, 1883.
3024. Dividing Rails into Sections, H. Britten, Sheffield.—19*th June*, 1883.
3030. Propelling Apparatus, J. Robinson, Coleraine. 19*th June*, 1883.
3036. Boots and Shoes, H. J. Morgan, Frome.—19*th June*; 1883.
3047. Lawn Tennis Balls, R. S. Moss, Manchester.—20*th June*, 1883.
3049. Breech-loading Small Fire-arms, T. Perkes, London.—20*th June*, 1883.
3052. Hopper Dredgers, A. Brown and W. Simons, Renfrew.—20*th June*, 1883.
3054. Roundabouts, E. G. Brewer, London.—20*th June*, 1883.
3064. Latches, Bolts, &c., J. D. Sprague, Upper Norwood.—20*th June*, 1883.
3069. Converting Reciprocatory into Rotary Motion, H. G. Williams, East Greenwich.—20*th June*, 1883.
3078. Tanks for Melting Glass, E. Brooke, Huddersfield.—21*st June*, 1883.
3082. Washing Machine, A. I. Denny, Zittau.—21*st June*, 1883.
3087. Mechanical Retorts, J. Lyle, London.—21*st June*, 1883.
3116. Arranging Circuits to be used in connection with Telephonic Communication, S. Pitt, Sutton.—22*nd June*, 1883.
3117. Blast Fans, G. M. Capell, Passenham.—22*nd June*, 1883.
3126. Applying Governors for Making and Breaking Contact, D. Salomans, Broomhill.—23*rd June*, 1883.
3181. Telegraphic, &c., Communication, O. Schäffler, Vienna.—23*rd June*, 1883.
3138. Velocipedes, &c., W. Wright, Droylsden.—25*th June*, 1883.
3146. Flushing Apparatus, M. Syer, J. Gilmore, and W. R. Clark, London.—25*th June*, 1883.
3159. Planing, &c., Plates, J. Imray, London.—26*th June*, 1883.
3161. Shoeing Horses, J. B. E. T. Lacombe, Loiret, France.—26*th June*, 1883.
3178. Facilitating the Action of Rifles, H. S. Maxim, London.—26*th June*, 1883.
3203. Facilitating the Loading of Steamers, G. Taylor, Penarth.—27*th June*, 1883.
3204. Ventilating Closets, J. Farrimond and J. Whittaker, Southport.—23*th June*, 1883.
3253. Wringing, &c, Fabrics, J. Kenyon, J. Barnes, and R. W. Kenyon, Accrington.—30*th June*, 1883.
3269. Folding Fabrics, H. J. Haddan, London.—2*nd July*, 1883.
3271. Telephonic Apparatus, A. J. Boult, London.—2*nd July*, 1883.
3272. Gas Motor Engines, G. J. Kirchenpauer and L. H. Phillippi, Hamburg.—2*nd July*, 1883.
3273. Corsets, &c., J. H. Johnson, London.—2*nd July*, 1883.
3291. Arseniate of Soda, F. C. Blythe, Accrington.—3*rd July*, 1883.
3312. Velocipedes, &c, J. White and J. Asbury, Coventry, and F. G. Francis, Folkestone.—4*th July*, 1883.
3317. Separating Impurities from China Clay, &c., A. S. Chinnock, St Austell.—4*th July*, 1883.
3327. Toy Pistol, A. C. Henderson, London.—5*th July*. 1883.
3358. Pistons, J. Elliot, J. S. Jeffery, and T. Kerman, Cardiff.—6*th July*, 1883.
3536. Eliminating Nitrogenous Matters from Fermentable, &c., Substances, E. R. Moritz and H. C. Lee. London.—18*th July*, 1883.
3603. Fire-escapes, G. S. Prindle, Washington, U.S.—31*st July*, 1883.
3893. Dumping Boats, &c., H. E. Newton, London.—11*th August*, 1883.
4287. Cotton Gins, H. J. Haddan, London.—6*th September*, 1883.
4403. Carpet Sweepers, H. J. Haddan, London.—14*th September*, 1883.
4421. Signalling, A. P. Price, London.—15*th September*, 1883.
4424. Gas-meters, H. Green, Preston.—15*th September*, 1883.
4575. Printing Presses, W. R. Lake, London.—25*th September*, 1883.
4650. Winding, &c., Yarn, B. A. Dobson, J. Hill, and A. Waite, Bolton.—29*th September*, 1883.
4697. Water-closets, W. R. Lake, London.—2*nd October*, 1883.
4801. Forming Plates for Secondary Batteries, H. J. Haddan, London.—9*th October*, 1883.
5047. Time-controlling System, W. F. Gardner, Baltimore.—23*rd October*, 1883.

List of Specifications published during the week ending December 15th, 1883.

2174*, 6d.; 1551, 4d.; 1615, 2d.; 1808, 6d.; 1956, 6d.; 2007, 2d.; 2076, 10d.; 2077, 2d.; 2087, 8d.; 2090, 2d.; 2091, 4d.; 2092, 2d.; 2106, 6d.; 2103, 2d.; 2109, 6d.; 2112, 6d.; 2113, 2d.; 2117, 2d.; 2118, 4d.; 2119, 4d.; 2121, 6d.; 2124, 6d.; 2128, 2d.; 2129, 2d; 2130, 10d.; 2131, 6d.; 2132, 6d.; 2136, 2d.; 2137, 2d.; 2138, 6d.; 2140, 6d.; 2142, 6d.; 2144, 6d.; 2145, 6d.; 2146, 2d; 2149, 2d.; 2150, 4d.; 2152, 2d.; 2154, 2d.; 2155, 10d.; 2156, 8d.; 2158, 6d.; 2159, 2d.; 2161, 2d.; 2163, 6d.; 2164, 2d.; 2165, 2d; 2166, 2d; 2167, 4d.; 2168, 6d.; 2170, 2d.; 2171, 6d.; 2174, 2d.; 2175, 6d.; 2176, 6d.; 2178, 6d.; 2179, 2d.; 2180, 2d.; 2181, 6d.; 2182, 2d.; 2183, 2d.; 2185, 6d; 2186, 6d; 2187, 2d; 2188, 4d.; 2189, 6d.; 2191, 2d.; 2192, 1s. 2d.; 2196, 2d.; 2198, 2d.; 2199, 4d.; 2201, 10d.; 2203, 2d.; 2208, 2d.; 2210, 8d.; 2211, 2d.; 2214, 6d; 3315, 4d.; 2216, 6d.; 2222, 6d.; 2223, 6d.; 2225, 6d.; 2230, 2d.; 2236, 6d.; 2243, 4d; 2250, 6d; 2253, 6d.; 2259, 2d.; 2261, 6d.; 2267, 2d; 2276, 2d; 2283, 6d.; 2293, 2d.; 2300, 4d.; 2343, 2d.; 3039, 4d.; 3733, 6d.; 5734, 8d.; 4136, 6d; 4137, 4d.; 4177, 4d.; 4192, 6d.; 4211, 6d.; 4254, 6d.; 4298, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

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

1551. Railway Brakes and Springs, *J. Armstrong, New Swindon.*—27*th March*, 1883.—(*Provisional protection not allowed.*) 4*d.*

A steam piston and cylinder are opposed to a vacuum cylinder and piston on the engine or tender, the two pistons being on the same rod, and the former in direct communication with the steam of the boiler, and the vacuum piston in direct communication with the main pipe of the automatic brake. The steam piston applies the brake when the vacuum is destroyed in the main pipe, and the vacuum piston takes them off when the vacuum is re-established.

1615. Saws, *W. R. Lake, London.*—30*th March*, 1883.—(*A communication from D. Brigham, Melbourne.*)—(*Provisional protection not allowed.*) 2*d.*

Diamonds are used to form the cutting parts of the saw.

1808. Gas Regulators, *S. Slack, Sheffield.*—10*th April*, 1883. 6*d.*

The object is to control the consumption of gas by means of a regulator which can be easily applied to ordinary fittings. A double-ended slotted lever or a slotted pulley is attached to the service tap on the gas main, the handle of the tap fitting into the slot and being secured therein. To each end of the lever or round the pulley is connected a wire or cord passing over guide pulleys and wound over a drum mounted on a spindle carrying a pointer, which moves over a dial to show to what extent the tap is opened.

1956. Telegraphic Apparatus, *E. J. Houghton, London.*—18*th April*, 1883. 6*d.*

The object of this invention is to obviate the necessity of having batteries at each intermediate station. This is accomplished by using one large battery and others of lower electro-motive force placed at any convenient point, the ordinary needle instrument being so modified that the currents may either balance or overcome each other in either direction.

2007. Machines for Cutting Labels, &c., *L. Alderson, Bradford.*—20*th April*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to machines for cutting several thicknesses of paper at each stroke to produce labels, which can be printed or plain, and also in employing the same apparatus for blocking instead of the arming-press hitherto used.

2076. Apparatus for Assisting Persons Learning to Sing, &c., *G. N. Carozz, Regent-street.*—24*th April*, 1883. 10*d.*

The object is to assist persons learning to sing by means of an apparatus which, by indicating the manner in which the pupil is using his breath, enables him to control the position of the mouth, tongue, and lips in the proper manner.

2077. Vehicles for Road Traction, &c., *E. Newman, Burnham.*—24*th April*, 1883.—(*Void.*) 2*d.*

The vehicle is provided with a number of platforms or rests carrying wheels, and the body of the vehicle carries rails, so that as the platforms are brought on to the road the rails run over the wheels.

2087. Membranes or Media for Eliminating Micro-organisms from Liquids and Gases, &c., *C. D. Abel, London.*—24*th April*, 1883.—(*A communication from T. Breyer, Vienna.*) 8*d.*

The medium consists essentially of exceedingly finely divided microliths, for which a specially prepared metallic gauge serves as support. The medium is prepared preferably by reducing microliths of talc, such as are known as stick asbestos, asbestos fibre, or Bostonile, under water by means of a roller mill, and the fibres produced separated in special apparatus, according to fineness.

2090. Injectors, *S. Borland, Manchester.*—25*th April*, 1883.—(*Not proceeded with.*) 2*d.*

This relates, First, to injectors without steam

cone spindles, the object being to arrange them, so that when fixed several feet above the surface of their water supply they will draw and lift it to start and maintain the working of the injector, for which purposes the combining cone is divided, or two employed with a space for overflow between them in addition to the ordinary overflow, between the second combining and the discharging cone; Secondly, to the combination of the above arrangement with the form of injectors described in patent No. 2499, A.D. 1880; Thirdly, to an improved injector consisting of a casting with junctions for four pipes and a diaphragm with a central orifice to receive the end of the combining cone; and Fourthly, to injector nozzles or cones combined with a cistern for water supply and overflow, and consisting of a steam cone arranged in one side of the cistern, a discharging cone opposite, and a combining cone between them.

2091. TREATMENT AND UTILISATION OF CERTAIN WASTE MATERIALS WHICH HAVE BEEN USED IN PURIFYING COAL GAS, *J. Walker, Leeds.*—*25th April*, 1883. 4*d*.

Fouled hydrate of lime which has been used in purifying coal gas is when cast out of the purifiers at once stored in a shed until required for use, when it is placed in tanks containing clean fresh water and well agitated. It is then allowed to stand twenty four hours, being re-raked several times for the first twelve. The sulpho-alkaline liquor thus produced can be used, First, for making a size or soft starch paste by adding to the liquor wheaten flour; Secondly, in connection with other alkalies in making common, fancy, or insecticide soaps; Thirdly, for unhairing skins or hides. The residuum in the tanks can be used in the preparation of a fertilising manure, or for other purposes.

2092. WIRE FENCING WITH SPURS, BARBS, OR POINTS, AND MACHINERY TO BE EMPLOYED IN CONNECTION THEREWITH, *E. A. Brydges, Berlin*—*25th April*, 1883. —(*A communication from C. Klauke, Germany.*)—(*Not proceeded with.*) 2*d*.

The object is to produce wire fencing with barbs or spurs, whereby one stout strong fencing wire is so employed that the barbs are firmly bound or attached to the chief or fencing wire, and it consists in machinery for cutting the barbs from suitable wire and securing them on the main wire.

2103. BOTTLES AND STOPPERS AND APPARATUS TO BE USED IN THE MANUFACTURE OF THE SAID BOTTLES, &c., *A. J. T. Wild, London.*—*25th April*, 1883. 6*d*.

This relates partly to improved bottles and stoppers of that class in which the stopper is designed to be screwed into the bottle neck; and this part of the invention has for its object to provide improved means whereby the stopper can be more readily and firmly secured in the bottle, and more easily removed therefrom, than is practicable with bottles and stoppers as heretofore made. Other improvements are described.

2105. CONSTRUCTION OF APPARATUS USED IN THE MANUFACTURE OF PAPER, *J. R. Fletcher and J. Fielding, Stoneclough.*—*26th April*, 1883.—(*Not proceeded with.*) 2*d*.

This relates principally to the construction of apparatus employed for straining the pulp as it comes from the rag engine, and before it is supplied to the paper-making machine.

2106. APPARATUS FOR MOVING AND GIVING MOTION TO FLUIDS, *W. Smedley, Liverpool.*—*26th April*, 1883.—(*A communication from C. Smedley, Philadelphia.*) 6*d*.

This relates to an apparatus in which an annular jet of steam, air, or other gas is caused to induce water or other fluid to flow through a pipe. It consists, First, in constructing such apparatus with a casing fitted internally with a sliding tube jet regulator or controller, actuated by an excentric on a spindle passing through the casing, and fitted with a handle, the chamber and tube being arranged so that an annular steam receptacle and a straight way for the induced fluid are formed; Secondly, in constructing the tubular jet regulator with a screw thread, so as to produce the end motion by screwing the tube backward and forward; Thirdly, in providing air induction openings in front as well as behind the annular steam or fluid jet; Fourthly, combining two or more of such apparatus to act on the fluid current at different points.

2107. FLEECE DIVIDERS FOR CARDING MACHINES, *C. Pieper, Berlin.*—*26th April*, 1883.—(*A communication from G. Josephys Erben, Bielitz.*) 4*d*.

This relates to improvements on patent 4588, A.D. 1881; and consists in supporting the fleece on its way from the doffer to the dividing rollers by means of the dividing straps.

2108. ELECTRIC MOTOR APPARATUS, *M. Kolyra, "Cardiff."*—*26th April*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to the arrangement of the electro-magnets and their armatures in a reciprocating motor.

2109. COMBING COTTON, SILK, &c., *J. Thompson and T. Barker, Manchester.*—*26th April*, 1883. 6*d*.

The object is to comb fibres by a machine, which draws a tuft from the lap or rolls, and combs first one end and then the other, by means of one cylinder comb, and three or other number of pairs of nip jaws to each combing head, and then lays the combed fibre between rollers, which form it into a fleece or sliver. The whole length of fibre is thus equally combed. The tubes carrying one line of nip jaws are coupled, and swing beams, racks, spur wheels, and segments are employed to actuate the top and lower nip jaws.

2111. CARTRIDGES AND WADS THEREFOR, *R. Morris, Blackheath.*—*26th April*, 1883. 6*d*.

This relates to the manufacture of the cases of miniature cartridges with large flanges, and to the preparation of wads for use in such cartridges.

2112. PURIFYING WATER AND ADAPTING IT FOR BREWING, &c., *E. M. Dixon, Glasgow.*—*26th April*, 1883. 6*d*.

To the water is added a somewhat larger quantity of lime than it can dissolve, and air is injected into it, preferably by a steam jet, which also heats the water to or near boiling point. The water is then filtered, after which acids may be added, and carbonic acid gas is injected by a steam jet or other means. The water is then again filtered. Suitable apparatus for effecting these operations is described.

2113. CLEANING, BEAUTIFYING, BLEACHING, OR RENOVATING SPONGE, *R. F. Elms, J. H. Payne, and F. R. Nurthen, Baker-street.*—*26th April*, 1883.—(*Provisional protection not allowed.*) 2*d*.

The sponges are dipped in succession into dilute solutions of (1) hyposulphite of soda; (2) carbonate of soda; (3) per-manganate of potash; (4) chloride of sodium; (5) muriatic acid.

2114. INSTRUMENT FOR SETTING OUT OR DRAWING GEOMETRICAL FIGURES, &c., *F. H. Wood, Chiswick.*—*26th April*, 1883. 6*d*.

The instrument consists essentially of a sector having a number of curved and radial lines thereon.

2116. BLOCK CALENDARS AND BLOTTING PADS, *G. F. Redfern, London*—*26th April*, 1883.—(*A communication from J. Patrick, Frankfort-on-the-Main.*) 6*d*.

This relates to the manufacture of a combined block calendar, blotting pad, letter weight, pen-cleaner, and ink-pot.

2117. SWITCH APPARATUS FOR CONNECTING AND DISCONNECTING ELECTRICAL LINES FOR TELEGRAPHIC OR TELEPHONIC COMMUNICATION, *J. Imray, London.*—*26th April*, 1883.—(*A communication from T. A. Connolly, Columbia, U.S.*)—(*Not proceeded with.*) 2*d*.

Relates to apparatus for putting any one line of a number of radiating lines in communication with any other line.

2118. ELECTRICAL ACCUMULATORS OR SECONDARY BATTERIES, *P. Higgs, Leath.*—*26th April*, 1883.—(*A communication from C. Forbes, Boston, Mass., U.S.*) 4*d*.

The negative electrodes are made of finely-divided lead and pulverised graphitoidal carbon. The compound is exposed to the atmosphere to oxidise the lead, and is then mixed with a solution of sugar and made into the desired shape, preferably a plate. The plate is placed between two thin sheets of perforated lead. For the positive electrode iron, or an alloy of zinc, lead, and antimony, is used. The cells are divided into two series, and are provided with a switch by which their like poles may be all connected together. A weighted bulb sinks in the liquid, when, through the deposition of the iron or zinc, its density is lowered and sounds an alarm.

2119. MANUFACTURE OF SALICYLIC ACID, PRODUCING ALSO ALCOHOLIC PHENATES, *W. L. Wise, London.*—*26th April*. 1883.—(*A communication from Dr. W. Hentschel, Dresden.*) 4*d*.

The inventor claims, First, the method of preparing diphenylcarbonate by passing chloro-carbonic acid gas into an aqueous solution of sodium phenolate; Secondly, preparing salicylic acid by acting upon diphenylcarbonate with alkalies, with or without the addition of sodium methylate or sodium ethylate; as well as by fusing together diphenylcarbonate of sodium phenylate and sodium hydrate; and Thirdly, obtaining methylphenyl ether or ethylphenyl ether by heating diphenylcarbonate, together with sodium methylate or sodium ethylate.

2121. LANTERNS, *A. M. Clark, London.*—*26th April*, 1883.—(*A communication from G. F. Fisher, Canada.*) 6*d*.

The object is to render lanterns more durable and facilitate the lighting. A cylindrical cap or casing is formed open at the bottom and arranged above the globe, and held by the funnel tube to crosspieces of side tubes of the lantern in such a manner that the upper end of the globe can pass within the cap. The cap has in one side a longitudinal slot through which the upper free end of a spring strip fastened to one of the side tubes projects. The spring strip has at its upper end two prongs, which project toward the interior of the cap. The globe has an annular head resting on a perforated plate. By withdrawing the upper end of the spring slit from the cap, the globe can be raised sufficient for the passage of a match to light the lantern.

2123. MANUFACTURE OF LUBRICATING OIL, *N. C. de Kroiber, Baku, Russia.*—*26th April*, 1883. 6*d*.

This relates to the treatment of the residue from petroleum by agitation with acid, exposure to light and air, and to contact with lime or alkali.

2124. MOWING AND REAPING MACHINES, *W. McI. Cranston, London.*—*26th April*, 1883.—(*A communication from W. A. Wood Reaping and Mowing Machine Company, New York.*) 6*d*.

The invention relates essentially, First, to means for ensuring the rotation of the gearing from the action of the main wheel while moving in the working direction, and a freedom of the gearing from any backward or reverse motion of the machine. Secondly, to establishing a connection and disconnection of the main wheel and the pinion by a throw-over action of a lever, the pinion frame moving about the main axle on which it is mounted. Thirdly, to carrying the single and cutter bar from the main axle, and steadying its rising and falling action by a curved plate working through a slotted plate fixed to the pole iron, said cutter bar being rigidly set by stay or tie rods affixed to the plate. Fourthly, to carrying the back mitre-wheel, whose socket has a sleeve, upon a fixed pin or axle, the front of the socket having pauls which engage in teeth on the inner face of the pinion collar at any part of its rotation. The pinion collar may have a sprocket-wheel affixed or teeth formed thereon for actuating the reel chain if desired.

2125. TRICYCLES AND OTHER VELOCIPEDES, *O. Pihlfeldt, Redcar.*—*26th April*, 1883. 6*d*.

This consists in the construction and arrangements of the gearing of the tricycles, whereby at the pleasure of the rider the driving wheels of the tricycle may be made to rotate at the same speed as the pedal shaft or at a reduced speed.

2126 APPARATUS FOR FILTERING WATER, &c., *F. H. Atkins, London.*—*26th April*, 1883. 6*d*.

This relates to means and apparatus for filtering water and other liquids, so arranged that the filtering materials or substances can be cleansed when required, by attrition or the friction of the particles against each other, when set free and agitated or set in motion within the filter case or otherwise.

2127. APPARATUS IN CONNECTION WITH STEAM BOILER FLUES OR FURNACES FOR REHEATING EXHAUST STEAM, SUPERHEATING LIVE STEAM, AND HEATING AIR FOR HEATING, DRYING, &c., *E. G. Colton, London.*—*26th April*, 1883.—(*A communication from L. Hussey and G. W. Donaldson, New York.*) 6*d*.

The invention consists in the combination with a steam boiler of an exhaust steam heating, live steam superheating, or air heating device located above the boiler within a flue, through which the products of combustion pass, the said heating device being connected with the valved exhaust pipe of the steam engine with a valved live steam pipe and with a valved air pipe, whereby it may be readily converted from an exhaust steam reheater to a live steam superheater or to an air heater, the heating device being also connected by valved conducting pipes to the radiators or other appliances for utilising the reheated exhaust steam, superheated live steam, or heated air.

2128. WEIGHING APPARATUS, *J. Darling, Glasgow.*—*27th April*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to dispense with the use of a series of separate weights or springs, and substitute one weighted body at one end of a lever, which is mounted on pivots, and at the end nearest the point where it is pivotted the scale or platform is attached, the weighted body suspended from the other end being sunk in a vessel containing water.

2129. DECORATIVE MATERIAL FOR WALLS, &c., *T. J. Palmer, Fulham.*—*27th April*, 1883.—(*Not proceeded with.*) 2*d*.

Any suitable paper-making materials are reduced to a pulpy mass, and conveyed to a paper-making machine in a thick layer. An endless blanket of great absorbent power is brought into contact with the top of the layer, and afterwards passes between pressing rollers, which remove the moisture absorbed. When the paper material reaches the couch rolls it proceeds on an endless blanket past the first pressing rollers, and then it is transferred to a wire cloth with a blanket beneath, the whole passing between engraved rollers, whereby the paper is embossed.

2130. MACHINES FOR MANUFACTURING STRAW WRAPPERS OR COVERINGS FOR BOTTLES, &c, *O. Wolff, Dresden.*—*27th April*, 1883.—(*A communication from Brothers Giese and Co., Germany.*) 10*d*.

In this machine the straw is sewn over a cylinder by means of two rows of stitches, so as to make a perfect shell or covering, the sewing mechanism being located inside the cylinder, and so constructed that it is not necessary to rethread the needle after each covering or wrapper is finished. When each wrapper is finished the threads are automatically severed, and the wrapper removed from the cylinder.

2131. CAPSULES FOR BOTTLES AND SIMILAR RECEPTACLES, &c., *E. P. Alexander, London.*—*27th April*. 1883.—(*A communication from C. Chesewright, Paris.*) 6*d*.

The main object is to so form the capsules that the labels used therewith are mutilated or destroyed when the capsules are removed or the bottles opened, thus preventing them being re-used.

2132. WASHING MACHINES, *E. K. Heaps, near Normanton.*—*27th April*, 1883. 6*d*.

This consists, First, in heating the water in the machine by means of pipes entering the side of the machine and having their outer ends connected to a tuyere placed over a fire; Secondly, in forming the roller for agitating the clothes angular or partly bevelled, so that the clothes are not continuously carried round; Thirdly, in causing the barrel to turn by means of coiled springs.

2133. MACHINE FOR PEELING POTATOES, &c., *J. C. Mewburn, London.*—*27th April*, 1883.—(*A communication from J. M. Burnichon, Paris.*) 4*d*.

This consists of a machine by which a number of potatoes or other articles can be mechanically peeled at the same time, nothing but the skin being removed.

2134. CENTRIFUGAL DRESSING MACHINES FOR DRESSING FLOUR, GRAIN, &c, *R. Lund and T. F. Hind, Preston.*—*27th April*, 1883. 4*d*.

This consists in providing a space between the outer edges of the longitudinal bars and the inner side of the gauze or covering of centrifugal dressing cylinders.

2135. APPARATUS FOR CUTTING AND EMBOSSING PATTERNS ON TEXTILE FABRICS, &c., *H. Pataky, Berlin.*—*27th April*, 1883.—(*A communication from M. Heimann, Berlin.*) 6*d*.

The apparatus consists chiefly of a system of rollers, which system comprises two feed rollers, adapted to guide the fabric towards the stamping and cutting rollers placed vertically behind the feed rollers.

2136 MECHANICAL MUSICAL INSTRUMENTS, *H. J. Haddan, Kensington.*—*27th April*, 1883.—(*A communication from W. Spaethe, Germany.*)—(*Not proceeded with.*) 2*d*.

This consists in replacing the pin barrels or perforated sheets by a sheet of metal with raised lines, and in making the distance of the barrel shaft from the keys adjustable, so as to enable barrels of different diameter to be used.

2137. GAS LIGHTING AND REGULATING APPARATUS, *T. Thorp, Whitefield, Lancs.*—*27th April*, 1883.—(*Not proceeded with.*) 2*d*.

The objects are to produce a steady shadowless light to increase the illuminating power of the gas, to regulate the supply of gas, and prevent down draught in the chimney.

2138. CUTTING, SHAPING, OR FORMING THE TEETH OF WHEELS, &c, *H. H. Grierson and T. O'Maher, Manchester.*—*27th April*, 1883. 6*d*.

Two or more revolving cutters are each mounted upon a separate slide capable of moving parallel or at an angle to each other, and are caused to act upon the wheel blank mounted upon a mandril provided with any dividing arrangement to set out the teeth.

2139. MANUFACTURE OF EXPLOSIVE COMPOUNDS, *E. Turpin, Paris*—*27th April*, 1883. 4*d*.

According to one arrangement the compound consists of pulverised chlorate of potash or chlorate of soda about 10 parts; pulverised nitrate of lead about 5 parts; pulverised nitrate of potash or nitrate of soda about 5 parts; pulverised dry pitch from coal tar about 2½ parts, and liquid pitch from coal tar about 2½ parts.

2140. VELOCIPEDES, &c., *G. J. Stevens and J. S. Smith, Surrey.*—*27th April*, 1883. 6*d*.

This consists in differential gearing to allow the axle to be driven at varying speed from a uniform motion of the crank, and also in providing a balance gear and automatic release motion combined. Expanding pulleys are employed to vary the speed.

2141. PRINTING MUSIC, *J. W. Coates, London.*—*27th April*, 1883.—(*Not proceeded with.*) 2*d*.

This consists in printing a chromatic stave for music wherein every semitone of the octave is represented by a distinct line or space on the stave.

2142. APPARATUS FOR CUTTING OR MINCING AND MIXING ANIMAL, VEGETABLE, AND OTHER SUBSTANCES, *H. Davidson, Tottenham.*—*27th April*, 1883. 6*d*.

In the drawing, which shows one form, A is an inverted and truncated conical vessel; B is an archimedian screw cutter secured by soldering, brazing, or otherwise on the spindle C, which rests and turns on the conical bearing point D secured in the bottom of

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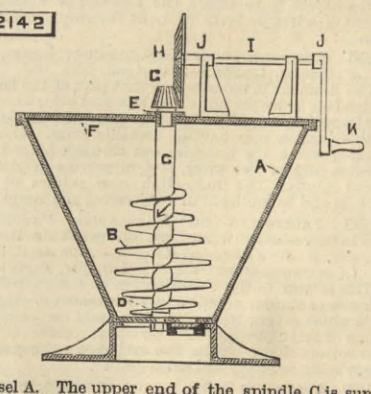

the vessel A. The upper end of the spindle C is supported in a bearing E in the cover F; G and H are bevel wheels by which rotary motion is communicated to the spindle C and cutters B, through the intervention of the shaft I turning in the bearings J secured to the cover and by a handle K.

2144. FINISHING OR SHEARING TEXTILE FABRICS, &c, *W. P. Thompson, Liverpool.*—*27th April*, 1883.—(*A communication from D. C. Sumner, Massachusetts.*) 6*d*.

The object is to produce new effects in the ornamentation of pile fabrics, and to provide means for cutting or shearing transverse lines intersecting lines broken or alternating checks and fancy patterns of various kinds. The apparatus consists of the revolving

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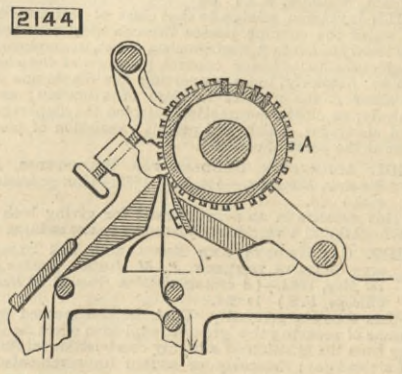


cylinder A, in which cutting studs are secured, and which act upon the fabric as it travels in the direction indicated by the arrows. The studs are fitted into holes in the cylinder, and are arranged in groups or lines, so as to produce the required design.

2146 BALANCES AND WEIGHING MACHINES, *C. H. Bartlett, Bristol.*—*27th April*, 1883.—(*Not proceeded with.*) 2*d*.

The balance is chiefly for weighing letters and parcels for postal purposes and the like, and is of the kind in which a constant weight is slid along a graduated beam. Two independent graduated arms are used, each having a sliding weight, and one serving to indicate pounds and the other ounces.

2145 SEWING MACHINES, *A. J. Boult, London*—*27th April*, 1883.—(*A communication from J. H. Whitney, Brooklyn, U.S.*) 6*d*.

The objects are to obtain elasticity and evenness of motion in running the machine, to gain ready access to oil and fix the working parts under the bed-plate without lifting the machine from the table, and to facilitate the putting on of the belt, and prevent it from getting off the wheel when the machine is tilted to gain access underneath the bed-plate. The machine can be tilted on pivots. The driving wheel is supported on a spring-supported slide block. A belt guard prevents the belt slipping off the wheel.

2149. DISTILLING SHALE AND OTHER MINERALS TO OBTAIN OIL, &c., *W. Crossley, Glasgow.*—*28th April*, 1883.—(*Not proceeded with.*) 2*d*.

The distillation is effected in a chamber heated internally by means of highly superheated steam, which is superheated alternately in two vessels connected with each distilling vessel. The steam acts on minerals, and the vapours given off are led to suitable condensing and separating apparatus.

2150. BRUSSELS AND TAPESTRY CARPETS, &c., *J. W Walker, Kidderminster.*—*28th April*, 1883 4*d*.

The object is to give a slope to the pile as it is formed without having to press it afterwards to produce this result, and it consists in forming the flat wire upon which the pile is laid in the process of manufacture with a twist at its end near the bowl, so as to throw it into a sloping position.

2151. LOOMS FOR WEAVING, *J. Langton, Leyland, and J. Gregson, Preston.*—*28th April*, 1883. 6*d*.

According to the invention either or both the crank and tappet wheels are so mounted upon their respective shafts as to be capable of being moved round thereupon, the wheel bosses being provided with friction cones, plates, or fine toothed clutches, which meet or engage with corresponding conical recesses, plates, or clutches fastened upon the shaft.

2152. INCANDESCENCE ELECTRIC LAMPS. *L. G. B. Arrighi. London.*—*28th April*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to the construction of the globe. The filament is formed as a helix one extremity being carried downwards through the centre of the helix to its conductor.

2153. ELECTRIC "CUT-OUTS" OR APPARATUS FOR AUTOMATICALLY PREVENTING TOO HIGH AN ELECTRIC CURRENT PASSING IN A CIRCUIT, *F. V. Andersen, London.*—*28th April*, 1883. 6*d*.

The apparatus consists of a combined switch and "cut-out." The switch has a constant tendency to break the circuit so long as the current is normal. This tendency is resisted by an armature, which is pressed against the moving part of the switch by a spring. When the current becomes excessive an electro-magnet moves the armature in opposition to the spring and releases the switch, which immediately breaks the circuit.

2154. FIRE-ESCAPE, *A. Messerli, Zurich.*—*28th April*, 1883.—(*Not proceeded with.*) 2*d*.

This consists chiefly in a flexible ladder wound upon a drum enclosed in a casing secured to the floor or wall beneath the window inside a room, and is provided with a crank handle to wind the ladder on or off the drum. An alarm apparatus may be used in combination with the ladder.

2155. BALING PRESSES, *J. Watson, Bayswater.*—*28th April*, 1883. 10*d*.

This relates especially to presses in which the material first receives a preliminary pressure by one or more rams, and then a final or finishing pressure by one or more other rams. The main object is to increase the output of such machines, and it consists in providing the press with two sets of boxes, each mounted upon a separate column, around which it revolves. One set consists of boxes each capable of receiving the loose material to form a bale, and the other of boxes each capable of receiving the same when partly compressed. After the loose material has received its first compression it passes to a box in the other set, which at that moment is beneath it, and is then shifted into position for being acted upon by the other set of rams, while at the same time a fresh supply of loose material is being compressed in another of the large boxes.

2156. CONSTRUCTION AND MANUFACTURE OF ELECTRICAL AND OTHER MEASURING INSTRUMENTS, *W. E. Ayrton and J. Perry, London.*—*28th April*, 1883. 8*d*.

The First part of this invention relates to attachments by which the position of the magnetic axis of the coil in the various instruments designed by these inventors may be adjusted without removing the dial. To make the "proportional law" true an adjustable piece of iron is introduced into the coils. The third part of the invention consists in making the soft iron pole pieces of the permanent magnets used adjustable. Fourthly, the inventors make spiral springs rectangular in cross section and utilise the rotation produced by axial forces of one end to actuate a pointer. The invention further relates to a method of using the "multiplex" principle of these inventors.

2157. LONGITUDINAL JOINT OR SEAM FOR SHEET OR PLATE METAL PIPES, &c., *E. Quadling, Forest-hill.*—*28th April*, 1883. 6*d*.

This relates to the process and apparatus for forming the joints or seams.

2158. STEAM COOKING APPARATUS, *E. A. Brydges, Berlin.*—*28th April*, 1883.—(*A communication from D. Grove, Berlin.*) 6*d*.

This consists chiefly in so constructing the steam cooking apparatus that any cooking vessel can be cut out of use and no longer heated, and further, so that the food can be cooked by direct steam introduced into the vessels.

2159. AUTOMATIC ELECTRIC, MAGNETIC, GALVANIC, AND MECHANICAL INDICATORS FOR RECORDING THE DIRECTION AND SPEED OF THE ENGINES AND THE HEIGHT OF THE WATER IN EACH OF THE BILGE WELLS OF A STEAMSHIP OR SUCH LIKE VESSEL, *C. Stout and C. H. Hillcoat, Liverpool.*—*28th April*, 1883.—(*Not proceeded with.*) 2*d*.

A number of points on the shaft make contact with plates, by which currents are sent to a recording instrument. A vertical tube and float by making contact with suitable plates serves to indicate height of water.

2160. APPARATUS FOR SURGICAL INJECTIONS, *O. Imray, London.*—*28th April*, 1883.—(*A communication from A. R. Larger, Paris.*) 4*d*.

This consists of an elastic ball with a flexible tube extending down from it, provided at its lower end with a filtering valve opening upwards, and with a flexible tube extending up from it, provided with a stop cock and suitable nozzle. The upper elastic ball is preferably covered with a network.

2161. SMALL BORE RIFLE TUBES, *R. Morris, Blackheath.*—*28th April*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to the manufacture of tubes to be inserted in fire-arms for the purpose of enabling a small charge to be used in rifle drill and practice, as described in patent No. 1773, A.D. 1881, and it consists in boring a rod for a short distance to a greater diameter than the intended bore, and then bore the remainder to the desired calibre. In the enlarged bore a second tube is secured and properly rifled, the outside of the tube then being turned true to the required diameter outside.

2162. MACHINERY FOR LIFTING OR HOISTING, *T. Thomas, Cardiff.*—*28th April*, 1883 6*d*.

This consists of the construction and combination of the parts of an adjustable belt shifter for shifting the driving belts from the fast to the loose pulleys of the driving mechanism, or the reverse, and also of the construction and combination of the parts for operating the belt shifter, and also of automatic stopping gear for arresting the motion of the machinery at the proper times.

2163. TACKLE OR APPARATUS FOR HAULING, *H. Johnson, jun., West Bromwich.*—*28th April*, 1883. 6*d*.

This relates to the hauling of coal tubs, wagons, and other vehicles and canal boats by wire ropes, and it consists in securing to the rope stops for temporarily connecting the rope with the wagon or vessel, and in

securing to the latter clips to receive the stops, both the stops and clips being of special construction.

2164. CHECKING CASH RECEIPTS IN PUBLIC VEHICLES, &c., *H. Lyon, Bloomsbury.*—28*th April*, 1883.—(*Not proceeded with.*) 2*d.*

Indicators are provided capable of being moved consecutively from 0 to 1000 by turning a finger-piece a half turn. A number of spindles carry tablets bearing the fares to be paid, and which the passenger on paying his fare turns to the right figure.

2165. APPLICATION OF GAS TO COOKING AND HEATING AND CONSTRUCTION OF OVENS AND STOVES, *W. Flint, Sheffield.*—28*th April*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the combination with the oven of an ordinary cooking range of a pipe with a set of burners, and the construction of the oven to enable it to be heated by gas. The oven door is fitted with a pane or sheet of glass to enable the contents to be viewed without opening the door. Pipes are arranged within the oven to contain and heat water.

2166. LUBRICATORS, PARTICULARLY APPLICABLE TO MOTOR ENGINES, *C. H. Andrew, Stockport.*—28*th April*, 1883.—(*Void.*) 2*d.*

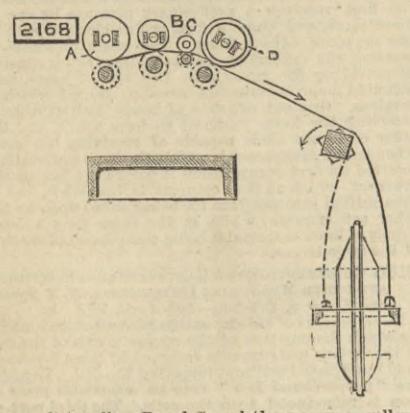
The object when applied to the cylinder of an engine is to force lubricants on to the head of the piston. The oil vessel is attached to a smaller chamber with a valve at the lower part, near where it screws into the cylinder. A small branch tube is connected from the lower portion of the lubricator to the space between the piston and cylinder cover. Oil drops from the upper to the lower vessel, and is guided through a hole on to a disc, such hole being partly filled by the valve stem of the disc, which is perforated with one or more holes. The disc has a projection beneath, and its end is conical and rests on a seating in the passage leading to the cylinder. The disc and valves at the top and bottom are free to rise and fall in a small chamber when acted on by steam or other pressure.

2167. MANUFACTURE OF SUGAR, *W. R. Lake, London.*—28*th April*, 1883.—(*A communication from J. H. Ross, Buffalo, U.S.*) 4*d.*

This consists, First, in the manufacture of crystallised grape sugar by preparing a solution thereof at a low temperature and increasing the same until the sugar is melted, and then permitting the heated solution to cool and crystallise; Secondly, in the manufacture of crystallised grape sugar by forming a concentrated solution thereof, then cooling such solution almost to solidification, then melting the solution by heating, and then permitting the heated solution to cool and crystallise; Thirdly, in the manufacture of crystallised grape sugar by reheating a concentrated solution of grape sugar until the sugar is melted, and then permitting the heated solution to cool and crystallise.

2168. ROLLERS OF MACHINES FOR SPINNING TEXTILE MATERIALS, *W. R. Lake, London.*—28*th April*, 1883.—(*A communication from E. Mehl, Augsburg.*) 6*d.*

This consists in arranging the rollers out of line with each other, as shown at A B C D. By means of this arrangement the fibres are caused to twist faster, but yet sufficiently by contact with the grooved and



intermediate rollers B and C, and the pressure rollers in the first row of drawing rollers are caused to incline as far towards the spindle as is necessary to enable the twisting of the sliver to take place, without obstruction, up to the point at which it issues from out of the drawing rollers.

2169. JET NOZZLES OF GARDEN ENGINES, HOP WASHERS, &c., *E. Haines, Horsmonden.*—28*th April*, 1883. 6*d.*

This relates to a detachable and reversible spreader for the jet nozzles of garden engines and similar apparatus, consisting of a metal plate, either curved transversely or not, in combination with grooves or clips on the nozzle for holding the spreader.

2170. FASTENINGS FOR CARRIAGE DOORS AND HANDLES FOR OPERATING THE SAME, *J. Edwards, London.*—30*th April*, 1883. 2*d.*

This relates to what are termed two-bolt locks or fastenings, and it consists in forming grooves in the tail part of the top bolt and inserting spiral springs therein to operate the bolt, hollows being formed in the case and top plate of the lock opposite each other so as to form guides for the spring. A lever has projections which engage the tail part of the bottom bolt to hold it in position. The hole in the follower, and also that in the handle are bushed, and the shank of the handle is of iron or steel, and to it the handle of different metal is rivetted. The door can be fastened in any required position by means of a curved plate, to which springs are attached, and which works through a slot in a bracket fastened to the doorpost.

2171. STOPPER FOR BOTTLES AND JARS, *J. Jackson, jun., Brixton.*—30*th April*, 1883. 6*d.*

A case or cap contains a conical elastic stopper, and between it and the top of the case is a spiral spring tending to force the stopper outwards, but being prevented by a flat steel spring near the open end, such flat spring being oblong or of O-shape and projecting out from the case, where it is provided with a pressure piece. When the cap is forced over the mouth of the bottle the stopper closes the same and the flat O-spring engages beneath the shoulder or collar round the neck and secures the cap. Pressure on the flat O-spring releases it from such collar, and a spiral spring forces the cap upwards.

2173. FULLING MACHINES, *P. Legrand, Paris.*—30*th April*, 1883. 6*d.*

This relates to constructing fulling machines with rollers having projecting discs, and rollers having grooves, and with friction plates and reservoirs, through which the fabric or cloth to be fulled passes.

2174. ROLLING CYLINDERS OF IRON AND STEEL, &c., *B. Walker, Leeds.*—30*th April*, 1883.—(*Void.*) 2*d.*

Weldless cylinders of iron or steel of comparatively large diameter are manufactured with the metal worked or extended lengthwise of the cylinder by a rolling operation, as well as being worked or extended circumferentially by another rolling operation.

2175. STEAM BOILERS, *S. Pitt, Sutton,*—30*th April*, 1883.—(*A communication from L. Schutte, Philadelphia.*) 6*d.*

The inventor claims, First, a steam boiler in which the generator sections are formed of inclined tubes and end fittings, and smaller vertical connections attached between two fittings with right and left-handed threads, a cover or plug opposite the end of the smaller vertical connections, and a valve seated cover or covers opposite one or more of the inclined tubes; Secondly, in combination with a steam boiler and furnace, of a superheater and connections allowing the boiler to be worked with or without the superheater in action or to act as an addition to the generator; Thirdly, in combination with the end fittings on inclined tubes of a pocket cast thereon for the support of nut and screw; Fourthly, the construction of boiler casing consisting of plates having ribs projecting symmetrically toward inside and outside of boiler, and two packing pieces either cast on to the plates or loose or fastened to the column, for the purpose of building a continuous closed front with plates of the same pattern; and Fifthly, in connection with plates as described in claim 4, of flat star or bar-shaped pieces of metal attached to the plate on distance pieces, so that the covering will surround these parts, and thereby support the covering.

2176. STOPPERING BOTTLES FOR CONTAINING AERATED OR GASEOUS LIQUIDS, *R. J. Sankey, near Ashford.*—30*th April*, 1883. 6*d.*

This relates to an improved method of fixing the india-rubber ring which forms the seating for internal stoppers in the neck of the bottle, and also to an improved stopper. The ring is secured in position by a ring or rings of vulcanite made small enough to pass into the bottle, and then heated so as to fit tightly in the neck of the bottle.

2177. BOOT AND SHOE SOLE PROTECTING PLATES, *J. Borrett, London.*—30*th April*, 1883. 6*d.*

This relates to a frame cut or reduced at suitable parts and having projections thereon, into which a layer of leather or the like is forced by pressure so as to form a sole plate of metal and leather or the like.

2178. MANUFACTURE OF BUTTONS, *W. Willeringhaus, London.*—30*th April*, 1883.—(*A communication from C. Umbeck, Barmen.*) 6*d.*

This relates to the manufacture of linen buttons.

2179. VALVE DISCS, *J. G. G. E. Bischoff, Hamburg.*—30*th April*, 1883.—(*Not proceeded with.*) 2*d.*

The valve discs are made by uniting two or more layers of a web, tress work, or felt, made of cotton, linen, wool, jute, or similar material by stitching in such a manner as to produce concentrical pads thereon.

2180. APPARATUS FOR FASTENING OR SUPPORTING NECKTIES, &c., *V. Vyse, London.*—30*th April*, 1883.—(*A communication from F. Smiley, San Francisco.*)—(*Not proceeded with.*) 2*d.*

The object is to secure cravats and such like articles to collar buttons or studs.

2181. METHOD OF AND APPARATUS FOR TREATING TEXTILE MATERIALS WITH LIQUIDS OR GASES, *H. J. Haddan, London.*—30*th April*, 1883.—(*A communication from O. Obermaier, Bavaria.*) 6*d.*

This consists chiefly in forcing a continuous current of liquid through a perforated upright pipe placed inside a perforated receptacle in which the material to be treated is placed and pressed at will, and which receptacle is placed in a tank. The upright pipe passes through the bottom of the tank, and is connected with a pump which causes liquid from the tank to pass through the pipe, and from there through the textile material before returning to the tank. As the pump draws liquid from the bottom of the tank, a continuous circulation of the liquid is maintained.

2182. DRILLS FOR GRAIN AND OTHER SEEDS, *G. W. von Nawrocki, Berlin.*—30*th April*, 1883.—(*A communication from C. Gindler, Germany.*)—(*Not proceeded with.*) 2*d.*

The object is to construct the parts, so that each of the receiving hoppers can be put out of action in a simple, sure, and direct manner, and so that the spindle provided with the feed cups can be removed and exchanged for another as required without the removal of the receiving hoppers, and without the use of slides or plates for shutting off the feed supply to the funnels as heretofore used.

2183. TREADLES FOR BICYCLES, LATHES, SEWING MACHINES, &c., *H. H. Lake, London.*—30*th April*, 1883.—(*A communication from F. S. Wilson, Vienna.*)—(*Not proceeded with.*) 2*d.*

The object is to effect the rotation of a shaft by means of a treadle lever without the employment of a crank.

2185. MANUFACTURE OF INCANDESCENT LAMPS, &c., *W. Crookes, London.*—30*th April*, 1883. 6*d.*

The filament is mounted in that part of the lamp to which it is to be permanently attached prior to adjusting its resistance. The lamp is provided at its neck with a wooden cup having metallic sides. The conducting wires are brought out through holes in the wooden part of the plug, and terminate in globular-ended studs. The invention also relates to lamp sockets and to methods of suspending the lamps.

2186. PROTECTING OR PREVENTING FRAUDULENT INTERFERENCE WITH THE CONTENTS OF BOTTLES, &c., *E. P. Alexander, London.*—30*th April*, 1883.—(*A communication from C. Cheswright, Paris.*) 6*d.*

This relates to the combination of a cage encircling a bottle or similar receptacle, a perforated or plain capsule which covers the neck of the said receptacle, and a cup or second capsule or disc which receives or covers the bottom of the bottle, the said cage and capsules or discs being securely united together.

2187. AUTOMATIC CHECKING OR STOPPING DEVICE OR APPARATUS FOR USE ON RAILWAYS, *E. C. M. Vanden Berghe, Upper Norwood.*—30*th April*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to enable the signalman to shut off the steam and apply the brakes if desired by means of an electric current.

2188. REMOVING THE HAIR OR WOOL FROM THE SKINS OR HIDES OF ANIMALS, &c., *J. Palmer, London.*—1*st May*, 1883. 4*d.*

This consists essentially in subjecting the hides or skins alternately to the action of water and to that of the atmosphere.

2189. ELECTRIC TELEPHONES, *H. J. Allison, London.*—1*st May*, 1883.—(*A communication from J. H. Robertson, Brooklyn, U.S.*) 6*d.*

This invention relates to that class of transmitters in which the current passes through electrodes that are loosely in contact, and consists, First, in employing magnetism to produce contact pressure of the electrodes; Secondly, in so supporting the diaphragm as to allow it the utmost freedom of vibration; and Thirdly, an elastic connection between the diaphragm and electrodes, which will permit a variation of pressure at the point of contact.

2191. ADJUSTABLE SADDLES FOR VELOCIPEDES, *E. Burstow, Horsham.*—1*st May*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in an arrangement for giving both a horizontal and a vertical adjustment to the saddles.

2192. GAS ENGINES AND REGULATING THE EXPLOSIVE CHARGES THEREOF, *P. M. Justice, London.*—1*st May*, 1883.—(*A communication from W. B. Hale, Chicago, U.S.*) 1*s.* 2*d.*

This consists generally, First, in the method and means of securing the greatest explosive effect resulting from the ignition of a highly combustible mixture of air and gas; Secondly, of certain improvements in gas engines, in which the mixture of air and gas is compressed in the working cylinder, and therein exploded; Thirdly, in certain improvements in gas engines, in which the charge is compressed in a cylinder separate from the working cylinder; Fourthly, in certain adjuncts, appliances, and connections and devices used, or which may be used, in connection with the engines.

2196. MANUFACTURE OF EMBOSSING ROLLERS, *O. Imray, London.*—1*st May*, 1883.—(*A communication from N. L. Cochen, Brooklyn, G. B. Walton, New York, and T. Y. Brown, New York.*) 2*d.*

This relates to the manufacture of a roller having on its periphery a pattern or design copied electrolytically from some surface, such, for instance, as that of leather or skin, so that it can be employed to produce on plastic material a copy of that surface.

2197. TENNIS BALLS AND OTHER COVERED BALLS, *A. W. Phillips, Atherstone.*—1*st May*, 1883. 2*d.*

The object is to provide tennis balls and other covered balls with a seamless cover that is cemented to the ball.

2198. INCANDESCENT ELECTRIC LAMPS, *F. Wright and M. W. W. Mackie, London.*—1*st May*, 1883.—(*Not proceeded with.*) 2*d.*

The filaments are made of a double helical shape, and at their junction with the ends of the conducting wires are coated with bichloride of platinum and heated. The filaments are made of vegetable carbon and immersed in a bath of hydrocarbon, where they are raised to a white heat by a current.

2199. MATERIALS FOR MAKING CEMENTS, CAPABLE ALSO OF BEING USED FOR OTHER PURPOSES, *T. Smith, Sunbury.*—1*st May*, 1883. 4*d.*

This relates to a compound substance consisting of the combination of the scrapings or sweepings or *débris* of macadamised roads, and chalk and coke or other analogous substances, with sulphur or brimstone.

2201. KNITTING MACHINES, *J. Higham, Manchester.*—1*st May*, 1883. 10*d.*

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

2203. CANDLES, *G. H. Kirk, Philadelphia.*—1*st May*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the combination with a candle of an inflammable material which will kindle by friction and ignite the wick of the candles.

2207. APPARATUS FOR PREVENTING HORSES FROM GETTING SHY, *G. W. von Nawrocki, Berlin.*—1*st May*, 1883.—(*A communication from G. Wille, Hildesheim.*) 6*d.*

This relates to a flap for each eye, which flaps are caused to cover the eyes by springs and cords controlled by the driver.

2208. SELF-ACTING FLUSHING APPARATUS, *E. R. Palmer, Beckenham.*—1*st May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a syphon flushing apparatus.

2209. FLUES OR FLUE TUBES FOR STEAM BOILERS, *J. A. Hopkinson, Huddersfield.*—1*st May*, 1883. 6*d.*

One part consists in so constructing the said flue tubes that strengthening hoops or flanges may be dispensed with and conical or other water-circulating tubes or pipes can be readily inserted and efficiently secured in the said flue tubes. Another part, which is applicable generally to flues having circulating pipes, is designed to provide means whereby the flame and heated products of combustion will be more effectually caused to impinge upon the sides of the flue tubes, and of the said circulating pipes than is the case with flue tubes as heretofore made.

2210. DYNAMO-ELECTRIC AND ELECTRO-DYNAMIC MACHINES, *Sir W. Siemens, London.*—1*st May*, 1883. 8*d.*

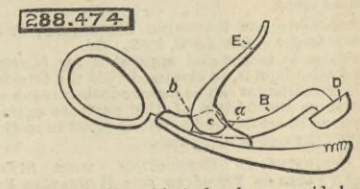
A coiled armature of any construction, and having a non-magnetic core, is surrounded by a stationary coil of wire, arranged as a meridian to the armature. The commutator and brushes, of ordinary construction, may collect or distribute the currents from either or both sets of coils. When used as a generator, induction may be started by an extraneous current, or by a permanent magnet. A small machine, provided with vanes revolving in a fluid, and geared to a counter, may be employed as an electric power meter.

SELECTED AMERICAN PATENTS.

(From the United States' Patent Office Official Gazette.)

288,474. HORN FOR DRAWING ON SHOES, *Emil Noppel, Philadelphia, Pa.*—*Filed August 31st*, 1883.

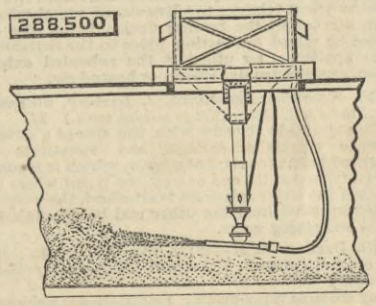
Claim.—(1) A shoe horn, in combination with a pivotted lever provided with a jaw and handle and a pivotted arm, the horn being formed with an abutment for said arm, substantially as and for the



purpose set forth. (2) A shoe horn provided with an ear *a*, having a shoulder or abutments *b*, a pivotted handle lever B, which is provided with a jaw D, and a folding arm E, combined and operating substantially as and for the purpose set forth.

288,500. STOWAGE OF GRAIN, *Thomas F. Seery, Montreal, Quebec, Canada.*—*Filed April 3rd*, 1883.

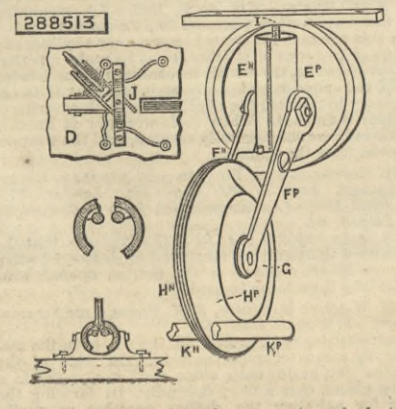
Claim.—An apparatus for stowing and trimming grain, placed at any point intermediate between the elevator discharge spout and the point at which the grain is to be delivered, composed of a hopper into which the grain is fed, discharge pipes through which



it gravitates, and nozzles through which a blast is forced at an angle to the course of the grain, said discharge pipes and nozzles being so constructed as to throw the grain at any angle to the floor and longitudinal axis of the compartment, all as herein set forth.

288,513. ELECTRIC RAILWAY AND LOCOMOTIVE, *William M. Thomas, Cincinnati, Ohio.*—*Filed November 6th*, 1882.

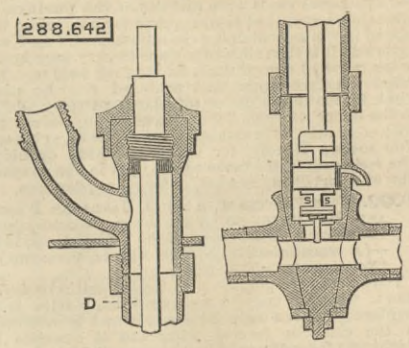
Claim.—(1) An electrical conductor composed of two parallel wires respectively in communication



with the opposite poles of a generator of electric currents, and having insulated attachment within housing L, having openings *i* and *i'*, as and for the objects designated. (2) The rolling conductor, whose wheel is composed of two parallel metallic discs with an interposed washer of vulcanite or other non-conducting material, the respective discs having contact with the respective tracks of the outgoing and returning generator currents on the one hand, and with the carriers of the ingoing and returning motor currents on the other hand, as set forth. (3) In an electric locomotive for use with two parallel wires K P K N, for the outgoing and returning currents respectively, the rolling conductor consisting of members as follows—to wit, springs D P D N, having electrical communication with the field-magnet, segments E P E N, stud I, cheeks F P F N, axle G, and insulated chamfered discs H P H N. (4) In combination with the rolling conductor D, the rigid yoke J, having inclined faces adapted to impart to the runner a tendency to parallelism with the track, as set forth.

288,642. WATER-SERVICE PLUG, *Patrick Keilt, Brooklyn, N.Y.*—*Filed September 29th*, 1882.

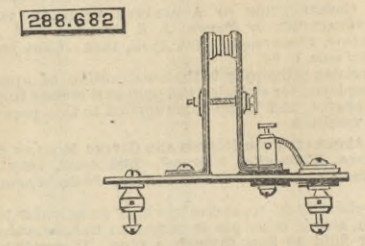
Claim.—The combination of an upright pipe D, of a street washer with an adjustable claw L, constructed



substantially as described, and the removable cover S supported by said claw, substantially as and for the purposes described.

288,682. SAFETY CUT-OUT FOR ELECTRIC LAMPS, *Charles J. Van Depoele, Chicago, Ill.*—*Filed May 24th*, 1882.

Claim.—A safety cut-out for lamps, provided with two contact points or surfaces arranged in immediate proximity and directly facing each other, one being connected to the positive and the other to the negative pole of the lamp, said points being carried by devices



constructed to be held at all times a regulated distance apart, whereby said points are held apart without an intervening substance, and are adapted to melt and unite together by the passage of the current between said points caused by an abnormal resistance of the arc, substantially as described.

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