THE TENSILE STRENGTHS OF LONG AND SHORT BARS

IN the December number for last year of *Van Nostrand's Engineering Magazine*, there appeared an interesting paper by Prof. W. S. Chaplin, of the Engineering Department of the Japanese University at Tokio. It has long been known that long tie-bars are proportionately weaker than short ones; and we believe that Prof. Chaplin is not the first who has suggested that the reason may be that the greater length of material we take, the greater is the risk of its containing a flaw, or exceptionally weak place. Prof. Chaplin does not, in his present paper, contemplate the existence of actual flaws in the bar. He bases his calculation simply on the fact that no two pieces of iron can be made exactly alike in quality and strength. The conditions under which the material is manufactured are continually varying, through numberless small influences, each one of which is quite unrecognisable, far less calculable. Different specimens of what was intended to be exactly the same quality of iron always differ more or less in strength. They all approach more or less nearly what they are intended to be. Some are stronger and some weaker; but the majority have strengths very nearly the same, and great deviations from this average strength are rare; the greater the deviation the rarer is its occurrence.

Prof. Chaplin is, we believe, the first who has endeavoured to turn these facts to practical account, by dealing with them in a strict mathematical way. We do not think that Prof. Chaplin's theory includes all the influences which make long and short bars differ in strength; but no doubt the facts he deals with form a most important element in the complete explanation.

Suppose we take a very large number of specimens, all of the same dimensions, and intended to be of the same quality, and by breaking them find the average strength of all of them. Then suppose we take one more specimen, still of the same dimensions and still of the class intended to be of the same quality as the previous ones. This one will certainly resemble very closely some one of the previously tested large number, but which one it is impossible to prophesy. The attempt to guess its strength without testing it is exactly as if we got all the previously tested bars piled together in a great indiscriminate heap and selected one of them blindfold. We find ourselves performing the same gambling feat that we used to be called upon, in the interests of morality and algebra, to imagine ourselves performing in our school days, when we were struggling through "probabilities," and became learned in the manipulation of lottery-boxes and red, white, and black balls, and in the science of tossing pennies. We have here, however, not only white and black balls which we may draw, but an infinite variety; the greater number of which, however, approximate to one and the same standard, and the stragglers away from that standard being few and far between. Thus it is more probable that we shall "draw" one near the standard or average than one deviating much from it. Also the specimen we draw may just as probably be stronger than the average than weaker.

The specimen drawn blindfold from the heap is the representative of the new piece whose probable strength we wish to estimate. The problem is exactly the same as that of the calculation of the probability of accidental errors, the theory of which is perhaps the most ingenious of all useful developments of mathematics. Using this theory and the elaborate tables which have been calculated to facilitate its application in practice, Prof. Chaplin proceeds to apply it to calculate the probable strength of a long bar in terms of the average strength of a large number of short bars of the same section. The ratio of the two lengths being n, he looks upon the long bar as n short bars put together. The pull is passed through one after the other of these short lengths. There is a chance that the first length is stronger than the average. The probability of this being the case is just $\frac{1}{2}$, being equal to the probability of its strength being below the average. There is just as much chance of the second short length having a strength greater than the average, and the same chance again exactly with the third. Taking the first two lengths alone, we have four possibilities. Thus, both may be above the average in strength; both may be below it; the first may be above and the second below, or the first may be below and the second above. Each of these possibilities is equally probable, and therefore the probability of each is $\frac{1}{4}$. Thus the probability that the first and second are both above the average in strength, or what comes to the same thing, the probability that the double length of bar is above the average in strength is only $(\frac{1}{2})^2$. Similarly a triple length has only $(\frac{1}{2})^3$ for the probability of its strength lying above the average; and the probability that a bar n units in length has its strength lying above the average strength of the short pieces is found to have dwindled down to $(\frac{1}{2})^n$. The misfortune lies in this, namely, that the strength of the whole length depends on that of its weakest part, and the greater the number of its parts the greater is the probability that one or other of them has a strength below the average strength.

But what is specially desired to be found out is not the probability of the strength of the bar n lengths long lying above a certain limit, namely the average strength of the short pieces. What is specially desired is to find out what strength the long bar most probably has. Since the probability of its being stronger than the average of the short pieces is extremely small, it is quite evident that its own strength is most probably considerably lower than the average of the short pieces. It is not *impossible* that its strength should turn out to be above that average, because it is not impossible—it is only extremely improbable—that each and all of the short pieces of which the long length is made up should be stronger than the average. The most probable strength of the long piece must evidently coincide with what would be the average strength of a large number of exactly similar pieces of the same length, if this large number were tested and their average strength calculated. Now the probability that the strength of this one specimen of the long lengths that we have selected to compare with the short ones lies above the average of all the long pieces is evidently again just $\frac{1}{2}$. If, then, we calculate in terms of the average strength of the short pieces a strength which will give a probability $\frac{1}{2}$ for the chance that that of the chosen long specimen will lie above it, then it is evident that the strength so calculated will coincide with the average strength of the long pieces. This calculation, then, gives a formula for the average strength of pieces n units long in terms of the average strength of pieces one unit long. This is what Prof. Chaplin wishes to obtain, and the above is the very ingenious yet simple reasoning by which he arrives at his conclusion.

Although of all possible values of the strength of a single specimen the most probable is, of course, the average of a large number of precisely similar specimens, still there is only an extremely small probability that it will agree exactly with that average. Most likely it will deviate from it to some extent in the plus or minus direction. If we sum up all the possible deviations in the plus direction, taking into account the greater frequency of small deviations than that of large deviations, and take the average of all these possible deviations, this average deviation is that that is most probable in the plus direction for any single untried specimen. It is called the "probable deviation," which phrase is a contraction for the most probable deviation from the average. The probable deviation in the minus direction is numerically the same as that in the plus direction When one mentions the average and the probable deviation, one asserts that the strength of any particular untried specimen is most likely to be greater or less than this average by an amount equal to the probable deviation.

Let S_1 and P_1 be the average strength and the probable deviation from that average of specimens unit length long, and let S_n and P_n be the similar average and probable deviation of specimens n units long. Let A_x be the probability that any particular untried specimen of unit length has a strength lying between S_1 and $(S_1 - x P_1)$. The chance that its strength lies above S_1 being $\frac{1}{2}$, that of its being below S_1 is also $\frac{1}{2}$. The probability that its strength lies below $(S_1 - x P_1)$ is therefore $(\frac{1}{2} - A_x)$.

Therefore, the probability that a bar of the same quality, the same section, and n units long has a strength lying below $(S_1 - x P_1)$ is $(\frac{1}{2} - A_x)^n$.

If, now, we find x, so that $(\frac{1}{2} - A_x)^n = \frac{1}{2}$;

$$\text{or } A_x = \tfrac{1}{2} - \sqrt[n]{\tfrac{1}{2}}.$$

this value of x will give the n units long bar an equal chance of lying in strength above or below $(S_1 - x P_1)$. That is, this value of x will give us the average strength of specimens n units long; or

$$S_n = S_1 - x P_1 .$$

Calculating A_x from the formula $\frac{1}{2} - \sqrt[n]{\frac{1}{2}}$ for different values of n, we find the corresponding value of x from tables in hand books on probability. Prof. Chaplin has thus calculated the following table :—

TABLE OF THE VALUES OF THE RATIO.

x = { Average strength of rods of unit length—Average strength of rods, n units long. }

÷ { The probable deviation of the strength of any single untried rod of unit length from the average strength of rods of unit length. }

AND OF THE RATIO—

$\frac{Pn}{P_1}$ = { Probable deviation of a single untried rod n units long from the average strength of rods n units long. }

÷ { Probable deviation of a single untried rod of unit length from the average strength of rods of unit length. }

n	x	$Pn \div P_1$	n	x	$Pn \div P_1$	n	x	$Pn \div P_1$	n	x	$Pn \div P_1$	n	x	$Pn \div P_1$
1	0	1	11	2·30	0·54	21	2·74	0·47	35	3·06	0·44	100	3·65	0·39
2	0·81	0·81	12	2·36	0·53	22	2·77	,,	40	3·14	0·43	150	3·87	0·38
3	1·21	0·72	13	2·41	0.52	23	2·80	0·46	45	3·21	0·42	200	4·03	,,
4	1·48	0·67	14	2·46	0·51	24	2·82	,,	50	3·26	0·41	300	4·25	,,
5	1·68	0·64	15	2·51	0·50	25	2·85	,,	55	3·31	0·40	400	4·41	,,
6	1·83	0·62	16	2·56	,,	26	2·87	,,	60	3·36	,,	500	4·53	,,
7	1·95	0·60	17	2·60	0·49	27	2·89	0·45	65	3·41	0·39	600	4·63	,,
8	2·06	0·58	18	2·64	,,	28	2·91	,,	70	3·45	,,	700	4·71	,,
9	2·15	0·56	19	2·68	0·48	29	2·94	,,	80	3·53	,,	800	4·79	,,
10	2·23	0·55	20	2·71	,,	30	2·96	,,	90	3·60	,,	900	4·85	,,
												1000	4·91	,,

In using this table we must have P_1, which must be calculated from the experiments by the methods explained in probability text-books, but to explain which here would be outside the intention of this article. The theory offers one compensation for the smaller average strength of long bars. It shows them to be more trustworthy; that is, that the probable deviation from the average is much less than for short bars. We thus find the ratio $\frac{P_n}{P_1}$ to have a decreasing value as the lengths grow greater. Prof. Chaplin explains the method of finding the value of this ratio, and we have calculated a series of values and added them to his table given above, which we have also extended beyond the value of n to which Prof. Chaplin has limited himself.

Prof. Chaplin gives in his paper the results of thirty-five experiments on copper wire which he made to test his theory. They agree remarkably well with it. We hear that he has since made further series of experiment, and that he has applied his theory to other people's experiments with very fair success. He is, however, anxious that much more numerous experiments than he has himself the means of making should be made; and we fully appreciate the desirability of this being done. Without further experimental test the theory cannot be accepted as thoroughly sound, and the importance of the subject and what seems to us the soundness of Prof. Chaplin's reasoning deserves that an effort should be made to prove or disprove the correctness of his rule, which, if correct, is undoubtedly of the greatest utility.

The probable deviation from the average strength is, of course, much smaller for very homogeneous qualities of metal in which much care is spent in the manufacture to secure uniformity of quality than for cheaper and less trustworthy sorts. The theory shows that for the latter the difference between long and short bars should be much greater than for the former, and we believe all experiments tend to show an accordance between fact and the above theory in this respect.

Granted Prof. Chaplin's premises, we think his conclusions are undeniable, but we must point out that it appears to us that his premises do not in some respects strictly represent the actual conditions of the problem. In the first place his hypothesis takes for granted that the short lengths into which a long bar may be geometrically imagined to be divided are precisely similar to short lengths actually separate. Now if the separate short lengths are obtained by cutting them off a long bar, as the professor's specimens of copper wire were obtained, no doubt the hypothesis is substantially correct. But if the short lengths are manufactured separately in short lengths, then it is by no means certain that the very fact of their being made in short lengths instead of in long lengths does not itself produce some considerable difference in quality. Thus, in our opinion, it is not likely that the theory will be found to apply so accurately to pieces forged to the special short and long lengths in which they are desired for use as to short and long pieces cut off rolled bars or from coils of wire or rope.

Again, the theory does not take into account the highly probable, we might almost say the almost certain fact that the behaviour under the severely distorting stress which produces rupture of each separate short portion of a long bar is greatly influenced by the very fact that it has at each end of it a long stretch of material of the same section, from and to which it is transferring the force exercised through it. The theory assumes that even under the maximum possible stress each short portion will behave exactly as if it were isolated from the rest of the bar. Experiment seems to indicate that this is not so, and we may say that we think that there are, besides, good theoretical grounds for believing that it is not so. These theoretic reasons have not, however, so far as we know, been yet worked out in definite mathematical form.

In conclusion, we may say that we shall be very glad to hear of experimentalists applying the theory to appropriate series of tests, and if they will publish their results, we are sure they will be considered highly valuable and interesting. The only labour involved in doing so—now that we have published the above extensive table of numericals factor—is the calculation of P_0, the probable deviation for each series of experiments. But quite independently of this or any other theory, this is a labour which most certainly ought to be undertaken by all experimentalists on materials if they wish to make their results as useful as they may be. The calculation of the probable deviation from the average makes each set of experiments at least tenfold as useful for practical guidance as it can be without that calculation being made.

TANK LOCOMOTIVE FOR THE BELGIAN CENTRAL RAILWAY.

WE publish this week as a supplement an engraving of an eight-wheeled tank engine, one of several constructed a couple of years ago for the Great Central Railway of Belgium. These engines have proved very successful, hauling heavy trains at a fair speed over steep inclines. The dimensions are fully given in French measures on the engraving, but it may be convenient to give here a few of them reduced to their nearest English equivalents.

The cylinders are 18·89in. in diameter; the piston stroke being 23·62in. The wheels are 4ft. in diameter, and the tractive force of the engine is 170 lb. per pound of effective pressure per square inch of piston, or for 100 lb.—which the engines can easily maintain as an average pressure throughout the stroke—17,000 lb., or say, 7·5 tons; which would suffice to take a load of 300 tons, including the engine, up an incline of 1 in 50 at a good pace.

The engine is fitted with a modification of Walschert's valve gear. The fire-box has the regular Belgian flat top. The tubes are 270 in number, and 11ft. 2in. long. The grate is 6ft. 6¾in. long, and 3ft. 8½in. wide. The smallest diameter of the boiler barrel is 4ft. 11in. The total wheel base is 14ft. 1in., and a certain amount of lateral play is allowed in the trailing axle, and provided for by a vertical joint in the coupling rod. The total height of the engine above the rails is 14ft. The centre line of the boiler is 7ft. 2¼in. above the rails.

The engine was constructed at the company's works at Louvain.

THE EDISON LIGHT IN NEW YORK.

ON page 5 we give the first of a series of illustrations intended to show the system adopted by Mr. Edison in lighting large areas. He selects a central position whereon his steam motors and dynamo machines are placed, and from whence street mains radiate in the directions required. The sectional illustrations given in this issue almost explain themselves, but will be referred to when the system as a whole is described. Mr. Edison's representative in London, Mr. Johnson, is rapidly carrying out a similar plan to that adopted in New York, but on a smaller scale, in Holborn. The lights used in the City Temple, in the Holborn Viaduct Hotel, in the surrounding houses of business, and in the streets, will all be on the incandescent principle. The details of the system will be seen as we proceed with our illustrations.

CONTINUOUS BRAKES, ROLLING STOCK, TRAIN MILEAGE, AND FAILURES.

HALF YEAR ENDING JUNE 30, 1881.

CHIEFLY COMPILED FROM BOARD OF TRADE RETURNS.

(*For description see page* 11.)

Name of Railway Company.	Westinghouse automatic brake. *a* Fitted. Engines. No.	Westinghouse Fitted. (*m*) Carriages, &c.	Westinghouse Train miles run.	Automatic vacuum brakes, all varieties. *a* Fitted. Engines, &c.	Automatic vacuum Fitted. Carriages, &c. No.	Automatic vacuum Train miles run. No.	Simple vacuum brakes. *b* Fitted. Engines, &c.	Simple vacuum Fitted. Carriages. No.	Simple vacuum Train miles run. No.	Chain brakes, all varieties. *c* No. carriages, &c., fitted.	Chain Train miles run. No.	Fay and Newall brakes, all varieties. *d* No. carriages, &c., fitted.	Fay and Newall Train miles run. No.	All other continuous brakes. *e* Fitted. Engines, &c.	All other Fitted. Carriages. No.	All other Train miles run. No.	Totals for continuous brakes. Fitted. Engines. No.	Totals Fitted. Carriages. No.	Totals Train miles run. No.	Totals not fitted with continuous brakes. Engines No.	Not fitted Carriages, &c. No.	Not fitted Train miles run.	Percentage of total train miles run with continuous brakes.
Caledonian	9	226	50,000	—	—	—	—	—	—	210	447,000	—	—	4	33	33,000	13	469	530,000	146	1,341	1,855,000	22
Glasgow and South Western ...	46	278	189,000	—	—	—	—	—	—	—	—	—	—	—	—	—	46	278	189,000	35	725	834,000	18
Great Eastern	41	602	498,000	—	—	—	20	109	178,000	27	146,000	3	9,000	2	79	194,000	63	820	1,025,000	236	1,734	2,489,000	29
Great Northern	2	14	27,000	2	33	26,000	316	2016	3,137,000	—	—	—	—	—	—	—	320	2063	3,190,000	37	177	235,000	93
Great Southern and Western ...	—	—	—	—	—	—	72	297	738,000	—	—	—	—	—	—	—	72	297	738,000	3	136	62,000	92
Great Western	—	—	—	221	726	619,000	14	99	114,000	—	—	104	120,000	—	—	—	235	929	853,000	289	3,393	4,582,000	15
Highland	—	—	—	—	—	—	—	—	—	—	—	111	206,000	—	—	—	—	111	206,000	63	482	38,000*	84*
Lancashire and Yorkshire	11	37	72,000*	9	35	68,000*	2	—	—	—	—	1688	3,181,000*	—	—	—	22	1760	3,321,000	211	614	—	100
London and Brighton	198	1786	1,789,000	—	—	—	—	—	—	—	—	—	—	—	—	—	198	1786	1,789,000	56	943	1,158,000	61
London, Chatham, and Dover ...	11	56	91,000	—	—	—	2	10	20,000	—	—	—	—	—	—	—	13	66	111,000	123	900	1,290,000	8
London and North-Western ...	—	—	—	—	—	—	—	—	—	5195	7,424,000	86	89,000	—	—	—	—	5281	7,513,000	431	2,031	795,000	90
London and South-Western ...	2	7	21,000	5	11	12,000	2	7	20,000	19	27,000*	178	253,000*	—	—	—	9	222	333,000*	301	1,985	3,053,000*	10*
Manchester, Sheffield *f*	—	—	—	—	—	—	168	850	1,125,000	—	—	—	—	—	—	—	168	850	1,125,000	—	343	861,000	57
Metropolitan	—	—	—	—	—	—	56	216	732,000	—	—	—	—	—	—	—	56	216	732,000	—	—	—	100
Metropolitan District	—	—	—	—	—	—	—	—	—	—	—	—	—	36	242	471,000	36	242	471,000	—	—	66,000	88
Midland...	57	209	378,000	202	2074	1,582,000	26	115	136,000	—	—	—	—	2	11	5,000	287	2409	2,101,000	191	1,225	3,921,000	35
North British	91	814	1,023,000	—	—	—	—	—	—	—	—	—	—	—	—	—	91	814	1,023,000	27	971	1,206,000	46
North-Eastern	178	977	1,214,000	—	—	—	46	49	311,000	—	—	193	383,000	1	9	13,000	225	1228	1,921,000	138	1,361	2,156,000	47
North London	—	—	—	—	—	—	—	—	—	551	825,000	—	—	—	—	—	—	551	825,000	83	24	—	100
Somerset and Dorset	—	—	—	—	—	—	—	—	—	98	208,000	—	—	—	—	—	—	98	208,000	17	22	?	?
South-Eastern	—	—	—	—	—	—	97	593	938,000	—	—	—	—	—	—	—	97	593	938,000	131	1,392	1,206,000	44
Taff Vale	—	—	—	3	15	12,000	12	114	95,000	—	—	—	—	—	—	—	15	129	107,000	—	43	12,000	90
All other companies	10	40	58,000*g*	—	—	—	25	62	45,000*h*	61	96,000*k*	56	111,000*l*	—	—	—	35	219	310,000	589	3,072	4,100,000*	7*
Totals	656	5046	5,410,000	442	2894	2,319,000	858	4537	7,589,000	6161	9,173,000	2419	4,352,000	45	374	716,000	2002	21,431*n*	29,549,000	3167	23,114	30,500,000*p**	49*

FAILURES.	Westinghouse No.	Westinghouse Train miles per failure.	Automatic vacuum No.	Automatic vacuum Train miles per failure.	Simple vacuum No.	Simple vacuum Train miles per failure.	Chain No.	Chain Train miles per failure.	Fay and Newall No.	Fay and Newall Train miles per failure.	All other No.	All other Train miles per failure.	Totals No.	Totals Train miles per failure.
Failures, collision being imminent	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Failures to stop, ordinary circumstances	20	270,500	5	463,800	67	113,300	8	218,600*q*	—	—	20	35,800	120	169,400
Out of order, causing delay	411	13,150	76	30,500	26	291,900	16	109,300	1	4,352,000	9	79,500	539	39,200
Total...	431	12,550	81	28,630	93	81,600	24	72,800	1	4,352,000	29	24,700	659	32,000

39 per cent. of the total number of engines are fitted, 7 per cent. during the half year. 48 per cent of the total number of carriages, &c., are fitted, 8 per cent during the half year.

Notes.—Board of Trade Remarks.

a Applied by guard and engine driver and self-acting.
b Not self-acting.
c These brakes being sectional are not continuous throughout the length of the train, and not self-acting.
d Brakes applied by guard only, are not self-acting.
e Includes Barker's automatic, Steel-McInnes automatic, Westinghouse non-automatic, Barker's hydraulic, and Kendall's steam brakes.
* Figures marked thus are estimated.
f Includes Cheshire lines and Manchester, South Junction and Altringham, &c.
g Includes Rhymney and West Lancashire.

Rolling Stock Fitted during Half-year.

Westinghouse. Engines.	Westinghouse. Carriages, &c.	Auto. vacuum. Engines.	Auto. vacuum. Carriages, &c.	Simple vacuum. Engines.	Simple vacuum. Carriages, &c.	Chain. Carriages, &c.	Fay, &c. Carriages, &c.	All other. Engines.	All other. Carriages, &c.	Total. Engines.	Total. Carriages, &c.
No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
161	1470	119	1171	91	258	394	133	6	54	377	3480

h Includes Great Northern of Ireland, Ballymena and Larne, &c.
k Includes Severn and Wye, North Staffordshire, Ryde, Newport and Cowes, Belfast Central, &c.
l Includes Brecon and Merthyr, Rhymney, and Furness.
m "Carriages" throughout include all vehicles used on passenger trains.
n Includes 713 carriages proper and 2914 other passenger train vehicles, fitted with pipes or chain connections only.
p This total is assumed, no exact data being available.
q The figures for the London and North-Western are omitted. They are as follows: One failure to stop in 1,060,000 miles, and one case of out of order in 530,000 miles. The Caledonian with the same carriages return one failure to stop in 74,000 miles. The contrast is striking.

RAILWAY MATTERS.

THE gauge of the Toronto City and Bruce Railway has now been changed throughout.

AN agitation is on foot in Pietermaritzburg, Natal, for a system of street tramways.

THE engineer in charge of the Souris branch of the Canada Pacific Railroad has discovered in that district lignite coal and iron ore, and has brought specimens of each to Winnipeg.

AS a result of the formation of the Canada Pacific Railway it is said that the contractors for section B of the railway are getting their supplies in to the east end of their contract this year by the Thunder Bay route, at an average cost of 2s. 7d. per 100 lb., whereas it previously cost them 16s. 8d. per 100 lb.

AT the meeting of the Academie des Sciences on the 19th ult., M. de Lesseps presented maps and plans of the project of a railway between the Niger and the Soudan, by the Fonta-Djallon. The Fonta-Djallon presents a central plateau 350 kilos. from the coast and 1000 metres in altitude; five parallel valleys run from it to the coast. The inman of Timbo, in that region, is friendly.

ALL parts of Canada seem already to be benefitting by the outlay of the Canada Pacific Railway Company. All the principal workshops and ironfoundries in the upper provinces are full of work for the company, and large contracts have just been given out to firms in the lower provinces. Messrs. Harris and Co., of St. John, N.B., have taken a contract for freight cars exceeding £30,000.

ACCORDING to the report to the Board of Trade on the accident which occurred on the 10th November last, close to Carnforth station on the Furness Railway, at a set of facing points, the accident was caused by the signalman having shifted the facing-points before all the train had passed over them. This accident would have been prevented had the facing-points been provided with a locking bar.

A PASSENGER train on the Boston and Maine Railroad on Monday night broke through an iron bridge near Wells, New Hampshire. The engine and the baggage and Pullman coaches had crossed when the bridge broke, precipitating the four hindermost coaches and 100 passengers down the embankment. The wreck caught fire and the coaches were destroyed. Two persons were killed and eighteen wounded.

THE average annual length of railways in France is shown for the quinquennial periods by the following figures: 1840-44, 704 kilometres; 1845-49, 1814 kilometres; 1850-54, 3819; 1855-59, 7371; 1860-64, 11,078; 1865-69, 15,192; 1870-74, 17,134, and 1875-79, 20,905 kilometres. The *Railway Review* says, completion of the great lines has been followed by a steady decline in the average receipts. The preponderance of slow freight is very marked of late years. But it has been found that it is only by continually reducing their charges that the railway companies have maintained themselves against other means of transport, and will be finally enabled to absorb the greater part of the national traffic.

IN the six years ending 30th June last, during which tramways have been in use in this country, they have shown a remarkable development. They had at the end of last June an authorised share capital of £7,602,509, of which £5,096,030 is paid up, whereas on June 30, 1876, the authorised share capital was only £3,141,000, of which £1,702,879 was paid up. Adding in the sum raised by loans and debentures, the total authorised capital amounts this year to £10,906,575. The total amount expended is £6,939,838. The length of miles open for traffic has risen from 158 in 1876 to 483 in 1881. The companies own 15,220 horses now as compared with 9222 in 1878, 40 locomotive engines now against 14 in 1878, and 2045 cars now against 1124 in 1878. The number of passengers carried has increased from 146,001,223 in 1878 to 205,623,510 in 1881; the gross receipts from £1,145,465 to £1,576,301, the working expenses from £868,315 to £1,239,896, and the net receipts from £230,956 to £336,405.

IN concluding his report on the collision that occurred on the 21st November, at Llanbrynmair station, on the Cambrian Railway, a mixed train, consisting of an engine and tender, thirteen loaded, thirteen empty wagons, a brake-van with the guard in charge, and two passenger coaches behind the brake-van, became divided into two parts while descending the incline towards Llanbrynmair station, and the rear portion ran into the front part of the train when it stopped at the west-end of the station. Col. F. H. Rich says, "This collision was caused by the hind drawbar of the tenth wagon giving way. I recommend that a great deal more brake power, which can be applied while the trains are running, should be provided; and although the signal and point arrangements at Llanbrynmair had nothing to do with the accident, it is very desirable that the modern improvements in the arrangement of station signals and points should be introduced on the Cambrian Railway."

IN this column of our last impression some reference was made to the light trains run on the Elevated Railway of New York. In comparing the two the following figures are of interest, as relating to the heavy trains of the Metropolitan Railway, which carries many millions of passengers per year:—The greatest number of trains run on one pair of rails is 16 in the hour out, and of course 16 trains in. The greatest number of trains that have been run out of the station, on each pair of rails, would be on "boat race" days, and then it has been about 20. Out of Farringdon-street and King's-cross, where there are four pairs of rails, there are over 1000 trains in the twenty-four hours, or 41·6 trains per hour on an average, and very much more than this during the busy hours. Through Moorgate-street about 450 trains pass per day in and the same number out, and from this station trains are despatched in five directions, viz.:—To Aldgate, to Mansion House and Hammersmith, to Snow-hill, London, Chatham and Dover Railway; to King's-cross, Great Northern Railway; to Kentish Town, &c., Midland Railway.

A REPORT has been published by the French Minister of Public Works which shows the condition of French railway work and enterprise at the beginning of this year. It is a volume of about 400 pages, so we will not pretend to deal with those parts which refer to traffic, finance, or railway politics, but it may be useful to note the length of railways open or in hand. There were at the beginning of the year 24,003 kilometres of ordinary or standard gauge lines sanctioned, and 21,492 kilometres in work. There were 356 kilometres of small industrial line sanctioned, of which 239 were in work. The State railways were 2614 kilometres, of which 1804 were in operation. The network of *chemin de fer d'interêt local*, or light railways, was 3681 kilometres, of which 2189 were in working order. The total length of railways of standard gauge declared of public utility and to be constructed by the State was 5370 kilometres, of which 442 were in operation; while projected State lines brought the total up to 7652 kilometres. The total of French railways under all headings on the 1st January, 1881, was thus 44,276 kilometres, made up as follows:—26,166 kilometres in operation, 10,312 in construction or to be constructed, and 7798 not yet finally sanctioned. During the year 903 kilometres of general railway have been opened, and 90 kilometres of light or local railways. As international lines France counts seventeen in connection with Belgium, seven with Germany, four with Switzerland, two with Italy, and five with Spain. In Algeria at the above date France possessed 1290 kilometres in operation, of which 189 are in Tunisian territory. There were also 104 kilometres of light railways in work, and 1343 kilometres sanctioned, and 920 projected. Only one other possession of France has a railway in operation, namely, the short line of 12 kilometres from Pondichéry to the river Gingy, but 152 kilometres are in course of construction on the island of Réunion, a narrow gauge line from Pointé des Galets to St. Denis, and 980 kilometres are projected as the Senegal railway from Dakkar to St. Louis, by Rufisgue. France's railway work is thus somewhat extensive.

NOTES AND MEMORANDA.

AS an explanation of the variation in the ratio of oxygen to nitrogen in the atmosphere of a given place, which Mr. Jolly has observed, he supposes the currents of air showing this deficiency to come from tropical regions, where the consumption of oxygen in the oxidation of organic matter is generally greater than in northern countries.

A CHEAP kind of sealing wax as used for bottles is made of—common strained resin, 6 lb.; yellow beeswax, ½ lb.; lampblack, 1 lb. Melt the resin and wax, and stir in the lampblack. If coloured wax is wanted use window-glass resin and white beeswax in the same proportions, adding Venetian red or other pigment for colouring in place of the lampblack.

A RECENT report of the Connecticut State Board of Health describes a series of cases of lead poisoning, the poison being traced to the use of boiled linseed barrels, which farmers had employed for the storage of cider. Some of the litharge employed in preparing the oil had been deposited on the inside of the barrels as a sedimentary coating, which the cider had dissolved.

ACCORDING to the *Wiener Gewerbe Zeitung*, a Vienna chemist has recently discovered a new variety of glass, which is said not to contain any silica, boric acid, potash, soda, lime, or lead. Externally it is exactly similar to glass, but its lustre is higher, and it has a greater refraction, of equal hardness, perfectly white, clear, transparent, can be ground and polished, completely insoluble in water, neutral, and it is only attacked by hydrochloric or nitric acid, and is not affected by hydrofluoric acid. It is easily fusible in the flame of a candle, and can be made of any colour. Its most important property is that it can be readily fused on to zinc, brass, and iron. It can also be used for glazing articles of glass and porcelain.

THE submarine cable between Dover and Calais was carried out during the month of December, 1851, just thirty years ago, and it was on the 31st that the first message was sent from France to England and the traffic opened to the public. The first message was handed to Louis Napoleon, then Prince-President of the French Republic. It was simply a congratulatory salutation. The second, *Nature* says, was sent by an English banker to his correspondent in Paris, and related to the price of Consols. The Paris firm sent in return the Côte de la Bourse. This exchange of messages, including conveyance to the several offices, did not take more than an hour. Before regular messages were sent experimental sparks were tried. The first which came over from the French shores fired an English gun which saluted the Duke of Wellington when leaving Dover by an express train. It was the last time he visited the place in his capacity of Lord Warden of the Cinque Ports.

A CURVE which Mr. G. M. Whipple, F.M.S., has deduced from a series of observations on the variations of the relative humidity and thermometric dryness of the air with changes of barometric pressure, resembles in a striking degree the one he previously deduced from the discussion of the relation between barometric height, sunshine and cloud—so much so, that he thinks it may be fairly adduced as evidence tending to prove that at Kew the amount of cloud and dryness of the air are in inverse ratio to one another, and, therefore, of course, as a rule, the clouds vary with the humidity; hence it follows that clouds observed at Kew are not brought from a great distance by the wind, but are probably formed comparatively near the place where they are seen. Referring, he says, to the weather glass legend, it may now be decided that this only holds good for the summer when the dryness varies directly with the height of the barometer. At other seasons forecasts founded on the basis of these terms will probably prove fallacious.

ACCORDING to a paper on the variations of relative humidity and thermometric dryness of the air with changes of barometric pressure at the new Kew Observatory, by Mr. G. M. Whipple, F.M.S., if the year is divided into two halves, combining the first and fourth periods, as representing the winter half of the year, and the second and third as the summer half, we find as the result, that during the winter the variations in dryness or relative humidity are but slightly affected by barometric height, the extremes of greatest moisture being at both ends of the barometric range, whilst the driest time occurs when the mercurial column stands at about 30·2in. In the summer half year, on the contrary, we have the curve closely approximating to a straight line in form, indicating thereby that at this time of the year the atmospheric pressure varies in exact proportion to the dryness of the air, the greatest humidity occurring with the lowest barometer, and the greatest dryness with the extreme height. Finally, taking the whole of the observations for ten years, and massing them together, a curve is produced, which indicates that the period of greatest dryness is synchronous with that of a barometric reading of 30·2in., whilst the extremes of humidity occur with the barometer at either end of the space through which its column varies.

A TABLE of the weight of American coal was recently published in the *New York Herald*, rendered necessary, it is said, by the tricks of coal sellers. From this table it appears that of six different coals burning with a white ash, there are from 38·6 to 38·9 cubic feet per ton. Two other white ash give 39·6 cubic feet to the ton. The pink ash coals give 39·2 cubic feet per ton, while the two lightest coals with a grey and red ash give 41·0 to 40·4 cubic feet to the ton. The ton of 2000 lb. contains about 4·1 cubic feet less:—

Colour of Ash.	Name of Coal.	Cubic Feet to 2000 lb.	Cubic Feet to 2240 lb.
White	Honey Brook	34·5	38·6
White	Hazleton	34·8	38·9
White	Sugar Loaf..	34·8	38·9
White	Old Company's..	34·8	38·9
White	Spring Mountain	34·8	38·9
White	Greenwood..	34·8	38·9
Pink	Cross Creek	35·1	39·2
Pink	Council Ridge	35·1	39·2
Pink	Buck Mountain	35·1	39·2
White	Locust Mountain	35·5	39·6
White	Mahanoy	35·5	39·6
Grey and red ..	Shamokin..	36·9	41·0
Red..	Lorberry	37·3	41·4

AT a meeting of the Royal Society of Edinburgh, early last month, Professor Tait read an interesting paper on "Mirage." He makes a certain assumption as to the law of variation of density in a stratum of air near the earth's surface, which, allowed, gives an explanation of the curious erect and inverted images observed by Vince, and which formed the subject of the Bakerian Lecture of 1799. The necessary geometric conditions fulfilled by contiguous rays so as to give either an erect or an inverted image are well known; but no attempt had been made to imagine a simple state of affairs which would give *both* images at once. If the refractive index of a portion of a medium is given by the equation $\mu^2 = a^2 + y^2$, where y is the distance of the portion considered from a given plane—the plane, namely, of minimum density, then it can be easily shown by Hamilton's general method that the path of any ray which is deflected without touching the plane of minimum density is a distorted inverted catenary, and is obviously symmetrical with respect to a vertical line through its vertex. Whatever the law of density, the upper of two such contiguous rays emanating from a given point must in general have its vertex either a little behind or a little in front of that of the lower ray. In the former case the rays *cross* before they return to the same level from which they started, and an inverted image is the consequence; in the latter case they do not cross, and the result is an erect image. Hence the mere inspection of the locus of vertices of all possible rays coming from a given point is enough to tell the kind of image seen by any given pencil of rays belonging to the system. Also all rays that pass between any two given points on the same level must have their vertices on the vertical line half way between these points. If then the locus of vertices is such that it can be cut in three distinct points by a vertical straight line, evidently three images will be possible, two direct and one inverted, precisely as seen by Vince.

MISCELLANEA.

THE Wirral and Birkenhead Society's next show will be held at Birkenhead on the 14th, 15th, and 16th of September, 1882.

THE competition to break down the ring in the Australian trade has been severe during the past year, goods being carried out to Australia as low as 12s. 6d. per ton.

MESSRS. E. R. and F. TURNER, of Ipswich, have considerably increased their turnery and tools departments in order to give them increased facilities for the execution of their specialities.

A CONCESSION has been applied for in the Volksraad to work a small steamboat of light draught in the Vaal River, with the view of lessening the cost of coal carriage to the diamond fields.

IT is stated that a scheme for the provision of a large dry-dock at Halifax has been taken up by a strong English company. The proposal, the *Colonies* says, is supported by the English and Canadian Governments, as well as by the province of Nova Scotia.

THE Bristol Corporation have resolved to expend £100 in obtaining the opinion of an eminent engineer upon the practicability of utilising the tidal forces of the Avon and the Severn for providing the necessary motive power for electric lighting and other purposes.

THE American production of pig iron during 1881 is estimated at 4,600,000 tons, and the consumption at 5,658,000 tons, being 1,658,000 tons increase over the previous year. The imports during 1881 are estimated at 400,000 tons. The Ironmasters' Association reports that the stock, both foreign and domestic, is virtually exhausted.

MESSRS. YEOMANS AND EADON, of Highbridge Forge, Owleston, have patented a new method of making shear steel, by which they claim that they can produce a more trustworthy and durable shear steel than has hitherto been made by the old process. The speciality of the invention largely consists in the arrangement of the heating appliances.

MESSRS. MIRRLEES, TAIT, AND WATSON intimate that after this date the title of their firm will be Mirrlees, Watson, and Co., Mirrlees, Glasgow. We may add that Messrs. Mirrlees, Watson and Company's Works, employing eight to nine hundred hands, are the largest in this or any other country devoted solely to the manufacture of sugar-making machinery.

IN his steamship circular Mr. J. White says, "Some important limited companies, to take over established private shipowning firms and to develope new enterprises, have been amongst the numerous companies of the past year, and new projects, including something of the description of a floating tunnel to cross from the States to England in five days, are spoken of."

MESSRS. DAVY BROTHERS, Limited, engineers, Park Ironworks, paid no dividend last year. On Monday the shareholders received the pleasing intimation that as the prospects of trade were somewhat more favourable this year, the directors had decided upon paying an instalment of 11s. 3d. per share—being at the rate of 5 per cent. per annum—on account of dividend for the current financial year. Messrs. Davy Brothers have been very busy for months on important orders for new plant.

AT the Newport Rolling Mills a strike has taken place by the rollers' helpers against the rollers who employ them. The object of the helpers is, it is said, to be paid by the ton instead of by the shift. Inasmuch, however, as they left their work without notice their grievances have not been considered as yet; but, on the other hand, summonses have been taken out against them for breach of contract. These cases will be heard on Monday or Tuesday next before the Middlesbrough stipendiary magistrate.

AT Stockton a largely attended but unauthorised meeting of ironworkers has been held, at which the speakers mainly advocated the discontinuance of the sliding-scale or any similar arrangement. A resolution to this effect was carried almost unanimously; so also was one that a week's notice should be given at all the works to discontinue Sunday fettling. This would have the effect of laying the forges idle on a Monday altogether. It seems probable that some of the advantages of better times will be thrown away at the outset by unreasonable conduct on the part of workmen.

ANOTHER serious dispute is going on between the owners of the Ushaw Moor Colliery and their workmen. The dispute has taken the form of the whole of the workmen, backed by their union leaders, resisting an attempt on the part of the manager to discharge a certain workman, who is also a union official. Mr. Clayton, one of the owners, has made a public statement of his views of the case, which, however, has been flatly contradicted with equal publicity by Mr. Crawford, secretary of the Durham Miners' Association. Meanwhile the production of the pit has ceased, to the great inconvenience of the customers.

IT was announced by the Mayor at the close of the Birmingham meeting on Tuesday evening, that a telegram had been received from London to the effect that at 20 minutes past 9 o'clock the whole of the *verbatim* report of Mr. Bright's speech had reached the metropolis. The despatch of the reports of Tuesday's meeting was the heaviest, but at the same time the most rapid piece of work of the kind yet performed at the Birmingham office. There were 202 press messages of the proceedings, consisting of either full or condensed reports. In respect of these, 182,152 words were actually transmitted through the various wires, but as some of the reports were written out in manifold on reaching their destination the number of words delivered was 541,983. Mr. Bright began to speak at 7.25 p.m.; six minutes later the first page of longhand manuscript was handed over by the reporter to the telegraph officials in attendance at the hall, and at 8.38 the dispatch to London, Manchester, and other stations began. Mr. Bright sat down at 8.35, and the last page of shorthand writers' notes of the report for London was transcribed and despatched from the hall by three minutes to 9 o'clock. It was immediately "worked off" to London, whence the postal authorities acknowledged the receipt of the whole speech of 7336 words at 9.20. Mr. Chamberlain's address followed, and afterwards Mr. Bright's remarks in thanking the Mayor. Mr. Chamberlain spoke 6236 words. The despatch of the entire *verbatim* report was finished by 10.42 for Manchester, Bradford, and Liverpool; 11.5 for London; 11.15 for Leeds, Sheffield, and Edinburgh; 11.55 for Nottingham; 12.10 for Glasgow, and 1.6 a.m. for Dublin.

A MONTHLY meeting of the Mines Drainage Commissioners was held at their offices in Wolverhampton on Wednesday. A resolution was passed, on the motion of the chairman, to the effect that every occupier of a mine within the drainage area should be required to make a return of the number of acres of mine occupied by him, and of the number of tons of mineral raised during the past half-year. The object of this is for the purpose of levying a surface drainage rate of 1d. per ton. The accounts presented showed a total expenditure for the month of £3159, of which £2230 was for mines drainage proper, the remainder being for surface drainage. The arbitrators, in reports upon the Tipton and Bilston Mines, recommended the filling-up of no fewer than 166 disused shafts, down which water flowed into working mines. Of these, 110 are styled "urgent cases." The estimated cost of the work is £1762. Reporting upon the desirableness of deepening and widening portions of the river Tame, and also puddling various brooks and canal branches, the arbitrators stated that there were 7500 acres of mines below the surface outlet levels in Tipton and Bilston, and it was estimated that two-thirds of the water now being pumped flowed again into the mines. The surface works had already cost £193,347, and to complete other necessary surface work would require £26,000. The cost of pumping might be reduced £5000 per annum if new and efficient pumping machinery were laid down. The chairman stated that at the next meeting of the Commission he should ask them to authorise the borrowing of £25,000 or £30,000 for the purchase and erection of pumping engines, and completing other surface work in Bilston.

GALLAS AND AUFDERHEIDE'S MOULDING MACHINE.

MESSRS. PFEIFFER BROS., KAISERSLAUTERN, BAVARIA, ENGINEERS.

(*For description see page 6.*)

FIG. 2

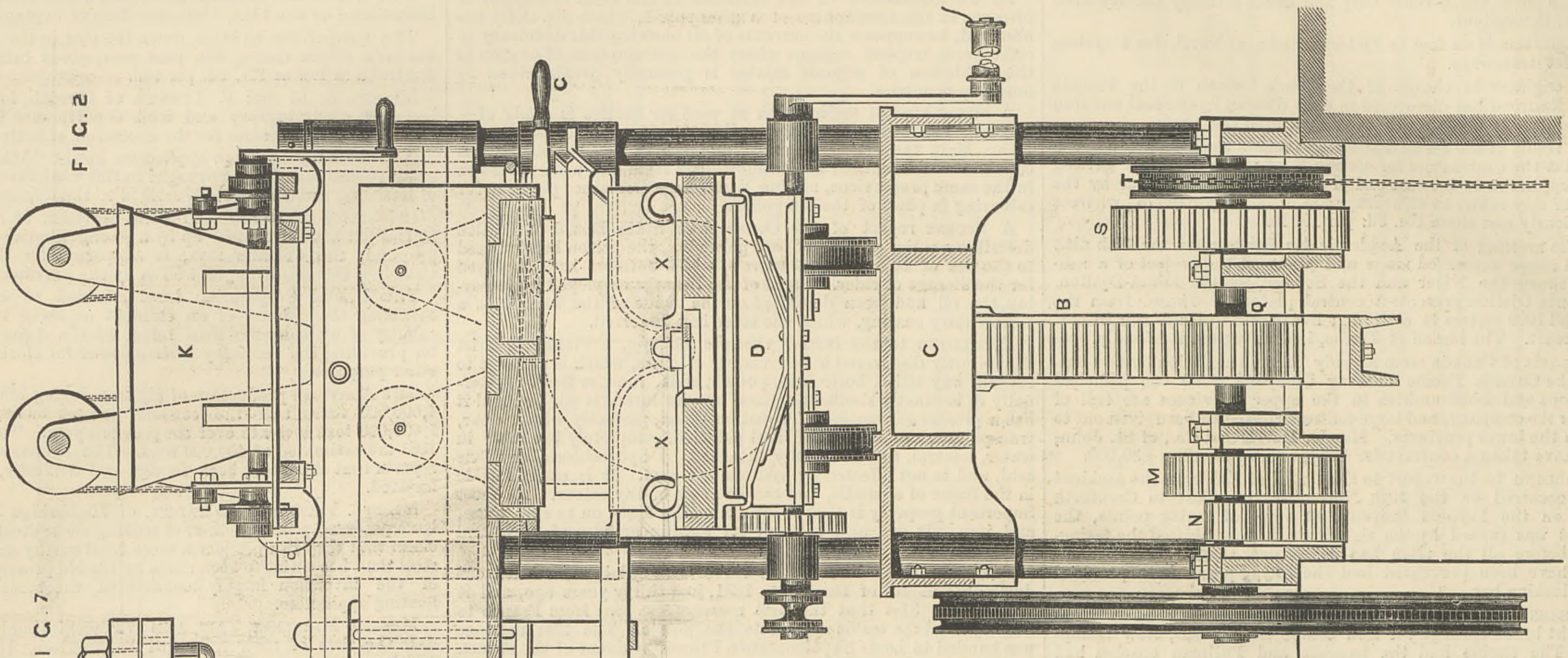


FIG. 7

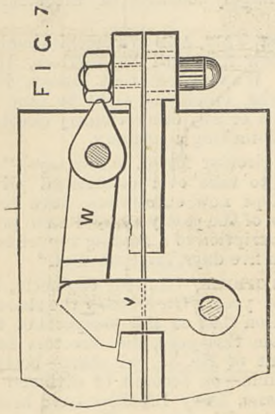


FIG. 1

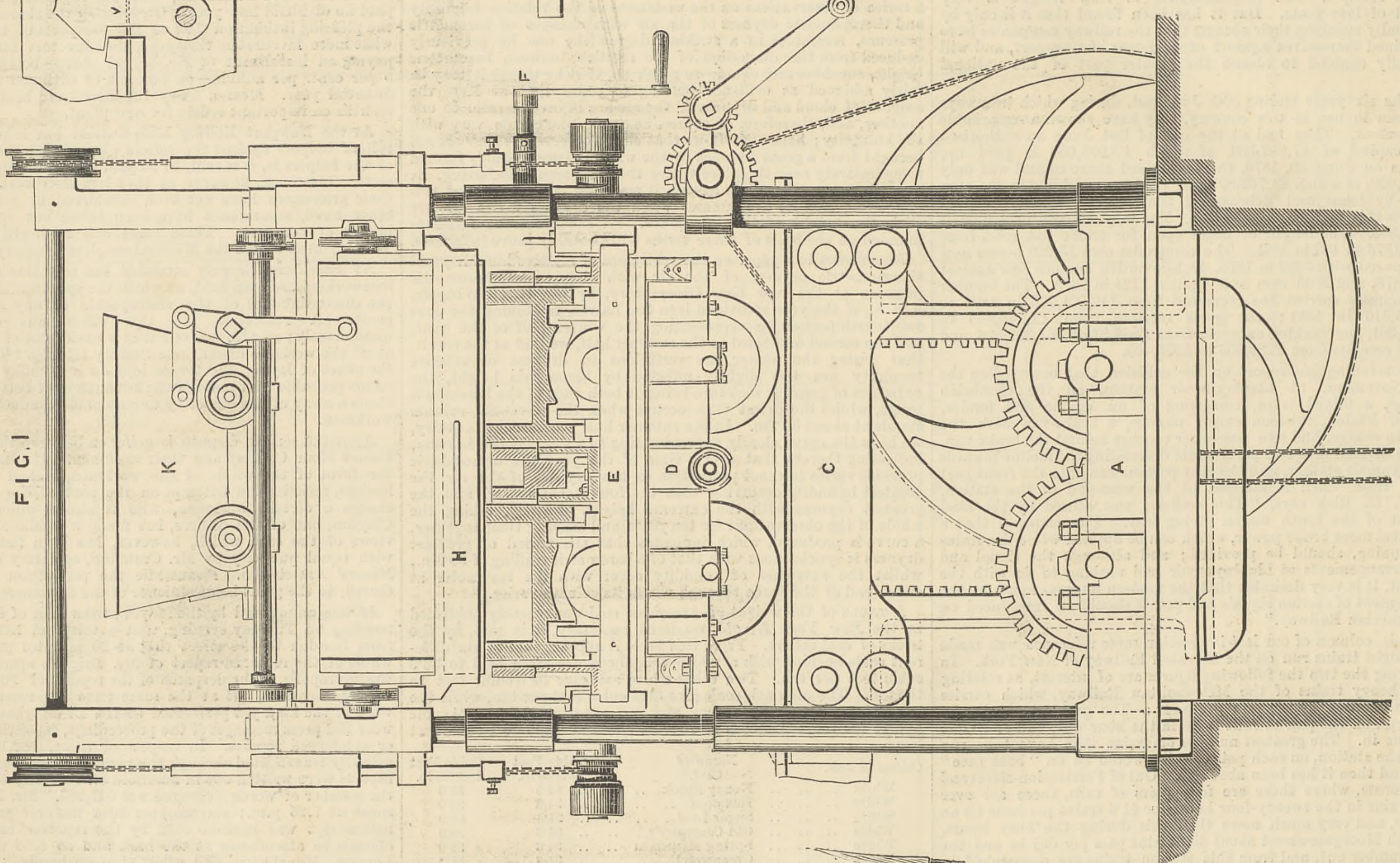


FIG. 3

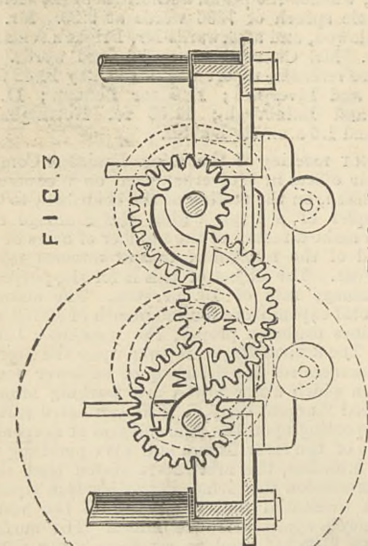


FIG. 4

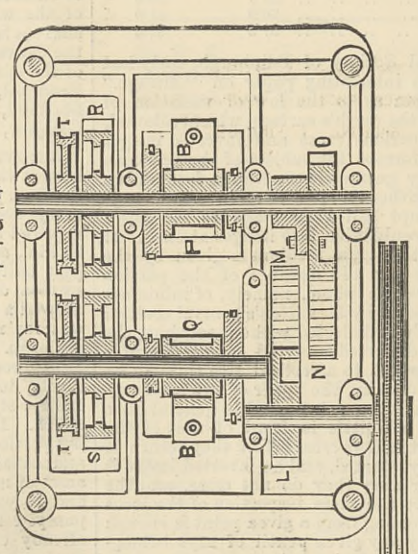


FIG. 5

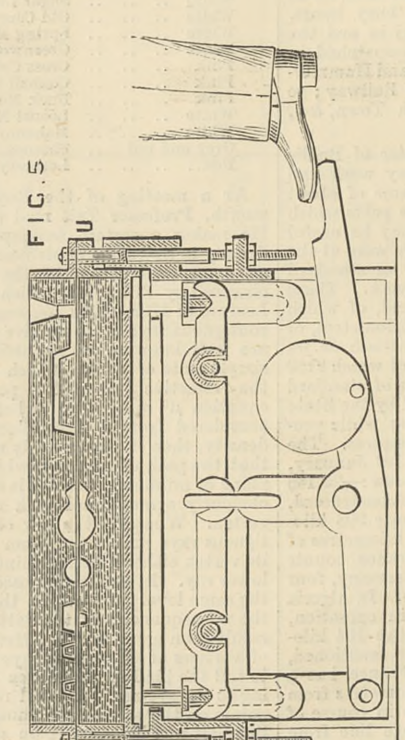
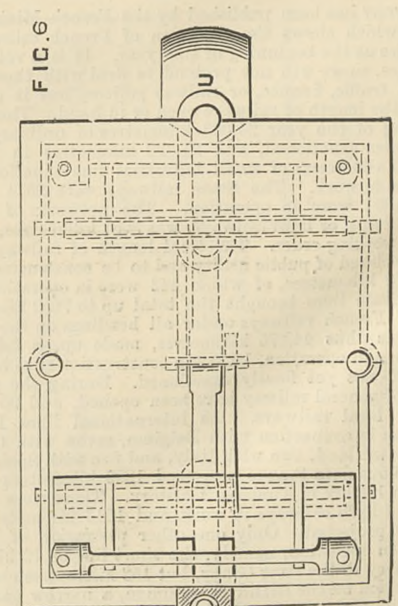
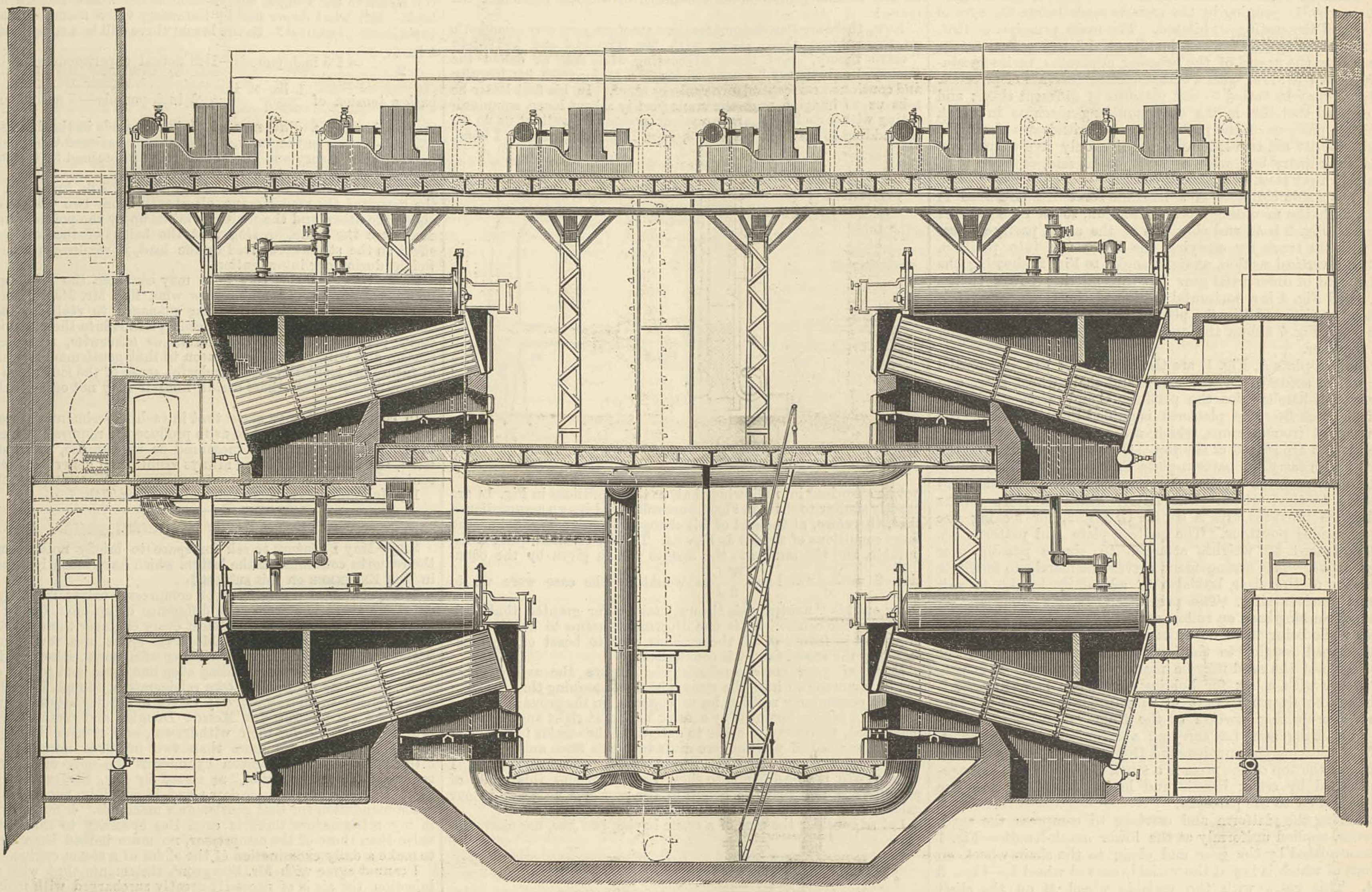


FIG. 6



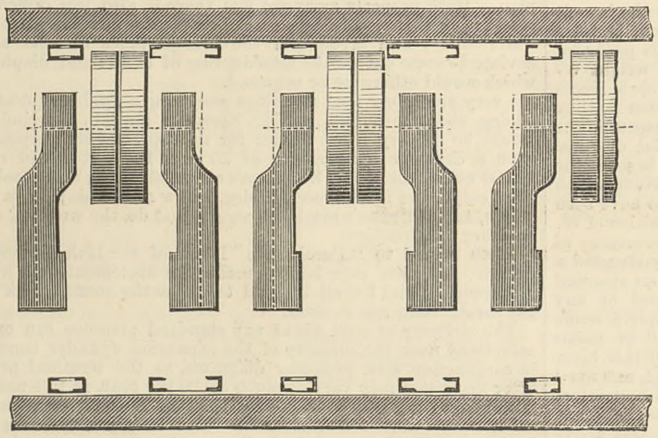
THE EDISON ELECTRIC LIGHT IN NEW YORK,—PRODUCING ESTABLISHMENT.

(*For description see page* 1.)

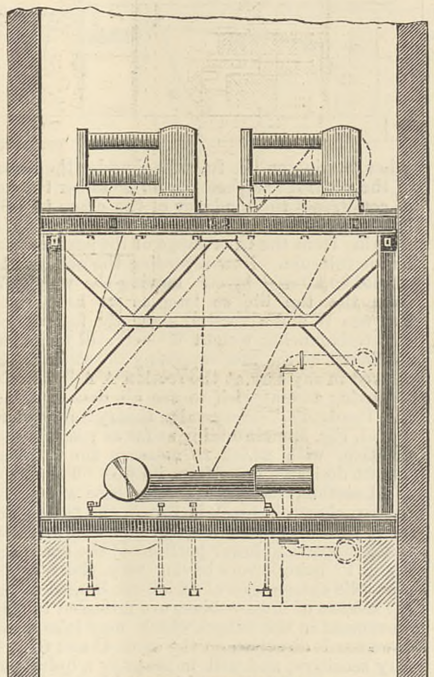


LONGITUDINAL SECTION

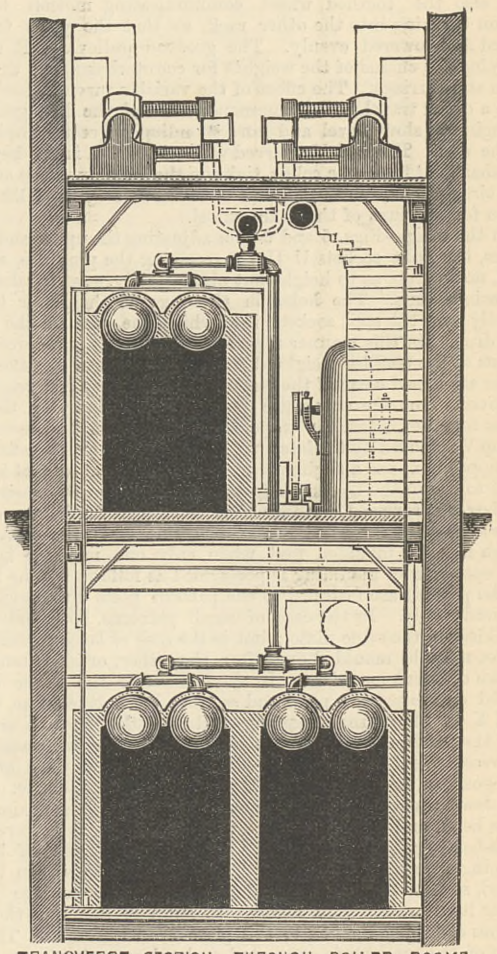
SCALE OF 0 5 10 15 20 25 30 FEET



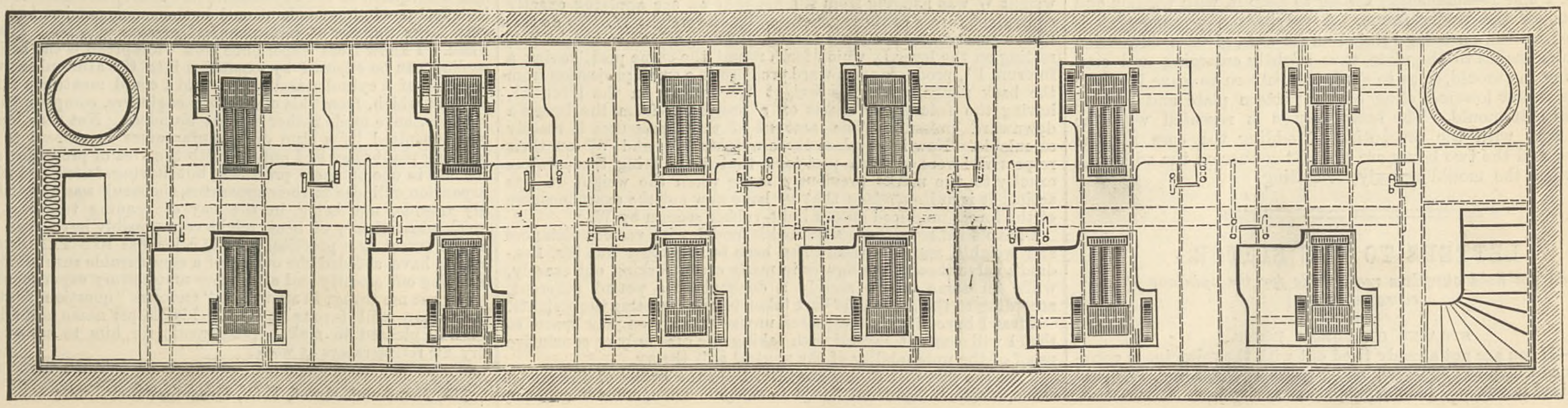
PART PLAN OF ENGINE FLOOR



TRANSVERSE SECTION THROUGH ENGINE & MACHINE ROOM SHOWING DRIVING BELTS



TRANSVERSE SECTION THROUGH BOILER ROOMS



PLAN OF MACHINE ROOM

GALLAS' MOULDING MACHINE.

A moulding machine, invented by MM. J. P. Gallas, foundry manager, and H. Aufderheide, engineer, was shown at work in the Machinery Annexe of the Frankfort Exhibition, and gave excellent results, judging by the moulds made before the eyes of visitors and the castings exhibited. The main principle is that, with a uniform speed of winch handle or driving pulley, as the case may be, the travel of the pressing apparatus varies gradually from fast to slow, with a corresponding increase of pressure. The travel may be varied to suit patterns of different sizes; and it is claimed that this is the only moulding machine in which detachable portions of the pattern may be withdrawn from the mould. By its aid two labourers require only five minutes to mould an ordinary box, with a saving, it is said, of more than seventy-five per cent. over skilled labour.

Fig. 7 is a side elevation of a machine somewhat improved in details, with the moulding blocks in section, so as to show the patterns. Fig. 2 is an end elevation of the same, partly in section, with the truck for carrying the boxes run into position. Fig. 3 is a vertical section, at right angles to Fig. 2, showing the arrangement of differential gear for transmitting power to the press; and Fig. 4 is a horizontal section of the same. Fig. 5 is a vertical section and Fig. 6 a plan of the table for adjusting the boxes; and Fig. 7 shows the automatic fastening for clamping them together.

In the bed-plate A, Fig. 1, are the bearings of the differential gear, which, actuated by the chain and chain-wheel, gear, and lower winch handle raise the platform C and carriage D by the aid of the rack B. The platform is guided by rollers along the four wrought iron columns, which are secured by nuts to the bed-plate and are stayed at the top. On these columns slide the sockets which carry the pattern-plate E, provided with a turning arrangement operated by the upper crank handle F, a pinion and an inside toothed wheel. The latter, which is plain on its periphery, is provided with a handle G, Fig. 2, for locking the plate in various positions. The pattern-plate and patterns are counterbalanced by weights attached to chains passing over pulleys above. This arrangement serves not merely to facilitate the turning of the plate, but also to adjust its height to suit boxes of various sizes. The press-head H is a stout casting capable of running back on rollers so as to allow the pattern-plate to clear while being turned. It carries on its lower side mould-blocks, shaped roughly to the form of the patterns, so that the compression of the sand may be practically uniform. It is provided above with a box for holding the coarse moulding sand, which may be drawn from it when pushed back into the box. From the projecting portion of the frame on which the press-head slides hang bars for carrying a scraping arrangement J, Fig. 3, for clearing the surplus sand from the box. Travelling on rails across the top of the press is a truck K, with screen arrangement worked by crank handle and levers for sifting the fine parting sand on to the patterns.

For raising the platform and carriage to compress the sand, the power, applied uniformly at the lower crank-handle—Fig. 1—is transmitted by the gear and chain to the chain wheel, on the shaft of which is keyed the variable curved wheel L—Figs. 3 and 4. This gears with the variable wheel M on the shaft of which is a similar wheel N gearing with a fourth similar wheel O. This shaft carries the pinion P, which takes into one rack, and also the toothed wheel communicating motion to the pinion Q taking into the other rack, so that the press table is raised and lowered evenly. The grooved pulleys R R are for carrying the chains of the weights for counterbalancing the platform and carriage. The effect of the variable curved wheels is to give a quick travel at the commencement of the lift, gradually changing to slow travel and correspondingly great compression at the end. The variable curved wheel O, Fig. 4, is not keyed on the shaft, but fixed to a collar, tight on the shaft, by a bolt and nut in a circular slot, so as to admit of different heights of lift being given for one turn of the chain wheel.

In the table—Figs. 5 and 6—for adjusting the upper and lower boxes, the split sockets U U, for receiving the pins are adjustable, not merely as to height but also laterally, so as to take boxes of various sizes. The holes in the lugs of the lower box fit exactly over the split sockets, into which the pins of the upper box drop. In this manner a perfect adjustment is secured. By means of the counter-weighted treadle and system of levers the boxes are raised clear of the sockets, so that they can readily be removed. In the automatic fastening for clamping the two boxes together, when the upper box is laid on the lower, the clamp V is caused by the latch W, Fig. 7, to close over the flange of the upper box, and a slight pressure with the hand or foot is sufficient to clamp the boxes firmly together. When the position of the boxes is reversed, the fastening disengages itself by gravity. This arrangement is quite convenient, as it is the lower box which must be moulded first when only one machine is used. The operation of moulding is performed as follows:—The halves of the pattern are fastened to the pattern plate by screws from the under-side. In the case of small patterns, both halves are moulded on the same plate; but in the case of large patterns the halves must be moulded one after the other, or simultaneously in two different machines. In the latter case the lower box is placed on the pattern plate and secured by bolt catches, shown at X X in Fig. 2, some parting sand from the truck K is sifted over the patterns, and the box is filled up with coarse sand from the receptacle over the press head. This latter is then brought into position, and the carriage D run under from the side.

A few turns of the crank handle bring the box against the press head, and compress the sand. The box is lowered, the press-head pushed back, and the surplus sand struck off by the scraping apparatus J—Fig. 2. The pattern plate is then turned round, so that the box hangs downwards. The carriage is run under it and raised high enough to support it, when the bolt catches clamping the box to the plate are withdrawn. The top plate of the carriage is supported on laminar springs—as shown in Figs. 1 and 2—sufficiently strong to keep it, with the box and contents, off the under frame. A polyhedron arrangement is provided, which, on being rotated on its axis, gives a succession of regular shakes to the plate, thus slightly enlarging and consolidating the mould, so as to allow the pattern to leave it. The carriage is now lowered clear of the pattern plate and run off with the half mould. The same process is repeated with the upper box, with the precaution of adding the core for the runner; and the two boxes are placed together on the adjusting table, when the mould is ready for casting.

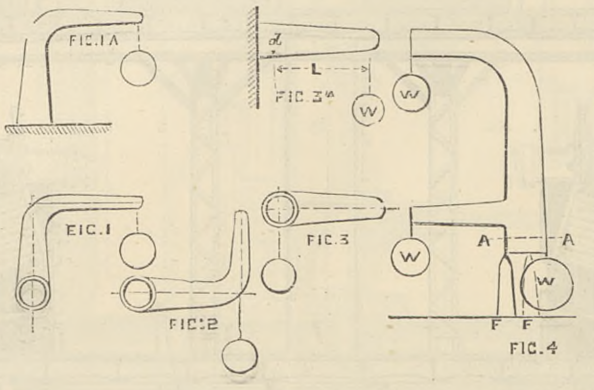
LETTERS TO THE EDITOR.

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

STRAINS ON CRANE POSTS.

Sir,—If you are not already tired out with the voluminous correspondence which has appeared under the above heading, I should feel obliged if you will permit me to air my views on the subject. As I understand the question raised by Mr. Pendred in your impression of Oct. 7th, the point at issue is:—Given a bent crane post, with a load suspended from its jib in a state of rest, all consideration of chains, winding gear, &c., being set aside, what will be the strains generated in the mast, or vertical portion of the crane?

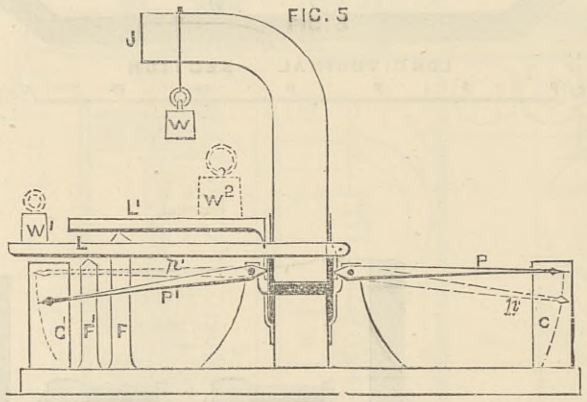
Now, there are two distinct factions amongst your correspondents on this subject, those siding with Mr. Pendred and his safety "valve theory," and those advocating what may be called the "neutral axis theory," among whom Mr. Major from his lengthy and continued correspondence ranks as chief. In his first letter he asks us to imagine that the crane post is a bent lever, communicating with a rocking shaft in various positions; well let us do so, and adding to his Figs. 1, 2, and 3, Figs. 1A and 3A, he will, I hope,



not be surprised into allowing that, as the conditions in Fig. 1A are exactly similar to those in Fig. 1—according to his own assumption—that, therefore, at the end of his changes of form, Fig. 3 has the same conditions of strains as Fig. 3A. This is, I think, quite indisputable, and the strains in the flanges will be given by the equation $S = \frac{W\,L}{d}$, and not $\frac{W\,L}{2\,d}$ as would be the case were we to carry out his "neutral axis theory," taking for granted that it is located at the centre. This one illustration seems to be the only argument in favour of his theory he is able to boast of, notwithstanding the strength of his convictions.

Many of your correspondents who oppose the safety valve theory seem to fall into the same mistake of arguing that, because a crane post merely resting, let us suppose, on the ground, may be kept from falling forwards by a force acting at right angles to the mast, that, therefore, in order to determine the strains in the mast of a crane fixed in position, we must take this force and see what effect it produces on the mast, accepting the results as correct. I think it will not be difficult to show how erroneous this mode of procedure is, and that the height of the post has no place in our calculation.

Let us consider the case of a crane having two jibs, one above the



other, resting on the fulcrum F under the breast, or for the benefit of the neutral axis theorists on F^1 under the neutral axis, and let us counteract the tendency of the crane to fall forwards produced by the weight W hung from the lower jib by a second weight W^1 hanging from the back flange of the post, so that the whole balances on the fulcrum. Now regarding the strains at any section A, they cannot be altered by our moving the weight W and suspending it from the top jib, so long as we keep the horizontal distance between W and a vertical above the fulcrum constant, because the counterbalancing weight W^1 will still maintain equilibrium, which would not be the case supposing the strain in the back to have been altered in any way at the section A A by altering the position of W.

Having a great wish to see all doubts as to the correctness of Mr. Pendred's "safety valve theory" cleared away, I constructed a model, Fig. 5, maintaining as far as possible the conditions of actual practice, with which to measure the strains developed by any weight desirable hung from its jib. The model is simply a crane of H section, having near the base a layer composed of india-rubber, shown in black in Fig. 5, the flanges and web of this layer being carefully cemented together with an elastic cement, and fixed to the upper and lower portions of the crane securely. The pointers P and P^1 being levers having very short arms nearest the crane post, the extremities of which are hinged to the flanges just above the section of india-rubber, are intended to magnify and record any movement in the flanges which may take place in an upward or downward direction on the cards C and C^1. This arrangement is very sensitive, and will indicate by a quite perceptible movement the pressure of 1 oz. on either of the flanges. It is therefore a very easy matter to hang a weight W from the jib J, and mark on the cards C C^1 the exact positions taken by the pointers P P^1, as shown by the dotted lines $p\,p^1$. If we now remove the weight W, the pointers will go back to their original positions, and it is quite clear that if we apply an upward force to the back flange, and a downward force to the front flange of such intensities that the pointers assume exactly the same positions that they indicated when the weight W was hanging from the jib, that we are applying exactly equivalent forces to those generated by the weight W. To do this I have constructed a simple arrangement by which a weight W^1, resting on the lever L, which forks round the crane post, having a fulcrum F^1, produces an upward pressure on a small projection from the back flange, while the weight W^2 resting on the lever L^1, having the fulcrum F exerts on a projection from the breast a downward pressure. The amount of these pressures is readily calculable. Now if we place these weights W^1 and W^2 on their respective levers in such positions that they bring the pointers exactly to the marks previously made when the weight W was acting, it is quite obvious that we have now got the exact measure of the forces produced on our india-rubber section by W.

I have tried several cases with this model, with various distances and weights, and the result has been to fully bear out Mr. Pendred's valve theory, the figures in many cases working out exactly, while in some others merely a decimal of a pound different, according to the amount of care taken in manipulating the weights.

I fear I have already trespassed unwarrantably on your space, so that I will content myself with taking one case only as conclusive proof of the untenability of the neutral axis theory.

Take the case of 1 lb. hanging 1in. from the breast of the model crane, which is 2in. from flange to flange. Then, according to the neutral axis theory, assuming it located at the centre—in this case it is visibly very much nearer the back, which makes it worse for the theory—we shall get $\frac{1\text{ lb.} \times 2}{1} = 2$ inch-pounds as the strain in the flanges, compression in the breast, tension in the back. But what do we find by the safety valve theory and actual experiment combined? In the breast there will be a compression $\frac{1\text{ lb.} \times 3}{2} = 1{\cdot}5$ inch-pounds—1·48 actual experiment—and in the back a tension of $\frac{1\text{ lb.} \times 1}{2} = {\cdot}5$ inch-pounds—·5 actual experiment—showing a difference of ·5 inch-pounds in the breast, and 1·5 inch-pounds in the back, as discrepancy between the results of neutral axis theory and the actual results obtained by the model, backed up by the safety valve theory.

I have also tried the effect of a weight of 1 lb. hung 4in. from the breast of the model crane, alternately from two jibs, one 7in. above the other, and the positions taken up by the pointers in each case were the same, proving that the height of the post has no effect on the strains produced by the load, if we disregard its own weight during our investigation.

These results I sincerely hope may convince the minds of the "eminent authority" and others who, like Mr. Major, seem so pleased with themselves at having managed to realise what the neutral axis is that they must needs press it into their service on every possible occasion, as fulcrum or otherwise, regardless of reason, and will, I trust, be a lesson to that gentleman to postpone in future his jocularity and wonderful sense of the ridiculous until he is quite sure that others beside himself may not occasionally be in the right.

In conclusion, I may state that in each experiment the weights were first carefully placed so as to produce the required movement in the pointers, and then measured as to distance, and not *vice versâ*, the neutral axis being always visible, and generally near the centre.

Wilfrid Stokes.

13, Holland-street, Kensington, December 27th.

COLD-AIR MACHINES.

Sir,—May I venture to ask for space to briefly notice some of the remarks contained in the letters which have recently appeared in The Engineer on this subject?

The question of accessibility of compressor valves is surely one on which there is no room for difference of opinion, for by well-known devices employed by almost every engineer these valves can be arranged so as to be removable in the space of a few minutes, without in the least degree sacrificing efficiency, either by introducing complication or by adding even one cubic inch to the clearance space. As regards my own refrigerators, though I should not expect either suction or delivery valves to require attention in less time than six months, yet Messrs. Douglas and Grant are very properly providing for their withdrawal, and, if need be, replacement, in certainly not more than two or three minutes. That "the valve of the expansion cylinder is the only one likely to require daily examination," as stated by Mr. Sturgeon, will be news to most of your readers; and is certainly not much of a recommendation for that gentleman's machines. I may say that in my refrigerators there is even less necessity to examine this valve than those of the compressor, no more indeed than there is to make a daily examination of the slides of a steam engine.

I cannot agree with Mr. Sturgeon's statements that with water injection the air is of necessity greatly surcharged with moisture. For excepting under the very special condition in which dry air is supplied to the machine, moisture sufficient to fully saturate the cooled compressed air at the temperature and pressure at which it is delivered to the expansion cylinder will always enter the compressor, even if the air be but partially saturated to commence with, and expansion will be effected under precisely similar conditions, whether the heat of compression be abstracted by surface cooling or by injection. Further, I may say that as Mr. Sturgeon only compresses his air to an absolute pressure of 30 lb. per square inch, in place of the 60 lb. more generally adopted by other makers, his air will hold just double the amount of water in solution, and his losses from condensation and freezing during expansion will, therefore, be twice as great. It is a curious, though well recognised condition, that during compression, air containing moisture is actually dried by the injection of cold water; and were it not for certain practical difficulties, I think this method of cooling would be more advantageous than that by surface contact, though until these difficulties are removed I shall certainly hold to the latter plan. With properly arranged jets there is also less difficulty in abstracting moisture in mechanical suspension, as the streams of water collect and precipitate the fine particles of mist and so obviate to some extent the introduction of baffles and diaphragms which would otherwise be required.

I very much fear that machines producing a final temperature of 18 deg. above zero Fah., as Mr. Sturgeon appears to recommend, would be of very little service for meat-preserving purposes, for with a chamber temperature of 25 deg. Fah., it would require 10,000 cubic feet of Mr. Sturgeon's air to effect the same cooling as 1000 cubic feet if delivered 50 deg. below zero Fah.; or in other words, ten Sturgeon's machines would just do the work of one of ordinary construction.

With regard to "Purchaser's" letter of the 13th December, I cannot remember ever having made the statement with which I am credited, and I shall be glad to know the source from which the information was derived.

The delivery of cold air at any standard pressure can only be calculated from the capacity of the expansion cylinder considered in conjunction with indicator diagrams, as the terminal pressure after expansion may vary as much as 20 per cent. in two machines with similar cylinder ratio but by different makers, while in some refrigerators there are considerable valve leakages, which can only be detected by the use of the indicator. There is great variation in the efficiency of compressors, some delivering about 95 per cent. of the displacement per stroke, and others only 75 per cent., or, indeed, even less, as I myself saw in one case which came under my notice. In judging of the value of any machine, it is therefore important to know the indicated or actual horse-power expended in driving, and if the steam engine is a special one or self-contained with the machine, the pounds of water which have to be evaporated in the boiler to produce this power.

While I am writing, perhaps you will allow me to say that I think Mr. Galwey was not justified in his wholesale condemnation of Mr. Coleman's interesting letter in your issue of November 18th. The description of the experiment was clearly not intended for the instruction of those well versed in thermo-dynamics, but for the very large number of non-technical persons who read The Engineer. I know from experience how widespread is the belief that cooling can be effected by expansion into the atmosphere without the help of a cylinder and piston, and I could mention a number a cases in which, from this cause, even engineers, competent in other respects, have made rather curious blunders. Not very long ago I was consulted by a firm of manufacturers in respect to a compressing plant they had put up, with the idea of producing cold air for use in one of their processes, but having failed to include an expansion cylinder in their apparatus, the result was unsatisfactory. My friends, not being in the way of reading treatises on the mechanical theory of heat, might very possibly have been warned at the outset by a practical note in a journal like The Engineer and so have avoided the outlay of a considerable sum of money in carrying out a costly and altogether unnecessary experiment.

Permit me to say, in answer to "Octopus'" question, that if that gentleman will favour me with his proper name and address, I shall be pleased to make arrangements for him to see one of my dry air refrigerators at work.

T. B. Lightfoot.

116, Fenchurch-street, E.C., December 26th.

particulars of, on the average, about one hundred patents every week. Each of the inventions described is believed by its inventor to be quite new, and it would be troublesome perhaps, if not impossible, to prove that it is not. Our readers have excellent opportunities of knowing whether the inventions thus patented ever come to anything. How many, for example, are adopted in our cotton mills, on our railways, in our ships? We shall be outside the mark if we say that of the 5000 patents annually taken out in England 100 are used. A truth like this should be taken to heart by those who believe in inventions and patents as sources of wealth. It seems, too, a little remarkable that inventors, men with plenty of ability, seem to miss their opportunities, and invent what is not really wanted, while they will not give a thought to demands apparently pressing enough which are to be found on every side. For example, the pressing want of the day—a want which will assuredly last all through 1882—is for labour-saving appliances. Much has been done in this direction, but much remains to be done. To indicate plainly what is wanted would be in a sense to invent the means of supplying the want. But we may illustrate our meaning by one or two examples which are possibly not new, yet none the less appropriate. There is not perhaps simpler manual mechanical work than nailing the boards of a packing case together. In the United States it has been found worth while to use a machine to supersede hand labour; and box-nailing machines are well known at the other side of the Atlantic. Again, those who have seen a lid soldered on a tin box know that the operation is one apparently requiring some skill, tact, and manual sympathy, if we may use the word, with the fluid metal. But in the United States lids are soldered on milk-cans, &c., by the million by machinery. These two examples show that in apparently the smallest trifles it is found worth while to use machinery instead of hand work when the latter is dear and scarce. To apply what we have said nearer home, we would point out that not in one engineering shop out of ten is the power of the steam engine driving the shafting made the most of. There are very few machine tools which will do more than one thing well. If anything else has to be done, it must be performed by another tool. The work has to be taken off one, carried to another and re-set, with the chance that errors will be introduced which must be subsequently corrected with the chisel and file. Let us take the case of the cylinder for a horizontal engine, 18in. or 20in. diameter. Following the usual practice, the casting, after being "fettled" in the yard, is mounted on a lathe and bored out; then the flanges at each end are faced; the cylinder is then taken to the planing machine, and the port faces, valve chest edges, and so on, got up. Next it is taken to the drilling machine, and the holes for the studs to secure the lids are drilled. Subsequently these are tapped with considerable expenditure of time by hand. Here, then, we have three distinct machines used in doing very simple work. Now, it seems to be not difficult to devise a machine for getting up cylinders in which they could be bored, planed, and drilled by successive operations, without ever disturbing the cylinder from the moment it was fixed in the machine until it was complete; and we shall go further, and say that all three operations might be performed at the same time, and that the work could be done by one man instead of by three. It is not easy to go into any shop, however well managed, in which it cannot be seen that what may be called the demurrage on tools is heavy. In other words, they are doing nothing, or next to nothing, for a portion of the day. A badly-made tool-holder may cost its owner a good many pounds in the year without his knowledge. We can do no more than indicate the direction in which improvement is urgently needed. We feel certain that there is ample stock of inventive talent in the country ready to supply the want.

It has always been the case in the mechanical arts that demand and supply act and react on each other. A notable example of this is supplied by the present position of the cold air or refrigerating machine trade. Such machines are by no means new; but the invention of a practical cold air machine is of comparatively recent date. If it had not been that a determined effort was made to import fresh meat into this country, it is probable that little or nothing would have been heard of the cold air process; but the demand for a machine capable of keeping a large room for a month or six weeks at a temperature below freezing point stimulated invention. The demand was met; and the circumstance that cold air machines are marketable commodities like steam engines, has in turn enormously stimulated the importation of meat. We do now what ten years—if not five years—ago would have been deemed impossible—import fresh meat in excellent condition from Australia. It would be rash to assume that a limit has been reached, and that no better cold air machines can be made than those now sold. It may not be out of place if, for the sake of the inventor who knows very little about the cold air machine, we say a few words about the principles involved in their construction, and this seems to be the more necessary because much confusion appears to exist in the minds of some persons concerning these principles. When air is compressed, it is raised in temperature, and the elevation of its temperature is, other things being equal, the measure of the work done on it. If, while heated and compressed, it is cooled down by passing it through tubes round which cold water circulates it will lose heat, nearly the precise equivalent of the work done upon it. It would be the precise equivalent if the air were cooled down to its original temperature, but in practice a difference must always exist between the temperature of the cooling water and the air, depending, if on nothing else, on the thermal resistance of the tubes. If now the compressed air be allowed to expand and do work in driving a piston, it will be cooled down yet further in the precise ratio of the work it does on this piston. To begin with, we may suppose that the air and the water both have the same temperature, namely, 60 deg. Fah.; we shall suppose that by compression the temperature of the air is raised to 200 deg., it is then passed through the cooler, and reduced by water at 60 deg. to a temperature of 80 deg. This air is then allowed to expand, and in doing so it will give back about one-half as much power as was expended in compressing it, and will fall to a temperature of about 30 deg. below zero, or even less. These figures are taken, not from calculation, but from actual practice. It will be seen that the greater the work done by the air in expanding the colder it will become; but this will depend on the initial pressure, because the terminal pressure is fixed at that of the atmosphere. Practical difficulties, however, stand in the way of getting very high pressures, and it remains to be seen how these are to be overcome. Hitherto the greatest trouble met with in working refrigerating machines is caused by the deposit of snow or ice on the valves and in the pipes, which is brought about in this way: The capacity of air for aqueous vapour, or, in other words, its power of suspending moisture, depends, other things being equal, on its temperature. The cooler the air the less aqueous vapour can it contain. Air taken from near the surface of the sea, as it is by refrigerators fitted in ships, is always charged with moisture, and this is deposited on cooling. If it could be got rid of in the cooling tubes well and good; but although a portion may be disposed of thus, enough remains to produce snow, when the air is finally cooled down, in and about the expansion cylinder. At the risk of offending the susceptibilities of some makers of excellent cooling apparatus, we venture to assert that the snow problem has not yet been fully disposed of. Three distinct methods are in use for dealing with it. According to one, the condition is accepted, and means are provided for removing the snow from time to time as it accumulates. According to the second, only air previously dried is used, and so the deposit of snow is wholly prevented. This entails the necessity of using the same air over and over again, the meat room being kept cool by cold-air pipes, the process being precisely the reverse of that by which a hothouse is heated by pipes. In some cases the pipes in the meat room may contain water, prevented from freezing by being mixed with alcohol or brine. The water is cooled by cold air. The third system consists in expanding the air in two cylinders, instead of in one. In the first it is reduced in temperature to just above the freezing point, when it throws down the larger part of its moisture in the form of water in the receiver between the two cylinders, and this water is drawn off from time to time. The remaining expansion is then effected in a large cylinder, which exhausts into the meat room.

Possibly because of the small attention that has been given until recently to this subject, the confusion of ideas about it which still exists has not been confined to practical engineers. Even such men as Thomson and Rankine have made mistakes, if not in facts, in deductions, and one recorded as lately as 1860 is worth citing here. Rankine, writing in Nichol's "Cyclopædia of the Physical Sciences," published in that year, concerning the phenomena of freezing, stated that it occurred to Professor, now Sir William, Thomson, that according to the great principle of Carnot, water at freezing point may be converted into ice by a process solely mechanical, and yet without the final expenditure of any mechanical work; yet that as water in freezing expands, and therefore must exert mechanical effect, this is tantamount to saying that mechanical work can be got out of nothing. He then goes on to illustrate his meaning as follows:—Suppose that into an indefinite lake at 32 deg. we plunge a cylinder full of air at 32 deg. "Compress that air suddenly by a piston. Heat will be given out and diffused through the lake. Let the piston, being released from the compressing force, be permitted to start back to its original position. It is evident the expanding air will withdraw from the water nearest it the heat it gave out, and the water will freeze. But at the close of the experiment all things are as they were at first. The force expended in compressing the air has been returned by the equivalent force of resillience, while the mechanical effects due to its expansion are superadded. In other words, we have obtained these into the bargain. Mr. Thomson, with great sagacity, detected the necessary presence of a new and unsuspected element, and at once declared that this element must be the truth that the freezing point becomes lower as the pressure to which the water is subjected is increased."

Now, in this passage there are two errors. In the first place, the cooling and heating of the air has nothing whatever to do with the suddenness or the slowness of the rate of compression or expansion; and secondly, after the expansion had taken place, all things were not as they were before, for the great body of the lake was no longer at 32 deg., because it still contained the heat diffused through it when the air was compressed. If this heat had been returned no ice would have been produced, and the lake would still be at 32 deg.; and however true it may be that the freezing point becomes lower as pressure increases, that fact has no apparent connection with the phenomena spoken of by Rankine in the paragraph we have quoted.

In mechanics no subject possesses more interest for the inhabitants of Great Britain than the marine engine, and it is quite evident that we have not even nearly approached finality in its design or construction. Two principal points claim attention—can it be made better as regards the matter of breaking down, or can it be improved in economy of working. As regards the first point it is doubtful if there is room for improvement; it may be safely said that when properly used engines never break down at sea, but as much cannot be said for crank and propeller shafts. Indeed, little or no improvement seems to have recently taken place in them, and the record of broken shafts is still very heavy. The most original attempt that has been made to establish a better order of things is that of Mr. Turton, of Liverpool, whose crank with built-up jaws we have already illustrated. It continues, we understand, to give perfect satisfaction in the now numerous ships to which it has been fitted. Concerning the second question little or nothing can be added to what Mr. F. C. Marshall said in his paper read before the Institution of Mechanical Engineers at the Newcastle meeting last summer. Progress has been made during the last nine years in the following particulars:—The power of engines made and being made shows a great increase. We may cite, as examples, the Servia, whose engines have indicated 10,385-horse power, and the City of Rome. Speeds previously unattainable are now possible. The Servia is an example of this in ocean-going ships, having steamed for fourteen miles from the Cloch to Cumbrae at 17·57 knots, or twenty miles an hour, and torpedo boats supply an illustration at the other end of the scale of dimensions. The consumption of fuel has been reduced by 13·38 per cent., and working pressures have been increased until many steamers are now being built for 120 lb. Mr. Marshall advocates the adoption of smaller engines, higher speeds, and locomotive boilers with forced draught. It is a curious and noteworthy fact, on which we have already dwelt, that the proportions of the various parts of marine engines and boilers to each other seem to exert no influence whatever on the consumption of fuel, so long as certain very wide and ill-defined limits are not overstepped.

The most prominent proposal connected with shipbuilding which has been made is that a line of steamers should be started to run from Liverpool to New York in one week. This has very nearly been done by one ship on one voyage, but to do it regularly is quite another thing. It was first proposed by Mr. Holt, of Liverpool, a couple of years since, but it has been seriously revived in the United States within the last few weeks.

It was at one time properly regarded as questionable whether a single screw of comparatively moderate diameter could utilise over 10,000-horse power. This question has been set at rest for ever in the affirmative during 1881. The screw propeller still remains one of the most wasteful instruments used. Not less than one-half the whole power exerted by the engines seems under the most favourable circumstances to be lost by it, and no radical improvement seems to be possible. The steamship De Bay, fitted with De Bay's screw, often described in our pages, has met with a series of mishaps, carrying away first one and then all the rest of her screw blades in the Mediterranean during her last voyage. Enough was done, however, to show that the propeller drove the ship much further and faster per ton of coal than any other propeller. A mistake seems to have been made in selecting a material for the blades and in proportioning their thickness to the work they had to do. A singular device has been tried on the Continent, steam being admitted to two large cylinders alternately, and water expelled from them astern. It is said that better results than were expected by any one but the inventor have been obtained.

In the construction of locomotives there is nothing new to record, nor does it seem probable that any radical change will be made during the year. Mr. Webb, of the London and North-Western Railway, has made a compound locomotive. In order to get rid of coupling rods, two inside cylinders drive one pair of wheels, and two outside cylinders, placed about midway of the length of the frame, drive another or trailing pair of wheels, all being of the same diameter. Very little is known as yet outside of the Crewe shops respecting this engine. It is said, however, that it has attained a speed of sixty miles an hour. Joy's valve gear continues to earn golden opinions for itself, and as much may be said of the somewhat similar device invented by Mr. F. C. Marshall, which has already been fitted to over thirty steamers, and is giving the utmost satisfaction. Improvements in locomotives can have but one legitimate object, the reduction in cost; that is to say, in the consumption of fuel and the frequency of repairs. It is a great matter to keep the engines out of the shops on any line of railway. There does not seem to be any room for improvement as regards steadiness of motion. In America the Fontaine locomotive has attracted a good deal of attention. We need hardly tell our readers that the reasoning of its inventor is based on a complete fallacy. We are sorry to see that a limited section of the American scientific press has endorsed Mr. Fontaine's opinions, no doubt without due consideration.

Concerning continuous brakes, we cannot do better than refer our readers to a table which will be found on page 2. It gives all the available statistics concerning brakes; but it must be understood that being compiled almost wholly from Board of Trade returns, it is in a great measure deceptive. It is well known that the returns made by the railway companies do not agree in principle, for one company will report an occurrence as a serious failure which another company would entirely disregard. This has been particularly the case with the Midland Company in dealing with the Westinghouse brake. It is further to be noticed that all automatic brakes must show a larger percentage of failures causing delay of trains than non-automatic brakes, for it is the essential feature of the automatic system that when it fails it stops the train, while a simple vacuum or a non-automatic brake may fail repeatedly and entail no delay. In this way is explained the fact that the percentage of failures, which delayed trains of the Westinghouse brake, appears comparatively high. The figures bear testimony to what may be termed the vigilance of the brake. Again, it is known by experience that nearly all these failures are due to neglect or carelessness on the part of those in charge; and as porters and others learn that the brake is certain to complain in a very unmistakeable way if it is not properly treated, we shall hear less and less of failures which are really so only in name.

It can still be said that engineers are only beginning to understand the principles of action of the steam engine, or, rather, of steam in the engine. The desire for high-pressures and great measures of expansion took its origin in the mistaken lesson taught in all text-books that steam behaved like a permanent gas; whereas in truth it is an extremely unstable fluid, little removed from the border land where fluid ends and liquid begins. To this moment not only is the curve of expansion regarded as a hyperbola, but it is explained that it can be no other curve. As far back, however, as the year 1846, Mr. Cowper calculated a true steam curve, and a good indicator card laid on this curve will always be found to coincide with it with wonderful accuracy. The difference from a hyperbola is well marked. Mr. Cowper maintained that steam to be worked economically must be kept hot, and that in a way which ordinary jackets cannot effect. The wonderful results obtained with the Ditton engines, and recently recorded in our pages, show the accuracy of his view and the soundness of his practice, and afford practical proof of the truth of the statement that high pressures are not necessarily conducive to economy, or capable of securing it. Mr. Perkins, with a courage worthy of a better cause, will during the year start an engine working at 1000 lb. pressure expanding some three hundred times. Mr. Collinson Hall exhibited an engine at the Salisbury Show more than twenty years ago, which worked with steam of this pressure. That any exceptional economy will be obtained we do not for a moment believe. The true secret of economy consists in expanding steam of moderate pressure not more than, at most, about eight to ten times, keeping it very hot all the time, and in running the engine at a high speed and with considerable compression. This principle is being carried out with great success by Mr. Arthur Rigg, concerning whose engines we shall have more to say. A demand for high-speed engines of moderate power to drive dynamo machines direct, as is now being done by Edison, is certain to arrive in the immediate future, and there will be plenty of scope for the preparation of new designs for this class of machinery.

Want of sufficient space prevents us from even alluding to many topics of much interest connected with mechanical engineering. We the less regret that we cannot deal with them here, that our pages contain from week to week a record of most that is worth writing about or illustrating in the mechanical world. One important scheme we cannot pass over in silence, namely, the heating of houses and whole towns from one or more centres by steam, as carried out by Mr. Holley in the United States. In Detroit the system is being tested on a large scale, but it is being applied in no fewer than thirty towns. In Detroit many buildings, two banks, a publishing-office, and a boot and shoe factory, the whole belonging to nineteen owners, and having an aggregate capacity of 3,300,000 cubic feet, are heated from one centre. In addition power to the amount of 196 indicated horse is furnished to eight establishments. The cost last year was about the same as that of private heating, but with the extension of the system it is anticipated that the expense would be reduced.

We cannot leave this subject without saying a few words concerning our Navy. The Inflexible, 11,400 tons, has been completed and sent to Malta. Her speed is not so great as was anticipated, but she draws about 18in. more water than was intended, a result of the substitution of 80-ton for 60-ton guns, and certain changes in her fittings, &c. Full reports of her performance at sea have not yet been made, but on the whole it is satisfactory. In the present year that strange craft the Polyphemus will be completed, as well as the Ajax and Agamemnon—small Inflexibles of 8490 tons each, and probably carrying four 38-ton breech-loading guns of a new type, which will it is hoped be nearly if not quite as powerful as the 80-ton gun. Besides, there are eight other ships being built—the Imperieuse, the Warspite, the Collingwood, the Rodney, a new ship not named, of 9000 tons displacement, and to carry two 43-ton breech-loaders, and a new gun, the most powerful to be had, probably a 60-ton breech-loader, the Colossus, Majestic, and the Conqueror. Besides, there are to be built four despatch vessels of the Iris type, four corvettes, and over a dozen smaller vessels.

The year's work in the development of the applications of electricity has been so great that any *résumé* will necessarily give but a faint idea of what has been done. There is, however, a growing custom periodically to make, so to speak, a balance-sheet of the position, and the custom has much to recommend it. Comparisons can readily be made. The future historian will have less difficulty in fixing pretty exactly the date when this or that application was introduced, not merely as a laboratory experiment, but for the general use of civilised man. The past year will be noted for the wonderful progress made in electric lighting, and as that application of electricity is the most prominent in men's minds at the present moment, we shall deal with it first. The various articles which have appeared in our columns relating to the exhibits at the Paris Electrical Exhibition will have shown that in the immediate future electric engineers will have a status, and if we may venture to predict, the time is not so very far distant when they will claim an equality with other engineers. Comparisons are odious, nevertheless we will indulge a little. Gas is said to have been discovered in 1690 by Dr. Clayton. Ninety and nine years after, the first published account of the gasholder was made in England—that is, in 1789. Three years after, viz., in 1792, Mr. W. Murdock lighted his house and premises at Redruth, and a few years after, in 1797, lighted some manufacturing works by similar means, and in 1802 gave a public display of gas lighting at Soho. From that time gas gradually obtained more extended use till in 1807 it was used to light up Pall Mall. In 1810 the first company was formed with a capital of £200,000 to supply a part of the metropolis with gas. We need not pursue the history further, but will merely say that many years elapsed before lighting by gas became at all general. It is well known that some two or three years ago, owing to the ignorant utterances of the political press—ignorance, we mean, on scientific and historical scientific matters—the public generally were led to suppose that the knell of destruction to gas companies had sounded, and that gas would at once be superseded. The gradual manner in which gas had been introduced was unknown or forgotten; as was also the gradual introduction of all our most important applications of science. The electric light was not likely to form any exception to the rule, although in these days of heavy working pressure the time for its general introduction might be somewhat shortened. It will be well, perhaps, to see how it is that the electric light is practicable. In the latter portion of Rankine's work on the steam engine—ours is the sixth edition published in 1873—the question of the cost of work done by electrical methods is discussed, and the very definite conclusion stated that it is far cheaper to obtain energy by the consumption of carbon, *i.e.*, coal, than by the consumption of zinc. At the time of Professor Rankine's writing magneto and dynamo-electric machines were in a very embryo condition. Pacinotti, however, as has been explained in our report of the Paris Exhibition, introduced certain modifications into these machines, which afterwards, in the hands of Gramme, paved the way for the one class of machines of the present day. Professor Rankine, p. 540, states that by the combustion of 1 lb. of zinc in a Daniell battery we obtain 1,095,468 foot-pounds of energy, and he states, as we have said above, that this cannot compete with coal combustion. Now, in a short article in the current number of the *St. James's Magazine* Mr. F. C. Webb, C.E., has made a calculation to compare a Brush machine with the Daniells cells. He finds that the machine known as the 7 A machine is equivalent to 351,960 Daniell's cells. This is perhaps a startling result to those who have never thought about the subject; but the figures, though not rigidly exact, are sufficiently so for the purpose of comparison. The machine is intended for 16-arc lights, and requires about 14-horse power to run it. The Brush, Gramme, &c., machines are modifications of Pacinotti's designs, and hence we may say that Pacinotti's work formed the germ which in its development made the electric light practicable. Upon an equal footing with Pacinotti, we ought, perhaps, to place Dr. Siemens, who, contemporaneously with Mr. Varley and Prof. Wheatstone, introduced improvements which, although previously used by Hjorth, of Copenhagen, only in the hands of Siemens became of practical value. The Siemens machines are known as among the best in the market. Mr. Crompton taking in hand the somewhat crude machine of M. Bürgin has simplified, modified, and raised its efficiency till it has become one of the most extensively used. His ring armature is simpler than any other of a similar class. The machines of Bürgin, Gramme, Siemens, are those generally used in England. During the year of grace 1882 we shall undoubtedly see other improvements made, but we have no great faith that any new law will be discovered to increase efficiency, but that progress will be made by simplification of design, the use of thicker wire, ribbon, or plates for the armature and field magnets, the use of cast in lieu of wrought iron, symmetry of parts, &c. The theory of the dynamo machine is being carefully studied by a number of able men, some of whom are eager to obtain but not to impart knowledge, and hence it frequently happens that investigations of great practical value are unknown to the world at large, and remain so till the wheel of fortune has carried us past the period when such investigations are useful. Progress is too rapid to hoard up these treasures, and we trust that some of the results will ere long be published.

Electric light apparatus consists of three parts—the generator of electricity, the motor to drive the generator, and the lamp. The electric lamp, then, next claims our attention. The improvements in the machines made the electric light practicable; the improvements in lamps made it probable. Whatever real progress has been made, has been made since 1876, when Werdermann or Jablochkoff—history is not certain which—invented what may be called the carbon candle. Last year we had little to say for the Jablochkoff light, and although it has quite recently been described as somewhat obsolete, it is a fact that during the past year a very large business has been done by the company owning the patents. The lamp is simple, which is in its favour. In England during 1881, Mr. Whiteley, of Westbourne-grove, has adopted this light; Messrs. Shoolbred have increased the number of lamps in use; Messrs. Smith and Saunders, of the Bon Marché, Brixton, have adopted it, and Messrs. Samuel Brothers, after having given it up once, have returned again to their first love. Contracts have been taken to light the harbour at Havre for ten years, and for a similar period the railway dock and basin at Antwerp. We understand that negotiations are being carried on with the Metropolitan Board of Works with a view to extend the use of this lamp, the Board in April last having arranged for a continuation of the lighting of the Thames Embankment and Waterloo Bridge for three years. Just lately some 39 installations have been made in France—15 in Paris and 24 in the provinces. To these must be added 11 installations in other places on the Continent. The company, with a certain amount of justice, take credit that their customers continue not only to use, but to extend their lights. The oldest of the English companies is the British Electric Light Company, which of necessity occupies a prominent position, owning as it does the Gramme patents for the United Kingdom. Rumours have from time to time been heard as to the validity of these patents, but it is difficult to trace the rise of such rumours, and as none of those interested in the patents seem desirous of impugning them, we may view the inuendos as the emanations of envy. The company is not prejudiced towards any system of lighting, but is ready to carry out the one thought to be best and most economical. A lamp largely used by this company is that of Mr. Brockie, which regulates itself periodically. These lamps are in use at Cannon-street; but various modifications have been introduced, which will be seen in the lamps at the Crystal Palace, where no less than thirty lamps will be shown. A step in the right direction is in the formation of central stations, one such being formed by this company in their premises in Heddon-street, Regent-street, from which the current is supplied to neighbouring clubs, &c. Thus the Scottish Club, in Dover-street, Piccadilly, is connected with the central station at Heddon-street at 3 p.m., and disconnected at 2 a.m. The company has an incandescent lamp, which is spoken of favourably. The three most prominent electric light companies, however, are the Brush Company, Messrs. Crompton and Co., and Messrs. Siemens Brothers and Co. It is well known that Messrs. Siemens have ever been active in introducing improvements, and it is hardly invidious to other engineers if the names of Mr. R. E. Crompton and Mr. A. Siemens be specified as the names of men who have carefully studied the art of electric lighting in its every phase. Mr. Crompton takes the initiative in introducing the light into mines at Pleasley and at Risca, whilst Messrs. Siemens have introduced the light into our theatres and steamships. After Mr. Crompton's experiment at Pleasley Colliery, Messrs. Graham, of Glasgow, carried out the work of lighting the Earnock Colliery of Mr. Watson. The greatest experiment during the year has been the lighting of a part of the City of London, Messrs. Siemens undertaking London Bridge, King William-street, Royal Exchange, Poultry, &c. They have also in hand the work of lighting the Winter Academy, whilst Mr. Crompton is busy with work at the Mansion House. We have seen the designs of some of the gear to be used in the last-mentioned work, and believe it will be pronounced to be very elegant. This work will also have some novelties, being perhaps the largest in which a combination of arc and incandescent lights are used. The mere cataloguing of the work done during the year, or the work these firms respectively have in hand, would be of little interest; but we may mention a few installations which are perhaps worthy of record. Messrs. Siemens have lighted Devonshire Park at Eastbourne, a place well known to all visitors to this fashionable watering place, the Victoria station at Manchester, the Rio Tinto Mines in Spain, the Liverpool Corporation Waterworks at Llanfyllin, the Severn Tunnel, Portskewet, Blaenavon Ironworks, the steamships City of Rome, Alaska, Chimborazo, &c., showing the cosmopolitan nature of the work.

Messrs. Crompton and Co., using generally the Bürgin machine, and for large open spaces the Crompton arc light, have been exceedingly busy throughout the year. The most important experiment was perhaps that of lighting the Pleasley Colliery, under the auspices of the Mines Accident Commission. The light used was the Swan lamp, and the lighting was so successful that Mr. Watson, the proprietor of the Earnock Colliery, near Glasgow, commissioned Messrs. Graham to light that colliery by electricity. This was carried out under the collaboration of Mr. A. Jamieson, Principal of the School of Science, Glasgow, with Messrs. Graham. Subsequently Messrs. Crompton lighted the Risca Colliery, which is generally supposed to be one of the most dangerous mines. The light till the time of writing has been wonderfully successful. Besides this onerous work, the firm has lighted up such towns as Dewsbury, Norwich, &c.; the harbours, docks, or piers at Greenock, Belfast, &c.; the stations at King's Cross, Bricklayers' Arms, North British goods at Glasgow, the dye works of Messrs. Ripley and Sons, and some forty or fifty other installations. One feature which, as it has been noticed with regard to the Jablochkoff light, might be mentioned again, to show conclusively that those who have once adopted the electric light continue its use and extend its use, is that in many cases Messrs. Crompton have supplied apparatus for a second order to the same people. The work in hand includes, besides many other installations, the lighting of the Egyptian Hall and Saloon at the Mansion House, the harbour works at Fraserburgh, the works of Messrs. Brown, of Edinburgh, of Messrs. Phillips Brothers, London, Messrs. Tate, Silvertown, &c.

The Brush Company and the various agents, licencees, and branch companies, have had a remarkable year. We have before us full and complete information relating to their work; but to analyse it into too brief a compass would give a very inadequate idea of their work. The annual report of the company, a proof of which the general manager, James Humphreys, Esq., has kindly sent us, will receive special attention at a future date; meanwhile we give a rough total of the number of Brush lights in use, including America, &c. This number has reached the enormous total of over 8700 lights. Here, again, we find second, third, fourth, and fifth orders from the same people. At Paris we carefully watched this light, and found the experiment there to be carried out in an exceptionally good way. Besides the Brush arc lights and the Brush machine, this company is manufacturing the Lane-Fox incandescent lamps on a very large scale. It is absolutely impossible to indicate the scope of the past year's work of this company in a short paragraph, but undoubtedly it has carried on the largest business of any of the light companies.

During the year the Electric Light and Power Generator Company have carried out the work of lighting the third district in the City, viz., from the Mansion House to Blackfriars Bridge, *viâ* Queen Victoria-street, Southwark-street, and Queen-street. The Weston lamp and machine are used. This lamp is a very good lamp, with the one drawback, shortness of carbon. During the short summer evenings it answered very well, but is now being replaced by another lamp calculated to burn a longer time. There are altogether thirty-two lamps in four circuits of eight each, worked from Bankside. This company is also the owner of the Maxim lamp for this country, some of which are used in the Post-office at Edinburgh; others with machines are to be supplied to H.M.S. Agamemnon and Polyphemus. The lighting of several of the metropolitan stations is carried out by this company.

These signs of progress might be supposed to afford a sufficiently satisfactory series of facts for those interested in the particular subject, but the year 1881 will long be memorable, and will probably be regarded as the year in which electric lighting by incandescence came into existence as a commercial reality. In 1880 the lectures of Mr. Swan had prepared the public mind for the reception of authentic information that incandescent lights were a fact, and not merely an experimental demonstration. Expectancy was for once to be gratified. The Paris Exhibition did for the incandescent lamp what the energy of Brush, Crompton, and Siemens had already done for the arc lamp, viz., proved its practical utility. Thousands of incandescent lamps were to be seen at Paris, and only the question of economy in practical use remains to be determined. The lights from these lamps is admired by all. In the spring of the year a company was formed to establish the manufac-

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE Glasgow iron market was closed from Friday till Tuesday in consequence of the new year holidays. Before it closed on the former day prices of warrants had considerably improved from the re-action that set in on the previous Tuesday, when the statistics of the iron trade were made known. As explained in this correspondence last week, the committee, who made up the iron report, did not as usual receive returns from ironmasters with reference to the amount of production and the stocks remaining in their hands. They were, therefore, obliged to estimate these two important items, and although the principle upon which their calculations were made appeared reasonable and fair, no little dissatisfaction was manifested with the result. It was alleged on the part of the ironmasters that the stocks were placed at too high a figure, as well as the amount of production. The ironmasters themselves met on Saturday, privately, in Glasgow and made up the returns of the actual production and stocks at all the works, with the exception of two, the owners of which declined to send in figures. Excluding these two works, they found that the make of pig iron during the year had amounted to 1,072,079 tons; whereas the iron merchants' committee had estimated the amount at 1,176,000 tons, leaving a difference of 103,921 tons. But at the two works from which returns were not received there has been an average of eleven furnaces in blast, and calculating the production of these at 195 tons each per week—the method employed by the iron merchants—it would appear that the production in the case of these works would amount to 111,540 tons, bringing up the entire output to 7619 tons more than the estimate in the official statistics. The ironmasters' figures showed that there were 266,346 tons in their hands, whereas the estimate of the iron merchants' committee was 312,814, a difference of 46,468 tons. It is well known that there are considerable stocks at the works not included in the ironmasters' returns, but whether they will be sufficient to account for the difference of fully 46,000 tons in the estimate can only be certainly known to the owners of those works. It seems to be generally admitted that the stocks at these two works cannot by any possibility be less than 20,000 tons. The probability is that they are considerably greater, so that the ironmasters' figures substantially confirm those made up a week ago by the committee hitherto charged with this important duty.

The market opened on Tuesday very firm, and a fair business was done at prices rather higher than those of Friday. In the afternoon transactions were effected at 51s. 11d. to 52s. 5½d. cash, and 52s. 3d. to 52s. 9d. one month; closing sellers 52s. 6d. cash, and 52s. 9d. one month; buyers very near. The market was strong on Wednesday at the opening, but gradually became easier, business being done down to 51s. 11½d. cash. To-day—Thursday—business was done at 52s. 1d. cash, also 52s. 3d. to 52s. 2d. one month, closing at 52s. 3d. one month.

There has not been much change in the prices of makers' iron this week, but the demand is considered satisfactory for the present season. Business is at the moment much interrupted by the new year holidays. The quotations are as follow:—Garsherrie, f.o.b. at Glasgow per ton, No. 1, 60s., No. 3, 54s.; Coltness, 61s. 6d. and 54s.; Langloan, 62s. 6d. and 55s.; Summerlee, 60s. and 53s.; Calder, 60s. and 53s. 6d.; Carnbroe, 54s. 6d. and 53s.; Glengarnock, at Ardrossan, 54s. and 53s.; Eglinton, 52s. and 50s.; Dalmellington, 52s. 6d. and 50s.; Shotts at Leith, 60s. and 54s. 6d.; Carron, at Grangemouth, 52s. and 51s.; Kinneil, at Bo'ness, 51s. 6d. and 49s. 6d.

In the manufactured iron districts and at the foundries and engineering works, as well as in the shipbuilding yards, business has been suspended during the greater part of the week owing to the holidays. There is every reason to believe, however, that work will be renewed with increased activity, and that these branches of trade have before them a period of great prosperity.

Up till the close of last week the coal trade was exceptionally busy on account of large deliveries having to be made for shipment previous to the holidays. On this account prices have advanced 3d. and in some cases 6d. per ton. These figures, however, were merely temporary, and it is expected that when business is fully resumed the prices will adjust themselves to their former level.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE new year is opening well. In the ironworks, from the steel works of Monmouthshire, notably Ebbw Vale, Blaenavon, Tredegar, and Rhymney, to Swansea, the activity is very marked, and there is a stiffness of price, which may be naturally expected to end in an advance. Up to a short time ago there was only one branch that showed any signs of weakness, and that was the tin-plate, in part from internal dissension, and in part from falling demand. I am now very pleased to be able to state that tin-plate, which made a spurt some week or so since, continues to look up, and prospects, even not taking the most sanguine view, are looking very favourable. The only new changes and enterprises in connection with iron are the forthcoming transfer of Melingriffith and Pentyrch Works to Spence and Co., and the establishment of wire works at Merthyr. Tredegar is fast completing its steel, Rhymney adding to its appliances for greater output, and the Swansea Works forging ahead.

In coal, as I had anticipated, the year 1881 gave, in the case of the Cardiff port, nearly a million tons excess over 1880. The figures are not quite completed, but so far as they run, they are as follows:—Cardiff, 1880, 4,897,440 tons; ditto, 1881, 5,508,086 tons. When to this we add the last month's totals, it will be seen that the fullest expectations have been realised. The outlook of the year is also a good one. Freights are easier from the quantity of shipping coming into play, and prices indicate more than a tendency upwards. In many cases which have come under notice, large contracts have been made for 1882. New companies are moving, and it is evident that where reasonable chances offer capital is soon forthcoming. The Nantgarw seams are being worked again, I see, by a firm under the name of the Ystradbarwig Company. The upper seams appear to have been worked to considerable advantage by the late Thos. Powell, father of the unfortunate aeronaut, and now there is a prospect of the under seams proving as remunerative. Two pits are being sunk by the Great Western Company to the west of Rhondda.

In addition to these movements the railway schemes that will shortly come before the committee have drawn attention to the virgin track lying westward from the Rhondda, and we may expect seams re-opened which have been left on account of deficient railway service. What with the South Wales mineral line, and the projected lines, a country little known will be opened up for coal.

The Dowlais tin-plate works are again idle, on account of a dispute between the men.

Mountain Ash seems generally to be in trouble. This is the point from whence most of the revolutionary movements spring. The sliding scale promises to come to the front in a more decided manner there than I had expected, and with it an effort on the part of the miners' representatives to get the association into better working order.

The Llanvabon house coal men are also beginning to agitate. They appeal against any link being fashioned between them and the steam coal colliers, and if this be persisted in, threaten to give notice in a month from date.

I see that notwithstanding a fair immunity from large explosions, there have been throughout the country twenty-seven explosions in mines, and out of thirteen of these ninety-seven lives were lost.

During last week 135,000 tons of coal were sent away from the whole of South Wales. At Mountain Ash there has been a little tardiness in output, but other parts of the neighbourhood continue flourishing.

Appearances in the Swansea iron trade foreshadow an advance. Stocks are very low, and as the tone of inquiry is well maintained, especially from the States, we may expect prices will move upwards. Common Welsh bars are quoted at £6; rails, £5 10s. to £5 15s.; old scrap unaltered. Iron is, however, not so much inquired for as steel, and these remain in brisk demand. Evidently an impression prevails that the sooner purchases are made the better.

Tin-plate prices are—ordinary coke, 18s. to 19s.; charcoal, 23s.

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.

27th December, 1881.

5670. TIMEPIECES, W. L. Wise.—(*W. E. Doolittle, U.S.*)
5671. MUSIC APPARATUS, M. Wagner, Berlin.
5672. SHIP COMPASSES, R. Evans, Newcastle-on-Tyne.
5673. PUNCHING MACHINES, G. Jones, West Hartlepool.
5674. TRANSMITTING APPARATUS for TYPE-PRINTING TELEGRAPHS, S. Pitt.—(*H. V. Hoevenbergh, U.S.*)
5675. FLOATING ANCHORS, W. M. Bullivant, London.
5676. BLACKING, &c., HIDES, W. Morgan-Brown.—(*F. B. Batchelder, East Boston, U.S.*)
5677. OPENING DOORS, J. Barrett, Eastburn.
5678. SPINNING MACHINERY, M. Wright, Wibsey.
5679. FIREPLACES, J. Gillingham, Chard.
5680. MIDDLINGS PURIFIERS, C. D. Abel.—(*C. Oberdofer and C. Hönig, Vienna.*)
5681. DYNAMO-ELECTRIC MACHINES, J. Richardson, Lincoln.
5682. VELOCIPEDES, J. White, Coventry.
5683. CONVERSION of IRON into STEEL, W. R. Lake.—(*J. Date, Montreal, Canada.*)
5684. THRESHING STRAW, R. G. Morton, Perth, N B.
5685. GUSSETS, &c., W. Lake.—(*S. Florsheim, U.S.*)
5686. OPERATING the CUT-OFF of VALVES, H. H. Lake.—(*S. A. Goodwin, Philadelphia, U.S.*)
5687. REGULATING ELECTRICITY, C. A. Carus-Wilson, London.
5688. CYMAPHENS, C. F. and E. H. Varley, London.
5689. ATTACHING the TRAVELLING PAPER in MUSICAL INSTRUMENTS, W. R. Lake.—(*Automatic Music Paper Company, Boston, U.S.*)

28th December, 1881.

5690. HANGING CARCASES, J. Millbourne, Manchester.
5691. TRUEING CYLINDERS, C. Barlow.—(*J. Tolra, Spain.*)
5692. DESIGNS, T. Jones, Clerkenwell, London.
5693. COVERING BOILERS, F. Castelin, Marseilles.
5694. FURNACE GRATES, J. Schofield, Littleborough.
5695. HANDLES, H. J. Haddan.—(*W. Miles, New York.*)
5696. RECORDING MUSICAL NOTES, J. Wallis.—(*J. Föhr, Stuttgart, Germany.*)
5697. ARTIFICIAL MILK, P. T. J. Voltmer.—(*O. Lahrmann, Altona, Holstein.*)
5698. SOAP, J. Mewburn.—(*J. Besson & C. Remy, Paris.*)
5699. FEEDING APPARATUS, J. Hurt and A. M. Strathern, Glasgow.
5700. SCREW TAPS, F. de Camp, Germany.
5701. OPERATING SIGNALS, A. Gough, Buckingham.
5702. SOCKETS, J. W. Swan, Newcastle-on-Tyne.
5703. COOKING STOVES, F. Brown, Luton.
5704. BURNISHING MACHINERY, W. R. Lake.—(*G. Copeland, Malden, U.S.*)

29th December, 1881.

5705. SHIPS' RUDDERS, W. Cooke and D. Mylchreest, Liverpool.
5706. LUBRICATING BEARINGS, H. Reisert, Cologne.
5707. ROSE CUTTERS, C. Abel.—(*W. Lorenz, Germany.*)
5708. ANCHORS, J. Nock, Turkey.
5709. SKATES, H. Haddan.—(*W. Tillmanns, Germany.*)
5710. BATHING APPARATUS, C. E. Winterross, Norway.
5711. WINDING YARNS, W. T. Stubbs and J. Corrigan, Manchester.
5712. SUPPLYING FEED-WATER to BOILERS, E. de Pass.—(*Société Volpp Schwarz et Compagnie, Paris.*)
5713. TREATMENT of YARN, C. Lightoller, Manchester, and J. Longshaw, Preston Brook.
5714. OVENS, J. Johnson.—(*Geneste, Herscher & Co., Paris.*)
5715. COCKS or TAPS, W. Lake.—(*J. Aymonnet, Paris.*)

30th December, 1881.

5716. ROASTING COFFEE, M. Robinson, Manchester.
5717. BRUSHES, W. Willeringhaus, London.
5718. WIND INSTRUMENTS, W. P. Thompson.—(*M. Harris, New York.*)
5719. TREATING BOG-PEAT, S. D. Cox, New Charlton.
5720. FIRE-LIGHTERS, F. Holmes, New-cross, London.
5721. LIFTS, J. Stevens & C. Major, Battersea, London.
5722. PREVENTING EXPLOSIONS, I. S. McDougall, Manchester.
5723. FEEDING HURDLES, A. Scott, Rotherfield, Alton.
5724. CANDLE SHADES, E. Wylam, Bermondsey, London.
5725. LINOLEUM, M. B. Nairn, Kirkcaldy.
5726. WINDING MACHINES, R. and T. Speight, Bradford.
5727. MILLS, F. Wirth.—(*W. Hartmann, Germany.*)
5728. SIGNALLING, J. M. Gray, Edinburgh.
5729. SAFETY VALVES, C. W. Collins, Manchester.
5730. BRUSHES, G. Beissbarth.—(*J. Beissbarth, Bavaria.*)
5731. GAS FURNACES, R. S. Casson, Brierley Hill.
5732. TOWING VESSELS, W. Lake.—(*H. Ressel, Vienna.*)

31st December, 1881.

5733. WIND MUSICAL INSTRUMENTS, W. P. Thompson.—(*M. Harris, New York.*)
5734. BINDING SHEETS of PAPER, W. F. Lotz, Barbican, London.—(*G. W. McGill, New York.*)
5735. HEATING WATER, T. Drake, Huddersfield.
5736. SHIRTS, J. Ridley, Fore-street, London.
5737. GLASSWARE, J. Hewitt.—(*R. W. Harris, Calais.*)
5738. ELECTRIC LAMPS, J. G. Lorrain, Westminster.
5739. TREATMENT of MAIZE, T. B. Kinder, Anerley.
5740. HOISTS, J. & J. T. Pickering, Stockton-on-Tees.
5741. STEAM BOILERS, G. H. Lloyd, Birmingham.
5742. HEATING METALS, J. S. Williams, London.
5743. ELECTRICAL RESISTANCES, G. Pfannkuche and R. E. Dunston, Charlotte-street, London.
5744. MARINE GOVERNORS, J. G. Batchelor, Liverpool.
5745. SOFTENING WATER, F. and W. Atkins, London.
5746. NUMBERING MACHINES, W. R. Lake.—(*P. L. Hanscom, U.S.*)
5747. ROOFS, A. Clark.—(*Le Comte de Barbara, Paris.*)
5748. CONSUMING SMOKE, J. MacDonald and A. J. M. Bolanachi, Dulwich.
5749. ALLOYING METALS, P. de Villiers, Silver Hill.
5750. COVERING METALS, P. de Villiers, Silver Hill.
5751. CONTROLLING BRAKES, W. R. Lake.—(*A. L. Duvelius, L. W. Goss, P. Higgs, F. R. Merrell, H. D. Peck, and H. Walter, U.S.*)

2nd January, 1882.

1. TABLE CUTLERY, &c., E. A. Lynde, Sheffield.
2. REFRIGERATORS, P. Justice.—(*H. C. Goodell, U.S.*)
3. PRESERVING TIMBER, H. Aitken, Falkirk, N.B.
4. LOCKS, V. Huppe and A. P. Bender, Germany.
5. MASHING MALT, L. Groth.—(*M. C. Seitz, New York.*)
6. NICKEL-PLATING, J. E. Chaster, Manchester.
7. HOT-AIR ENGINES, T. Morgan.—(*S. Sudheim, Cassel.*)
8. SAFETY VALVES, J. S. Stubbs, Manchester.
9. TUBE EXPANDERS, G. Allix, Poplar, London.
10. TUYERES, E. G. Brewer.—(*T. Martin, Victoria.*)
11. DESICCATING, &c., A. Goutard, Mockau, Saxony.
12. AXLE-BOXES, W. Clark.—(*C. Candee & A. Story, U.S.*)
13. COATING COMPOSITIONS, W. G. Little, Doncaster, and B. Nickels, London.
14. ELECTRIC LIGHTING, A. Mackie, Pimlico, London.
15. TRANSMITTING HEAT to FLUIDS, T. Duffy, Liverpool.
16. HORSESHOES, J. Buckham & G. Jackson, Lanchester.
17. INCREASING the HEAT of FUEL, G. Peters, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

5644. RAILWAY RAILS, A. J. Acaster, Sheffield.—*24th December*, 1881.
5670. TIMEPIECES, W. L. Wise, Westminster.—A communication from W. E. Doolittle, West Haven, U.S.—*27th December*, 1881.
5695. BACKS of BRUSHES, &c., H. J. Haddan, Kensington.—A communication from W. H. Miles, New York.—*28th December*, 1881.

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

5318. TOOLS, J. Goodrich, Henry, U.S.—*30th December*, 1878.
5283. COVERING CYLINDERS with CARD FILLETS, J. S. Dronsfield, Oldham.—*27th December*, 1878.
5292. TELEGRAPH APPARATUS, S. Pitt, Sutton.—*27th December*, 1878.
5299. CASKS, J. C. Lane, South Kensington, London.—*27th December*, 1878.
40. EMBROIDERING MACHINES, A. Bonnaz, Paris.—*3rd January*, 1879.
250. FACTITIOUS MILLSTONES, G. A. Buchholz, Potsdam, Germany.—*21st January*, 1879.
332. OBTAINING CURRENTS of ELECTRICITY, W. B. F. Elphinstone, Musselburgh, N.B., and C. W. Vincent, Holloway.—*27th January*, 1879.
90. TOOTHED WHEELS, S. Buckley and J. Taylor, Oldham.—*9th January*, 1879.
2. GAS-MOTOR ENGINES, H. Williams and J. Baron, Southport.—*1st January*, 1879.
29. GAS PRESSURE REGULATORS, J. Stott, Oldham.—*3rd January*, 1879.
39. FURNACES, G. F. Redfern, Finsbury, London.—*3rd January*, 1879.
84. DELIVERING WOVEN FABRICS, J. Kerr, Church.—*8th January*, 1879.
112. SWORD SCABBARDS, F. M. Mole, Birmingham.—*10th January*, 1879.

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

5021. MOULDING INLAID DESIGNS, A. M. Clark, Chancery-lane, London.—*28th December*, 1876.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 20th January, 1882.

3706. CHAIN BARREL, J. Lynn, Sunderland.—*25th August*, 1881.
3712. AMMONIA, C. D. Abel, London.—A communication from F. Twinch.—*25th August*, 1881.
3713. BATHS, C. D. Douglas, London.—*25th August*, 1881.
3729. RANGE-FINDERS, F. Charteris, London.—*26th August*, 1881.
3733. STARTING VEHICLES, E. A. Brydges, Berlin.—A communication from L. Helm.—*26th August*, 1881.
3734. FISHING NETS, R. Balderston, Paisley.—A communication from A. Bonamy.—*26th August*, 1881.
3737. RAILWAY BRAKES, J. Pilbrow, Tunbridge Wells.—*27th August*, 1881.
3747. RING-SPINNING MACHINE, W. R. Lake, London.—A com. from S. A. Jenks.—*27th August*, 1881.
3767. STEAM ENGINE, J. H. Fox, Farnborough.—*30th August*, 1881.
3771. PRODUCTION of VOLTAIC ELECTRICITY, A. Banks, Birmingham.—*30th August*, 1881.
3808. CONVEYING SOUND, C. D. Abel, London.—A communication from C. Ader.—*1st September*, 1881.
3809. TELEPHONIC EXCHANGES, C. D. Abel, London.—A communication from La Société Générale des Telephones.—*1st September*, 1881.
3830. PREPARATION OF TEA, J. P. Brougham, Inverness.—*2nd September*, 1881.
3856. ARTIFICIAL FUEL, W. Thompson, London.—A com. from M. Neuhaus & O. Henniges.—*5th September*, 1881.
3921. STITCHING APPARATUS, W. R. Lake, London.—A com. from J. Gutmann.—*9th September*, 1881.
3934. TRANSMITTING MOTION, A. M. Clark, London.—A com. from A. Samper.—*10th September*, 1881.
3990. FIRE-EXTINGUISHING APPARATUS, A. Clark, London.—A com. from P. Oriolle.—*15th September*, 1881.
4394. OBTAINING BAS-RELIEFS, E. de Pass, London.—A com. from W. H. Guillebaud.—*10th October*, 1881.
4866. VOLTAIC BATTERIES, T. Coad, London.—*7th November*, 1881.
4867. CABINET, T. Coad, London.—*7th November*, 1881.
5183. PURIFICATION of WATER, P. Spence, Manchester.—*28th November*, 1881.
5313. MULES, B. A. Dobson, Bolton.—*5th December*, 1881.
5330. COMBING MACHINES, B. A. Dobson and J. Macqueen, Bolton.—*6th December*, 1881.
5331. OPENERS, B. A. Dobson and T. Wood, Bolton.—*6th December*, 1881.
5355. BELT FASTENERS, W. H. Steil, Battersea.—*7th December*, 1881.
5358. WHEELS, W. R. Lake, London.—A communication from I. Friedlander.—*7th December*, 1881.
5644. RAILWAY RAILS, A. J. Acaster, Sheffield.—*24th December*, 1881.
5670. TIMEPIECES, W. L. Wise, London.—A communication from W. E. Doolittle.—*27th December*, 1881.

Last day for filing opposition 24th January, 1882.

3754. SHEATHING METAL SURFACES, W. Elmore and J. J. Atkinson, London.—*29th August*, 1881.
3764. VELOCIPEDES, J. K. Starley, Coventry.—*30th August*, 1881.
3772. REMOVING TIN, A. Gutensohn, London.—*30th August*, 1881.
3783. FURNACES, J. H. Johnson, London.—A communication from M. Perret.—*30th August*, 1881.
3786. GAS-MOTOR ENGINES, J. J. Butcher, Gateshead.—*31st August*, 1881.
3817. AIR COMPRESSORS, A. Chapman, Liverpool.—*2nd September*, 1881.
3820. FACING BRICKS, F. G. Pearson, Dudley.—*2nd September*, 1881.
3824. UTILISING VOLATILE PRODUCTS, J. Wetter, New Wandsworth.—A communication from R. S. Jennings.—*2nd September*, 1881.
3827. RUCHED FABRICS, C. D. Abel, London.—*2nd September*, 1881.
3976. ELECTRIC ARC LAMPS, P. Jensen, London.—A com. from A. Cance.—*14th September*, 1881.
4117. SELF-FILLING BUCKETS, G. Allix, jun., Isle of Dogs.—*24th September*, 1881.
4126. CONDENSING VAPOURS, A. Chapman, Liverpool.—*24th September*, 1881.
4160. TUNNELLING MACHINERY, F. B. Dœring, Trefriw.—*27th September*, 1881.
4235. PUMPS, H. J. Haddan, London.—A communication from C. Arentsen.—*30th September*, 1881.
4377. CLUTCH MECHANISMS, J. Hardinge, London.—*8th October*, 1881.
4381. INDIGO PRINTING, F. Wirth, Germany.—A communication from J. Ribbert.—*8th October*, 1881.
4434. TRICYCLES, A. Clark, London.—A com. from S. N. Silver and C. E. Page.—*11th October*, 1881.
4621. REEL, F. Wirth, Frankfort-on-the-Main.—A communication from Adt Brothers.—*21st October*, 1881.
4690. COUPLING BUFFERS, G. Turton, Westminster.—*26th October*, 1881.
4872. ACTIONS of SMALL-ARMS, H. A. Silver and W. Fletcher, London.—*7th November*, 1881.
5048. RECOVERING RUBBER, C. A. Day, London.—A com. from M. C. Mitchell.—*17th November*, 1881.
5226. JOINING CABLES, A. W. Brewtnall, London.—*29th November*, 1881.
5279. HEATING, &c., T. Ivory, Edinburgh.—*2nd December*, 1881.
5347. SCALES, J. Post, London.—*7th December*, 1881.
5352. MELTING COMPOSITION, R. Corsham, London.—*7th December*, 1881.
5353. DIVINING RODS, C. F. Varley, Bexley Heath.—*7th December*, 1881.
5380. DETACHING BOATS, E. J. Hill and J. L. Clark, London.—*9th December*, 1881.
5427. COLOURING MATTERS, J. A. Dixon, Glasgow.—A com. from C. Koenig.—*12th December*, 1881.
5569. REVOLVING FIRE-ARMS, W. R. Lake, London.—A com. from J. H. Wesson.—*20th December*, 1881.
5584. EXPLOSIVE COMPOUND, H. H. Lake, London.—A com. from S. R. Divine.—*21st December*, 1881.
5589. REFINING IMPURE COPPER, H. H. Lake, London. A com. from C. T. J. Vautin.—*21st December*, 1881.
5590. DOOR-CHECKS, H. H. Lake, London.—A communication from L. C. Norton.—*21st December*, 1881.
5596. CARTRIDGES, H. H. Lake, London.—A communication from S. R. Divine.—*21st December*, 1881.
5695. BACKS for BRUSHES, H. J. Haddan, London.—A com. from W. H. Miles.—*28th December*, 1881.

Patents Sealed.

(*List of Patent Letters which passed the Great Seal on the 28th December*, 1881.)

2497. PROVISION CASES, W. Rollason, London.—*8th June*, 1881.
2831. LAMPS, H. J. Haddan, London.—*28th June*, 1881.
2837. DYEING, W. E. Gaine, Hammersmith.—*28th June*, 1881.
2839. SCREW BOLTS, W. R. Lake, London.—*28th June*, 1881.
2841. PLAIN REPPS, J. Horrocks, Ainsworth Mill.—*29th June*, 1881.
2843. INDICATING WORDS, J. M. Jones, Battersea.—*29th June*, 1881.
2845. HEATING WATER, T. Drake, Huddersfield.—*29th June*, 1881.
2849. PURIFYING COAL GAS, J. G. Hawkins, London.—*29th June*, 1881.
2853. STARTING VEHICLES, A. Piffard, Felden, and C. H. Gimingham, London.—*29th June*, 1881.
2855. TENONING MACHINE, G. H. Couch, Croydon.—*30th June*, 1881.
2861. STEAM BOILERS, F. H. F. Engel, Hamburg.—*30th June*, 1881.
2864. SHARPENING SAWS, F. Myers, London.—*30th June*, 1881.
2865. PURIFICATION of COAL GAS, C. F. Claus, London.—*30th June*, 1881.
2878. WAGON AXLES, S. Bradley, Blakedown Works.—*1st July*, 1881.
2898. EXTINGUISHING FIRES, F. Grinnell, Providence, U.S.—*2nd July*, 1881.
2905. PURIFYING FEATHERS, J. Martin, Liverpool.—*4th July*, 1881.
2941. BOXES or CASES, C. R. E. Bell, London.—*5th July*, 1881.
2955. LAMPS, F. R. Baker, Birmingham.—*6th July*, 1881.
2964. BURNISHING EDGES of BOOTS, P. M. Justice, London.—*6th July*, 1881.
2975. BRICKS, &c., E. Johnson, St. Helen's.—*7th July*, 1881.
2989. TRANSMISSION of POWER, J. Hopkinson, London.—*7th July*, 1881.
2996. PROPULSION of VESSELS, W. Coppin, jun., Londonderry.—*7th July*, 1881.
3013. SPRING MOTORS, J. H. Johnson, London.—*8th July*, 1881.
3025. ROASTING TOBACCO, C. H. Andrew, Stockport.—*9th July*, 1881.
3038. FIRE-LIGHTERS, J. F. Wiles, Old Charlton.—*11th July*, 1881.
3039. PLAYING ORGANS, H. E. Newton, London.—*11th July*, 1881.
3044. PRINTING on ENVELOPES, W. McKenzie, Minkston.—*12th July*, 1881.
3078. CAKES, &c., W. R. Lake, London.—*14th July*, 1881.
3093. DRYING MACHINERY, W. A. and D. H. Gibbs, Chingford.—*15th July*, 1881.
3143. BREECH-LOADING SMALL-ARMS, J. S. Edge, Yardley, and J. Deeley, Birmingham.—*19th July*, 1881.
3188. MALLEABLE BRONZE, H. H. Lake, London.—*21st July*, 1881.
3195. SLEEPERS, H. Lindsay-Bucknall, Westminster.—*22nd July*, 1881.
3211. OBTAINING ZINC, H. H. Lake, London.—*22nd July*, 1881.
3254. CABLES, H. H. Lake, London.—*26th July*, 1881.
3309. LASTING the UPPERS of BOOTS, H. H. Lake, London.—*28th July*, 1881.
3349. ELECTRIC LAMPS, A. W. L. Reddie, London.—*2nd August*, 1881.
3551. WEIGHING MACHINES, C. Ruether, Hennef.—*16th August*, 1881.
3567. TUNNELLING APPARATUS, A. L. Blackman, London.—*16th August*, 1881.
3615. SELF-ACTING BOTTLE-STOPPING MACHINES, C. M. Sombart, Magdeburg.—*19th August*, 1881.
3654. BREECH-LOADING FIRE-ARMS, P. Mauser, Germany.—*22nd August*, 1881.
3709. FLYERS, T. A. Duncan, Otley.—*25th August*, 1881

3793. India-rubber Articles, B. J. B Mills, London.—*31st August*, 1881.
3875. Starting Engines, A. B. Brown, Edinburgh.—*7th September*, 1881.
3883. Acetifying Alcoholic Wash, E. Luck, London.—*7th September*, 1881.
3951. Regenerative Furnaces, S. Pope, Newburn.—*13th September*, 1881.
4039. Corsets, H. E. Newton, London.—*19th September*, 1881.
4072. Coloured Sized Yarns, F. A. Gatty, Accrington.—*21st September*, 1881.
4086. Gas Engines, J. Atkinson, London.—*22nd September*, 1881.
4092. Cutting Corn Crops, J. Howard and E. T. Bousfield, Bedford.—*22nd September*, 1881.
4099. Unhairing Hides, J. W. Janson, London.—*23rd September*, 1881.
4105. Winding Thread, R. Spöndlin, Zurich.—*23rd September*, 1881.
4170. Corking Machine, C. Farrow, London.—*27th September*, 1881.
4178. Superheating Steam, C. D. Abel, London.—*28th September*, 1881.
4191. Gas Cooking Stoves, G. J. Cox, Maidstone.—*29th September*, 1881.
4194. Intermitting Audible Sounds, F. W. Durham, New Barnet.—*29th September*, 1881.
4265. Rotary Valves, P. G. B. Westmacott, Newcastle-upon-Tyne.—*1st October*, 1881.
4295, Steam Engines, H. E. Newton, London.—*4th October*, 1881.
4311. Electric Lamps, J. H. Johnson, London.—*4th October*, 1881.
4349. Strings, &c., J. Turner and C. McBride, Glasgow.—*6th October*, 1881.
4355. Boots and Shoes, W. H. Stevens, Leicester.—*6th October*, 1881.
4359. Indicating Speed, D. Young, London.—*7th October*, 1881.
4373. Grinding Corn, W. R. Lake, London.—*7th October*, 1881.
4379. Rolling, &c., Metallic Wire, J. Westgarth, Warrington.—*8th October*, 1881.
4383. Electric Bridges, St. G. Lane Fox, London.—*8th October*, 1881.
4409. Telegraph Conductors, W. O. Callender, London.—*11th October*, 1881.
4419. Paper Pulp, D. O. Francke, Korndal Möndal,—*11th October*, 1881.
4437. Hats, W. R. Lake, London.—*11th October*, 1881.
4451. Discharging Torpedoes, P. Brotherhood, London.—*12th October*, 1881.
4509. Sheaf-binding Machinery, J. Hornsby, J. Innocent, & G. Rutter, Grantham.—*15th October*, 1881.
4597. Safety Envelopes, W. W. De la Rue, London.—*20th October*, 1881.
4599. Food for Horses, J. H. Cox, Matlock.—*20th October*, 1881.
4619. Filter Presses, E. A. Pontifex and R. Gunning, London.—*21st October*, 1881.

(List of Patent Letters which passed the Great Seal on the 30th December, 1881.)

1031. Attaching Door Knobs, G. Price, Birmingham.—*10th March*, 1881.
2608. Signalling by Sound, J. G. Jebb, London.—*27th June*, 1881.
2866. Looms, F. O. Tucker, Hartford, U.S.—*1st July*, 1881.
2869. Gas-lamps, F. W. Clark, Westminster.—*1st July*, 1881.
2885. Cranes, W. D. Bruce, Westminster.—*2nd July*, 1881.
2890. Bleaching Fibres, W. A. Barlow, London.—*2nd July*, 1881.
2892. Scribbling Machinery, A. Barker, London.—*2nd July*, 1881.
2897. Safety Fastening, A. E. Parkes and F. Westwood, Birmingham.—*2nd July*, 1881.
2901. Card-setting Machines, J. Haley and J. Pinder, Cleckheaton.—*2nd July*, 1881.
2910. Hair Clippers, J. Trickett, Newark-upon-Trent.—*4th July*, 1881.
2911. Mechanical Stokers, T. Kay, Bolton-le-Moors, and R. Heywood, Salford.—*4th July*, 1881.
2923. Locomotive Engines, T. Morgan, Cockspur-street, Westminster.—*4th July*, 1881.
2938. Attachments to Harvesting Machines, W. P. Thompson, Liverpool.—*5th July*, 1881.
2958. Looms for Weaving, J. Bullough and E. and S. Tweedale, Accrington.—*6th July*, 1881.
2966. Grain-binding Machines, G. E. Vaughan, London.—*7th July*, 1881.
2969. Ventilating Buildings, E. Aldous, Peckham, London.—*7th July*, 1881.
2992. Steam Engines, J. E. Outridge, Egham.—*7th July*, 1881.
3003. Taps, G. Furness and J. Robertshaw, Manchester.—*8th July*, 1881.
3004. Steam Pressure Gauges, G. Furness and J. Robertshaw, Manchester.—*8th July*, 1881.
3018. Spinning Machine Rollers, H. J. Haddan, Kensington, London.—*9th July*, 1881.
3103. Steamships, R. F. Fairlie, Victoria-street, Westminster.—*16th July*, 1881.
3138. Treatment of Soap Lyes, F. Versmann, New Charlton.—*19th July*, 1881.
3184. Tanning, W. H. Cox, Bermondsey, London.—*21st July*, 1881.
3493. Registering Apparatus, J. G. Wilson, London.—*12th August*, 1881.
3716. Chains, J. I. Warman, Coventry.—*25th August*, 1881.
3812. Transmitting Secret Messages, W. R. Lake, London.—*2nd September*, 1881.
3829. Damping Machines, W. Powrie, Camberwell, London.—*2nd September*, 1881.
4071. Leno or Gauze Cloth, T. Bottomley, Buttershaw, near Bradford.—*21st September*, 1881.
4240. Corrugated Plates, R. Armitage and T. Gillott, Leeds.—*30th September*, 1881.
4455. Secondary Batteries, J. W. Swan, Newcastle-on-Tyne.—*13th October*, 1881.
4563. Holders or Receptacles, H. J. Haddan, Kensington, London.—*19th October*, 1881.
4779. Augers, P. A. Gladwin, Boston, U.S.—*1st November*, 1881.
4912. Torpedoes, S. Pitt, Sutton.—*9th November*, 1881.
4913. Propelling Vessels, S. Pitt, Sutton.—*9th November*, 1881.

List of Patent Letters which passed the Great Seal on the 3rd January, 1881.)

1472. Steam Steering Gear, G. W. Robertson, Glasgow.—*5th April*, 1881.
2158. Measuring Milk, M. A. Fox, Oxton.—*17th May*, 1881.
2903. Perambulators, G. B. Lovedee, Birmingham.—*4th July*, 1881.
2907. Cut Nails, B. J. B. Mills, London.—*4th July*, 1881.
2919. Exploding Gases, W. Watson, Leeds.—*4th July*, 1881.
2924. Steering Engines, G. W. Robertson, Glasgow, and I. Beck, Sheffield.—*5th July*, 1881.
2927. Propelling Vehicles, J. Simmons, Brixton.—*5th July*, 1881.
2968. Vehicles, R. Brabyn, Bodmin.—*7th July*, 1881.
2970. Nails, H. Booth, Bilston.—*7th July*, 1881.
2977. Grinding Paints, W. Hawley, jun., and F. Hawley, Duffield.—*7th July*, 1881.
3000. Self-closing Tap, G. Crawford, Port Glasgow.—*8th July*, 1881.
3001. Anchors, H. Terrell, London.—*8th July*, 1881.
3006. Condensing Pumps, J. McEwen and S. Spencer, Manchester.—*8th July*, 1881.
3010. Signalling Code, H. Gardner, London.—*8th July*, 1881.
3045. Shuttles, J. Broadhead, Huddersfield.—*12th July*, 1881.
3165. Drilling Wood, J. F. Wiles, Old Charlton.—*20th July*, 1881.
3178. Fastening Rubber Threads, T. Taylor, Derby.—*21st July*, 1881.
3181. Water-tube Boilers, F. C. Glaser, Berlin.—*21st July*, 1881.
3267. Commodes, H. J. Haddan, London.—*29th July*, 1881.
3279. Brakes, W. R. Mortimer, Rogate Lodge.—*26th July*, 1881.
3303. Artificial Stone, J. H. Johnson, London.—*28th July*, 1881.
3518. Steam Engines, M. Lowe, Wigan.—*12th August*, 1881.
3665. Steam Boilers, J. W. de V. Galwey, Warrington.—*23rd August*, 1881.
3780. Controlling Type-setting Machines, J. E. Munson, New York.—*30th August*, 1881.
3790. Covering Cables, W. R. Lake, London.—*31st August*, 1881.
3968. Heating Water, F. T. Bond, Gloucester.—*14th September*, 1881.
3989. Producing Cold Air, E. Hesketh, Dartford.—*15th September*, 1881.
4023. Stitching Seams, R. H. Brandon, Paris.—*19th September*, 1881.
4104. Treating Blue-ground, A. J. Struthers, Hawick.—*23rd September*, 1881.
4120. Cutting Strips of Chenille, W. P. Thompson, Liverpool.—*24th September*, 1881.
4156. Floating Batteries, A. Longsdon, London.—*27th September*, 1881.
4161. Wrought Iron Diggers, A. Goodwin, Southwark.—*27th September*, 1881.
4193. Electric Lamps, C. H. Gimingham, Newcastle-upon-Tyne.—*29th September*, 1881.
4211. Cartridge Feeder, R. H. Brandon, Paris.—*29th September*, 1881.
4535. Distilling Apparatus, C. Paulmann, London.—*18th October*, 1881.
4605. Steam Boilers. J. and G. Tinker, and J. and R. Shenton, Hyde.—*21st October*, 1881.
4910. Preserving Eggs, T. Stead, London.—*9th November*, 1881.
4914. Shaping Metals, S. Pitt, Sutton.—*9th November*, 1881.
4988. Puring Hides, S. Pitt, Sutton.—*15th November*, 1881.

List of Specifications published during the week ending December 31st, 1881.

1945, 6d.; 2099, 6d.; 2204, 8d.; 2218, 6d.; 2253, 4d.; 2264, 4d.; 2304, 2d.; 2334, 4d.; 2346, 2d.; 2347, 2d.; 2348, 6d.; 2350, 2d.; 2351, 2d.; 2352, 2d.; 2353, 2d.; 2355, 8d.; 2356, 2d.; 2359, 6d.; 2360, 6d.; 2361, 2d.; 2363, 4d.; 2364, 2d.; 2365, 4d.; 2370, 6d.; 2371, 2d.; 2374, 2d.; 2376, 2d.; 2377, 2d.; 2379, 2d.; 2380, 2d.; 2381, 2d.; 2382, 4d.; 2385, 2d.; 2389, 6d.; 2390, 6d.; 2392, 2d.; 2393, 2d.; 2397, 4d.; 2399, 6d.; 2409, 2d.; 2401, 2d.; 2403, 2d.; 2406, 6d.; 2407, 6d.; 2400, 2d.; 2410, 6d.; 2411, 6d.; 2413, 2d.; 2414, 6d.; 2417, 2d.; 2419, 2d.; 2420, 6d.; 2423, 6d.; 2425, 6d.; 2426, 6d.; 2427, 8d.; 2431, 6d.; 2433, 2d.; 2434, 6d.; 2440, 2d.; 2441, 6d.; 2443, 2d.; 2445, 2d.; 2447, 2d.; 2448, 4d.; 2449, 6d.; 2450, 6d; 2451, 6d.; 2454, 2d.; 2456, 8d.; 2464, 4d.; 2465, 2d.; 2466, 2d.; 2476, 6d.; 2512, 6d.; 2513, 6d.; 2514, 6d.; 2531, 6d.; 2630, 4d.; 2750, 2d.; 3422, 10d.; 3594, 6d.; 3826, 4d.; 3864, 6d.; 4004, 6d.; 4110, 6d.; 4168, 6d.; 4357, 6d.

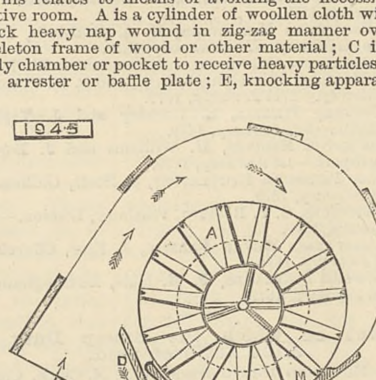
*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane,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

ABSTRACTS OF SPECIFICATIONS.

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

1945. Machinery for Separating Light Solid Particles from Air Escaping from Middlings Purifiers, &c., *L. Fiechter, Minneapolis, Minnesota.—4th May*, 1881.—*(A communication from Christian Brothers and Co., Minneapolis.)* 6d.

This relates to means of avoiding the necessity of a stive room. A is a cylinder of woollen cloth with a thick heavy nap wound in zig-zag manner over a skeleton frame of wood or other material; C is an eddy chamber or pocket to receive heavy particles; D, air arrester or baffle plate; E, knocking apparatus;



H, main delivery spout for stive and dust; L, a cam on driving shaft drawing back the knocker or hammer K, once at each revolution by coming in contact with the pin M on same, and thus compressing the spring R, until the cam passing the pin, the knocker is free to bound back and strike a corner on the cylinder.

2099. Self-stopping, Warping, or Beaming Machines, *S. and S. Cook, Bury, Lancaster.—13th May*, 1881. 6d.

A shaft is fixed across the machine and to it motion is imparted. On it are a number of wheels with slots in their peripheries, and over them passes an endless chain, carrying a number of bars in an open lattice form. When a thread breaks the pin falls and comes in contact with the bars, thus stopping the chain and throwing the shaft out of gear. To take the weight of one or more of the slack rollers off the yarn, the back roller is caused to arrive at the bottom first before the second roller moves, and when at the bottom it strikes the ends of levers which cause the second roller to be put into action, and the second the third, the weight of one roller only resting on the twist at the same time.

2204. Lathes for Turning Buttons, &c., *H. J. Haddan, London.—20th May*, 1881.—*(A communication from E. Kretschmann, Saxony.)* 8d.

This consists in driving the two cutters employed by one band, which can be tightened and stopped by means of a pulley; also in the feeding mechanism, consisting of a movable groove, safety lever, and movable knee, combined with a holder, the lever being connected with a box and spiral spring, the feeder and knee actuated by an excentric and lever; also in the arrangement of two crossheads fastened on the main frame and moved by an excentric, the crossheads having check pieces, which are opened and shut automatically by an excentric and slot arrangement.

2218. Padlocks, *T. Harby, Liverpool.—20th May*, 1881. 6d.

This relates to padlocks in which the shackle allows the padlock when unfastened to drop away from the loops, and thereby prevents fraud from the shackle being apparently secured when it is only wedged into its locked position. The shackle is opened and closed by the axial movements of a part of the case, and secured in its locked position by a locking bolt or stud.

2253. Railway Signals, *W. Morgan-Brown, London.—24th May*, 1881.—*(A communication from G. H. Roth, Boston, U.S.A.)*—*(Void.)* 4d.

This relates to indicating mechanism to be actuated by a passing train.

2272. Improvements in Secondary Batteries, *J. W. Swan, Newcastle-on-Tyne.—24th May*, 1881. 4d.

Plates of lead are prepared having a cellular, corrugated, or grooved surface or surfaces capable of retaining in the cells, &c., spongy or finely divided lead.

2323. Improvements in Secondary Electric Batteries, *J. H. Johnson, London.—26th May*, 1881.—*(A communication from La Société "La Force et la Lumière," Société Generale d'electricité, Brussels.)*—*(Not proceeded with.)* 2d.

The only new feature is in the manner of obtaining lead surface by bundles of finely drawn lead wire.

2334. Furnaces Used in the Metallurgy of Copper, *A. M. Clark, London.—27th May*, 1881.—*(A communication from J. Garnier.)* 4d.

This consists in eliminating arsenic, antimony, and phosphorus from coarse or black copper or matt by refining on a hearth of basic material, on which at each operation is spread a layer of basic fluxes and carbonates, such as lime or magnesia, raw limestones, or dolomites, peroxide of manganese, litharge, fluor spar, &c.

2346. Looms, *J. Bottomley, Bradford.—28th May*, 1881.—*(Not proceeded with.)* 2d.

The object is to run a fast reed loom with a loose reed pick and spring at a higher speed and much easier pick than hitherto. This is accomplished by removing the swell hinged to the back part of the shuttle-box, and in its place introducing a loose reed spring, thus enabling the force of the shuttle to act upon the picker. Mounted upon the picker guide rod and behind the picker is a strap connected to the stop rod catch, so that when the picker is pushed back by the shuttle the stop rod catch is raised.

2347. Railways, *A. J. H. Smythe, Ireland.—28th May*, 1881.—*(Not proceeded with.)* 2d.

This relates to the use of sleepers of steel or iron plates of trough section, and stiffened with cement, concrete, or timber, which sleepers are placed between the rails at intervals. Also to the use of steel or iron plates outside the rails, the plates, rails, and sleepers being fastened together by bolts.

2348. India-rubber Valves, &c., *A. Pegler and T. J. Watson, Retford, Nottingham.—28th May*, 1881. 6d.

This relates to means to prevent india-rubber valves from cracking, and consists mainly in embedding in the rubber strong pieces of twine, or strands, or shreds of other flexible material, in such a manner and in such position as to arrest any cracking.

2350. Rotary Heels for Boots and Shoes, *W. Clegg, Strand.—28th May*, 1881.—*(Not proceeded with.)* 2d.

This relates to a circular heel, fitted so as to be capable of revolving on a bolt secured to the heel.

2351. Putting Together or Affixing Stairs, Steps, &c., *T. A. Brockelbank, Old Broad-street.—28th May*, 1881.—*(Not proceeded with.)* 2d.

Crutches, bands, supports, or clips have on their underside studs, holes, or projections, to fit into holes or grooved slots formed in supports secured to the stair framing.

2352. Spring Bottoms for Beds, &c., *H. A. Dalrymple, Worcester, U.S.A.—28th May*, 1881.—*(Not proceeded with.)* 2d.

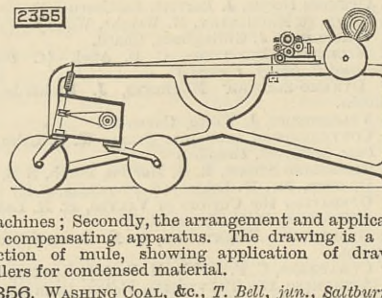
Upright helical springs are secured to longitudinal slots, between which cross slats extend and are suspended by chains from the springs. Longer chains connect the end springs with the slats by means of hooks, both sets of chains in passing from the slots over the outer coils of the springs having curved tubes thrust through one of their links and placed upon the outer coils of the springs to protect the same.

2353. Cool Chamber for Storing Food, &c., *J. Gwynne, Hammersmith.—28th May*, 1881.—*(Not proceeded with.)* 2d.

The chamber consists of corrugated walls of a material being a good conductor of heat, around which is a second chamber, the space between the two being in communication with a refrigerator or cooling apparatus.

2355. Machinery for Doubling, Drawing, &c., Wool, Cotton, and other Fibrous Substances, *T. Robinson, Leeds.—28th May*, 1881. 8d.

This consists, First, in the arrangement and combination of drawing rollers applied to mule spinning



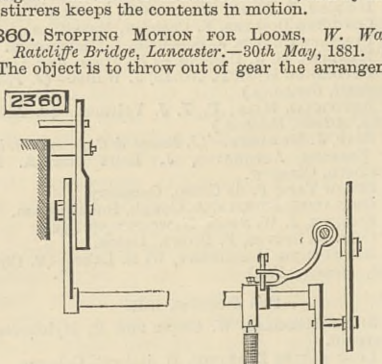
machines; Secondly, the arrangement and application of compensating apparatus. The drawing is a part section of mule, showing application of drawing rollers for condensed material.

2356. Washing Coal, &c., *T. Bell, jun., Saltburn-by-the-Sea, and W. Ramsay, Durham.—28th May*, 1881.—*(Void.)* 2d.

A semi-cylindrical trough is used, and is mounted in an inclined position, the coal being placed upon it at the higher end, and a stream of water directed along it. An axis is caused to revolve, and by means of stirrers keeps the contents in motion.

2360. Stopping Motion for Looms, *W. Walker, Ratcliffe Bridge, Lancaster.—30th May*, 1881. 6d.

The object is to throw out of gear the arrangement



known as "Diggles chain" immediately on the breaking of the weft, and thus to prevent the necessity for turning back the sley to obtain the correct pattern and to save the time of the weaver. A shaft bearing a small cam somewhat resembling a ratchet wheel is fixed at a right angle with the chain motion, and is connected with the ring wheel of the chain motion by means of a suitable lever. Upon the same axis, and of the same diameter as the ring wheel, is made an extension thereof, the extension having a plain periphery upon which the arms of the star wheel may slide instead of being engaged as they are with the cavities and studs in the existing sley. The shaft and lever are kept in position so long as the weft remains unbroken by means of a small catch against which the shaft is held by a spiral or other spring. A rod is carried from the finger lever to a position opposite to the catch. To this rod is fixed a projecting forked lever which comes in contact with the catch.

2359. Filtering, &c., *J. F. N. Macay, Charapoto, Ecuador.—28th May*, 1881. 6d.

The apparatus consists of a barrel or shell of wood, earthenware, or other substance not acted upon by the solvents or chemical agents employed, and inside which is constructed an inner barrel or prismatic or polygonal shell, a space being left between the two. The inner barrel is perforated, and one surface covered with the filtering medium. The outer barrel is provided with draw-off cocks.

2361. Disinfectant and Antiseptic Compounds, &c., *T. F. Scott, Surrey.—30th May*, 1881.—*(Not proceeded with.)* 2d.

Oxide of manganese is mixed with a potash sulphate of alumina, or potash alum, and fused, producing a combined salt of potassia manganate or permanganate of alumina.

2363. Cleaning Milk Vessels, &c., *S. J. Pocock, Vauxhall.—30th May*, 1881. 4d.

Two brushes are mounted on axles and caused to revolve rapidly, one acting on the inner surface and the other on the outer surface of the milk vessel, such brushes being partly immersed in a suitable cleaning liquid.

2364. Pocket-knife, *G. Roe, Ireland.—30th May*, 1881.—*(Not proceeded with.)* 2d.

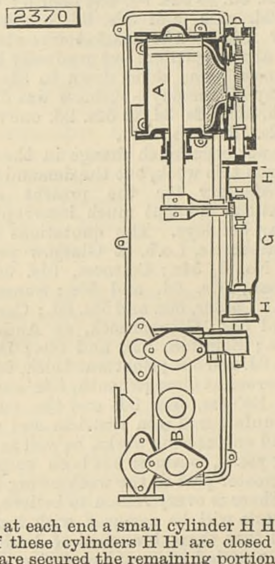
This relates to means for preventing the main blade opening accidentally, and which, when open, cannot recoil so long as the handle is grasped in the handle. A lever of equal length to and outside the knife case swings on the pivot of the main blade, on which pivot between the lever and case is keyed a cam, with which a pin on the lever engages when desired to open or close the blade.

2365. Motive-power Engine, *J. Neil, Glasgow, and J. Kerry, Greenock.—30th May*, 1881.—*(Not proceeded with.)* 4d.

The invention consists in forming the cylinder rather more than three times the length of the stroke, and boring out a part rather longer than the stroke at each end, in each of which a piston works, such pistons being connected by rods, between which, in the space between the pistons, is fitted the crank shaft connected by a connecting rod to one of the pistons.

2370. Working the Slide Valves of Steam Engines, &c., *H. E. Newton, London.—30th May*, 1881.—*(A communication from A. Nathan, Milan.)* 6d.

The drawing shows a side elevation of a direct-acting steam pump. A is the steam cylinder and B the pump cylinder. The cylinder A, instead of having only one discharge port placed between the two admission ports, as in the ordinary slide valve engines, is formed with two discharge ports, which are placed one immediately outside of the two admission ports. To provide for moving the slide valve the distance required to open and close the several ports at the end of each stroke of the piston, the central portion of the slide valve rod is removed and replaced by a casting G,



having at each end a small cylinder H H¹. The outer ends of these cylinders H H¹ are closed by covers, to which are secured the remaining portion of the slide valve rod. In each of the cylinders H H¹ is placed a piston, which pistons are connected together by a light rod at such distance apart that when one piston is pushed forward to compress the air in its cylinder, the other piston is drawn back in its cylinder so as to uncover a small opening made in the side of the cylinder, through which air can enter to make good any loss which may have in any way occurred during the act of compressing the air in that cylinder.

2371. Knotter or Strainer Plates, *J. H. Annandale, Edinburgh.—30th May*, 1881.—*(Not proceeded with.)* 2d.

A thin sheet of vulcanite is attached to a metal mould or frame, the vulcanite being cut in slits to correspond to the grooves in the frame, and serving as the straining medium. Another method consists in coating the whole frame with vulcanite.

2374. Combined Globe, Globe Holder, and Gas Burner, *G. E. Webster, Nottingham.—30th May*, 1881.—*(Not proceeded with.)* 2d.

This consists in the combination of a governor burner, globe, and holder. The burner consists of a cylindrical barrel with a float working inside it, and actuated by the pressure of gas so as to partially close or open the passage for the gas. The globe has at the opening a conical air director coming part of the way up to the flame, and which directs the current of air. The holder consists in a triangular U-shaped rim.

2376. Equilibrium Valve, *C. Wenner, Switzerland.—31st May*, 1881.—*(Not proceeded with.)* 2d.

An outer shell has a hole tapering from each end to the centre, and a lateral hole is provided to admit the water or other fluid under pressure. At the opposite side, between the centre and the ends, are two other outlet lateral tubular passages, through which the fluid is conveyed to each side of the piston. An annular passage is formed where each outlet passage joins the main shell, and in each is a hollow taper plug fixed in place by a screw cap. One plug has a longitudinal central passage for the discharge of the fluid, and through the other the valve spindle works. On the latter are two piston valves working inside the plug, and governing the passage of the fluid to and from both sides of the piston.

2377. Manufacture of Finings for Clarifying and Preserving Ales, &c., *C. J. T. Digby, Hammersmith.—31st May*, 1881. 2d.

The refining or clarifying and preserving mixture is composed of from 4 lb. to 5 lb. sulphuric or acetic acid, which is poured over from 7 lb. to 8 lb. of oyster shells and left in an air-tight vessel for from five to six hours, after which an equal quantity by weight of water is added, and the vessel again closed for five or six hours. 3 lb. or 4 lb. of gelatine is placed in a second air-tight vessel with about 27 gallons of water and well agitated each day for three days. The two mixtures are then poured together and well agitated, after which the vessel is closed air-tight for about two days, when the compound is ready for use.

2379. LAMPS, *E. P. Alexander, London.*—31st *May*, 1881.—(*A communication from E. Gény, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to means for affording ready access to the wick for lighting and trimming, and at the same time facilitating the filling of the lamp without removing the globe or other part, and it consists essentially in providing a lateral opening in that part of the lamp which supports the globe or chimney, and in rendering such part capable of being slid up or down so that the aperture may be brought opposite the wick.

2380. MACHINE FOR WHETTING SCYTHES BY HAMMERING, *M. Bauer, Paris.*—31st *May*, 1881.—(*A communication from T. Jacquot and J. Thirion, Nancy.*)—(*Not proceeded with.*) 2*d.*

The apparatus is carried on a tripod, the upper part of which is of iron, to which three legs are fastened; this upper part carries an anvil, and to it the frame of the machine is fastened. This frame supports a disc carrying a suitable number of cams, which serve to raise a hammer, and then allow it to fall suddenly on the anvil. On each cam is a tooth, which, at its lowest position, acts on a ratchet wheel, whereby the feed is effected.

2381. PRINTING PHOTOGRAPHS IN RELIEF, *H. A. Bonneville, Paris.*—31st *May*, 1881.—(*A communication from W. H. Guillebaud, New Jersey, U.S.A.*)—(*Not proceeded with.*) 2*d.*

The object is to produce embossed photographs in a rapid and comparatively cheap manner in bold rounded relief, instead of the flat relief so far obtained.

2382. SHUTTER WORKERS, *H. A. Bonneville, Paris.*—31st *May*, 1881.—(*A communication from F. D. Blake, Brooklyn, U.S.A.*)—(*Not proceeded with.*) 4*d.*

This consists in the combination of a box to be fastened to the outside of a window, and containing a cog-wheel, a shutter arm fixed to the cog-wheel spindle, a spindle capable of being inserted into the window-sill, a hand crank, a pinion and a recessed wheel on the spindle, the pinion gearing with the cog-wheel, and a spring detent engaging the recessed wheel, so that when the spindle is turned, the shutter arm is moved to open or close the shutter, while the detent and recessed wheel lock it in any position.

2385. VENTILATOR OR CHIMNEY TOPS OR CAPS, *H. J. Haddan, London.*—31st *May*, 1881.—(*A communication from R. J. Evans, Toronto, Canada.*)—(*Not proceeded with.*) 2*d.*

The object is to produce an upward draught in the ventilator, no matter in what direction the wind strikes against it, and it consists of a casing formed by the union of two cone frustrums provided with a conical cap supported a slight distance above the upper cone frustrum. The lower cone frustrum has an air tube extending about half way into its interior, the latter frustrum having a circle of holes pierced through it on a line with the top of the air tube.

2389. DEVICE FOR BOOTS AND SHOES TO PREVENT SLIPPING, *W. R. Lake, London.*—31st *May*, 1881.—(*A communication from E. Willins, A. Lequin and E. Le Gallois, Paris.*) 6*d.*

A plate of metal with two curved hooks in front to lay hold of the boot between the sole and the upper has at the back two holes in which the ends of an india-rubber band are secured, such band passing above the heel and so securing the plate in position. On the under surface of the plate are a number of conical tempered steel points.

2390. PIANOFORTES, *W. R. Lake, London.*—31st *May*, 1881.—(*A communication from A. K. Hebard, Massachusetts, U.S.A.*) 6*d.*

This consists, First, in a jack in one part hinged on a stationary rail and connected to the key, and in the other part hinged to a hammer butt and arranged to rest upon its hinged part, all in such manner, and in such relation to each other and to the key and hammer, that on a depression of the finger end of the key the hammer will be thrown against the string, and at or before striking the same the part of the jack connected to the hammer butt will have changed position in relation to the hinged part and the hammer butt, so as to cause the hammer to return from the string and be caught against another rebound under the same depression of the key by the then relative positions of the two parts of the jack, and on a lift of the finger to return of themselves to their normal position; and Secondly, in the combination of a fulcrum pin for the hammer butt, or for other parts of the action that swing about a centre made with a rounded and with a flat portion, and of a spring arranged to bear upon said flat portion.

2392. HARROW, *J. McKinley, London.*—31st *May*, 1881.—(*A communication from R. Cockerell, Melbourne.*)—(*Not proceeded with.*) 2*d.*

This relates to a rotary harrow and consists of tines or teeth formed in the shape of serrated bobbins or flanged wheels, and fixed on jointed rods which allow the rollers yielding to the inequalities of the ground.

2393. REVERSIBLE SLAB FOR SCHOLASTIC PURPOSES, &c., *B. Tomkys and W. Tattersall, Haslingden, Lancashire.*—31st *May*, 1881.—(*Not proceeded with.*) 2*d.*

This consists of a white slab of pot opal glass, the surfaces of which are made rough by grinding so as to show marks made by black or coloured chalks. The slab is hung in a frame so that either surface can be readily exposed.

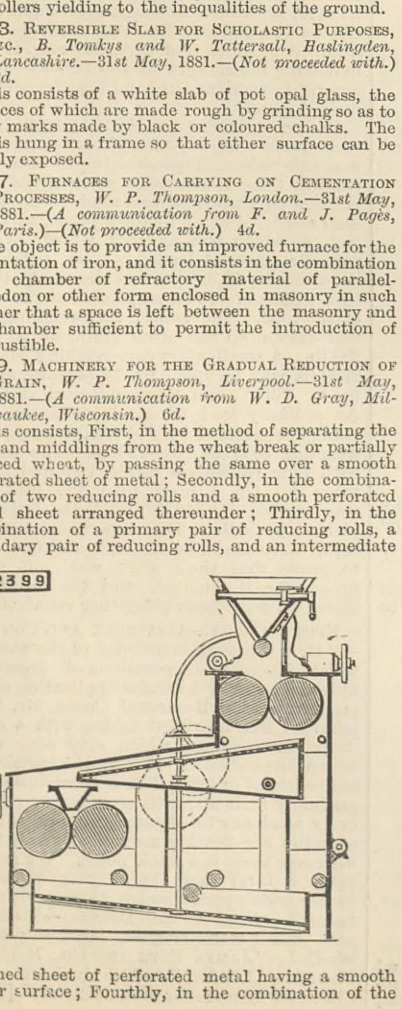
2397. FURNACES FOR CARRYING ON CEMENTATION PROCESSES, *W. P. Thompson, London.*—31st *May*, 1881.—(*A communication from F. and J. Pagès, Paris.*)—(*Not proceeded with.*) 4*d.*

The object is to provide an improved furnace for the cementation of iron, and it consists in the combination of a chamber of refractory material of parallelopipedon or other form enclosed in masonry in such manner that a space is left between the masonry and the chamber sufficient to permit the introduction of combustible.

2399. MACHINERY FOR THE GRADUAL REDUCTION OF GRAIN, *W. P. Thompson, Liverpool.*—31st *May*, 1881.—(*A communication from W. D. Gray, Milwaukee, Wisconsin.*) 6*d.*

This consists, First, in the method of separating the flour and middlings from the wheat break or partially reduced wheat, by passing the same over a smooth perforated sheet of metal; Secondly, in the combination of two reducing rolls and a smooth perforated metal sheet arranged thereunder; Thirdly, in the combination of a primary pair of reducing rolls, a secondary pair of reducing rolls, and an intermediate

2399



inclined sheet of perforated metal having a smooth upper surface; Fourthly, in the combination of the upper reducing rolls, the lower reducing rolls, the intermediate screen to receive the material from the first rolls and deliver its tailings to the second rolls, the second and lower screens arranged to receive the material from the lower rolls, and the inclined delivery board arranged to conduct the screenings from the two screens and the tail of the machine. Other improvements are described. The drawing is a longitudinal vertical section.

2400. APPARATUS FOR HOLDING BOTTLES CONTAINING EFFERVESCENT AND STILL LIQUIDS, *E. Farrow and R. B. Jackson, Great Tower-street.*—31st *May*, 1881.—(*Not proceeded with.*) 2d.

This consists of a frame working on centres in a stand, and provided at one end with an adjustable back to fit into the punt of the bottle, and at the other end with an adjustable cork for fitting into the mouth of the bottle. In the cork is a passage closed by a cock and communicating with the interior of the bottle.

2401. PLOUGHS, *J. Cooke, Lincoln.*—31st *May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to "gang" ploughs and "turnwrest" ploughs, and the First improvements consist in making gang ploughs of one main beam which carries the binder frame or plough, and from it the secondary iron beam which carries the front frame or plough, is carried by large screws to admit of its being set further from or near to the main beam. The draw-hook and lanes are attached to the main beam and pole so as to be readily removable to suit the draught for two, three, or four horses. In "turnwrest" ploughs the wheels are attached so that they will each alternately act as land and furrow wheels by being mounted in a swing carriage fixed under the beam.

2403. MAKING PAINT WITH THE REFUSE FROM ARSENIC FURNACES, &c., *D. Brown, Falmouth, and R. Michell, Combe Hill, Cornwall.*—31st *May*, 1881. 2*d.*

The arsenic refuse obtained from crude arsenic after burning is either ground and mixed with ochre and with oils to form paint, or is incorporated with tar or pitch, and used to preserve wood and iron.

2406. CHIMNEY TOPS OR VENTILATORS, *W. Chrystal, Commercial-road.*—31st *May*, 1881. 6*d.*

The object is to induce upward currents in the chimney or shaft, and it consists of a number of upright plates placed radially around the flue, and having fixed between each two of them a number of upwardly inclined deflecting plates or louvres placed one over the other, with a space between them opening into the flue.

2407. FIRE-ARMS, *A. M. Clark, London.*—31st *May*, 1881.—(*A communication from A. Hope and A. S. Oliver, Elberton, U.S.A.*) 6*d.*

This consists in attaching the gun stock so that it may be fixed at any desired inclination to the barrel, and the stock shortened or lengthened.

2409. SPRING BALANCES, *C. Maschwitz, Birmingham.* 31st *May*, 1881.—(*A communication from E. F. Grell.*)—(*Not proceeded with.*) 2*d.*

The object is to enable the pointers of spring balances required to weigh certain materials in a plate, dish, or basin, to be placed at zero when the dish or plate is on the scale, so that it will not be necessary to weigh it separately, and deduct its weight from the gross weight when it contains the material to be weighed.

2410. QUARRYING SLATE, &c., *A. M. Clark, London.*—31st *May*, 1881.—(*A communication from A. R. R. Reese, Phillipsburg, U.S.A.*) 6*d.*

The objects are to avoid excessive waste, labour, and expense incidental to the ordinary modes of quarrying, and it consists in the use of a reciprocating travelling frame, provided with rotary saws or cutters, supported on a frame with adjustable legs, and which also supports the mechanism for driving the cutters.

2411. TRANSMITTING MOTIVE POWER, *J. Aylward, Birmingham.*—1st *June*, 1881. 6*d.*

A chain or band is used having projecting cross pieces on its under side to take into recesses formed in the peripheries of the pulleys over which it passes. The cross pieces each consist of two half frustra of cones having a common axis, and joined together at their smaller ends by a short cylindrical piece, the recesses in the pulleys being of a corresponding form.

2413. GLOBE HOLDER, *J. Chatwin and H. Shipway, Hay Mills, Worcester.*—1st *June*, 1881.—(*Not proceeded with.*) 2*d.*

The holder consists of three arms, two having a notch to receive the bottom edge of the globe, while the third is a plane on the surface where the edge of the globe rests, the globe being secured in position by an internal button, screw hook, or excentric inserted from the lower side of the third arm inside the edge of the globe.

2414. MANUFACTURE OF MILANAISE, *J. A. Sparling, Highgate.*—1st *June*, 1881. 6*d.*

This relates to a machine for the manufacture of "Milanaise"—a material with a cotton core covered with silk and used to weave into textile fabrics. The machine carries two spindles, on one of which is the bobbin containing the cotton, and on the other is a bobbin to receive the covered cotton. The cotton in its passage from one bobbin to the other is caused to revolve without twisting, and to it a number of silk threads are led and become twisted round it.

2417. CUTTING CROPS, *H. H. Duke, Westbury.*—1st *June*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to reaping machines, the knives of which are in the form of an endless chain, and it consists in making such chain of oblong pieces of metal, near the centre of which at each end is an annular cavity, half in one link and half in the adjoining one, and into this annular cavity a steel ring is placed to form a hinged joint. This chain is supported in a horizontal position by two or more pulleys over which it travels.

2419. ASCERTAINING THE DEFLECTION OF SHOT AND SHELL, *F. W. Panzerd, Harwich.*—1st *June*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to an instrument mounted on a stand and intended to enable the range officer to determine with accuracy when a shot fired has struck within the allowed limits of deviation or beyond such limits.

2420. STEAM BOILER AND OTHER FURNACES, *J. Henderson, London.*—1st *June*, 1881.—(*A communication from J. R. Russell, Rangoon.*) 6*d.*

This relates to steam boilers to be heated by paddy husks, sawdust, or small coal, and it consists, First, of a complete method of stoking by machinery, the fuel being equally spread over the grate; Secondly, in rendering the boiler portable by mounting it on rails and wheels; Thirdly, supplying the fuel by means of a slotted fixed plate forming the top of the furnace, and over which is mounted a similar swinging plate; and Fourthly, making the firegrate surface of a concave form, having segments of perforated plates or bars, with rollers intervening, through which a current of air can pass.

2423. TREATMENT OF ORGANIC SUBSTANCES FOR THE PRODUCTION OF AMMONIA, &c., *W. L. Wise, Westminster.*—1st *June*, 1881.—(*A communication from Dr. H. Grouven, Leipzig, Saxony.*) 6*d.*

This consists, First, in converting nitrogen of organic substances into carbonate of ammonia by reducing such substances to ash with steam at a temperature of from 400 to 700 deg. Cent. in an atmosphere from which air is excluded, and conducting the products of combustion in admixture with an excess of steam through a glowing substance, such as described in patents No. 1136, A.D. 1878, and No. 5504, A.D. 1880; and Secondly, in the apparatus to be employed in the operation.

2425. ORDNANCE, *W. Palliser, South Kensington.*—2nd *June*, 1881. 6*d.*

This relates to guns which may be either breech-loaders or muzzle-loaders, the drawing showing the application of the invention to a breech-loader, and it consists of a cast steel casing C the whole length of the gun, annealed and turned inside to receive the inner lining tube A butting, by a sloping shoulder E against a corresponding shoulder of the casing, and extending the whole length. The outer lining tube B is screwed into position, and a shoulder on it butts against a corresponding shoulder on A.

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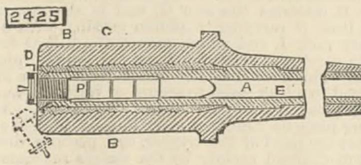

The tubes fit easily in the casing and in one another, and are made of soft coiled iron. D is a short breech-lining tube screwed in from the breech, and receiving an inner lining tube, into which the breech plug P is screwed.

2426. LOOMS, *R. L. Hattersley, Keighley, and D. Bailey, Huddersfield.*—2nd *June*, 1881. 6*d.*

This relates to operating the weft fork and knocking-off lever in looms having change shuttle-boxes. On each side of the slay board, and for operating on each single shot of weft, the weft fork is placed about the centre of the slay board, and is fixed to an oscillating rod extending to opposite the lever for knocking off. On this rod is an arm, from which a pin hangs down beneath the arm and passes through slide bearings attached to the slay board, rising and falling with the weft fork. Through the same bearings passes an upright pin, the lower end of which rests on a lever hinged beneath the slay board, the upper end being under the arm on the weft fork rod. A stud on the end of the last lever rides during the forward motion of the slay on a circular bearing attached to the loom end, and over a hinged inclined plate during the back motion, which movement elevates the weft fork, and keeps it in this position until the end of the plate is reached, when it drops down on to the circular bearing. Under the slay board is hinged a lever capable of working horizontally. As the slay board recedes this lever comes in contact with a stop piece attached to the loom end, which causes the end of the lever to project forward under the weft fork mechanism.

2427. WAGONS AND TRUCKS, *J. C. Martin, East Indies.*—2nd *June*, 1881. 8*d.*

This relates to discharging the wagon so that the load is discharged clear of the road. The bottom of the truck is adjustable, and is in the form of a double slope, highest at the centre. The sides of the wagon are hinged at top, and open outwards when released, the pressure of the load on them forcing them.

2431. RAILWAY SIGNALLING APPARATUS, *T. M. Ford, London.*—2nd *June*, 1881. 6*d.*

This relates to means whereby passing trains operate the signals to indicate to following trains whether the line is clear, and it consists of a plate B arranged inside one of the rails and depressed by a

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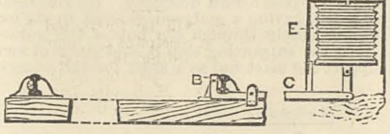

passing train. The piece B is attached to lever C, the other end of which is attached to a collapsible chamber E, to the top of which a whistle is secured. To prevent the whistle sounding when the line is clear a valve is operated at the same time as the signal, and the air compressed by the bag is prevented from issuing by the whistle.

2433. POTATO DIGGERS, *W. Dewar, Dundee.*—2nd *June*, 1881.—(*Not proceeded with.*) 2*d.*

A rotating digging instrument is carried at the back of a wheeled frame, and is driven by bevel wheels from the axle of the carrying wheels, but instead of being on a rigid shaft it is upon a tube running on a spindle fixed to the framing, the object being to enable the shank of the sock to be fixed on the end of the fixed spindle, which projects behind the digging instrument.

2434. LOOMS FOR WEAVING BRACE WEBBING, &c., *G. H. Smith, Manchester.*—2nd *June*, 1881. 6*d.*

This relates to the needle and shuttle motion and also to the taking-up motion. The two needles for carrying the weft are made of a straight arm with a curved segmental portion concentric to a bush, in which are two sliding pieces, to one of which each needle is connected by the straight arm. The needles are actuated by a cam and levers, and an up-and-down motion is communicated from the needles to the sliding pieces to cause the needles to change their positions each time they enter the shed, in weaving a double cloth to form the selvage on one side. The selvage on the other side is formed by a horizontal stationary shuttle. The taking-up motion consists of a bush driven by a band turning on a rod in which right and left-handed endless threads are cut crossing each other. A pin in the bush takes into the groove and causes the bush to travel to and fro.

2440. WOVEN SILK FABRICS, &c., *F. A. Arbenz, Zurich.*—2nd *June*, 1881.—(*Not proceeded with.*) 2*d.*

The warp and weft threads are both made varigated by twisting two threads of different shades or colours together, and they are then woven into stuffs.

2441. CALCULATING APPARATUS, *H. H. Lake, London.*—2nd *June*, 1881.—(*A communication from H. Beaucourt, Villeurbanne, France.*) 6*d.*

In a suitable frame is mounted a wheel with 100 teeth engaging a pinion connected with a disc having nine openings corresponding to the teeth of the pinion. There is also a dial carrying a pinion with ten teeth and divided into ten parts, and marked 0, 100, 200, up to 900. Two openings allow the numbers on the toothed wheel and those on the dial to be seen, and when the number 99 appears at the right hand opening the disc is caused to make one-ninth rovolution, a projection on the toothed wheel causes the pinion of the dial to advance one tooth, so as to present the first hundred at the left opening. At each ninth rotation of the disc the toothed wheel advances one tooth.

2443. REGULATING THE FLOW OF WATER, &c., *C. H. von Ullner, Euston-road.*—3rd *June*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to prevent waste, and it consists of a tube bent in the form of a horseshoe, which acts as a syphon, and is placed in a cistern. Both ends of the tube are open, one being bent outwards and passing through the bottom of the cistern, while the other rests thereon, and hinged to the bottom is a scoop-shaped box which is raised and lowered by a lever.

2445. SUPPORTING LAWN TENNIS NETS, *R. H. Edmondson, Manchester.*—3rd *June*, 1881.—(*Not proceeded with.*) 2*d.*

The pole stands on four feet, one longer than the others, and weighted to prevent it being pulled over or raised by the strain of the net, the lower corner of which is secured to the bottom of the standard, and a cord passes through the upper edge of net and is secured to one extremity of a cord or chain passing over a pulley near the top of the standard, and carrying a weight to keep the net taut.

2447. COMBING COTTON, &c., *W. R. Moss, Bolton.*—3rd *June*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to prevent the accumulation of waste from forming on the ends or bearings of the "detaching" and fluted rollers, and it consists in constructing the comb cylinder so as to cause it to act as a revolving clearer for brushing the waste fibres from the ends of these rollers.

2448. TREATING RICE, *E. Martin, Whitechapel, and R. Besins, St. George's-in-the-East.*—3rd *June*, 1881. 4*d.*

The object is to obtain a substitute for malt for use in brewing or distilling and for other uses, and it consists in steeping paddy or unshelled rice in water for two or three days, after which it is spread on a malting floor and heated until the requisite germination has taken place. It is then dried, and if desired roasted to fit it for use as a colouring matter for beer.

2449. MEASURING MECHANICAL AND ELECTRICAL POWER, *C. V. Boys, Wing, Rutland.*—3rd *June*, 1881. 6*d.*

The drawing shows an integrating apparatus applicable to a double-acting steam or other fluid pressure engine. A are two vessels covered by flexible diaphragms, the centres of which are connected by a stem, and which communicate respectively by pipes with the two ends of the working cylinder of the engine; B is the integrating cylinder fitted on an axis along which it can slide, while it also revolves with it. The axis gears with a suitable counter. D is a lever connected to the piston rod or other part of the engine, and to it is connected, by a ball-and-

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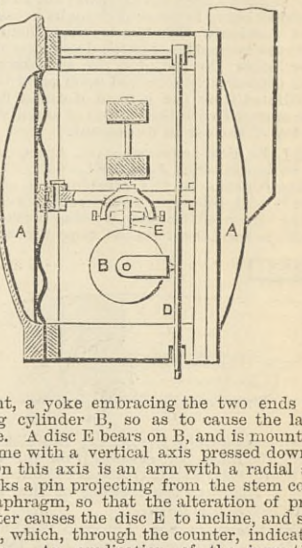

socket joint, a yoke embracing the two ends of integrating cylinder B, so as to cause the latter t reciprocate. A disc E bears on B, and is mounted in swivel frame with a vertical axis pressed down by a spring. On this axis is an arm with a radial slot in which works a pin projecting from the stem connecting the diaphragm, so that the alteration of pressure on the latter causes the disc E to incline, and so turn cylinder B, which, through the counter, indicates the work done. An application of the invention to measure the work done by an electrical current between two points of a conductor is also described.

2450. PERFORATING INSTRUMENT FOR PRODUCING STENCILS TO BE EMPLOYED IN THE REPRODUCTION OF WRITINGS, &c., *D. Gestetner, Thurloe-square.*—3rd *June*, 1881. 6*d.*

A small toothed, notched, or roughened wheel is mounted on an axis carried by a holder, and when used in writing or drawing upon thin waxed paper or other suitable material, the work produced consists of lines of minute perforations, the sheet so perforated forming the stencil.

2451. STYLOGRAPHIC FOUNTAIN PENS, *J. Nadal, Southampton-row.*—3rd *June*, 1881. 6*d.*

A pointed movable writing rod extends through the writing tube and projects slightly, the other end extending beyond the opposite end of the tube. The rod is surrounded by a spiral spring which closes the hole for the flow of ink, except when the point of the rod is pressed. These parts are all detachable from the reservoir, so that they may be readily removed when requiring cleaning.

2454. ROTARY PUMPS, *S. Mellor, North Bow.*—3rd *June*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 1311, A.D., 1880, and it consists in a revolving cylinder rotating upon fixed hollow discs, of which there are two. The cylinder has a centre within its periphery, from which a pendulous tongue vibrates, such tongue passing through a circular revolving block provided with trunnions that take into recesses in the discs. The periphery of this block works in contact with the bore of the cylinder, and the inlet and outlet ports are arranged one in each disc on opposite sides of the block.

2456. AXLE-BOXES FOR LOCOMOTIVES, &c., *J. Bottomley, Manchester.*—4th *June*, 1881. 8*d.*

This relates to a radial axle-box intended for locomotives and other vehicles, so as to ensure its assuming a correctly radial position or a curve, and also its return to a central position when leaving such curve. The axle-box D combines in one piece the two bear-

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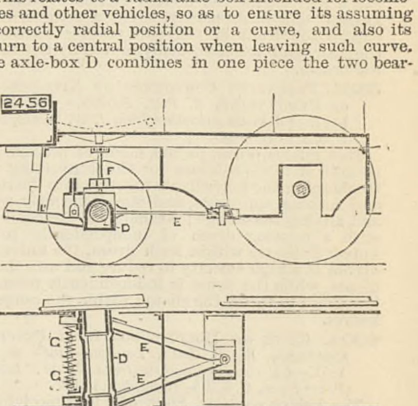

ings; it has no guides, but is furnished with radius bars E pivotted to the frame. The bearing springs rest on the axle-box over the bearings by means of spring pillars F, so that the axle-box is free to move laterally, the degree of motion being controlled by the springs G.

2464. TILES, *J. Taylor, Clapham-road.*—4th *June*, *June*, 1881.—(*Not proceeded with.*) 4*d.*

The object is to reduce the quantity of tiles required to cover a given area by reducing the amount of lap, and it consists in the use of a hexagonal tile, the sides that are vertical with the roof being equal to the lap required. At the apex of the upper angle is an enlargement to receive a hook or fastening, and in each vertical edge is a notch to receive the head of the fastening beneath.

2465. ATTACHING OR SECURING HANDLES OF KNIVES, &c., *W. R. Lake, London.*—4th *June*, 1881.—(*A communication from C. Couzon-Grimaud, Paris.*)—(*Not proceeded with.*) 2*d.*

The blade is entirely separate from the handle, and is fixed by screws between two extensions or arms of a forked blade-holder forming part of the tang, which is fitted into the handle in the usual way.

2466. BORING BROOM OR BRUSH STOCKS AND BOARDS, *S. Ludbrook, Middlesex.*—4th *June*, 1881.—(*Not proceeded with.*) 2*d.*

The holder for the stocks consists of two vice-plates or jaws adapted to come into contact with and grip the ends of the stock, such jaws being capable of moving endwise on a frame by means of a right and left-handed screw passing through them and actuated by a crank handle.

2476. MOUTH-PIECES OF MUSICAL INSTRUMENTS, *W. R. Lake, London.—7th June, 1881.—(A communication from P. Thomsen, Philadelphia, U.S.A.)* 6d.

The mouth-piece is formed with an air chamber adjustable in size and capacity, whereby it can be adapted to the requirements of different instruments and to the use of different performers.

2512. BOTTLE WRAPPERS, *H. J. Haddan, London.—9th June, 1881.—(A communication from B. D. Marks, Louisville, U.S.A.)* 6d.

The wrapper consists of a thin sheet or veneer of wood, paper, or metal, with ridges or flanges on its outer side, which serve to strengthen the wrapper and also prevent the bottles being broken by coming in contact with each other.

2513. BOTTLE WRAPPERS, *H. J. Haddan, London.—9th June, 1881.—(A communication from B. D. Marks, Louisville, U.S.A.)* 6d.

A cord, band, or strip of paper is wrapped spirally round the bottle, and to its lower edge a veneer of wood is secured, while strips of soft elastic material are fastened inside the veneer so as to come into contact with the bottle.

2514. HATCHWAY DOORS, *H. J. Haddan, London.—9th June, 1881.—(A communication from G. M. Eames, J. Stever, and H. L. Eames, Washington, U.S.A.)* 6d.

This relates to means for automatically operating hatch doors to close the hatchways of an elevator shaft, the object being to prevent draught in case of fire, and avoid accidents through leaving them unguarded. There are two series of hatch doors, one above and the other below the elevator car, and they are adapted to be successively collected upon or by the top of and distributed from the bottom of car in its ascent, and to be engaged with the bottom of and distributed from the top of the car in its descent.

2531. BREACH-LOADING SMALL ARMS, *E. James, Birmingham.—10th June, 1881.* 6d.

This consists in the combination of the vertical lever D with the upper and lower bolts or slides G and H, the upper bolt or slide G being withdrawn by the excentric hand lever on the tang through the headed

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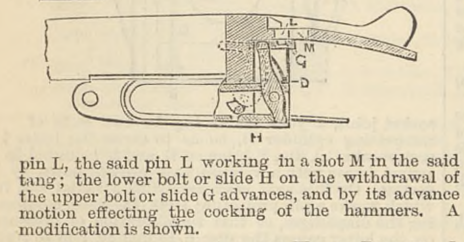

pin L, the said pin L working in a slot M in the said tang; the lower bolt or slide H on the withdrawal of the upper bolt or slide G advances, and by its advance motion effecting the cocking of the hammers. A modification is shown.

2630. STOPPERS FOR AERATED WATER BOTTLES, *J. Massey, Nottingham.—16th June, 1881.* 4d.

This consists of a central core of earthenware, the central part of which is turned down so as to form a recess to receive an india-rubber band.

2750. DEPOSITING METAL UPON THE SURFACES OF IRON AND STEEL COATED WITH MAGNETIC OXIDE, *G. Bower, St. Neots.—23rd June, 1881.* 2d.

This consists in effecting the deposit of metals upon iron and steel surfaces coated with magnetic oxide by attrition by rubbing such surface with a brush or device having filaments or attenuated or finely-divided bodies composed of or coated with the metal it is required to deposit.

3422. PIANOFORTE ACTIONS, *F. L. Mitchell, Halifax.—8th August, 1881.* 10d.

This consists, First, in the combination with the action or hammer mechanism of an adjustable check lever, which receives its impetus direct from the rear end of the key, and transmits the action direct to the hammer butt by means of sticker connecting the two; Secondly, the application and use of an adjustable check lever, acting also as an augmenter and escapement, and which is actuated as and controls the hammer.

3594. TARGETS, *H. J. Haddan, London.—18th August, 1881.—(A communication from G. Ligowsky, Cincinnati, U.S.A.)—(Complete.)* 6d.

This relates to a flying target made of burnt clay or other material which will break upon being struck by a shot, and which is furnished with a tongue on its brim, by means of which it is grasped in the jaws of any suitable trap used to project it in the desired manner.

3826. DUST PANS, *E. L. and M. A. Dietz, Oakland, California.—2nd September, 1881.—(Complete.)* 4d.

The front part of the chamber to receive the dust is bent to form a double incline, the outer one facilitating the entrance of the dust when pushed by the broom, and the inner one facilitating the removal of the dust. Under the double incline a recess will be formed, and such part receives a weight, so as to ensure the front of the pan resting heavily upon the floor, and not be so easily moved by the action of the broom.

3864. PREPARING COMPOUNDS OF NITRO-CELLULOSE OR PYROXYLINE, *S. Pitt, Surrey.—6th September, 1881.—(A communication from J. W. Hyatt, Newark, U.S.A.)—(Complete.)* 6d.

This relates, First, to the mode of preparing compounds of nitro-cellulose for the converting process by charging the ingredients together into the reducing and mixing apparatus, and simultaneously reducing and mixing the charge; Secondly, to the combination with a rotating drum of independently revolving knives or beater within such drum, the knives being driven at a high velocity to reduce and mix the ingredients, while the drum is independently rotated at a low speed to throw the charge within the range of the knives.

4004. CASES OR HOLDERS FOR LEAD PENCILS AND CRAYONS, *W. R. Lake, London.—16th September, 1881.—(A communication from C. W. Livermore, Providence, U.S.A.)—(Complete.)* 6d.

The holder consists, First, of a lead-receiving tube with spring jaws, capable of being closed upon a projecting portion of the lead to hold the same firmly; Secondly, a clamping sleeve to act upon the jaws; and Thirdly, an outer tube or case, capable of longitudinal movement with respect to the lead-receiving tube, so as to protect the projecting end of the lead.

4110. FIRE-ARMS, *H. H. Lake, London.—23rd September, 1881.—(A communication from J. H. Bullard, Massachusetts, U.S.A.)—(Complete.)* 6d.

This relates more particularly to fire-arms with a

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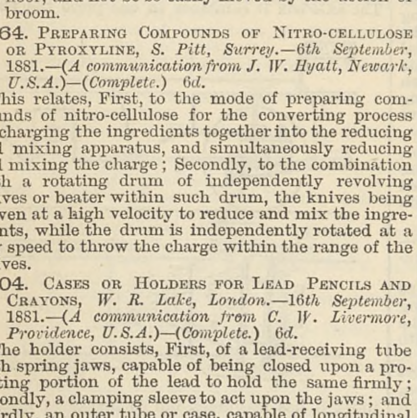

magazine, and the objects are to rapidly transfer the cartridges from the magazine to the barrel to prevent premature explosion by the forward movement of the hammer, to ensure the locking in place of the bolt against the cartridge when exploded, and to provide for the rapid loading and discharging by the movement of the lever to and fro. A is the frame, B the barrel, and C the magazine; D is the carrier moving in a recess and actuated by arm G. The swinging lever H operates the arm G, and is also connected with link F carrying a pinion gearing with a stationary rack I, and which moves the bolt O to and fro to carry the cartridge from the carrier into the barrel. The lever H is also connected with an arm L pivotted to a lock used to secure a vertically-moving breech block E firmly up against the bolt O. A projecting piece on handle of lever H is adapted to strike against the pawl of the trigger, and permits the arm to be discharged rapidly by the simple movement of the lever to and fro.

4357. VACUUM PANS, *W. R. Lake, London.—6th October, 1881.—(A communication from C. Wahl, Chicago, U.S.A.)—(Complete.)* 6d.

This consists partly in providing the liquid pan with a scroll or extended channel having a sufficient length to reduce the liquid or material passing through to the desired consistency before it escapes; this scroll or channel, moreover, is so formed that the

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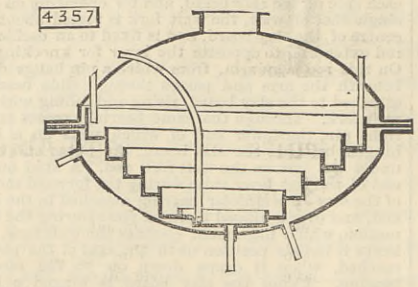


said liquid or material will have its parts kept separate or uncommingled in its passage through the pan, or has the divisions or walls high enough to prevent the fresher parts from mingling with the partly or fully condensed parts of the stream flowing through. It also consists in an improved method of applying steam, and in the means for disposing of the heated liquid, the vacuum pan or evaporating apparatus being designed and arranged for continuous operation.

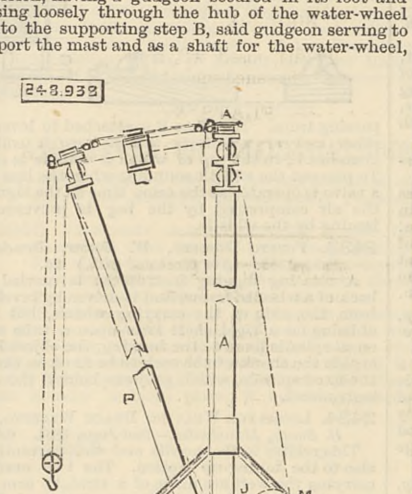
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

248,938. HYDRAULIC DERRICK, *Orange M. Loveridge, Weaverville, Cal.—August 15th, 1881.*

Claim.—(1) In combination with a derrick consisting of the mast A, boom P, and the rope drum or reel and operating gears, the horizontal water-wheel C beneath the platform, spur gear, and pinions F E, vertical shaft G, and bevel gears, substantially as and for the purpose herein described. (2) The mast A of a derrick, having a gudgeon secured in its foot and passing loosely through the hub of the water-wheel C into the supporting step B, said gudgeon serving to support the mast and as a shaft for the water-wheel,

248.938



substantially as herein described. (3) In a derrick having the mast A, boom P, and tackle, the reel shaft M, having large and small gears upon opposite ends, the intermediate shaft J, with corresponding gears and operating levers, and the driving or winch shaft I, with its gear, in combination with the vertical shaft G, bevel gears H, spur gears E F, and the horizontal water-wheel C, substantially as herein described.

249,064. RECEIVER FOR TELEPHONES, *Robert M. Lockwood, New York, N.Y.—September 10th, 1881.*

Claim.—(1) A diaphragm of cork or equivalent non-resonant and non-magnetic material, made in two parts, consisting of a central disc and a ring surround-

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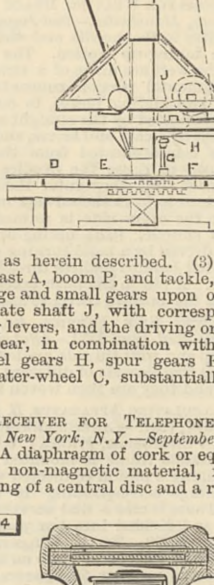
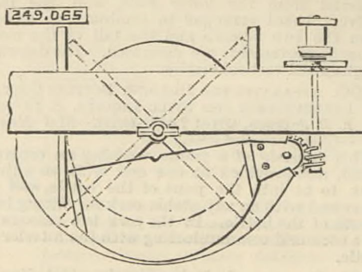


ing said disc and holding it against lateral movement. (2) A diaphragm composed of a central disc and an annular portion surrounding said disc, in combination with clamping rings overlapping the outer edge of the central disc and preventing its displacement.

249,065. MECHANISM FOR OPERATING FAN DOORS OF THRASHING MACHINES, *Zebedee Macomber, Bradford, Mich.—July 6th, 1881.*

Claim.—(1) In combination with the movable doors of a separator blower, the shafts journalled at opposite sides of said blower, and the gearing for operating the doors, the loose sleeves mounted on said shafts and adapted to engage and disengage the same, and the connecting chain or belt, substantially as and for the purposes specified. (2) In combination with the shafts, a chain or belt and loose pulleys, as described,

249.065

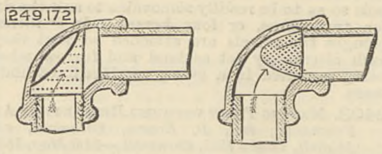


the worm-gear at their lower ends, and the pivotted doors, having pinions or toothed segments thereon, substantially as and for the purposes specified.

249,172. PIPE FITTING, *Frederick Grinnell, Providence, R. I.—March 9th, 1881.*

Claim.—As a new article of manufacture, a screw-

249.172



threaded pipe fitting containing a split strainer sprung into it, substantially as before set forth.

249,192. ROCKET TORPEDO, *W. H. Mallory, Bridgeport, Conn.—May 2nd, 1881.*

Claim.—(1) A rocket torpedo provided with a number of independent radially arranged propelling

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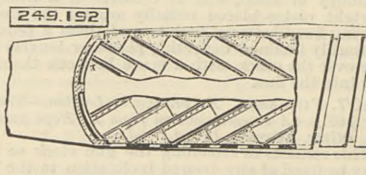

charges, and means, substantially as described, whereby said charges may be simultaneously fired.

249,215. SOLDERING COPPER, *Samuel Woodhead, West Troy, N.Y.—July 22nd, 1881.*

Claim.—(1) The combination of the shank A, point F, pivotted head-block B, and means for securing said block at different angles to the shank, substantially

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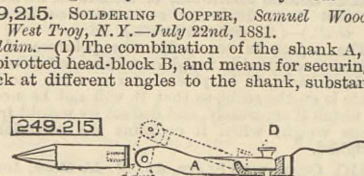
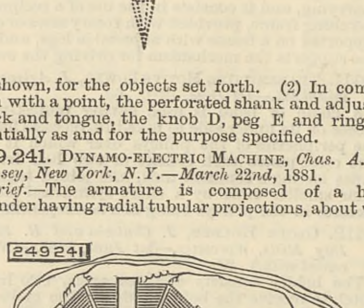


as shown, for the objects set forth. (2) In combination with a point, the perforated shank and adjustable block and tongue, the knob D, peg E and ring, substantially as and for the purpose specified.

249,241. DYNAMO-ELECTRIC MACHINE, *Chas. A. Hussey, New York, N.Y.—March 22nd, 1881.*

Brief.—The armature is composed of a hollow cylinder having radial tubular projections, about which

249241

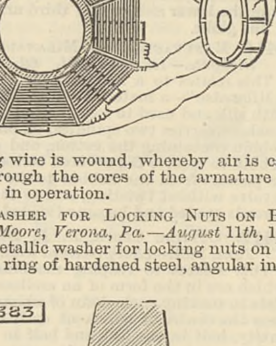


the conducting wire is wound, whereby air is caused to circulate through the cores of the armature when the machine is in operation.

249,383. WASHER FOR LOCKING NUTS ON BOLTS, *George H. Moore, Verona, Pa.—August 11th, 1881.*

Claim.—A metallic washer for locking nuts on bolts, consisting of a ring of hardened steel, angular in cross

249.383

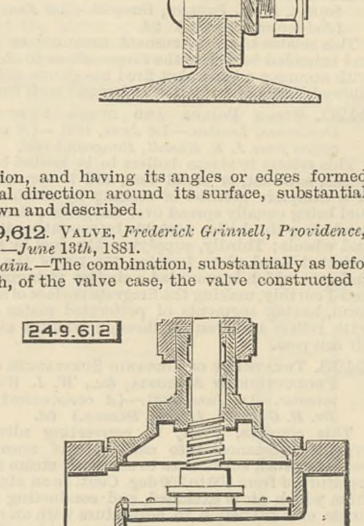


section, and having its angles or edges formed in a spiral direction around its surface, substantially as shown and described.

249,612. VALVE, *Frederick Grinnell, Providence, R. I.—June 13th, 1881.*

Claim.—The combination, substantially as before set forth, of the valve case, the valve constructed to be

249.612

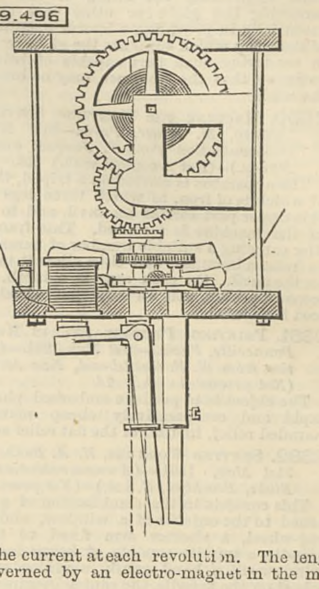


seated and unseated from the exterior of the case, and a yielding diaphragm secured within the case and provided with an aperture encircled by a valve seat, which, when the valve is seated, is held against said valve by internal pressure against the diaphragm at the side opposite the valve.

249,496. ELECTRIC LIGHT, *Chas. E. Ball, Philadelphia, Pa.—April 20th, 1881.*

Brief.—Parallel carbons are rotated by clockwork or an electro-motor, each carbon having commutators for

249.496



reversing the current at each revolution. The length of arc is governed by an electro-magnet in the main circuit.

CONTENTS.

THE ENGINEER, January 6th, 1882.

CASTINGS OF IRON AND BESSEMER STEEL.—A correspondent of the *American Machinist*, in Arizona Territory, who has been in the foundry business twenty-five years, and who owns a shop, writes that he has melted pig iron and Bessemer steel together in a cupola furnace for the last three years with the most satisfactory results, although the mixture cuts out a cupola twice as fast as the melting of pig alone. The castings, he says, are almost as tough as wrought iron, and can be chipped or planed as easily as wrought iron. A great deal of care, however, is required in making the charges in the furnace as well as practical experience in handling the metal in its melted state.

TRACTIVE FORCE UPON MACADAMISED ROADS.—Some interesting experiments have recently been made at Salem, Massachusetts, to ascertain the tractive force requisite to move street cars and vehicles on a macadamised road. The apparatus used consisted of an inclined plane, at the upper end of which was an iron wheel, over which passed a rope. A loaded box-car, weighing, with its contents, 12,820 lb. was drawn up the grade by a weight of 970 lb. suspended at the other end of the rope. The empty car, weighing 4820 lb., was drawn up the same grade by a weight of 283 lb. A smaller box car, weighing when empty 2730 lb., was occupied by 14 persons, and drawn up by 339 lb., and when unoccupied by 176 lb. An ordinary load of sand on a macadamised road was started by 514 lb., an empty hack, weighing 1550 lb. by 196 lb. The same hack with four passengers inside required 230 lb. to move it. On a level road the load of sand was started by 240 lb., while the large box car yielded to 56 lb. The experiments, the *Times* says, were made by a horse railroad company to prove that their work was not unusually severe for the horses, and the result was declared to have been altogether satisfactory.